MD Nastran 2011 &
MSC Nastran 2011

Installation and Operations Guide

MSC Software

Main Index

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List of MD/MSC Nastran Books

Below is a list of some of the MD/MSC Nastran documents. You may find any of these documents from MSC.Software at http://simcompanion.mscsoftware.com.

Installation and Release Guides
• Installation and Operations Guide
• Release Guide

Reference Books
• Quick Reference Guide
• DMAP Programmer's Guide
• Reference Manual

User's Guides
• Getting Started
• Linear Static Analysis
• Dynamic Analysis
• MD Demonstration Problems
• Thermal Analysis
• Superelements
• Design Sensitivity and Optimization
• Implicit Nonlinear (SOL 600)
• Explicit Nonlinear (SOL 700)
• Aeroelastic Analysis
• User Defined Services
• EFEA User's Guide
• EFEA Tutorial
• EBEA User's Guide

Note: This list contains both MSC Nastran and MD Nastran documents.

Technical Support

For technical support phone numbers and contact information, please visit:
http://www.mscsoftware.com/Contents/Services/Technical-Support/Contact-Technical-Support.aspx

Support Center (http://simcompanion.mscsoftware.com)

Support Online. The Support Center provides technical articles, frequently asked questions and documentation from a single location.

Internet Resources

MSC.Software (www.mscsoftware.com)

MSC.Software corporate site with information on the latest events, products and services for the CAD/CAE/CAM marketplace.

1 Introduction

- Document Scope
- Document Structure
- Supported Hardware and Operating Systems
- Changes to MD/MSC Nastran 2011
- The Directory Structure

Document Scope

The *MD/MSC Nastran Installation and Operations Guide* (IOG) provides instructions on how to install, customize, and use MD/MSC Nastran 2011 on UNIX and Windows systems. This document assumes that you have a working knowledge of the applicable operating environments.

Note: This document includes information for systems not yet supported by MD/MSC Nastran. MSC.Software does not guarantee later support for these systems.

Key for Readers

The IOG uses certain stylistic conventions to denote user action, to emphasize particular aspects of a MD Nastran or MSC Nastran run, or to signal other differences within the text.

Italics	Represent user-specified variables. Example: The system RC file is *install_dir*/conf/nast20111rc.
Courier font	Indicates system input or output. Example: `$ install_dir/bin/msc20111`
Quote marks	Distinguish words or phrases such as lowercase keywords, commands, variables, Dbsets or file suffixes from regular text. Example: If "out" is not specified, MD/MSC Nastran saves the output files using the basename of the input data file as a prefix.

Definitions Used in this document

The IOG uses certain definitions to denote installation directories, and product versions of MD Nastran and MSC Nastran.

install_dir	The full path to the directory used in the installation Example: The system RC file is *install_dir*/conf/nast20111rc.
prod_ver	The Product and Version of MD / MSC Nastran Example: `For MD Nastran 2011 prod_ver=mdnast20111` `For MSC Nastran 2011 prod_ver=nast20111`

ver_num	The version number. For MD/MSC Nastran 2011, this is 20111.
util_ver	The version number used for building utilities.

Example: `For MD Nastran 2011 util_ver=md20111`

`For MSC Nastran 2011 util_ver=20111`

Document Structure

The IOG focuses on three areas of MD/MSC Nastran use and also features additional information in the form of appendixes.

Note: Chapters 2 and 3, discussing installation and configuration, are the only two chapters intended for system administrators; all other information in this document is intended for MD/MSC Nastran users.

Installation and Configuration

Chapter 2 discusses the installation of MD/MSC Nastran, while Chapter 3 demonstrates how to configure your system and MD/MSC Nastran.

Basic and Advanced Use

Chapter 4 presents the basic functions of the nastran command and provides some details on how to use system files and databases. Chapter 5 explains how to use the advancedfeatures of the nastran command and includes information on computer resource management.

Utility and Sample Programs

The final two chapters contain information on utility and sample programs, including MSC.ACCESS and the beam server. Chapter 6 focuses on using and customizing utility programs, while Chapter 7 explains how to build and use sample programs.

Supplementary Information

In addition to these seven chapters, the IOG also includes four appendixes. Appendix B contains a glossary of terms. Appendix C reviews keywords and environmental variables. Appendix D details system descriptions, and Appendix E provides a form for product timing data.

Supported Hardware and Operating Systems

Vendor	OS	Hardware	FORTRAN Version	C Version	Default MPI
IBM (64-bit)	AIX 5.3	Power 6	11.1.0.0	9.0.0.0	MPICH
Linux (32-bit)	RedHat AS 4.5 (Kernel 2.6.9)	Intel Pentium	Intel 10.1	Intel 10.1	HP MPI 2.3
Linux (64-bit)	RedHat AS 4.5 (Kernel 2.6.9)	Itanium 2	Intel 10.1	Intel 10.1	HP MPI 2.2.5.1
		Intel EM64T	Intel 10.1	Intel 10.1	HP MPI 2.3
Microsoft (32-bit)	Windows XP SP3	Intel Pentium	Intel 10.1	Microsoft VS 2005 SP1 C/C++	Intel MPI 3.1
Microsoft (64-bit)	Windows Server 2003 x64	Intel EM64T	Intel 10.1	Microsoft VS 2005 SP1 C/C++	MSMPI 2.0
HPUX	HPUX 11.11	PARISC	F90 3.1	B.11.11.16	HP MPI 2.3
	HPUX 11.23	Itanium 2	F90 3.1	A.06-02	HP MPI 2.2
Sun	Solaris 5.10 Patch 120754-08 is required	Intel EM64T	F90 8.4	CC 5.10	HPC 7.1
	Solaris 5.10	SPARC	F90 8.4	CC 5.10	HPC 5.0

Continued...

Vendor	OS	Also Works On
IBM (64-bit)	AIX 5.3	
Linux (32-bit) Linux (64-bit)	RedHat AS 4.5	AMD Opteron, RedHat 5, SuSE 10
Microsoft (32-bit)	Windows XP SP3	Vista 32, Windows 7
Microsoft (64-bit)	Windows Server 2003 x64	Windows XP 64, Vista 64, Windows 7 64

Changes to MD/MSC Nastran 2011

There are no operating system specific changes for MD/MSC Nastran 2011.

The Directory Structure

The installation directory structure provides the following capabilities:

- Multiple versions of MSC products, such as the current and prior versions of MD/MSC Nastran.
- Multiple computer architectures, such as IBM AIX, Sun SPARC Solaris, etc.

Note: This structure does not permit both UNIX and Windows installations to share the same directory tree, e.g., on an NFS or Samba server.

Figure 1-1 shows the structure of the *install_dir* directory, which is selected during installation.

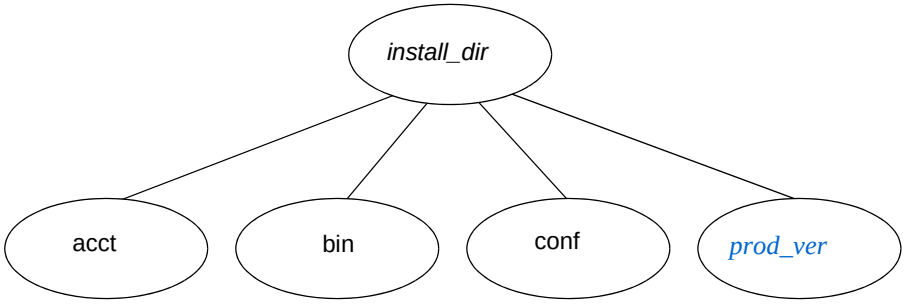


Figure 1-1 Directory for *install_dir*

Multiple Products Support

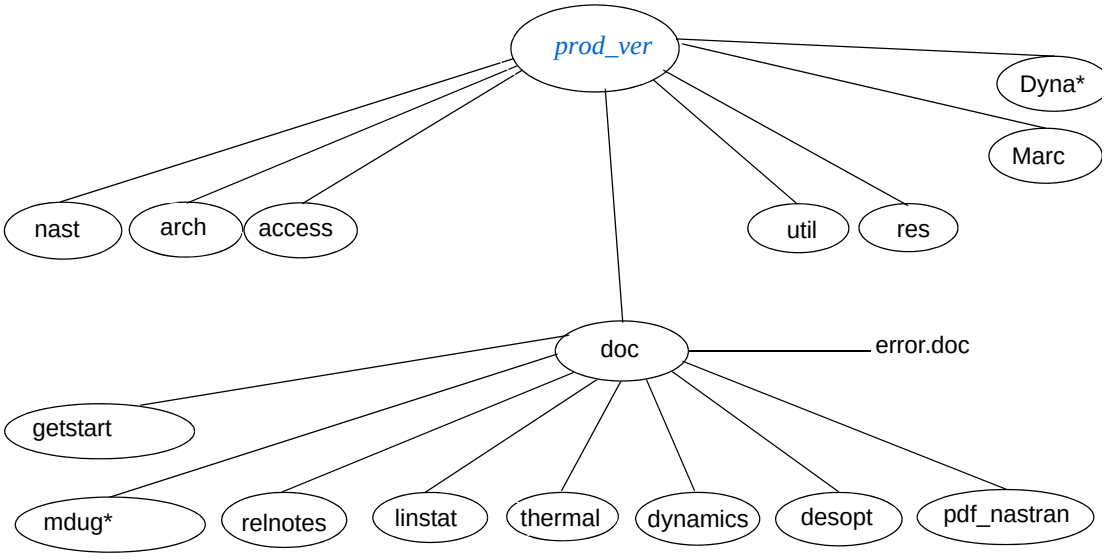
The MD/MSC Nastran installation directory structure supports multiple products by using product-dependent and architecture-independent directories and files. For example, Figure 1-2 shows that the *install_dir*/*prod_ver*/nast directory on UNIX and *install-dir**prod_ver*\nast on Windows contains the product-dependent files for MD/MSC Nastran while the util and access directories contain the product-independent files for the various utilities and MSC.ACCESS.

Multiple Computer Architecture Support

The MD/MSC Nastran installation directory structure also supports multiple computer architectures by using architecture-dependent directories and files. Several directories that hold architecture-dependent files are:

1. install_dir/*prod_ver*/arch on UNIX and install_dir*prod_ver*\arch on Windows
2. install_dir/*prod_ver*/nast/beamlib/lib/arch, install_dir/*prod_ver*/nast/dr3/lib/arch, install_dir/*prod_ver*/nast/spline_server/lib/arch on UNIX and install_dir*prod_ver*\nast\beamlib\lib\arch, install_dir*prod_ver*\nast\dr3\lib\arch, install_dir*prod_ver*\nast\spline_server\lib\arch on Windows.

where *arch* is the name of the architecture, e.g., aix, hpux, linux32 (see Table 3-1).



* MD Nastran only

Figure 1-2 Directory for *prod_ver*

The *install_dir*/*prod_ver*/nast directory on UNIX and *install_dir**prod_ver*\nast directory on Windows contains news, documentation, and sample problems for MD/MSC Nastran. None of these files is architecture dependent.

In MD/MSC Nastran 2008, building beam servers and dresp3 servers used classic make utilities and required source files and make utilities could be found at install_dir/*prod_ver*/bmsrv and install_dir/*prod_ver*/dr3srv. With the replacement of make utilities with the SCons tool in MD/MSC Nastran 2010, the old subdirectories are removed from install_dir/*prod_ver* directory and two new subdirectories are created in the install_dir/*prod_ver*/nast/ directory for building beam server, dresp3 server as shown in Figure 1-3. In addition, another new subdirectory is added for building spine server.

The root directory for beam library server: install_dir/*prod_ver*/nast/beamlib

The root directory for DRESP3 server: install_dir/*prod_ver*/nast/dr3

The root directory for Spline server: install_dir/*prod_ver*/nast/spline_server

The data structures of three external servers are described in Figure 1-5, Figure 1-7 and Figure 1-8. Notice the ~lib/ director for each server directory is architecture dependent.

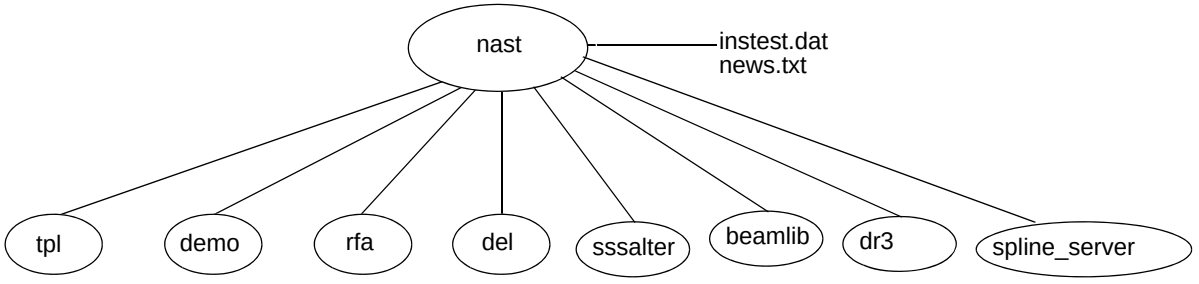


Figure 1-3 Directory for nast

The MSC.ACCESS directory (install_dir/*prod_ver*/access on UNIX and install_dir*prod_ver*\access on Windows) contains source and build files for the MSC.ACCESS sample programs (see Figure 1-4). All architecture-dependent are located within the lib directory.

```
access
  |-- SConopts
  |-- SConscript
  |-- SConstruct
  |-- include
  |      |-- grdblk.cmn
  |      |-- grfist.cmn
  |      |-- ptrblk.prm
  |      |-- sysfil.cmn
  |      |-- vernum.prm
  |
  |-- lib
  |      |-- UNIX Architecture
  |      |      |-- clkeys.o
  |      |      |-- dbct.o
  |      |      |-- libdbio.a
  |      |      |-- libfmsc.o
  |      |      |-- msort.o
  |      |      |-- ngtarg.o
  |      |
  |      |-- Windows Architecture
  |             |-- clkeys.obj
  |             |-- dbct.obj
  |             |-- getargs.obj
  |             |-- dbio.lib
  |             |-- libfmsc.obj
  |             |-- msort.obj
  |             |-- ngtarg.obj
  |
  |-- src
        |-- SConscript
        |-- ddladd
        |      |-- SConscript
```

```
|      |-- ddladd.F
|      |-- ld2001.F
|      |-- ld2004.F
|      |-- ld66.F
|      |-- ld67.F
|      |-- ld675.F
|      |-- ld68.F
|      |-- ld681.F
|      |-- ld69.F
|      |-- ld70.F
|      |-- ld705.F
|      |-- ld706.F
|      |-- ld707.F
|
|-- ddlprt
|      |-- SConscript
|      |-- ddlprt.F
|
|-- ddlqry
|      |-- SConscript
|      |-- ddlqry.F
|
|-- demo1
|      |-- SConscript
|      |-- demo1.F
|
|-- demo2
|      |-- SConscript
|      |-- demo2.F
|
|-- smplr
       |-- SConscript
       |-- smplr.F
```

Figure 1-4 Directory for access

The beam server directory (*install_dir*/*prod_ver*/nast/beamlib on UNIX and *install_dir**prod_ver*\nast\beamlib on Windows) contains three SCons configuration files, include, library and source directories (see Figure 1-5) for the beam server sample programs. All architecture-dependent files are located within the lib directory.

```
---- beamlib
     |
     --- SConopts
     --- SConscript
     --- SConstruct
     --- Include
            |-- include files
     --- lib
          |
          ----- < ARCH 1>
             |
          ----- linux64
            | -- libbmmain.a
```

```
                | -- libbmsrv.a
                | -- cnxx.o
                | -- semd.o
                | -- initgmsrvcmns.o
                | -- main.o
            ----- win64
                | -- bmmain.lib
                | -- bmsrv.lib
                | -- cnxx.obj
                | -- semd.obj
                | -- getlserm.obj
                | -- initgmsrvcmns.obj
                | -- main.obj
      ----- < ARCH i>
--- src
           | -- SConscript
           | -- beamserv
                     | -- SConscript
                     | -- SConscript
                     | -- brtuc.F
                     | -- brtug.F
                     | -- brtui.F
                     | -- brtup.F
                     | -- bsbrc.F
                     | -- bsbrg.F
                     | -- bsbri.F
                     | -- bsbrp.F
                     | -- bsgrq.F
                     | -- bsgrt.F
                     | -- bscon.F
                     | -- bsmsg.F
                     | -- mevbr.F
                     | -- msbrc.F
                     | -- msbrg.F
                     | -- msbri.F
```

Figure 1-5 Directory for bmsrv

The utility programs directory (*install_dir*/*prod_ver*/util on UNIX and *install_dir**prod_ver*\util on Windows) contains source and make files (see Figure 1-6) for the utilities that are also delivered in source form. None of these files is architecture dependent.

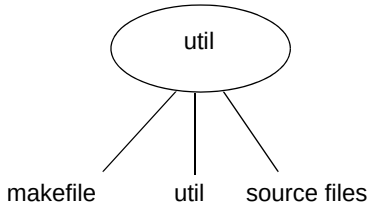


Figure 1-6 Directory for util

The dr3 server directory (`install_dir/`*`prod_ver`*`/nast/dr3` on UNIX and install_dir*prod_ver*\nast\dr3 on Windows) contains three SCons configuration files, include, library and source directories (see Figure 1-7) for the dr3 server sample programs. None of theses files is architecture dependent except the lib directory, i.e., `install_dir/`*`prod_ver`*`/nast/dr3 /lib/arch` on UNIX and `install_dir\`*`prod_ver`*`\nast\dr3\lib\arch` on Windows.

```
---- dr3
     |
     --- SConopts
     --- SConscript
     --- SConstruct
     --- Include
         |-- ftncalls.h
         |-- stdmsc.h
         |-- stdsystm.h
     --- lib
          |
          ----- < ARCH 1>
             |
          ----- linux64
                | -- libdr3srv.a, libdr3main.a
                | -- cnxx.o
                | -- initgmsrvcmns.o
                | -- main.o
                | -- semd.o
          ----- win64
                | -- dr3srv.lib
                | -- cnxx.obj
                | -- semd.obj
                | -- getlserm.obj
                | -- initgmsrvcmns.obj
                | -- main.obj
                | -- semd.obj
          ------ <ARCH i>
     ---- src
            | -- SConscript
            | -- dr3serv
            |         | -- SConscript
            |         | -- r3sgrt.F
            |         | -- r3svald.F
            |         | -- r3svals.F
            |
            | -- additional directories for other sample problems
```

Figure 1-7 Directory for dr3 server

The spline server directory (`install_dir/`*`prod_ver`*`/nast/spline_server` on UNIX and `install_dir\`*`prod_ver`*`\nast\spline_server` on Windows) contains three SCons configuration files, include, library and source directories (see Figure 1-7) for the spline server sample programs. None of theses files is architecture dependent except the lib directory, i.e., `install_dir/`*`prod_ver`*`/nast/spline_server/lib/arch` on UNIX and `install_dir\`*`prod_ver`*`\nast\spline_server\lib\arch` on Windows.

```
---- spline_server
     |
     --- SConopts
     --- SConscript
```

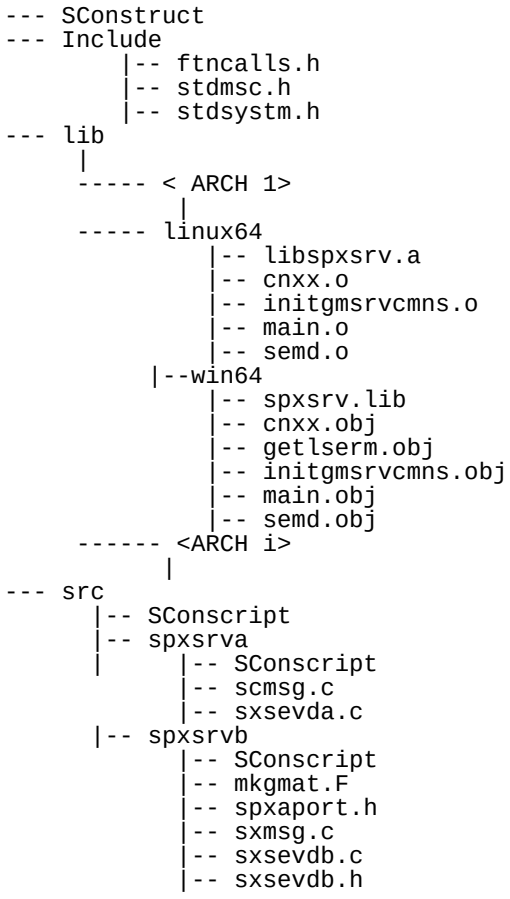


Figure 1-8 Directory for spline server

2 Installing MD/MSC Nastran

Overview

This chapter discusses the MD/MSC Nastran interactive installation script, and includes installation procedures for UNIX and Windows systems.

Installing MD/MSC Nastran on UNIX Systems

This section begins with a brief set of installation notes and general information regarding MD/MSC Nastran and the FLEXlm License Server Version 11.6. This section concludes with instructions on how to repeat a UNIX installation; this is useful when MD/MSC Nastran is being installed on a number of computers.

GUI based (also known as standard or default) Console and silent modes of running installer are currently supported. The GUI based mode requires a X windows environment and appropriately configured DISPLAY variable.

Installation Notes

- If you need a license file (served by FLEXlm), please contact your MSC account manager or MSC account administrator for assistance.

MSC Nastran

- Any run time libraries needed by MD/MSC Nastran are included in this distribution.
- The installation test option will only be performed on the current architecture.
- You must install the “MD/MSC Nastran Utility Program Source” option if you want to customize the accounting procedures for your site.
- If you install MD/MSC Nastran in an installation base directory containing previous versions of MSC Nastran, your current settings for the “authorize”, “sdirectory”, “buffsize”, and “memory” keywords will be used as defaults.
- To install MD/MSC Nastran for Distributed Memory Parallel (DMP) operations, you must select one of the following three installation schemes if you want to use more than one host in a single MSC Nastran job:
  - Install MD/MSC Nastran on afilesystem that is global to every host. This provides the easiest installation and system administration, but may present network load issues when the MSC Nastran is started and the delivery databases are being read.
  - Install MD/MSC Nastran on every host on host-private file systems. This is harder to install and administer, but reduces the network load when MD/MSC Nastran is started.
  - A combination of the above.

Note: In all cases, the mdnastran/nastran command must have the same pathname, or be in the default PATH of every host that will run a DMP job. Recall that your “.profile” and “.login” files are not used for rcp and rsh operations.

- With the exception of HP-UX and Intel Linux systems, you must obtain Message Passing Interface (MPI) software from your hardware vendor and install it prior to running an MD/MSC Nastran DMP job. See "DMP System Prerequisites" on page 145 to determine the MPI software requirements.

FLEXlm License Server Version 11.6

- In general, you should only install the FLEXlm License Server on one computer. Advanced licensing requirements may dictate more than one FLEXlm License Server.
- See "Managing MD/MSC Nastran Licensing" on page 33 for the systems supported by FLEXlm.
- If you have a FLEXlm network or counted node-lock license file, identify the name of the FLEXlm license server using "FLEXlm Server" option in the "Authorization Information" menu.
- If you have a FLEXlm uncounted node-lock license file, identify the pathname of the license.dat file using the "Authorization File" option in the "Authorization Information" menu; the file will be copied to *install_dir*/flexlm/licenses/license.dat.
- If you have a node-lock authorization code file, identify the pathname of the file using the "Authorization File" option in the "Authorization Information" menu; the file will be appended to *install_dir*/conf/authorize.dat.
- If you have a node-lock authorization code, enter the code using the "Authorization Code" option in the "Authorization Information" menu; the code will be appended to *install_dir*/conf/authorize.dat.
- The default port number for the FLEXlm license server is 1700. You must select an alternate port number if this port is already in use.
- If you want the FLEXlm license server to be automatically started at system boot time, you must run the installer as root. The installer will then be able to add an entry to your /etc/inittab file to start lmgrd at system boot time.
- After the installation is completed, see the URL

  file:*install_dir*/flexlm/htmlman/flexframe.html

  for information on configuring and using FLEXlm with MSC products. This file is part of the FLEXlm "HTML Documentation File" option.
- FLEXlm on-line documentation is available from Flexera, see the URL

  http://support.flexerasoftware.com/doc/

Note: The above URL is not an MSC.Software Corporation site, and MSC has no control over the site's content. MSC cannot guarantee the accuracy of the information on this site and will not be liable for any misleading or incorrect information obtained from this site.

Installation Procedures

The installer is self extracting binary that needs to be downloaded and run on your system to install all the necessary components of MD/MSC Nastran. You can download the binaries from:

```
https://mscsoftware.subscribenet.com
```

Installing using Downloaded Files

1. Login as root
2. “cd” to a temporary directory with enough disk space. Create a subdirectory and “cd” into the subdirectory.
3. Download the delivery file from Solution Download Center. If you previously downloaded the file please proceed to the next step.
4. Executing the installation binary may require adding execution privilege:

   For MD Nastran - `chmod +x mdnastran_20xx_<platform>.bin`

   For MSC Nastran - `chmod +x mscnastran_20xx_<platform>.bin`
5. Execute the (md/msc)nastran_20xx_<platform>.bin script and follow the on screen prompts and the instructions in the product installation guide for the remainder of the installation process.

For Example, to execute the installation binary:

IBM:	./mdnastran_20xx_aix.bin or ./mscnastran_20xx_aix.bin
LINUX:	./mdnastran_20xx_linux32.bin or ./mscnastran_20xx_linux32.bin
	/mdnastran_20xx_linux64.bin or ./mscnastran_20xx_linux64.bin

6. Cleanup: After installation is complete – you may remove the subdirectory created in Step 2 above.

Console Installation

The MSC Nastran installation supports console installations, which run in a xterm window with no graphical interface. Installations running in Console mode require the same input as the GUI based installer, but without needing the graphics display. MD/MSC Nastran Console installations are generally used to facilitate installations on machines without graphics displays on your network

Installing using Downloaded Files

1. Login as root
2. “cd” to a temporary directory with enough disk space. Create a subdirectory and “cd” into the subdirectory.
3. Download the delivery file from Solution Download Center. If you previously downloaded the file please proceed to the next step.
4. Executing the installation binary may require adding execution privilege:

   For MD Nastran - `chmod +x mdnastran_20xx_<platform>.bin`

   For MSC Nastran - `chmod +x mscnastran_20xx_<platform>.bin`
5. Execute the (md/msc)nastran_20xx_<platform>.bin script in console mode. Follow the on screen prompts and the instructions in the product installation guide for the remainder of the installation process.

For Example, to execute the installation binary:

IBM:	./mdnastran_20xx_aix.bin --mode console or ./mscnastran_20xx_aix.bin --mode console
LINUX:	./mdnastran_20xx_linux32.bin --mode console or ./mscnastran_20xx_linux32.bin --mode console
	/mdnastran_20xx_linux64.bin --mode console or ./mscnastran_20xx_linux64.bin --mode console

6. Cleanup: After installation is complete – you may remove the subdirectory created in Step 2 above.

Silent Installation

The MSC Nastran installation supports silent installations, which run in the background with no graphical interface or interaction with the desktop. Installations running in Silent mode rely on a pre-configured answer file to do the installation. Silent installations are generally used in a batch manner to facilitate installation on many machines on a network

Creating the Answer file

To create the answer file you need to run the MSC Nastran installation in normal (GUI) mode with a special switch which instructs the installation to record all of your answers in a specified answer file (config.rec). The following example is for Linux. For other platforms use appropriate setup instead of (md/msc)nastran_20111_CL#####_linux32.bin

To build a response file run the installer with the following options:

For MD Nastran - `mdnastran_20111_CL#####_linux32.bin -record`

For MSC Nastran - `mscnastran_20111_CL#####_linux32.bin -record`

An on-screen popup message will show the directory where the answer file (config.rec) will be saved. The *config.rec* response file will be generated at the very end of the installer run.

Running the Silent mode installation

For the silent installation to run, the installer and the *config.rec* file must be in the same directory. The installer will automatically look for *config.rec* and start the installation. To run installation in silent mode use the following command:

For MD Nastran - `mdnastran_20111_CL#####_linux32.bin -mode silent`

For MSC Nastran - `mscnastran_20111_CL#####_linux32.bin -mode silent`

Installing MD/MSC Nastran on Windows Systems

This section discusses the MD/MSC Nastran Windows installation. The installation notes contain information regarding performance and disk space requirements, directory structures and setup information.

Note: To install MD/MSC Nastran on Windows, it is a required that you be a member of the Administrator group.

Installation Notes

- You must have one of the following systems to install and run MSC Nastran:
  - Intel 486DX or later processor (or compatible) running Windows XP, XP-64, Vista, Vista 64, Windows 7 and Windows 7-64, with at least 1 Gigabyte RAM, and 4 Gigabytes available disk space to install the system.

Note: The disk space listed above is for installation of the system only. Additional disk space is required to run MD/MSC Nastran,dependent on the problem run. MD/MSC Nastran has been fully tested using Windows XP, Vista and Windows 7.

- To build the Utility Programs using the supplied source, you must also have a suitable set of compilers. Refer to “Using the Utility Programs” on page 193 and “System Descriptions” on page 117 for details.
- The default directory (called the *install_dir*) for MD/MSC Nastran products is “c:\msc.software”. This can be changed to a new or existing directory of your choice.
- The default for the MD/MSC Nastran scratch file directory is “c:\scratch”. Having this directory on a separate drive from the system swap file can help performance.
- The default program group (folder) is named MSC.Software; you can have the icons installed in a different group if you choose. On Windows XP or later systems, this group is created as a common group if the user doing the installation has administrator authority. Otherwise, this group is created as a private group.
- To run MD/MSC Nastran from any directory, you must add the path *install_dir*\bin to your PATH. You can change your path in Windows by selecting the “control panel”, and then “system”. Then, click on the “Path” variable and add the following to text in the “Value” box.

```
install_dir\bin
```

Select “set”, then “OK”, and your path will be updated.

Installation Procedure

If you are downloading from the Solutions Download Center, download the self-extracting archive (.exe). You can download the binaries from:

`https://mscsoftware.subscribenet.com`

Then follow these steps:

1. Download the self-extracting installer (.exe) file to a subdirectory with enough disk space where the file can be executed.
2. Double clicking on the Product Installer will start the installation process. For the remainder of the installation process follow the instructions in the product installation guide.
3. Cleanup: You may remove the installer file from the subdirectory used in step 1 after the installation is complete. If you remove the installer, you will have to download or copy the installer back onto your computer to repair or modify your MD/MSC Nastran installation. Uninstalling MD/MSC Nastran can be done using either the installer, or from Add/Remove Programs in the Control Panel.

3 Configuring MD/MSC Nastran

- Overview
- System-Specific Tuning
- Using the “md20111” or “msc20111” Command
- Using the “mscinfo” Command (UNIX)
- Managing MD/MSC Nastran Licensing
- Activating MD/MSC Nastran Accounting
- Determining System Limits
- Managing Remote and Distributed Hosts
- Limiting “memory” Requests
- Customizing the News File
- Defining a Computer Model Name and CONFIG Number
- Generating a Timing Block for a New Computer
- Customizing Queue Commands (UNIX)
- Customizing the Templates
- Using Regular Expressions

Overview

This chapter is intended for system administrators or anyone who needs to manage an MD/MSC Nastran installation. It starts with information on tuning your system for better performance. The chapter then concentrates on configuring MSC Nastran for your system. Licensing must be configured before MSC Nastran will run. Other items that may require configuration include system resource limits, the command initialization file, runtime configuration files, timing blocks, and queue commands.

Two documentation conventions are used throughout the remainder of this document (typically in directory specifications). The string "*install_dir*" indicates the directory where MD/MSC Nastran was installed; on UNIX, this might be "/msc", and on Windows "c:\msc". The string "*arch*" indicates the MSC.Software architecture name for your computer; they are generally based on the operating system name on UNIX, while on Windows, they describe the processor. The architectures are as follows:

Table 3-1 Architecture Names

Computer	arch
HP-UX	hpux
Itanium HP-UX	hpuxipf
IBM pSeries - AIX	aix
Intel Linux	linux32
Intel Windows	win32
Intel Windows x86-64	win64
Intel x86-64	linux64
Itanium Linux	linuxipf
Sun SPARC - Solaris	solaris
Intel x86-64 - Solaris	solaris8664

Throughout this document, while file pathnames and sample commands for Windows systems will use the standard backslash "\" directory separator character, MD/MSC Nastran also accepts pathnames using the slash "/" character as a replacement.

Note: On Windows operating systems, the command shell, CMD.EXE does not accept slash "/" characters as the first character in a pathname.

System-Specific Tuning

This section presents some information on system-specific tuning that can help MD/MSC Nastran performance. Additional tuning information may be available in the "Read Me" file

```
install-dir/ver_num/README.txt
```

on UNIX, or

```
install-dir\ver_num\readme.txt
```

on Windows.

All Systems

All systems benefit from ensuring the I/O system is configured for the highest possible bandwidth. Setting up disk striping, or RAID-0, for use with MD/MSC Nastran databases is one of the most effective I/O performance improvements that can be made for MD/MSC Nastran.

AIX

AIX provides a utility, vmtune, that can be used by root to display and adjust AIX's memory and paging behavior. The current values are obtained by running vmtune without options. For example,

```
/usr/samples/kernel/vmtune
```

The parameters of interest to MD/MSC Nastran tuning are

Parameter	Command Option	Default Value	Comments
minperm	-p	20	Preferred physical memory reserved for persistent storage buffers (%).
maxperm	-P	80	
minpgahead	-r	2	File read-ahead (number of 4KB pages)
maxpgahead	-R	8	
minfree	-f	120	Free list size (number of 4KB pages)
maxfree	-F	128	
maxrandwrt	-W	0	Random writes of persistent storage buffers.

By default, AIX allocates 20% to 80% of physical memory for persistent storage buffers. With a memory-intensive, high-I/O bandwidth program like MD/MSC Nastran, this is too large, resulting in too few pages allocated for working sets. More appropriate values for a system primarily running MD/MSC Nastran are set with the command

```
/usr/samples/kernel/vmtune -p5 -P10
```

This sets “minperm” and “maxperm” to 5% and 10% of physical memory, respectively.

The minimum and maximum read ahead values, “minpgahead” and “maxpgahead”, are measured in 4KB pages. Proper settings for MD/MSC Nastran are a function of BUFFSIZE and physical memory size. The “minfree” and “maxfree” values are the minimum and maximum number of free pages. Better settings for “average” MD/MSC Nastran workloads using the default BUFFSIZE are

```
/usr/samples/kernel/vmtune -p5 -P10 -r8 -R32 -f120 -F280
```

Heavy MD/MSC Nastran workloads using larger BUFFSIZE values (e.g., buffsize=32767 or larger) on a large memory system (e.g., 1GB physical memory) will benefit from a larger maximum read-ahead and free-page list, for example

```
/usr/samples/kernel/vmtune -p5 -P10 -r8 -R128 -f120 -F560
```

Users with multi-processor (SMP) system can benefit from writing persistent storage pages asynchronously by setting “maxrandwrt”. This can be added to any of the above examples,

```
/usr/samples/kernel/vmtune -p5 -P10 -W128
/usr/samples/kernel/vmtune -p5 -P10 -r8 -R32 -f120 -F280 -W128
/usr/samples/kernel/vmtune -p5 -P10 -r8 -R128 -f120 -F560 -W128
```

The vmtune command can be run at any time to change parameters, even several times during the day to suit demands of changing workloads.

The changes made by vmtune are not persistent across system restarts, you may want to set these values via an /etc/inittab entry. A sample entry is:

```
vmtune:23456:once:/usr/samples/kernel/vmtune options > /dev/console 2>&1
```

where *options* is the list of options you want to set.

HP-UX

HP-UX 11 and PA-RISC 2.0

The maximum allocatable memory is controlled by the *maxdsiz* kernel parameters. It must be large enough to accommodate the memory requests of each MD/MSC Nastran job. If this value is not large enough, MD/MSC Nastran will not be able to allocate open core memory and will terminate with the following message in the LOG file:

```
memory allocation error: unable to allocate mem words
```

where *mem* is the memory allocation request. The limit can be increased using the sam(1M) utility. The value is found in “Configurable Parameters” under “Kernel Parameters.”

Intel

MD/MSC Nastran makes very high memory bandwidth demands, and particular attention should be paid to the memory subsystem. A faster memory bus is more important to MD/MSC Nastran performance than a faster processor with a slower memory bus.

Windows Server 2003

By default, Windows Server 2003 is configured to cache files as much as possible. This can cause an MD/MSC Nastran job to appear to “hang” a system running on Windows Server 2003.

To correct this problem, open the “Network Connections” Control Panel and right-click on “Local Area Connection”. Select “Properties” from the menu. Click on “File and Printer Sharing for Microsoft Networks” and click on the “Properties” button. Make sure the “Maximize Throughput for File Sharing” radio button is not selected (this is the default). Instead select either “Balance” or “Maximize Throughput for Network Applications.” Changing this option will require you to restart Windows Server 2003.

Windows Vista and Windows 7

MSC Software has found performance issues on Windows with models greater than 100 thousand DOF. These issues may be addressed using MAPIO options. Please see “Using File Mapping” in Chapter 5 of the *MD/MSC Nastran 2011 Installation and Operations Guide* for more information.

Systems Running on Intel® Processors with Hyper Threading

The Intel® Pentium® 4 processor introduces a feature called Hyper Threading, where a single physical processor can support more than one logical instruction stream, simulating multiple logical processors on a single physical processor. For many applications and environments, this capability may offer performance improvements over non-Hyper Threading processors. If multiple MD/MSC Nastran

analysis jobs are running concurrently, however, there may be performance degradations. If an installation determines this to be the case, hyper threading should be disabled. This can be done on a permanent basis through BIOS operations or, for Windows platforms, hyper threading may be disabled on a process by process basis using the “hyperthreads” keyword.

Using the “md20111” or “msc20111” Command

The “md20111” or “msc20111” command is shown as a prefix for most of the programs and commands described in this document, for example:

```
md20111 nastran ...    or
msc20111 nastran ...
```

Note: For simplicity, the symbol *prod_ver* will be used for msc20111 and md20111.

By ensuring the *prod_ver* command is in each user’s PATH, all the commands and utilities in this release are uniformly available. The *prod_ver* command also permits version-dependent utilities, such as TRANS, to be easily accessed.

The `md20111 or msc20111` command is located in

install-dir`/bin/`*prod_ver*

on UNIX, and

install-dir`\bin\`*prod_ver*

on Windows.

Using the “mscinfo” Command (UNIX)

The “mscinfo” command is available on UNIX systems to display various hardware and software configuration info. This utility is run with the command

prod_ver `mscinfo`

mscinfo will display hardware and software configuration report, including

- Hostname.
- MSCID.
- Computer Manufacturer.
- OS Name, version, and patches.
- Computer Model.
- Processor type, number, and speed.
- Window manager, Motif version, and graphics board.
- Physical and virtual memory sizes.
- Temporary directory sizes.
- Local disk sizes.

Due to the machine-dependent nature of the information, the report will vary between computer architectures.

Note: Root access is required to generate the complete report on some systems. If you are not root when mscinfo is run, those items requiring root access will be noted in the report.

Managing MD/MSC Nastran Licensing

Note: FLEXlm documentation can be found at the following URL:

`http://support.flexerasoftware.com/doc/`

This is not an MSC.Software Corporation site and MSC has no control over the site's content. MSC cannot guarantee the accuracy of the information on this site and will not be liable for any misleading or incorrect information obtained from this site.

In order to run, MD/MSC Nastran requires one of the following licensing methods:

- The name of a network license server (if your computer supports FLEXlm).
- The pathname of a file containing FLEXlm licenses (if your computer supports FLEXlm).
- The pathname of a file containing one or more node-locked authorization codes.

When selecting the licensing method, MD/MSC Nastran will use the first non-null value that it finds in the following hierarchy:

1. The value of the "authorize" keyword (p. 48) on the command line.
2. The value of the MSC_LICENSE_FILE environment variable.
3. The value of the "authorize" keyword in an RC file.
4. The *install_dir*/flexlm/licenses/license.dat file, if it exists.
5. The *install_dir*/conf/authorize.dat file, if it exists.
6. The value of the LM_LICENSE_FILE environment variable.

If a non-null value cannot be found, the following User Fatal Message (UFM) is displayed by the nastran command:

```
*** USER FATAL MESSAGE (nastran.validate_authorize)
    authorize=""     (program default)

    The keyword shall not be blank or null.
```

UFM 3060

If a non-null value is found for the "authorize" keyword, your MD/MSC Nastran job will be started. If the licensing information is later determined to be invalid or insufficient for the analysis, a UFM 3060 error message is printed in the .f06 file:

```
*** USER FATAL MESSAGE 3060, SUBROUTINE MODEL - OPTION opt NOT IN APPROVED LIST.
     SYSTEM DATE (MM/DD/YY): mm/dd/yy
     SYSTEM MSCID: d (DECIMAL) h (HEXADECIMAL) SYSTEM MODEL NUMBER: m, SYSTEM OS
CODE: c
```

where *opt* is a keyword indicating the specific capability requested. The initial authorization check is for option “NAST”, subsequent checks request specific features as required by your job. Other information pertinent to this failure will be found in the LOG file.

FLEXlm Licensing

FLEXlm is available on the following MD/MSC Nastran platforms:

- HP-UX
- IBM pSeries - AIX
- Intel - Linux IA32, Linux IPF, HP-UXIPF
- Intel - Linux x86-64
- Intel - Windows
- Sun SPARC - Solaris

Clients with network-licensed MSC software installations are encouraged to employ the most recent versions of the FLEXlm and MSC licensing daemons (lmgrd/lmutil/msc).

The binaries maintain downward compatibility, and regular upgrades are recommended, regardless of whether the current software application level required the upgrade. Updates are available at:

http://www.mscsoftware.com/support/software_updates/licserver.cfm

or from the MSC external ftp site:

ftp://ftp.mscsoftware.com/msc-products/system_util/flexlm/

A license server on either UNIX or Windows can serve licenses for any number of UNIX and/or Windows systems.

FLEXlm offers two types of node-locked licensing: counted and uncounted licenses. An uncounted license does not require a license server, is the easiest to install and maintain, and offers unlimited concurrent MD/MSC Nastran jobs. A counted license requires a license server on the MD/MSC Nastran platform and limits the number of concurrent MD/MSC Nastran jobs. In either case you will need to determine the MSCID of the system running MD/MSC Nastran.

A FLEXlm concurrent license always requires a license server that can communicate with every computer that will run MD/MSC Nastran.

Determining the MSCID of the FLEXlm License Server

Note: Windows: The FLEXlm License Server must be accessed via TCP/IP.

If you are using a counted node-locked license or a concurrent license, the MSCID of the computer that will run the FLEXlm License Server is required. The MSCID is obtained with the command:

prod_ver `mscid`

The command will output a line similar to

```
Please wait...
MSC ID: n
```

where *n* is a hexadecimal number.

Installing a FLEXlm “license.dat” File

A FLEXlm “license.dat” file is a text file that can be manipulated as any text file. Its default location is

install_dir`/flexlm/licenses/license.dat`

on UNIX, and

install_dir`\flexlm\licenses\license.dat`

on Windows.

Note: The only lines that can be altered are the SERVER, DAEMON, and comment lines; FEATURE lines, in particular, cannot be altered. On the SERVER line, the “HOSTID” field cannot be altered.

A FLEXlm license can be installed during the initial installation or any time thereafter.

UNIX

If the old license used a license server, i.e., there was a SERVER and/or DAEMON line in the file, you will need to stop and restart the FLEXlm License Server. To stop the server, enter the command

install_dir`/bin/flexlm lmdown`

It may take a few minutes for the shutdown to complete.

The new “license.dat” file is installed with the command:

```
prod_ver flex license.dat
```

where *license.dat* is the new license file. This file may be an E-mail message that has been saved to disk but still contains the E-mail headers. If an existing license file is found, it will be versioned. In addition, alternate port number and options information from the SERVER and DAEMON lines will be automatically copied to the new file.

If the new license is a counted node-lock or concurrent license, restart the FLEXlm License Server with the command

```
install_dir/bin/flexlm lmgrd
```

where the default log files is

```
install_dir/flexlm/lmgrd.log
```

An alternate log file can be specified with the “-l” option, e.g.,

```
install_dir/bin/flexlm lmgrd -l log_file
```

Windows

If the file was sent as an E-mail message, you will need to extract the license file portion of the message text. The actual license text is contained between the “Start of License File” and “End of License File” sentinel lines as shown:

```
.
.
.
------- Start of License File -------
SERVER hostname hostid port
DAEMON MSC pathname
FEATURE ...
.
.
.
------- End Of License File ---
.
.
.
```

All lines from the beginning of the file to the “Start” sentinel (inclusive), and all lines from the “End” sentinel to the end of the file (inclusive) must be deleted. You may also need to delete a “forwarding” prefix from the start of each line; this is typically the two character sequence “> ”.

Before overwriting it, you should examine the previous file to determine if any customizations were present on the SERVER or DAEMON lines. Copy these customizations to the new license file using any text editor.

Note: Be sure you update the *hostname*, *port*, and *pathname* lines of the SERVER and DAEMON lines to correctly reflect your installation. You cannot alter the *hostid* on the SERVER line.

Uncounted Node-locked License

Copy the new file to

```
install_dir\flexlm\licenses\license.dat
```

Counted Node-locked or Concurrent License

Open the Control Panel applet “FLEXlm License Manager”. On the “Control” tab, select the “Stop” button to stop the FLEXlm License Server. Select the “Setup” tab to display the path name of the current license file. Copy the new file to the location shown; by default, the location is

```
install_dir\flexlm\licenses\license.dat
```

Return to the “Control” tab and select the “Start” button to restart the FLEXlm License Server with the new file.

Automatically Starting a FLEXlm Server

UNIX

The FLEXlm server can be automatically started at system boot time by entering one of the following lines in the “/etc/inittab” file.

Platform	User	Entry
AIX	non-root	`msclmgrd:23456:once:su` *`user`* `-c '(umask 022;` *`install-dir`*`/bin/flexlm lmgrd)'`
	root	`msclmgrd:23456:once:`*`install-dir`*`/bin/flexlm lmgrd`
Solaris	non-root	`ml:23456:once:su` *`user`* `-c '(umask 022;` *`install-dir`*`/bin/flexlm lmgrd)'`
	root	`ml:23456:once:`*`install-dir`*`/bin/flexlm lmgrd`
Others	non-root	`mscl:23456:once:su` *`user`* `-c '(umask 022;` *`install-dir`*`/bin/flexlm lmgrd)'`
	root	`mscl:23456:once:`*`install-dir`*`/bin/flexlm lmgrd`

Notes:

1. The entries in the table above should be coded in /etc/inittab as one line.
2. MSC.Software and Flexera strongly recommend that lmgrd is not run as root. Root privilege is unnecessary and could compromise system security.

Using FLEXlm Licensing

The following table describes various keywords that control MD/MSC Nastran's licensing subsystem.

Table 3-2 MD/MSC Nastran Keywords Related to Licensing

Keyword	Comments
authorize	The license specification.
authqueue	The number of minutes to wait for licenses if the license server cannot immediately honor a license request, with 0 (zero) indicating no licensing queuing. If not specified, 20 minutes is the MD/MSC Nastran default.
authinfo	The level of licensing diagnostic messages written to the MD/MSC Nastran log file, in the range of 0-9 with 0 indicating minimal diagnostics, and 9 indicating extensive diagnostic output.
a.port	The default port number for FLEXlm licensing. The default value is "1700". If a.port is set to an integer value greater than 0, FLEXlm license specifications in the form "@node" are converted to "port@node", where port is the value of the keyword a.port. If a.port is set tothe value "no" or "0", FLEXlm license specifications in the form "@node" are passed to the licensing subsystem without change. This allows use of the FLEXlm "default port scanning" feature.

The “authorize” keyword is used to indicate the licensing source. The value can be any of the following:

Value	Comments
@node	The specified node is the license server using the default port number 1700. See the description of the a.out keyword above for details.
port@node	The specified node is running a license server listening on the specified port.
filename	The specified file is used for authorization. This file may contain FLEXlm licensing information for either a node-locked or network license.
value,*value*,*value*	A quorum of three FLEXlm license server nodes.
value:*value*:...	UNIX: A list of FLEXlm licensing files, license server nodes, or quorums.
value;*value*;...	Windows: A list of FLEXlm licensing files, license server nodes, or quorums.

Examples are:

```
auth=install_dir/flexlm/licenses/license.dat
```

on a UNIX system, and

```
auth=install_dir\flexlm\licenses\license.dat
```

on a Windows system, the specified FLEXlm license file will be used. If this license file contains one or more “SERVER” lines, the file is only used to identify the server(s). If not, the file will be treated as a FLEXlm node-lock license file.

```
auth=@troll
```

Node “troll” is a FLEXlm license server using the default port number. If a port is set to "no", node "troll" is a FLEXlm license server using a port number in the FLEXlm default range of 27000-27009.

```
auth=1700@troll
```

Node “troll” is a FLEXlm license server using the specified port number.

For UNIX:

```
auth=1700@banana1:1700@banana2
```

For Windows:

```
auth=1700@banana1;1700@banana2
```

Two alternate network license servers, “banana1" and “banana2", will be used to provide network licensing services.

Manually Starting and Stopping the FLEXlm License Server

UNIX

The FLEXlm License Server is started with the command

```
install_dir/bin/flexlm lmgrd
```

where the default license and log files are

```
install_dir/flexlm/licenses/license.dat
install_dir/flexlm/lmgrd.log
```

An alternate license file is specified with the “-c” option, e.g.,

```
install_dir/bin/flexlm lmgrd -c license-file
```

An alternate log file is specified with the “-l” option, e.g.,

```
install_dir/bin/flexlm lmgrd -l log-file
```

Use the following command to shut down the license server.

```
install_dir/bin/flexlm lmdown
```

or

```
install_dir/bin/flexlm lmdown -c license-file
```

It may take a few minutes for the shut down to complete.

Note: Do not shut down the FLEXlm license server using the kill(1) command.

Windows

To start the FLEXlm License Server, open the Control Panel applet “FLEXlm License Manager”. On the “Control” tab, select the “Start” button to start the FLEXlm License Server.

To stop the FLEXlm License Server, open the Control Panel applet “FLEXlm License Manager”. On the “Control” tab and select the “Stop” button to stop the FLEXlm License Server with the new file.

Node-locked Authorization Codes

The node-locked licensing system is available on all systems running MD/MSC Nastran; it remains unchanged from earlier versions.

Using Node-locked Authorization Codes

A node-locked authorization code is entered into a text file, usually *install-dir*/conf/authorize.dat on UNIX and *install-dir*\conf\authoriz.dat on Windows. Any number of authorization codes for any number of computers can be present in one file. The authorize keyword isused to specify the file's pathname, e.g.,

```
authorize=install-dir/conf/authorize.dat
```

on UNIX, or

```
authorize=install-dir\conf\authoriz.dat
```

on Windows.

Installing a Node-locked Authorization Code

An MSCID is required for the computer that will run MD/MSC Nastran. The MSCID is printed in the UFM 3060 message in the .f06 file when a run fails due to licensing problems. See "UFM 3060" on page 33.

The MSCID can also be obtained with the command

```
prod_ver mscid
```

This command will output a line similar to

```
Please wait...
MSC ID: n
```

where *n* is a hexadecimal number.

A node-locked authorization code is installed by entering the code into the authorization file using any text editor. Any number of authorization codes for any number of computers can be present in one file. The standard node-locked authorization code file is

```
install_dir/conf/authorize.dat
```

on UNIX and

```
install_dir\conf\authoriz.dat
```

on Windows.

Activating MD/MSC Nastran Accounting

MD/MSC Nastran provides a simple accounting package that collects usage information from each job and saves a summary of the job in the accounting directory, i.e., *install_dir*/acct on UNIX systems and *install_dir*\acct on Windows systems.

Note: Users must be able to read, write, and create files in the accounting directory.

To activate MD/MSC Nastran accounting, set the keyword "acct=yes" in any RC file or on the command line. Placing the keyword in the System RC file will enable accounting for all jobs. The location of the System RC files is described in "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A.

Instructions for generating usage summaries from the MSC accounting data are provided in the section titled "Using the Basic Keywords" on page 83.

Enabling Account ID and Accounting Data

The "acid" and "acdata" keywords are supported by the nastran command to provide hooks for a site to track additional accounting data. The "acid" keyword may be used to specify an account ID. The "acdata" keyword may be used to specify any additional accounting data needed by a site.

These keywords are activated as follows:

1. Activate accounting by putting the line "acct=yes" (page 46) in the command initialization file or a system RC file.
2. The account validation keyword, "acvalid" (page 46), can be used to validate the "acid" keyword. If "acvalid" is not defined in the command initialization file, MD/MSC Nastran will not require the "acid" keyword; if the "acvalid" keyword is defined, MD/MSC Nastran will require a valid "acid". See "Enabling Account ID Validation" on page 43 for a complete description of this capability.

Enabling Account ID Validation

Account ID validation is enabled by defining anon-null value for the "acvalid" keyword in the command initialization file. "Specifying Parameters" on page 2 in Appendix A contains additional information. There are two types of account ID validation available. The nastran command's built-in regular expression facility can be used if the account ID can be described by a regular expression (see "Using Regular Expressions" on page 73). Otherwise an external program can be used.

Validating an Account ID with a Regular Expression

To use a regular expression, the first character of the "acvalid" value must be "f" or "w" and the remainder of the valueis the regular expression.The "f" indicates that an "acid" value that is not matched

by the regular expression is a fatal error, while “w” indicates that an unmatched value is only a warning. Note, the regular expression is always constrained to match the entire account ID string.

For the following examples, assume “acvalid=f” was set in the initialization file and an account ID is not defined in any RC file.

```
prod_ver nastran example
```

This job will fail with a message indicating an account ID is required.

```
prod_ver nastran example acid=123
```

This job will be permitted to start. Since a regular expression was not defined, any non-null account ID is valid.

For the following examples, assume “acvalid=w” is set in the initialization file and an account ID is not defined in any RC file.

```
prod_ver nastran example
```

A warning message will be issued indicating an account ID is required, but the job will be permitted to start.

```
prod_ver nastran example acid=123
```

This job will be permitted to start. Since a regular expression was not defined, **any** non-null account ID is valid.

For the following examples, assume the following line is set in the command initialization file and an account ID is not defined in any RC file:

```
acvalid=f[A-Za-z][0-9]\{6\}
```

This regular expression requires the account ID to be composed of a single upper- or lower-case letter followed by six digits

```
prod_ver nastran example
```

This job will fail with a message indicating an account ID is required.

```
prod_ver nastran example acid=123
```

This job will fail with a message indicating the account ID is not valid.

```
prod_ver nastran example acid=Z123456
```

This job will be permitted to start.

Validating an Account ID with an External Program

To use an external program, the first character of the "acvalid" value must be a grave, "`" and the remainder of the value is a simple command to execute the external program. The command may include keyword references but must not include pipes or conditional execution tokens.

The program must examine the account ID and write zero or more lines to its standard output indicating the result of the examination. A null output indicates a valid account ID. The non-null output is composed of two optional parts. The first part is indicated by an equal sign "=" as the first non-blank character. If this is found, the next blank delimited token is taken as a replacement account ID. With this, the external program can replace the user's account ID with any other account ID. The second part is indicated by an "f" or "w" character. If either of these two characters are present, the remainder of the line and all remaining lines of output are taken as the body of an error message to be issued to the user. If no message text is provided, but the "f" or "w" are present, a generic message is written.

Before we discuss the external program, let's first consider some examples of the external program's output.

```
=Z123456
```

This job will be permitted to start after the account ID is silently replaced with "Z123456".

```
f
The account ID is not valid.
See your Program Manager for a valid account ID.
```

This job will fail with the above message.

```
= Z123456
w
The account ID is not valid, it has been replaced by the standard
overhead charge.  See your Program Manager for a valid account ID.
```

This job will be permitted to start after the account ID is replaced with “Z123456" and the above warning message is issued.

Sample Account Validation Programs

The account validation program can be written in any language that can process the command line. Two samples have been provided below. The Korn shell version is primarily intended for UNIX systems; the Perl version can be used on any UNIX or Windows systems that have Perl installed.

Note: You must have Perl installed on your system to use the Perl sample account validation program. Perl is available from numerous sources, including the URL

http://www.perl.com

This is not an MSC.Software Corporation site and MSC has no control over the site’s content. MSC cannot guarantee the accuracy of the information on this site and will not be liable for any misleading or incorrect information obtained from this site.

The Korn shell version is:

```
#!/bin/ksh
#
# THIS PROGRAM IS CONFIDENTIAL AND A TRADE SECRET OF MSC.SOFTWARE
# CORPORATION.  THE RECEIPT OR POSSESSION OF THIS PROGRAM DOES
# NOT CONVEY ANY RIGHTS TO REPRODUCE OR DISCLOSE ITS CONTENTS,
# SELL, LEASE, OR OTHERWISE TRANSFER IT TO ANY THIRD PARTY,
# IN WHOLE OR IN PART, WITHOUT THE SPECIFIC WRITTEN CONSENT OF
# MSC.SOFTWARE CORPORATION.
#
# Sample site-defined account validation program.
#
# usage: ksh checkac.ksh _account_file_ _account_id_
#
# If the file containing the list of valid account ID's is not specified
# or cannot be opened, report a fatal error.
#
if [[ $#argv -lt 1 || $#argv > 2 ]] ; then
print "f"
print "Illegal usage.  See System Administrator."
elif [[ ! -r $1 || ! -s $1 ]] ; then
print "f"
print "Account data file \"$1\" cannot be opened."
print "See System Administrator."
#
# If no argument is specified, issue a warning and use the default
# account ID of Z123456
#
elif [[ -z $2 ]] ; then
print "= Z123456"
print "w"
print "An account ID has not been specified."
print "The standard overhead charge has been assumed."
print "See your Program Manager for a valid account ID."
else
#
#   The file is organized with one account ID per line.
#   Make sure the account ID is in the file.
#
acid=$(fgrep -ix $2 $1 2>/dev/null)
[[ -n $acid ]] && {
print "$acid"
exit
}
#
# If we get here, the account is invalid.
#
print "f"
print "The account ID is not valid."
print "See your Program Manager for a valid account ID."
fi
```

On UNIX, this program is activated with the following

```
acvalid=‘install-dir/bin/checkac install-dir/acct/account.dat %acid%‘
```

The Perl version is:

```
#!/usr/local/bin/perl
#
# THIS PROGRAM IS CONFIDENTIAL AND A TRADE SECRET OF MSC.SOFTWARE
# CORPORATION.  THE RECEIPT OR POSSESSION OF THIS PROGRAM DOES
# NOT CONVEY ANY RIGHTS TO REPRODUCE OR DISCLOSE ITS CONTENTS,
# SELL, LEASE, OR OTHERWISE TRANSFER IT TO ANY THIRD PARTY,
# IN WHOLE OR IN PART, WITHOUT THE SPECIFIC WRITTEN CONSENT OF
# MSC.SOFTWARE CORPORATION.
#
# Sample site-defined account validation program.
#
# usage: perl checkac.pl _account_file_ _account_id_
#
# If the file containing the list of valid account ID's is not specified
# or cannot be opened, report a fatal error.
#
if( $#ARGV < 0 or $#ARGV > 1 ) {
print "f\n";
print "Illegal usage.  See System Administrator.\n";
} elsif( ! open AC, $ARGV[0] ) {
print "f\n";
print "Account data file \"$ARGV[0]\" cannot be opened.\n";
print "See System Administrator.\n";
#
# If no argument is specified, issue a warning and use the default
# account ID of Z123456
#
} elsif( $#ARGV < 1 ) {
print "= Z123456\n";
print "w\n";
print "An account ID has not been specified.\n";
print "The standard overhead charge has been assumed.\n";
print "See your Program Manager for a valid account ID.\n";
} else {
#
#   The file is organized with one account ID per line.
#   Make sure the account ID is in the file.
#
$acid = lc "$ARGV[1]";
while( $line = <AC> ) {
chomp $line;
if( $acid eq lc "$line" ) {
print "= $line\n";
exit
}
}
#
#   If we get here, the account is invalid.
#
print "f\n";
print "The account ID is not valid.\n";
print "See your Program Manager for a valid account ID.\n";
}
```

On Windows, this program is activated with the following

```
acvalid='perl install-dir\bin\checkac.pl install-dir\acct\account.dat %acid%'
```

Securing the Accounting ID Settings and Files

To secure the account ID settings, you must set the account ID keywords in a write-protected file and lock the values to prevent changes. For example, the following keywords can be set in the command initialization or system RC file

```
acct=yes
lock=acct
lock=accmd
acvalid=some-value-appropriate-to-your-site
lock=acvalid
```

UNIX

UNIX sites can also secure the accounting files to prevent unauthorized modification or inspection of the accounting data. This can be done by making the accounting logging program, *install_dir*/*prod_ver*/*arch*/acct, a “set uid” program.

Note: Before making *install_dir*/*prod_ver*/*arch*/acct a set-uid program, MSC.Software recommends that you carefully review the *install_dir*/*prod_ver*/util/mscact.c source code, ensure that you have built *install_dir*/*prod_ver*/*arch*/acct in a controlled and repeatable manner, and have performed adequate testing to ensure correct functionality.

The following commands may be executed (as root):

```
chown secure-user install_dir/prod_ver/arch/acct
chgrp secure-group install_dir/prod_ver/arch/acct
chmod ug+s install_dir/prod_ver/*/acct
chmod o= install_dir/acct
chmod o= install_dir/acct/*
```

where *secure-user* is the userid that will own the files and *secure-group* is the groupid of the group that will own the files.

Determining System Limits

System resources can have a profound impact on the type and size of analyses that can be performed with MD/MSC Nastran. Resources that are too low can result in excessive time to complete a job or even cause a fatal error. The current resource limits on the local computer are obtained with the following command:

```
prod_ver nastran limits
```

On UNIX, the resource limits on a remote computer that has MD/MSC Nastran installed are obtained with:

```
prod_ver nastran limits node=remote_computer
```

Note:

1. The limits can vary among users and computers. If a queuing system such as NQS or NQE is installed, different limits may also be found on the various queues.
2. The output from the limits special function may specify "unlimited" on UNIX systems. In this context, "unlimited" means there is no limit on your use of a resource that is less than those architectural limits imposed by the processor or the operating system.
   - For example, on an IBM RISC System/pSeries, an unlimited virtual memory address space is limited by the smaller of the 2 gigabyte address space or the swap space configured in the operating system.
   - A more important interpretation of unlimited occurs when describing file size limitations. Table 4-7 lists those systems that support large files, i.e., in excess of 2 gigabytes. In this case, unlimited can mean 2**32-1 (4 294 967 295) bytes if large files are not supported, or upwards of 2**64-1 (18 446 744 073 709 551 615) bytes if large files are supported.

Sample output from this command for the various computers used to port MD/MSC Nastran follows.

HP-UX

```
Current resource limits:
CPU time:               unlimited
Virtual address space:  unlimited
Working set size:       unlimited
```

```
Data segment size:      1048576        KB
Stack size:             8192           KB
Number of open files:   60
File size:              unlimited
Core dump file size:    2047           MB
```

IBM pSeries - AIX

```
Current resource limits:
CPU time:               unlimited
Working set size:       unlimited
Data segment size:      unlimited
Stack size:             unlimited
Number of open files:   2000
File size:              unlimited
Core dump file size:    unlimited
```

Intel IA-32 - Linux

```
Current resource limits:
CPU time:               unlimited
Virtual address space:  unlimited
Working set size:       unlimited
Data segment size:      unlimited
Stack size:             8192                KB
                        (hard limit: 8192   KB)
Number of open files:   1024
                        (hard limit:
                        1024)
File size:              unlimited
Core dump file size:    0                   MB
```

Intel IA-32 - Windows

```
Current resource limits:
Physical memory:            255     MB
Physical memory available:  192     MB
Paging file size:           504     MB
Paging file size            423     MB
available:
Virtual memory:             2074    MB
Virtual memory available:   2033    MB
```

Intel IPF-Linux

```
Current resource limits:
CPU time:               unlimited
Virtual address space:  unlimited
Working set size:       unlimited
Data segment size:      unlimited
Stack size:             8192 KB
Number of open files:   1024
                        (hard limit:1024)
File size:              unlimited
Core memory available:  unlimited
```

Intel 64 - Linux

```
Current resource limits:
CPU time:               unlimited
Virtual address space:  unlimited
Working set size:       unlimited
Data segment size:      unlimited
Stack size:             10240 KB
```

```
Number of open files:   1024
                        (hard limit:1024)
File size:              unlimited
Core memory available:  unlimited
```

Sun SPARC - Solaris

```
Current resource limits:
CPU time:               unlimited
Virtual address space:  unlimited
Data segment size:      2097148       KB
Stack size:             8192          KB
Number of open files:   64
File size:              unlimited
Core dump file size:    unlimited
```

Managing Remote and Distributed Hosts

Your site can control the hosts available to remote and distributed (DMP) jobs by creating host “accept” or “deny” utilities that list the hosts that a remote or DMP job may or may not use respectively.

For remote jobs, specified by “node=*node-name*”, the two utilities are *install-dir*/*prod_ver*/*arch*/rmtaccept and *install-dir*/*prod_ver*/*arch*/rmtdeny.

For DMP jobs, specified by “dmparallel=*number*”, the two utilities are *install-dir*/*prod_ver*/*arch*/dmpaccept and *install-dir*/*prod_ver*/*arch*/dmpdeny.

The “rmtdeny” and “dmpdeny” utilities list those hosts that cannot be used by a remote or DMP job. The “rmtaccept” and “dmpaccept” utilities lists those hosts thatcan be used by a remote or DMP job. At most one and only one of these utilities will be used. The nastran command will first look for the “deny” utility. If it exists and is executable, it will be run and its stdout parsed — any host listed cannot be selected by the job. If the “deny” utility does not exist, the nastran command will look for the “accept” utility. If it exists and is executable, it will be run and its stdout parsed — only those hosts listed can be selected by the job. If neither utility exists, any host will be accepted.

The required output format of these utilities is one host per line of output. For example, consider the following output:

```
banana1
banana2
```

If written by a “deny” utility, neither “banana1” nor “banana2” will be available to an MD/MSC Nastran job; if written by an “accept” utility, only these two hosts will be available.

See “Sample dmpdeny Implementation (AIX)” on page 54 for a special format supported only for the dmpdeny utility on AIX.

Sample dmpdeny Implementation (AIX)

MSC.Software has provided a default “*install-dir*/*prod_ver*/aix/dmpdeny” utility that converts the output of the IBM Parallel Environment for AIX command

```
jmstatus -j
```

into a form usable by the nastran command. The format of the dmpdeny output on AIX is:

```
host:adapter
```

where *host* is the name of a host where the jmstatus output is listed as “DEDICATED”, and *adapter* is the name of an adapter where the jmstatus output is listed as “DEDICATED”. The utility has been annotated to describe this process.

This sample implementation provides a trivial job control facility that can be used as-is, replaced with code more appropriate to your site, or removed.

Limiting “memory” Requests

The nastran command provides a “memorymaximum” keyword that permits you to specify a maximum memory request on a site-wide, per-architecture, or per-node basis. This value can be set to any legal memory size.

The default values are

```
memorymaximum=0.8*physical
```

on UNIX, and

```
memorymaximum=1.2*physical
```

on Windows. If this limit is exceeded, the nastran command will issue a UWM and reduce the memory request.

You may leave the default limits in place, or specify any value or values appropriate to your site.

It may be advisable to lock this keyword to ensure the limit is not removed. This is accomplished with the RC file entry

```
lock=memorymaximum
```

Note: Be sure you specify this line after any specification of the “memorymaximum” keyword.

Customizing the News File

MSC delivers a news file (*install_dir*/*prod_ver*/nast/news.txt on UNIX and *install_dir**prod_ver*\nast\news.txt on Windows) that briefly describes important new features of the release. You can also use news file to distribute information to the users of MD/MSC Nastran.

There are two ways the news file can be viewed. The most common way is by specifying “news=yes” or “news=auto” on the command line or in an RC file. This specification will cause the news file to be printed in the .f06 file just after the title page block. The other method is by using the news special function

prod_ver nastran news

This will display the news file on the screen.

Customizing the Message Catalog

MD/MSC Nastran uses a message catalog for many messages displayed in the .f06 file. The standard message catalog source file is

```
install_dir/prod_ver/util/analysis.txt
```

on UNIX and

```
install_dir\prod_ver\util\analysis.txt
```

on Windows. This file may be modified to meet the needs of a site or a user.

When reviewing the analysis.txt file, note the use of system(319), also called keyword XMSG, to provide a mechanism for printing additional information associated with messages. If the "I" in Information is a lower case "i" and XMSG=1, then the additional information will be printed.

Once the changes have been made, a message catalog is generated using the command

```
prod_ver msgcmp myfile
```

where "*myfile*.txt" is the message catalog source file. This command will generate a message catalog in the current directory with the name "*myfile*.msg". The message catalog is identified with the "msgcat" keyword (p. 73), and can be tested using the command

```
prod_ver nastran msgcat=myfile.msg other_nastran_keywords
```

Once the message catalog has been validated, it may be installed with the command

```
cp myfile.msg install_dir/prod_ver/arch/analysis.msg
```

on UNIX, or

```
copy myfile.msg install_dir\prod_ver\arch\analysis.msg
```

on Windows, where *install_dir* is the installation base directory and *arch* is the architecture of the system using the message catalog. You will need write permission to the architecture directory to do this.

Note: Message catalogs are computer-dependent. Table 6-1 identifies the systems that are binary compatible; binary compatible systems can use the same message file.

Defining a Computer Model Name and CONFIG Number

If the nastran command cannot identify a computer, the following message will be written to the screen before the MD/MSC Nastran job begins:

```
     *** SYSTEM WARNING MESSAGE (nastran.validate_local_keywords)
         s.config=0     (program default)
           Default CONFIG value.

         A config number for this computer could not be
         determined.  Defining this computer in the model file
         install_dir/conf/arch/model.dat, using rawid=rawid; or
         defining <config> in an RC file may correct this
         problem.
```

There are two possible resolutions to this warning message. The preferred solution is to create the file *install_dir*/conf/*arch*/model.dat on UNIX or *install_dir*\conf*arch*\model.dat on Windows with the model name and configuration number of the computer. This file contains zero or more lines of the form:

```
model, proc, rawid, config
```

where

model	is the name of the computer model. This string should be enclosed in quote marks if it contains spaces or commas.
proc	is the file type of the alternate executable. This value is set to null to select the standard executable. The “system” special function reports this name.
rawid	is the “rawid” value reported in the above message text or by the “system” special function.
config	The CONFIG number used to select the timing constants. If this value is null, *rawid* is used as the CONFIG number.

Any values in this table will override the default values built into the nastran command.

An alternative solution to creating this file is to set the “config” keyword (page 50) in the node RC file; see “Command Initialization and Runtime Configuration Files” on page 2 in Appendix A and “Customizing Command Initialization and Runtime Configuration Files” on page 16 in Appendix A. Note, however, this will not set a model name.

Generating a Timing Block for a New Computer

MD/MSC Nastran uses timing constants to determine the fastest algorithm or “method” to perform certain numerically intensive operations. Timing constants are installed by MSC.Software for a variety of computers. If constants are not installed for your particular computer, MD/MSC Nastran will select default timing constants and display the following warning message:

```
*** USER WARNING MESSAGE 6080 (TMALOC)

THE TIMING CONSTANTS DATA BLOCK TIMEBLK NOT FOUND ON THE DELIVERY DATABASE FOR:

MACHINE = 5 CONFIG = 56 OPERASYS = 3 OPERALEV = 7 SUBMODEL = 1
LOADING DEFAULT TIMING CONSTANTS DATA BLOCK FOR:
MACHINE = 5 CONFIG = 56 OPERASYS = 3 OPERALEV = 5 SUBMODEL = 1

MODULE TIMING ESTIMATES INACCURATE AND MAY CAUSE INEFFICIENT JOB EXECUTION
```

Ignoring the message may result in excessive runtimes. Proper timing constants for a specific computer may be generated and installed by running a job that measures the timing constants of the computer and stores them in the delivery database.

Use the following steps to add timing constants for your computer to the delivery database:

1. Determine the MSC architecture name of your system by consulting Table 3-1 or executing the command

   ```
   prod_ver nastran system
   ```

2. Change the working directory to the architecture directory of your computer.

   ```
   cd install_dir/prod_ver/arch
   ```

   on UNIX, or

   ```
   cd install_dir\prod_ver\arch
   ```

   on Windows, where ***DUFK*** was determined in Step 1 above.

3. Copy the Structured Solution Sequence files to be modified by the gentim2 run with the commands:

   ```
   cp SSS.MASTERA gentim2.MASTERA
   cp SSS.MSCSOU gentim2.MSCSOU
   cp SSS.MSCOBJ gentim2.MSCOBJ
   ```

on UNIX, or

```
copy SSS.MASTERA gentim2.MASTERA
copy SSS.MSCSOU gentim2.MSCSOU
copy SSS.MSCOBJ gentim2.MSCOBJ
```

on Windows.

4. Issue the command

```
prod_ver nastran DELDIR:gentim2 old=yes scratch=no batch=no
```

on UNIX, or

```
prod_ver nastran DELDIR:gentim2 old=yes scratch=no
```

on Windows.

This command runs the job “DELDIR:gentim2.dat”, where “DELDIR” is a pre-defined logical symbol pointing to the directory containing the solution sequence source files. The value of the Bulk Data parameter “PARAM” is set to 7 by default, as shown in the partial listing of gentim2.dat below

```
NASTRAN MESH SYSTEM(124)=-1
PROJ LTC LOAD TIMING CONSTANTS
INIT MASTER,LOGICAL=(MASTERA(5000))
INIT SCRATCH(NOMEM)
TIME 2000
SOL GENTIMS
CEND
BEGIN BULK
PARAM,PARAM,7
.
.
.
```

In general, the larger the value of “PARAM”, the longer the gentim2 job runs and the more accurate the timing results. If gentim2 runs for more than one hour, you may choose to reduce the value of “PARAM”. This will shorten the elapsed time of the gentim2 job.

5. If there are no errors, replace the old DBsets with the new DBsets created by the gentim2 run. Do this with the following commands:

```
mv gentim2.MASTERA SSS.MASTERA
mv gentim2.MSCOBJ  SSS.MSCOBJ
mv gentim2.MSCSOU  SSS.MSCSOU
```

on UNIX, or

```
copy gentim2.MASTERA SSS.MASTERA
copy gentim2.MSCOBJ SSS.MSCOBJ
copy gentim2.MSCSOU SSS.MSCSOU
```

on Windows.

Customizing Queue Commands (UNIX)

The nastran command runs an MD/MSC Nastran job by validating the command line and RC files, generating a "job script" that will run the MD/MSC Nastran executable, and running that script. When the "queue" keyword is specified, the corresponding "submit" keyword defines the command used to run the job script. The "submit" keyword (p. 92), only specified in RC files, consists of a list of queue names followed by the command definition for the queues as shown below:

```
submit=queue_list=command_definition
```

or

```
submit=command_definition
```

When specified, the *queue_list* contains one or more "queue" namesseparated by commas. If a queue list is not supplied (as shown in the second example), the *command_definition* applies to all queues.

The *command_definition* of the "submit" keyword value defines the command used to run a job when a "queue" keyword is specified that matches a queue name in a submit keyword's *queue_list*. The *command_definition* can contain keyword names enclosed in percent "%" signs that are replaced with the value of the keyword before the command is run.

Note:

1. When defining queue commands, it may be useful to build the job script but not actually execute it. Use the "-n" option, for example

   ```
   prod_ver -n nastran myjob queue=myqueue
   ```

2. The examples presented below are only intended to illustrate the "submit", "qopt" and "queue" keywords. The examples may not work with your queuing software.
3. The Korn shell must be used to run the script generated by the nastran command.

Consider the following example:

```
submit=small,medium,large=qsub -q %queue% -x -eo -s /bin/ksh %job%
```

In this example, the "qsub" command is used to run a job when "queue=small", "queue=medium", or "queue=large" is specified.

Any keyword used by the nastran command may be specified in the "submit" keyword's command definition. The most common keywords used in the command definition are:

Keyword	Value
after	Value specified with the “after” keyword
cputime	Value specified with the “cputime” keyword.
job	Name of the job script file built by the nastran command.
log	Name of the LOG file.
ppc	Value of “ppc”, i.e, (%cputime% - %ppcdelta%).
ppm	Value of “ppm”, i.e., (%memory% + %ppmdelta%).
prm	Value of “prm”, i.e., (%ppm% + %prmdelta%).
qclass	This can be used to define an optional queue class in the command definition.
qoption	This can be used to define any option not directly represented by the other variables or not explicitly included in the command definition.
username	User name

Using the previous example, the command

```
prod_ver nastran example queue=small
```

runs the job script using the command:

```
qsub -q small -x -eo -s /bin/ksh example.J12345
```

The %queue% keyword reference is replaced by the specified queue, and the %job% keyword reference is replaced by the name of the execution script.

Keyword references can also contain conditional text that is included only if the value of the keyword is not null, or matches (does not match) a regular expression. A complete description of the keyword reference syntax is described in “Keyword Reference Examples” on page 70. To check for a nonnull value, use the form

```
%kwd:condtext%
```

where *kwd* is the name of the keyword and *condtext* is the conditional text to be included. If the value of the keyword is null, the keyword reference is removed from the command. If the value of the keyword is not null, the keyword reference is replaced with the contents of *condtext*. Within *condtext*, the value of the keyword is represented by an open-close brace pair “{}”.

For example:

```
submit=s=qsub -q %queue% %after:-a {}% -x -s /bin/ksh %job%
```

In this example, the “aft” keyword is references with conditional text. Using this example, the command

```
prod_ver nastran example queue=s after=10:00
```

runs the job script using the following qsub command:

```
qsub -q s -a 10:00 -x -s /bin/ksh example.J12345
```

Using the same “submit” keyword, the command

```
prod_ver nastran example queue=s
```

runs the job script using the following command:

```
qsub -q s -x -s /bin/ksh example.J12345
```

In this case, the “after” keyword was not specified and the entire contents of the %after% keyword reference was removed from the qsub command line.

Special Queues

When the “queue” keyword is not specified, the following three special queues are used:

Keyword	Queue Name	Command Definition
after	-aft	| at %after%
batch=yes	-bg	%nice=^$:nice %%j.nice:{} %%job%"
batch=no	-fg	%j.nice:{} %%job%

Note:

1. If the first character of the command is the UNIX pipe character, "|", the contents of job script will be piped into the command.
2. The command for the "-bg" queue is always executed in the background; the "-fg" and "-aft" commands are always executed in the foreground.

Changing the command definitions of these queues (using the "submit" keyword) will change the way the nastran command runs a job under the "after" and "batch" keywords.

Customizing the Templates

The nastran command relies on several templates to construct the job script (UNIX) or control file (Windows) that is built for every MD/MSC Nastran job. Note that, for UNIX, the job script includes the necessary commands to build the control file. Several templates are provided:

For UNIX, the following files are used. Note that the installed template files are the same for all architectures. The file names in the *arch* directory are linked to files in the bin directory.

- *install_dir*/*prod_ver*/*arch*/nastran.dmp is used for DMP jobs.
  At installation time, this name is linked to *install_dir*/bin/nast2011.dmp.
  The keyword defining this file name is 0.dmp.
- *install_dir*/*prod_ver*/*arch*/nastran.lcl is used for serial or SMP jobs run on the local system.
  At installation time, this name is linked to *install_dir*/bin/nast2011.lcl.
  The keyword defining this file name is 0.lcl.
- *install_dir*/*prod_ver*/*arch*/nastran.rmt is used for serial or SMP jobs run on a remote system using the "node" keyword. At installation time, this name is linked to *install_dir*/bin/nast2011.rmt.
  The keyword defining this file name is 0.rmt.
- *install_dir*/*prod_ver*/*arch*/nastran.srv is used for Toolkit jobs.
  At installation time, this name is linked to *install_dir*/bin/nast2011.srv.
  The keyword defining this file name is 0.srv.

The templates provided by MSC support all versions of MD/MSC Nastran since MSC.Nastran 68.0 for all UNIX platforms.

For Windows, two file names are listed for each template. The file used is the *first* one found.

- *install_dir**prod_ver*\i386\nastran.lcl or *install_dir*\bin\nast2011.lcl is used for serial or SMP jobs run on the local system.
  The keyword defining this file name is 0.lcl.
- *install_dir**prod_ver*\i386\nastran.rmt or *install_dir*\bin\nast2011.rmt is used for serial or SMP jobs run on a remote system using the "node" keyword. Currently, the remote system *must* be a UNIX system running the "rshd" daemon.
  The keyword defining this file name is 0.rmt.
- *install_dir**prod_ver*\i386\nastran.srv or *install_dir*\bin\nast2011.srv is used for Toolkit jobs.
  The keyword defining this file name is 0.srv.

The templates provided by MSC support all versions of MSC.Nastran since Version 70.0 for Windows platforms.

These templates may be modified to suit your needs. For UNIX, if you modify these files, you may either replace the link in the *arch* directory with your changes if your changes only affect a single architecture or you may change the file in the bin directory if your changes are valid for all architectures. For Windows, if you modify these files, make sure your changes are used by putting them in the i386 directory or by modifying or replacing the appropriate file in the bin directory. Alternatively, you may

use the appropriate keyword, specified either in the INI file or on the command line, to specify the location of your modified template file.

Note: When customizing the templates, it may be useful to build the job script or control file but not actually execute it. Use the "-n" option, e.g.,

prod_ver `nastran -n myjob`

The name of the generated file will be echoed to stdout.

Keyword Reference Syntax

The script templates use the keyword reference syntax that was partially introduced in the previous section. Table 3-3 provides examples.

Table 3-3 Keyword Syntax

Syntax	Value	Side effects
%%	%	
%*keyword*%	Value of keyword.	
%*keyword*:*condtext*%	condtext	
%*keyword*=*re*%	Value of the parenthetic expression if specified in the re, otherwise the string matched by the re.	
%*keyword*=*re*:*condtext*%	condtext if re is matched.	
%*keyword*!*re*:*condtext*%	condtext if re is not matched.	
%*keyword*:%		Kill remainder of line if *keyword* has null value. In a case construct, the default case.
%*keyword*=*re*:%		Kill remainder of line if *re* does not match.
%*keyword*!*re*:%		Kill remainder of line if *re* does match.
%*keyword*?:%		Start of case construct. See “Using Regular Expressions” on page 73.
%*keyword*>*cmp*:*context*%	condtext if keyword is > than cmp	

Table 3-3 Keyword Syntax (continued)

Syntax	Value	Side effects
%keyword>=cmp:condtext%	condtext if keyword is ≥ than cmp	
%keyword<cmp:condtext%	condtext if keyword is < than cmp	
%keyword=<cmp:condtext%	condtext if keyword is ≤ than cmp	
%keyword>cmp:%		Kill remainder of line if keyword is not > than cmp
%keyword>=cmp%		Kill remainder of line if keyword is not ≥ than cmp
%keyword<cmp:%		Kill remainder of line if keyword is not < than cmp
%keyword<=cmp:%		Kill remainder of line if keyword is not ≤ than cmp

Keyword Reference Examples

The keyword reference syntax is described using the following examples from the UNIX "*install_dir*/bin/nast2011.lcl file. The same syntax is supported for the Windows control file templates.

Unconditional Keyword Substitution

```
export MSC_BASE=%MSC_BASE%
```

The keyword reference %MSC_BASE% will be replaced by the value of the “MSC_BASE” keyword.

```
export DBSDIR=%dbs=\(.*\)/%
```

The keyword reference %dbs=\(.*\)/% will be replaced with the value of the parenthetic regular expression. For example, given the keyword value “onedir/anotherdir/myfile”, the parenthetic expression is “onedir/anotherdir”, and the substituted line would read:

```
export DBSDIR=onedir/anotherdir
```

Conditional Keyword Substitution

```
%sysfield:SYSFIELD={}%
```

The keyword reference %sysfield:SYSFIELD={}% will be replaced by the string "SYSFIELD=*keyword-value*" if and only if the keyword is not null.

```
%dcmd=dbx:run%
```

The keyword reference %dcmd=dbx:run% will be replaced by "run" if and only if "dcmd=dbx" was specified. If the equal sign in the keyword reference was replaced by an exclamation mark, i.e., %dcmd!dbx:run%, then the keyword reference will be replaced by "run" if and only if "dcmd" was set to a nonnull value not equal to "dbx".

Conditional Inclusion

```
%MSC_ARCH=aix:%startdate=date +%%a %%h %%d %%H:%%M:%%S %%Z %%Y
%MSC_ARCH!aix:%startdate=date
```

Conditional inclusion is indicated by a null conditional text string; i.e., the colon is immediately followed by a percent sign. This capability is generally used with a regular expression to include the remainder of the line if a keyword value matches or does not match a regular expression. In the first line, the remainder of the line will be included if the "MSC_ARCH" keyword contains the string "aix" while the remainder of the second line will be included if "MSC_ARCH" does not contain the string "aix". More than one conditional inclusion keyword reference can be used on a line to create more complex tests.

```
%prt=y:%%pdel=y:%/bin/rm %out%.f04 %out%.f06 %out%.log
```

The "rm" command will included if and only if "prt=yes" and "pdel=yes".

A "case" structure is specified as follows:

```
...%s.model?:%
...%s.model=IP.$:%  SGI_ISA=mips1; export SGI_ISA
...%s.model=IP12:%  SGI_ISA=mips1; export SGI_ISA
...%s.model=IP15:%  SGI_ISA=mips1; export SGI_ISA
...%s.model=:%      SGI_ISA=mips2; export SGI_ISA
```

This sequence will result in the line

```
SGI_ISA=mips1
```

if “s.model” is “IP” followed by a single character (using the second line), or “IP12" (using the third line), or “IP15" (using the fourth line), otherwise

```
SGI_ISA=mips2
```

will be generated using the last line. Case constructs can be nested, but a keyword may only be active in one case at a time.

Greater and less-than comparisons can be used instead of regular expression matching to control conditional inclusion. These comparisons are done with integer, floating, or string values based on the types of the two values.

```
%a.release>68: %CONFIG=%config%
```

The CONFIG statement will be included if “a.release” is greater than 68.

Nested Keyword Values

One level of nested keywords may occur anywhere within the %.*% string. Only unconditional keywords substitutions are supported for nested keywords. Nested keywords are specified as \%keyword\%.

```
%dmparallel>\%maxnode\%:%#@ node = %maxnode%
```

This sequence will cause the “#@ node ..” text to be included if the value of the “dmparallel” keyword is greater than the value of the “maxnode” keyword.

Using Regular Expressions

The regular expression syntax supported by the nastran command is compatible with the standard ed(1) regular expression syntax with the exception that only one parenthetic expression is permitted. The syntax follows.

One-character Regular Expressions

- Any character, except for the special characters listed below, is a one-character regular expression that matches itself.
- A backslash, “\”, followed by any special character is a one-character regular expression that matches the special character itself. The special characters are: period, “.”, asterisk, “*”, and backslash “\”, which are always special except when they appear within brackets; circumflex, “^”, which is special at the beginning of a regular expression or when it immediately follows the left bracket of a bracketed expression; and dollar sign “$”, which is special at the end of a regular expression.
- A period, “.”, is a one-character regular expression that matches any character.
- A nonempty string of characters enclosed within brackets, “[” and “]”, is a one-character regular expression that matches one character in that string. If, however, the first character of the string is a circumflex, “^”, the one-character regular expression matches any character except the characters in the string. The circumflex has this special meaning only if it occurs first in the string. The dash, “-”, may be used to indicate a range of consecutive characters. The dash loses this special meaning if it occurs first (after an initial circumflex, if any) or last in the string. The right square bracket, “]”, does not terminate such a string when it is the first character within it (after an initial circumflex, if any).

Regular Expressions

- A one-character regular expression is a regular expression that matches whatever the one-character regular expression matches.
- A one-character regular expression followed by an asterisk, “*”, is a regular expression that matches zero or more occurrences of the one-character regular expression. If there is any choice, the longest left most string that permits a match is chosen.
- A one-character regular expression followed by “\{*m*\}”, “\{*m*,\}”, or “\{*m*,*n*\}” is a regular expression that matches a ranges of occurrences of the one-character regular expression. The values of *m* and *n* must satisfy $0 \le m \le n \le 254$; “\{*m*\}” exactly matches *m* occurrences; “\{*m*,\}” matches at least *m* occurrences; “\{*m*,*n*\}” matches any number of occurrences between *m* and *n* inclusive.
- A concatenation of regular expressions is a regular expression that matches the concatenation of the strings matched by each component of the regular expression.
- A regular expression enclosed between the character sequences “\(” and “\)” defines a parenthetic expression that matches whatever the unadorned regular expression matches. Only one parenthetic expression may be specified.

- The expression “\1" matches the same string of characters as was matched by the parenthetic expression earlier in the regular expression.

Constraining Regular Expressions

- A circumflex, “^”, at the beginning of an entire regular expression constrains the regular expression to match an initial segment of a string.
- A dollar sign, “$”, at the end of an entire regular expression constrains the regular expression to match a final segment of a string.
- The construction “^*re*$” constrains the regular expression to match the entire string.
- The construction “^$” matches a null string.

4 Using the Basic Functions of MD/MSC Nastran

- Overview
- Using the mdnastran or nastran Command
- Using the Basic Keywords
- Specifying Memory Sizes
- Determining Resource Requirements
- Using the Test Problem Libraries
- Making File Assignments
- Using Databases
- Using the INCLUDE Statement
- Using the SSS Alter Library
- Resolving Abnormal Terminations

Overview

This chapter is directed to the engineer running MD/MSC Nastran, and discusses how the basic functions of MD/MSC Nastran are used. It covers using the nastran command, including file types, filenames, logical symbols, the help facility, and other functions. In addition, this chapter provides an overview of the basic keywords, outlines resource requirements, describes how to specify memory sizes, introduces the sample problem libraries, and how to make file assignments, as well as how to use databases, how to apply the INCLUDE statement, and how to resolve abnormal terminations.

Using the mdnastran or nastran Command

MD/MSC Nastran jobs are run using the nastran command. The basic format of this command is

prod_ver `nastran` *`input_data_file keywords`*

where *input_data_file* is the name of the file containing the input data and *keywords* is zero or more optional keyword assignments. For example, to run an MD/MSC Nastran job using the data file example.dat, enter the following command:

prod_ver `nastran example`

Various options to the nastran command are available using keywords described in "Keywords" on page 46. Keyword assignments consist of a keyword, followed by an equal sign, followed by the keyword value, for example:

prod_ver `nastran example scratch=yes`

Note: In Windows you can use a hash mark "#" instead of the equal sign. This is useful if the nastran command is being placed in a ".bat" file.

prod_ver `nastran example scratch#yes`

Keyword assignments can be specified on the command line or included in RC files.

The following sets of RC files are controlled by you:

- The user RC files are used to define parameters applicable to all MD/MSC Nastran jobs you run.
- The local RC files should be used to define parameters applicable to all MD/MSC Nastran jobs that reside in the input data file's directory, and are located in the same directory as the input data file. If the "rcf" keyword is used, this local RC file is ignored.

The locations and names of these RC files are described in "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A.

Note: 1. The UNIX tilde (~) shorthand is not recognized within RC files.

2. Environment variables are only recognized when used in the context of a logical symbol (see "Using Filenames and Logical Symbols" on page 79) or when used to initialize user defined keyword (see "User-Defined Keywords" on page 8 in Appendix A).
3. When a keyword is specified on the command line, embedded spaces or special characters that are significant to the shell must be enclosed in quote marks; quotes marks should not be used within RC files unless they are significant to the keyword's value.

File Types and Versioning

MD/MSC Nastran's default input and output files use the following types: For a more comprehensive list, refer to "FORTRAN Files and Their Default Attributes" on page 47 of the *MD/MSC Nastran Quick Reference Guide*.

Type	Type of File	Description of File
.dat	Input	Input Data File
.f04	Output	Execution Summary File
.f06	Output	Output Data File
.log	Output	Job Log File
.op2	Input Output	OUTPUT2 File
.pch	Output	Punch File
.plt	Output	Binary Plot File
.xdb	Output	Results Database

Note:

1. If the input file is specified as "example" and the files "example.dat" and "example" both exist, the file "example.dat" will be chosen. In fact, it is impossible to use a file named "example" as the input data file if a file named "example.dat" exists.
2. The "jidtype" keyword may be used to specify an alternate default suffix for the input data file. For example, "jidtype=bdf" will change the default file type to ".bdf".
3. The XDB file is not versioned.
4. The "oldtypes" keyword may be used to specify a list of additional file types that are versioned. For example, "oldtypes=xdb" will cause the XDB file to be versioned.

When a job is run more than once from the same directory, the previous output files are versioned, or given indices. The indices are integersappended to the filename; the same integer will designate files for the same job. For example,

v2401.f04	v2401.f04.1	v2401.f04.2	v2401.f04.3
v2401.f06	v2401.f06.1	v2401.f06.2	v2401.f06.3

The files listed (according to time of execution from oldest to newest) are:

v2401.f04.1	v2401.f06.1
v2401.f04.2	v2401.f06.2
v2401.f04.3	v2401.f06.3
v2401.f04	v2401.f06

Using Filenames and Logical Symbols

Several of the parameters used by MD/MSC Nastran, including command line arguments, initialization and RC file commands, and statements within MD/MSC Nastran input files, specify filenames. The filenames must follow your system's standard filename conventions, with the addition that filenames can include a "logical symbol" component, i.e., the filename can be specified in either of the following forms:

```
filename
logical-symbol:filename
```

Logical symbols provide you with a way of specifying file locations with a convenient shorthand. This feature also allows input files containing filename specifications to be moved between computers without requiring modifications to the input files. Only the logical symbol definitions that specify actual file locations need to be modified.

Only one logical symbol name may be used in a filename specification. This logical symbol must be the initial component of the filename string, and it must be separated from the filename by a colon ":". If the symbol has a non-null value, the actual filename is created by replacing the symbol name with its value and replacing the colon with a slash; otherwise, both the symbol name and the colon are left as is.

Note:

1. A logical symbol can be defined using any environment variable or previously defined symbol. Use the standard environment variable reference convention, i.e., "$*name*" or "${*name*}" on UNIX and "%*name*%" on Windows.

2. Logical symbols must be more than one character long, i.e., the filename reference “D:\temp\myfile.dat” will be interpreted on Windows as a drive reference followed by a pathname.
3. MD/MSC Nastran will accept Windows pathnames using the slash “/” character as a replacement for the backslash “\”.

For example, assume that your home RC file contains the line

```
SYMBOL=DATADIR=/dbs/data
```

on UNIX, or

```
SYMBOL=DATADIR=d:\dbs\data
```

on Windows, and a job is submitted with the command

```
prod_ver DATADIR:nastran example
```

Since MD/MSC Nastran automatically sets the OUTDIR environment variable to the value of the “out” keyword, if DATADIR is defined as above, the filenames

```
'DATADIR:myfile.dat'
'OUTDIR:testdata.info'
```

will reference the files

```
/dbs/data/myfile.dat
./testdata.info
```

on UNIX and

```
d:\dbs\data\myfile.dat
.\testdata.info
```

on Windows respectively, see “symbol” on page 93 for more information.

Several other symbols are automatically created by the nastran command. These include DELDIR, DEMODIR, TPLDIR, and SSSALTERDIR to access the delivery database source directory, and DEMO, TPL, and SSSALTER libraries, respectively.

Using the Help Facility and Other Special Functions

Several special functions are supported by reserved input data filenames. If these names are specified as the input data file, the nastran command will execute the special function and exit.

Note: If you need to use one of these reserved names as an actual input filename, you must either prefix the filename with a path or append a file type to the filename.

The special functions are invoked as follows:

prod_ver `nastran help`

This request will display the basic help output. Additional help capabilities are described in the basic help output.

prod_ver `nastran help` *`keyword1`* `[`*`keyword2`* `...]`

This request will display help for the keywords listed on the command line.

prod_ver `nastran limits`

This request will display the current UNIX resource limits.

prod_ver `nastran news`

This request will display the news file.

prod_ver `nastran system`

This request will display system information about the current computer.

On UNIX, these requests can be executed on a remote computer that has MD/MSC Nastran installed by also specifying the keyword “node=*nodename*”, for example:

```
prod_ver nastran system node=thatnode
```

Using the Basic Keywords

The following table is a partial list of the basic keywords that may be used on the command line or placed into RC files as appropriate. More advanced keywords are listed in “Using the Advanced Keywords” on page 115, and a complete list of all keywords and their syntax is listed in “Keywords” on page 46.

All Systems

Keyword	Purpose
append	Combines the .f06, .f04, and .log files into a single file after the jobs completes.
dbs	Specifies an alternate name for user database files.
memory	Specifies the amount of memory to be used by the job.
old	Renames existing output files with version numbers or deletes existing output files.
out	Specifies an alternate name for output files.
rcf	Specifies an alternate name of the local RC file.
scratch	Indicates databases are to be deleted when job completes.
sdirectory	Specifies an alternate scratch file directory.
symbol	Defines a symbolic name and value.

UNIX Systems

Keyword	Purpose
after	Holds the job until the specified time.
batch	Runs the job in background or foreground.
xmonast	Automatically runs the Motif-based output file monitor.

Queuing (UNIX)

Note: These capabilities depend upon the queue submission commands defined by the “submit” keyword and your queuing system. The keywords may not work on your system.

Keyword	Purpose
cputime	Specifies maximum CPU time to be allowed.
queue	Specifies name of queue where the job will be submitted to.

Specifying Memory Sizes

Several nastran keywords specify memory sizes. In all cases, the value can be specified either as the number of words (64-bit words on i8/ILP64 platforms when mode = i8, and 32-bit words on all others) or as a number followed by one of the following modifiers:

Table 4-1 Memory Size Specifications

Specification	Size (Words)
*n*T, *n*TW	$n(1024^4)$
*n*TB	$n\frac{(1024^4)}{bpw}$
*n*G, *n*GW	$n(1024^3)$
*n*GB	$n\frac{(1024^3)}{bpw}$
*n*M, *n*MW	$n(1024^2)$
*n*MB	$n\frac{(1024^2)}{bpw}$
*n*K, *n*KW	$n(1024)$
*n*KB	$\frac{n(1024)}{bpw}$
*n**physical, *n*xphysical	$n \cdot memory_{physical}$
*n**virtual, *n*xvirtual	$n \cdot memory_{virtual}$

where: $bpw = 8$ on i8/ILP64 supported platforms when mode = i8, and $bpw = 4$ on all other platforms; “physical” is the computer’s physical memory, i.e., the “RAM”; and “virtual” is the swap size on UNIX systems, and the maximum paging file size on Windows systems.

Note: In order to use the “physical” and “virtual” specifications, the computer’s physical memory and swap file size must be known to the nastran command. The nastran command always knows both these sizes on Windows systems. On UNIX systems, the physical memory is known on Linux, and Solaris. The computer’s physical and virtual memory sizes can also be set via the “s.pmem” and “s.vmem” keywords respectively.

Examples are

prod_ver `nastran memory=1gb`

Set the memory request to one gigabyte, 1024 megabytes, 1048576 kilobytes, 1073741824 bytes, 134217728 words for i8/ILP64 or 268435436 words on all other systems.

prod_ver `nastran memory=0.5xPhys`

Set the memory request to 50% of the computer's physical memory.

Maximum Memory Size

Table 4-2 lists the maximum"memory" size for MD/MSC Nastran platforms. A "memory" request larger than this value results in an error as the job starts.

Note: The actual maximum value you can specify depends on several factors, including the physical memory systems and the swap file size on UNIX systems, the paging file size on Windows systems, and your virtual memory limit on most UNIX systems. You must also deduct from the maximum value the size of the executable, listed in "System Descriptions" in Appendix D, and space required for the various operating system and Fortran runtime libraries. Jobs submitted with mode=i8 on platforms that support it, have unlimited memory.

Table 4-2 Maximum Memory Size

Platform	Memory
AIX	8 GB
HPUXIPF	8 GB
HPUX	8 GB
Linux32	2 GB
Linuxipf	8 GB
Linux64	8 GB
Solaris	8 GB
Solaris8664	8 GB
Win32	1.5 GB
Win64	8 GB

Note: When running with mode = i8 or ILP64 on platforms that support it, the maximum memory is limited by system limits and virtual address space.

Determining Resource Requirements

For most models of moderate size (up to 5000 grid points for static analysis), you need not be concerned with resource requirements since the default MD/MSC Nastran parameters allocate sufficient resources. The analysis of larger models may require you to check the resource requirements and the various options that are available to manage memory and disk resources.

There are several tools available to assist you in determining the resource requirements of your job. Table 4-3 and Table 4-4 are the simplest tools, they present gross estimates of the memory and total disk space requirements of static analyses using default parameters with normal output requests. Other solution sequences will generally have greater requirements.

Table 4-3 Estimated Memory Requirements of Static Analyses

Degrees of Freedom	Memory Requirements
	Others
$DOF < 10000$	3 MW
$10000 < DOF \leq 50000$	5 MW
$50000 < DOF \leq 100000$	10 MW
$100000 < DOF \leq 200000$	22 MW
$200000 < DOF \leq 400000$	44 MW

Table 4-4 Estimated Total Disk Requirements of Static Analyses

Degrees of Freedom	Total Disk Space Requirements
$DOF < 10000$	90 MB
$10000 < DOF \leq 50000$	500 MB
$50000 < DOF \leq 100000$	1000 MB
$100000 < DOF \leq 200000$	2000 MB
$200000 < DOF \leq 400000$	4000 MB

More detailed resource estimates can be obtained from the ESTIMATE program, described in “ESTIMATE” on page 195. ESTIMATE reads the input data file and calculates the job's memory and disk requirements. The ESTIMATE program is most accurate in predicting the requirements of static analyses that don't have excessive output requests. The memory requirements for normal modes analyses using the Lanczos Method are reasonably accurate; however, the disk requirements are dependent upon the number of modes. This is a value that ESTIMATE does not know. Memory and disk requirements for other solutions are less accurate.

The best estimates of the memory requirements for a job are available in User Information Message 4157, described in “User Information Messages 4157 and 6439” on page 133, but this requires an MSC Nastran run.

Estimating BUFFSIZE

Table 4-5 presents recommendations for BUFFSIZE based on model size. These values have been chosen to represent the best compromise between database access speed and storage requirements for typical problems. An excessively large BUFFSIZE can result in more I/O data transferred and wasted space in the database for smaller problems; an excessively small BUFFSIZE can result in increases I/O counts for larger problems. You may be able to achieve higher performance or smaller databases using other values.

Table 4-5 Suggested BUFFSIZE Values

Degrees of Freedom	BUFFSIZE
$DOF \leq 100000$	8193
$100000 < DOF \leq 200000$	16385
$DOF > 400000$	32769

Note: The actual I/O transfer size is $(BUFFSIZE - 1) \times bpw$ where *bpw* is 8 on i8/ILP64 and *bpw* is 4 on all other systems.

Using the Test Problem Libraries

Three libraries of test problems are delivered with MD/MSC Nastran.

- These files are accessible via the DEMODIR symbol, or via the path *install_dir*/*prod_ver*/nast/demo on UNIX and *install_dir**prod_ver*\nast\demo on Windows.
- The test problem library (TPL) contains a general selection of MD/MSC Nastran input files showing examples of most of the MD/MSC Nastran capabilities. In general, these files are not documented. The files are accessible via the TPLDIR symbol, or via the path *install_dir*/*prod_ver*/nast/tpl on UNIX, and *install_dir**prod_ver*\nast\tpl on Windows.

The DEMO and TPL libraries contain “demoidx.dat” and “tplidx.dat” respectively. These files contain one-line descriptions of the library members. Also included are files named “tplexec” and “demoexec”, which are scripts used to run the problems on UNIX, or “tplexec.bat” and “demoexec.bat”, which are batch files used to run the problems on Windows.

If you only want to run a job from the DEMO or TPL libraries, the easiest method is to use either the “DEMODIR” or “TPLDIR” symbols, running the command from any convenient directory. For example,

```
prod_ver nastran DEMODIR:d10101d
```

If you want to experiment with the file, copy the file to your own directory and then execute the problem. Note that several of the library files have “INCLUDE” files that should also be copied if they too will be modified, or they can be referenced as-is via the standard INCLUDE file processing; see “Using the INCLUDE Statement” on page 100.

Some example problems contain references to files that are qualified with the following logical symbols:

TPLDIR

DEMODIR

DBSDIR

OUTDIR

Unless they already exist in your environment as environment variables, the logical symbols DEMODIR and TPLDIR automatically point to the DEMO and TPL libraries respectively. DBSDIR and OUTDIR are always based on the “dbs” and “out” keywords respectively.

Making File Assignments

Using the ASSIGN statement in your input file, you can assign physical files used by MD/MSC Nastran to FORTRAN units or DBset files or you can modify the properties of existing or default file assignments. The ASSIGN statement is documented in the "File Management Statements" in Chapter 2 of the *MD/MSC Nastran Quick Reference Guide*.

ASSIGN Statement for FORTRAN Files

For FORTRAN files, the format of the ASSIGN statement is

```
ASSIGN logical-key[={filename|*}] [UNIT=u] [[STATUS=]{NEW|OLD|UNKNOWN}]
[[FORM=]{FORMATTED|UNFORMATTED|BIGENDIAN|LITTLEENDIAN|LTLEND|<ostype>}] [DEFER]
[{TEMP|DELZERO}] [DELETE] [SYS='sys-spec']
```

Currently, there are no values of the SYS field defined for FORTRAN files on any system. For a list of the FORTRAN files and their default attributes, please refer to Table 2-1 in the "File Management Statements" in Chapter 2 of the *MD/MSC Nastran Quick Reference Guide*. For more information about byte-ordering within binary files (the "endian" of a file), please refer to "Binary File Byte Ordering (Endian)" in Appendix D.

ASSIGN Statement for DBsets

ASSIGN *logical-name*[=*filename*|*}] [TEMP] [DELETE] [SYS='sys-spec']

See "Using the SYS Field" on page 122 for details on the SYS field for DBsets.

Scratch DB Set Names

The default base name for scratch DB Sets uses the base name of the input data file as a prefix; this will permit you to more easily identify the job that created specific files in the scratch directory.

UNIX:	*prod_ver* nastran example sdir=/tmp
Windows:	*prod_ver* nastran example sdir=c:\temp

The SCRATCH DBset names will be named "/tmp/example.T<unique>.*" on the UNIX systems and "c:\temp\example.T<unique>.*" on Windows systems where "<unique>" is a string created from the process ID of the nastran command and the current time.

The following tables give information about the DBALL and SCRATCH DBset default allocations.

DBset	Memory			BUFFSIZE		Physical File Attribute		
	Type	Size	Units	Assignable	Size	Logical Name	Physical Name	Size
MASTER	RAM	200000	Words	YES	8193	MASTER	*dbs*.MASTER	5000
DBALL	N/A	-		YES	8193	DBALL	*dbs*.DBALL	See Table 4-6
OBJSCR	N/A	-		NO	8193	OBJSCR	*sdir*.OBJSCR	5000
SCRATCH	SMEM	See note	GINO Blocks	YES	8193	SCRATCH	*sdir*.SCRATCH	See Table 4-6
SCRATCH	N/A	-		YES	8193	SCR300	*sdir*.SCR300	See Table 4-6
User DBset	N/A	-		YES	8193	DBset	dbs.DBset	25000

Note: The default SMEM value is 100 for all platforms.

where:

DBset The DBset name.

Memory The size of open core memory (in words) used by the RAM of the MASTER DBset. The size may be modified using the FMS statement, INIT MASTER (RAM = *value*).

BUFFSIZE The buffer size (words) used for I/O transfer for each DBset. This size may be changed if "YES" is in the Assignable column.

Logical Name The logical name of the DBset. This name may be set with the ASSIGN or INIT statement.

Physical Name The name of the file as known to your operating system. This name may be changed by using the ASSIGN statement.

Size The default maximum file size (in GINO blocks) allowed for each DBset. This size may be changed by using the INIT statement.

Table 4-6

Default Maximum DBALL and SCRATCH DBset Sizes in GINO Blocks			
Memory (MEM)	**BUFFSIZE**		
	BUFFSIZE < 32769	**32769 < BUFFSIZE < 65537**	**BUFFSIZE = 65537**
MEM < 32 MW	250,000	250,000	250,000
32 MW ≤ MEM < 64 MW	500,000	1,000,000	1,000,000
MEM ≥ 64 MW	1,000,000	2,000,000	2,000,000

Note: These values will be reduced, if necessary and without any information messages, to the maximum file size supported by the filesystem on which the file was allocated. For example:

- For Windows XP using a FAT filesystem, the maximum file size is 2 GB.
- For Windows XP using a FAT32 filesystem, the maximum file size is 4 GB.
- For AIX using a non-largefile enabled JFS filesystem, the maximum file size is 2 GB.
- For AIX using a largefile enabled JFS filesystem, the maximum file size is 63.88 GB.

Default Maximum DBALL and SCRATCH DBset Sizes in GB for Specific BUFFSIZE Values			
Memory (MEM)	**BUFFSIZE**		
	8193	**32769**	**65537**
MEM < 32 MW	7.63 GB	30.52 GB	61.04 GB
32 MW ≤ MEM < 64 MW	15.26 GB	122.07 GB	244.14 GB
MEM ≥ 64 MW	30.52 GB	244.14 GB	488.28 GB

Using Databases

MD/MSC Nastran uses a database for the storage and subsequent retrieval of matrices and tables. This facility consists of several database sets (DBsets) that conform to the following specifications:

- The MD/MSC Nastran limit on the maximum number of DBsets for an analysis is 200. Your computer may have a lower limit on the maximum number of open files that a process can open. This limit is displayed as the "Number of open files" by the "limits" special function. See "Using the Help Facility and Other Special Functions" on page 81.
- Each DBset may consist of 1 to 20 physical files. Again, this is subject to the maximum number of open files that your system permits.
- The maximum size of each DBset is machine dependent. There are several factors affecting the maximum size a given file can reach. Among these are: the job's file resource limit; the available space of the file system containing the file; the maximum file size supported by the operating system, and the BUFFSIZE. On UNIX systems, the "if" command lists the maximum space and available space in a file system. Your resource limit is displayed by as the "Maximum file size" by the "limits" special function.

Table 4-7 Database I/O Capabilities

Computer	Large File	File Mapping	Buffered I/O	Async I/O
AIX	Yes[1]	No	Yes	No
HPUX	Yes[2]	No	Yes	No
HPUXIPF	Yes[2]	No	Yes	No
Intel Linux32	Yes	No	Yes	Yes
Intel Linuxipf	Yes	No	Yes	Yes[4]
Intel Linux64	Yes	No	Yes	Yes[5]
Intel Windows	Yes	Yes	Yes	Yes
Solaris	Yes[3]	Yes	Yes	Yes
Solaris8664	Yes	No	Yes	No

Notes:

1. Large files are available if the file system containing the file supports large files. See your system administrator to determine which file systems, if any, support large files.
2. Large files can only be created on file systems supporting large files (the flags value from "df -g" must show the 0x10 bit set).
3. Large files are available on Solaris 2.6 or later if the file system containing the file supports large files. See your system administrator to determine which file systems, if any, support large files.

4. Supported on SGI Altix IA64 only.
5. MIO is available with an MIO license from IBM.

The default database provides for five DBsets that are subdivided into two categories (scratch and permanent DBsets) as follows:

- Three DBsets are scratch DBsets that are typically deleted automatically at the end of a run. The logical names for these DBsets are SCRATCH, SCR300, and OBJSCR.
- The remaining two DBsets have the default names of *dbs*.MASTER and *dbs*.DBALL, where *dbs* is set by the "dbs" keyword.

The database may be defined in two different ways:

1. Using the "dbs" keyword on the command line; see "Using the "dbs" Keyword" on page 95.
2. Using ASSIGN statements in the FMS Section of the input data file. See "ASSIGN Statement for DBsets" on page 91 and "Using the ASSIGN Statement" on page 97.

Using the "dbs" Keyword

To illustrate the use of the "dbs" keyword, see the TPL file "am762d.dat"

```
ID MSC, AM762D $ JFC 30SEP88
$ DBS=AM762D SPECIFIED WHEN JOB SUBMITTED
TIME 2
SOL 101 $ SUPERELEMENT STATICS
CEND
TITLE = EXAMPLE: SPECIFY DBS=AM762D WHEN JOB SUBMITTED      AM762D
SUBTITLE = COLD START
LOAD = 11
DISPLACEMENT = ALL
ELFORCE = ALL
BEGIN BULK
CBEAM,1,1,10,20,0.,1.,0.
FORCE,11,20,,100.,1.,.8,1.
GRID,10,,0.,0.,0.,,123456
GRID,20,,10.,0.,0.
MAT1,100,1.+7,,.3
PBEAM,1,100,1.,.08,.064,,.1
ENDDATA $ AM762D
```

To run this job, enter

```
prod_ver nastran TPLDIR/am76:am762d
```

The default value for "dbs" in this example is "./am762d" on UNIX and ".\am762d" on Windows. The DBALL and MASTER DBsets are created in your directory as "am762d.DBALL" and

"am762d.MASTER" respectively; and the output files are "am762d.f04", "am762d.f06", and "am762d.log".

To restart from the previously created DBsets, use the following command:

```
prod_ver nastran TPLDIR/am76:am762r dbs=am762d
```

The input data for the restart is TPL file am762r.dat. The "dbs" keyword is set to "am762d". The following is sample input for the am762r.dat file:

```
RESTART VERSION = 1 $ RESTART FROM AM762D
$ DBS=AM762D SPECIFIED WHEN JOB SUBMITTED
ID MSC, AM762R $ JFC 30S3088
TIME 2
SOL 101
CEND
TITLE = EXAMPLE: RESTART, ATTACH DATABASE VIA DBS=AM762D     AM762R
SUBTITLE = RESTART WITH LARGER LOAD
SELG = ALL $ GENERATE NEW LOAD
SELR = ALL $ REDUCE NEW LOAD
LOAD = 11
DISPLACEMENT = ALL
ELFORCE = ALL
BEGIN BULK
FORCE,11,20,,100.,1.,.8,1.
ENDATA $ AM762R
```

The existing DBALL and MASTER DBsets created in your directory by the "am762d" job are used. The output files from this job are "am762r.f04", "am762r.f06", and "am762r.log".

Using the ASSIGN Statement

This section contains two examples using the ASSIGN statement. The first example, TPL file am763d.dat shows how to use the ASSIGN statement to create the database files. The second example shows how to use the ASSIGN statement to assign database files in a restart job.

```
ASSIGN 'MASTER=DBSDIR:am763d.MYMASTER'
ASSIGN 'DBALL=DBSDIR:am763d.MYDBALL'
$
$ DBSETS CREATED WITH DIRECTORIES AND NAMES AS ASSIGNED ABOVE.
$ THIS IS ALTERNATE METHOD TO BE USED INSTEAD OF SPECIFYING DBS = AM763D
$ WHEN JOB IS SUBMITTED.
$
ID MSC, AM763D $ FILENAME CHANGED 16SEP88 -- JFC
TIME 2
SOL 101 $ STRUCTURED SUPERELEMENT STATICS WITH AUTO RESTART
CEND
TITLE = EXAMPLE: DATABASE CREATED VIA ASSIGN CARDS          AM763D
SUBTITLE = COLD START.
LOAD = 11
DISPLACEMENT = ALL
ELFORCE = ALL
BEGIN BULK
CBEAM,1,1,10,20,0.,1.,0.
FORCE,11,20,,100.,1.,.8,1.
GRID,10,,0.,0.,0.,,123456
GRID,20,,10.,0.,0.
MAT1,100,1.,.08,.064,,.1
ENDDATA
```

Before you submit this job, create a "dbs" directory in your current working directory and set the DBSDIR environment variable to "dbs" as follows:

```
export DBSDIR=dbs
```

in the Korn shell,

```
setenv DBSDIR dbs
```

in the C-shell, or

```
set DBSDIR=dbs
```

on Windows.

Once the DBSDIR environment variable is set, the job is submitted with the command:

```
prod_ver nastran TPLDIR/am76:am763d
```

The DBsets “mydball” and “mymaster” are created in the “dbs” directory with the names “am763d.MYMASTER” and “am763d.MYDBALL” respectively. The output files “am763d.f04”, “am763d.f06”, and “am763d.log” are created in the current working directory.

The second example (TPL file am763r.dat) illustrates a restart that uses the ASSIGN statement:

```
RESTART $ RESTART FROM AM763D, SAVE VERSION 1 ON DATABASE
$ ATTACH AM763D DATABASE WITH ASSIGN COMMANDS BELOW
ASSIGN MASTER='DBSDIR:am763d.MYMASTER'
ID MSC,AM763R $ FILENAME CHANGED 16SEP88 -- JFC
TIME 2
SOL 101
CEND
TITLE = EXAMPLE: RESTART, DATABASE ATTACHED VIA ASSIGN CARDS   AM763R
SUBTITLE = RESTART -- ADD STRESS RECOVERY COEFFICIENTS TO PBEAM
LOAD = 11
DISPLACEMENT = ALL
ELFORCE = ALL
STRESS = ALL
BEGIN BULK
$ WITH STRUCTURED SOLUTION SEQUENCES (SOL 101+), ALL BULK DATA IS STORED
$ ON DATABASE.
$ ON RESTART, ONLY INCLUDE ADDITIONAL CARDS OR CHANGED CARDS.
/,6 $ DELETE OLD PBEAM CARD ON DATABASE, ADD STRESS RECOVERY COEFFICIENTS
$ AND REPLACE AS FOLLOWS.
PBEAM,1,100,1.,.08,.064,,.1,,+PBEAM1
+PBEAM1,0.0,0.5,0.0,-0.5,0.3,0.0,-0.3,0.0,+PBEAM2
+PBEAM2,YES,0.5,1.0,.08,.064,,.1,,+PBEAM3
+PBEAM3,0.0,0.5,0.0,-0.5,0.3,0.0,-0.3,0.0
ENDDATA $ AM763R
```

To submit the above file, issue the command:

```
prod_ver nastran TPLDIR/am76:am763r
```

The DBsets “am763d.MYMASTER” and “am763d.MYDBALL” created by the previous job in the “dbs” directory are used. The output files “am763r.f04”, “am763r.f06”, and “am763r.log” are created in the current working directory.

Using the INIT Statement

DBsets are created using the INIT statement, which is documented in the “The File Management Section (FMS)” on page 35 of the *MD/MSC Nastran Quick Reference Guide*. For example,

```
INIT  DBALL LOGICAL=(DBALL1(2000),DBALL2(300KB))
```

creates and allocates two members DBALL1 and DBALL2 to the DBALL DBset with a maximum size of 2000 GINO blocks for DBALL1 and a maximum size of 300 kilobytes for DBALL2. The maximum size can be specified either as the number of GINO blocks or as a number followed by one of the following modifiers:

M or Mw	Multiply the size by 1024^2, round up to a BUFFSIZE multiple.
Mb	Multiply the size by $1024^2/(bpw)$, round up to a BUFFSIZE multiple.
K or Kw	Multiply the size by 1024, round up to a BUFFSIZE multiple.
Kb	Multiply the size by $1024/(bpw)$, round up to a BUFFSIZE multiple.
w	Round the size up to a BUFFSIZE multiple.
b	Divide the size by *bpw*, round up to a BUFFSIZE multiple.

where *bpw* is 8 when mode = i8; 4 on all others. The modifier may be specified using any case combination.

Note: This syntax is similar to, but not the same as, the syntax described in “Specifying Memory Sizes” on page 85.

Using the INCLUDE Statement

The INCLUDE statement is used to insert a specified file into the input file. This statement is especially useful when you want to partition your input into separate files. The format is:

`INCLUDE` *`filename`*

or

`INCLUDE` *`logical-symbol:filename`*

The file name must be quoted in *single* quotes if the name contains spaces, commas, special characters or dollar signs or, on UNIX; lowercase characters. for example,

`INCLUDE '`*`filename`*`'`

The file name may include a directory specification, where directory levels are indicated using a using a directory level separator character ("/" on Unix and "/" or "\" on Windows).

Note: The RFINCLUDE and RFALTER statements may be used instead of the INCLUDE statement to insert a specified file into the input file. Except for the directory searching order specified below, these statements are processed in the same manner that the INCLUDE statement is processed.

Specifying the INCLUDE Filename

The *filename* can be continued, if necessary, on multiple lines of the input file. The *filename* is obtained from an INCLUDE, RFALTER, or RFINCLUDE statement as follows:

1. The *filename* is built up by concatenating tokens. A token is either a blank- or comma-delimited unquoted word or a quoted string (which can be continued across lines).
2. Token are separated by blanks or commas. The blanks or commas separating the tokens are ignored.
3. Statements may be continued by following the last token on a line by a comma, or specifying an incomplete quoted string (i.e., the closing quote is missing from the line). All trailing blanks on the incomplete quoted string's initial line, all leading and trailing blanks on the incomplete quoted string's intermediate lines, and all leading blanks on the incomplete quoted string's final line are ignored.
4. Comments may be specified after the last*filename* token of a line that is not within an incomplete quoted string. The comment is started with an unquoted dollar sign "$", and continues to the end of the current line.
5. Only the first 72 columns of a line are scanned, i.e., any characters from column 73 and onward are ignored.

These rules are best explained via some examples.

Note: The following examples contain a mixture of UNIX and Windows pathnames. The concepts demonstrated by each example are valid on both systems.

```
include datafile.dat
```

The filename is “DATAFILE.DAT”.

```
include 'c:\abc\def\ghi.include'
```

The filename is “c:\abc\def\ghi.include”.

```
include '/mydir' /level1 /level2/ 'myfile.x'
```

The filename is “/mydir/LEVEL1/LEVLEL2/myfile.x”.

```
RFAlter '/mydir
/level1
/level2
/level3/mydata'
```

The filename is “/mydir/level1/level2/level3/mydata”.

```
include '/proj
/dept123
/sect 456
/joe/flange.bdf'
```

The filename is “/proj/dept123/sect 456/joe/flange.bdf”.

```
rfinclude c:\project,
$ A comment line
'\Data Files' \subdir\thisfile
```

The filename is “C:\PROJECT\Data Files\SUBDIR\THISFILE”.

```
include 'MYTESTDIR:*/mytestfile.dat'
```

If the logical symbol MYTESTDIR has the value "/myfiles/test", the expanded filename is "/myfiles/test/*/mytestfile.dat". Note that this filename includes a subdirectory search request, explained below.

The following examples illustrate what happens when comments or quotes are incorrectly placed.

```
include 'TPLDIR:alter.file $ comment
stmt 2 $ word ' $ comment 3 ' info
```

The filename is “TPLDIR:alter.file $commentstmt 2 $ word ”.

```
include '/proj, $ Proj Name
'/dept123, $ Dept Name
'/sect456, $ Sect Name
'/myfile.dat $ File Name
```

The filename is “/proj, $ Proj Name/DEPTNAME/sect 456, $ Sect Name/MYFILE.DAT”.

Requesting Subdirectory Searching

MD/MSC Nastran has the ability to search subdirectories when attempting to locate an INCLUDE file. This can be requested in two ways:

1. Specify "*" as the *last* directory component within the *filename* specification. For example,

   ```
   include '/testdir/dir1/dir2/*/myfile.dat'
   ```

   says that the directory "/testdir/dir1/dir2" and all of its subdirectories, including nested subdirectories, are to be searched for the file to be included. Note that the "*" specification must be followed by a directory level separator character as described above and, if it is not the first character in the file name, must be preceded by a directory level separator character.
2. Omit any directory specifications on the *filename* specification and specify "*" as the *last* directory component of a directory in the directory list specified by the "jidpath" keyword. See the description of the jidpath keyword in the “Keywords and Environment Variables” in Appendix C.

Locating INCLUDE Files

Once the filename has been obtained from the include statement and any logical symbols have been expanded, up to four filenames on UNIX systems and two filename on Windows systems will be searched for. The filenames are:

1. The *filename* as specified by the include statement. If filename does not end in the file type specified by the “jidtype” keyword, it is appended.
2. UNIX: The *filename* constructed immediately above, converted to lower-case, unless filename is already all lower-case (i.e., it was specified as a quoted string).
3. The *filename* as specified by the include statement, without the file type specified by “jidtype”.

4. UNIX: The *filename* specified above, converted to lower-case, unless *filename* is already all lower-case (i.e., it was specified as a quoted string).

For example, consider the statement

```
include File1
```

and assume “jidtype=dat” was specified or defaulted. MD/MSC Nastran will consider the following filenames on UNIX in the order specified:

```
FILE1.dat
file1.dat
FILE1
file1
```

and the following filenames on Windows in the order specified:

```
file1.dat
file1
```

Note: Recall that character-case is insignificant to Windows file names.

For another example, consider the statement

```
include 'File1.bdf'
```

and assume “jidtype=dat” was specified or defaulted. MD/MSC Nastran will consider the following filenames on UNIX in the order specified:

```
File1.bdf.dat
file1.bdf.dat
File1.bdf
file1.bdf
```

and the following filenames on Windows in the order specified:

```
File1.bdf.dat
File1.bdf
```

Here is an example with a directory specification. Consider the statement

```
include 'mydir/File1.dat'
```

and assume “jidtype=dat” was specified or defaulted. MD/MSC Nastran will consider the following filenames on UNIX in the order specified:

```
mydir/File1.dat
mydir/file1.dat
```

and the following filename on Windows:

```
mydir/file1.dat
```

If *filename* contains a directory component, MD/MSC Nastran will attempt to locate one of the four UNIX or two Windows filenames in the specified directory as follows.

- If there is no subdirectory search request specified, MD/MSC Nastran will look in the specified directory for the file.
- If there is a subdirectory search request specified, MD/MSC Nastran will look for the file first in the specified directory then in all of its subdirectories

If none of the names exist or are not readable, a UFM will be issued and the job will exit.

If *filename* does not contain a directory component, MD/MSC Nastran will attempt to locate one of the four UNIX or two Windows filenames by searching the following directories or search paths:

- the current working directory (the "`.`" directory, i.e., the directory where the nastran command was run).
- If an RFALTER or RFINCLUDE statement is being processed
  - the directory specified by the RFADIR environment variable, if that variable is defined.
  - the directory specified by the SSSAALTERDIR environment variable, if that variable was defined.
- the directory containing the file that specified the INCLUDE, RFALTER or RFINCLUDE statement.
- If file that specified the INCLUDE, RFALTER or RFINCLUDE statement itself was included, the directory containing the parent file will be searched. This nesting will continue until the directory containing the input data file has been searched.
- the list of directories specified by the “jidpath” keyword will be searched in order, noting that one or more of the directories in this list may specify subdirectory searching.
- If an INCLUDE statement is being processed:
  - the directory specified by the RFADIR environment variable, if that variable is defined.
  - the directory specified by the SSSALTERDIR environment variable, if that variable was defined.

If no readable file can be found in any of these directories, a UFM will be issued and the job will exit.

Using the SSS Alter Library

The SSS Alter directory, *install_dir*/*prod_ver*/nast/sssalter on UNIX and *install_dir**prod_ver*\nast\sssalter on Windows, contains alters (modifications to MD/MSC Nastran solution sequences) and associated support files that represent client-requested or prototype features that are not yet implemented in MD/MSC Nastran's standard solution sequences. These alters can be inserted using the INCLUDE statement and the SSSALTERDIR symbol. For example,

```
INCLUDE 'SSSALTERDIR:zfreqa.dat'
```

Note: The SSSALTERDIR specification is not required since the directory specified by the SSSALTERDIR is one of the directories automatically searched as part of INCLUDE file processing. However, using the SSSALTERDIR specification is suggested to ensure that the file in the SSS Alter directory is the one actually used instead of a file with the same name located in one of the other directories in the INCLUDE file search paths.

Resolving Abnormal Terminations

MD/MSC Nastran generates a substantial amount of information concerning the problem being executed. The .f04 file provides information on the sequence of modules being executed and the time required by each of the modules; the .log file contains system messages. A list of known outstanding errors for MSC Nastran is delivered in the file *install_dir*/*prod_ver*/doc/error.lis on UNIX and *install_dir**prod_ver*\doc\error.lis on Windows. Please consult this file for limitations and restrictions.

MD/MSC Nastran may terminate as a result of errors detected by the operating system or by the program. If DIAG 44 is set (see the keyword "diag" on page 54 and the *MD/MSC Nastran Quick Reference Guide*), MD/MSC Nastran will produce a dump of several key internal tables when most of these errors occur. Before the dump occurs, there may be a fatal message written to the .f06 file. The general format of this message is

```
***SYSTEM FATAL ERROR 4276, subroutine-name ERROR CODE n
```

This message is issued whenever an interrupt occurs that MD/MSC Nastran is unable to satisfactorily process. The specific reasons for the interrupt are usually printed in the .f06 and/or .log file; "*n*" is an error code that is explained in Chapter 16 of the *MD/MSC Nastran Reference Manual*.

Whenever the System Fatal Error 4275 or 4276 is associated with a database error, further specific information is written to the .f06 file as follows:

```
bio-function ERROR - STATUS = errno, FILX = i, LOGNAME = logical, NSBUF3 = j
FILE = filename
BLKNBR = k
ERROR MESSAGE IS --
error-message-text
```

The FILE and/or BLKNBR lines may not be present, depending upon the *bio-function* issuing the message.

Interpreting System Error Codes

If an operating system error occurs, an attempt is made to catch the error and place the error number in the .log file. A description of these error numbers may be obtained with the following command:

IBM	`cat /usr/include/sys/errno.h`
Sun	`man -s2 intro`
Other UNIX	`man 2 intro`

Terminating a Job

There may be instances when a running job must be prematurely terminated; this is accomplished using one of the following procedures:

Job Running in the Foreground (batch=no on UNIX; all jobs on Windows)

Use the interrupt sequence (on Silicon Graphics systems this sequence is usually “Ctrl-\”; on other systems “Ctrl-C”).

Job Running in the Background (batch=yes or after=*time on* UNIX)

Use the “ps” command to find the process ID (PID) of the MD/MSC Nastran job (i.e., the *install_dir*/*prod_ver*/*arch*/analysis executable) and issue the command

```
kill pid
```

where *pid* is the process ID.

Job Running Under NQS or NQE (queue=*queue_name on* UNIX)

1. Use “qstat -a” to find the request-id of your job.
2. Use “qdel *request-id*” to delete a job that has not yet started; or use “qdel -k *request-id*” to kill a job that has already started where *request-id* is the request ID.

Flushing .f04 and .f06 Output to Disk (UNIX)

As MD/MSC Nastran writes to the .f04 and .f06 files, the FORTRAN runtime libraries will buffer this I/O in memory to reduce the amount of time consumed by disk I/O. When the buffers are filled (i.e., MSC Nastran has written a sufficient amount of information to the .f04 or .f06 file), the buffers will be flushed to the files by the FORTRAN runtime libraries. In a large job, some modules may do substantially more computation than I/O. As a result, the I/O may remain in the FORTRAN buffers (possibly for several hours) before they are written to disk.

AIX, HP-UX, and Linux computers support asynchronous flushing of the .f04 and .f06 files. To do this, enter the command

```
kill -USR1 pid
```

where *pid* is the process ID of the running MD/MSC Nastran job (i.e., the *install_dir*/*prod_ver*/*arch*/analysis executable). There may be a time delay between the time you issue the kill command and the time the files are actually updated.

Common System Errors

The most common system errors encountered during an MD/MSC Nastran job are described below.

UNIX Disk I/O Errors

- ERRNO 1 (EPERM) - no permission to file (all systems).

  Please check the ownership and mode of the file or directory with the “ls -l” command. Change either the ownership or permissions of the file or the directories along the path. The chgrp(1) command is used to change the group of a file, chmod(1) is used to change permissions of the file, and chown(1) is used to change ownership of the file.

- ERRNO 27 (EFBIG) - file is too large (all systems)

  This error occurs if a file's size exceeds a resource limit. The resource limits in effect during the job's execution are printed in the .log file under the heading “Current Resource Limits.” Increase the “-lf” and “-lF” parameters on your qsub command if you are running NQS or NQE; ask your system administrator to increase your “File Size” limit (all platforms).

- ERRNO 28 (ENOSPC) - disk space is completely filled (all systems).

  MD/MSC Nastran deletes its scratch files at termination even if the disk space fills up. Therefore, the df(1) command may show a large amount of free space even though the job failed due to lack of disk space. Both the current working directory and the scratch directory need to be checked. Move your files to a disk with more space (see the “out”, “dbs”, and “sdirectory” keywords), or delete unnecessary files from the disk.

Inability to Allocate the Requested Amount of Memory (OPEN CORE Allocation Failed)

- Temporary lack of swap space (all systems).

  This error may be caused by too many processes running at the same time. Decrease the number of processes or increase the available swap space.

- The data segment of the process has exceeded the UNIX resource limit (UNIX).

  The resource limits in effect during the job's execution are printed in the .log file under the heading “Current Resource Limits.” Ask your system administrator to increase your “Data Segment Size” (all), “Maximum break size” (HP-UX), or “Virtual Address Space” (all others).

- memory allocation error: unable to allocate *n* words (HP-UX).

  The resource limits in effect during the job's execution are printed in the .log file under the heading “Current Resource Limits.” Check your “Maximum break size”; if this is smaller than the requested memory, ask your system administrator to increase your limit.

  If your limit is large enough, the system wide “shmmax” and “maxdsize” kernel parameters may be too small. These parameters must be large enough to accommodate all simultaneously executing MD/MSC Nastran jobs plus all others users of shared memory. These values are modified using sam(1M), see “Kernel Parameters” under “Configurable Parameters”.

It may also be possible to correct these errors with the following:

- Reduce the amount of memory requested by the “memory” keyword.

- Increase the "-lm" and "-lM" parameters if you directly submitted your job to NQS or NQE using a "qsub" command.
- Increase the "prmdelta" or "ppmdelta" keyword values if you submitted your job to NQS or NQE using the nastran command's "queue" keyword.

EAG FFIO Errors (Altix)

The following error message may appear on LINUXIPF systems when FFIO is being used:

```
eie open failure  :  Not enough space for cache pages
```

This message is a consequence of not having enough memory for the eie cache pages. System memory requirements are as follows:

Description	Size	Where Documented
executable	6.5 MW	"System Descriptions" on page 115
opencore	memory keyword	"Keywords and Environment Variables" on page 45 and "Managing Memory" on page 120
EIE buffers/ Cache		"Keywords and Environment Variables" on page 45

If the job was directly submitted with the "qsub" command, then the error can be avoided by increasing the NQS "lm" and "lM" parameters. The value should be at least 6.5 MW **plus** the value specified by the "memory" keyword **plus** the amount needed for eie. To determine the amount needed for FFIO, consider the following "ff_io_opts" request:

```
(eie:128:16:1:1:1:0,set:0:0)
```

This request requires an additional:

$$128(blocks/page) \times 16(pages) \times 512(words/block) \;=\; 1048576W{=}1MW$$

If the job was submitted with the nastran command's "queue" keyword, the nastran command automatically adjusts the memory request based on the "ff_io_cachesize" keyword. The "eie open failure" message should only appear if the user modified the "ff_io_defaults" or "ff_io_opts" keywords without modifying the "ff_io_cachesize" keyword. This error can be avoided by increasing the value set by the "ppmdelta" keyword (see "ppmdelta (UNIX)" on page 79) to 6.5 MW plus the amount of memory for FFIO.

See the URL

file://*install_dir*/*prod_ver*/*arch*/ffio.html

where *arch* is linuxipf, for a complete description of EAG FFIO.

5 Using the Advanced Functions of MD/MSC Nastran

- Overview
- Using the Advanced Keywords
- Using the MD NASTRAN or NASTRAN Statement
- Managing Memory
- Managing DBsets
- Interpreting the .f04 File
- Running a Job on a Remote System
- Running Distributed Memory Parallel (DMP) Jobs
- Configuring and Running SOL 600
- SOL 600 Parallel Processing on Windows
- Configuring and Running SOL 700 (MD Only)
- Running an ISHELL Program
- Using the ISHELL-INCLUDE Statement (“!”)
- Improving Network File System (NFS) Performance (UNIX)
- Creating and Attaching Alternate Delivery Databases

Overview

This chapter discusses the NASTRAN statement, as well as how to manage MD/MSC Nastran's internal memory allocations and databases. It also shows how to interpret performance related information in the .f04 file and some of the lower-level database messages, how to run a job on a remote system, run a DMP job, use the ISHELL module, and finally, how to create alternate delivery databases.

Using the Advanced Keywords

The following is a partial list of the advanced keywords that may be used on the command line or placed into RC files as appropriate. More basic keywords are listed in "Using the Basic Keywords" on page 83; keywords specific to remote processing are listed in "Running a Job on a Remote System" on page 136, while keywords specific to distributed processing are listed in "Running Distributed Memory Parallel (DMP) Jobs" on page 145. Finally, a complete list of all keywords and their syntax is listed in "Keywords" on page 46.

All Systems

Keyword	Purpose
buffsize	Specifies the size of database I/O transfers.
bpool	Specifies the number of GINO blocks set aside for buffer pooling.
delivery	Specifies an alternate delivery database name.
ifpbuff	Specifies the size of IFPStar database I/O transfers
exe	Specifies an alternate solver executable.
nastran	Specifies NASTRAN statements.
proc	Specifies an alternate solver executable file type.
rank	Specifies the rank size for the sparse solvers.
smem	Specifies the number of GINO blocks to set aside for MEMFILE portion of the SCRATCH DBset.
sysfield	Specifies global SYS parameters. See "Using the SYS Field" on page 122.
sys*n*	Specifies SYSTEM cell values.

UNIX Systems

Keyword	Purpose
post	Specifies UNIX commands to be executed after the job completes.
pre	Specifies UNIX commands to be executed before the job begins.

All Systems

Keyword	Purpose
parallel	Specifies the number of SMP tasks to use in certain numeric modules.

AIX and Linux64 Only

Keyword	Purpose
mio-cachesize	Specifies the size of the MIO cache to be used.

LINUX IPF (SGI Altix) Only

Keyword	Purpose
ff_io	Enables the FFIO high performance I/O system.
ff_io_cachesize	Specifies the size of the FFIO cache.

Solaris Only

Keyword	Purpose
sun_io	Enables the SUN_IO high performance I/O system and specifies the parameters.

Queuing (UNIX)

Note: These capabilities are dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The keywords may not work on your system.

Keyword	Purpose
ppcdelta	Specifies the per-process CPU time limit delta.
ppmdelta	Specifies the per-process memory limit delta.
prmdelta	Specifies the per-request memory limit delta.
qclass	Specifies an optional queue class.
qoption	Specifies other queue command options.
submit	Defines queues and their associated submittal commands.

Using the MD NASTRAN or NASTRAN Statement

The NASTRAN statement allows you to change parameter values at runtime.

The format of NASTRAN statements is

```
MDNASTRAN    KEYWORD1=A, KEYWORD2=B, ... KEYWORDi=I    for MD Nastranor
NASTRAN    KEYWORD1=A, KEYWORD2=B, ... KEYWORDi=I      for MSC Nastran
```

An input file may contain more than one NASTRAN statement. A full description of these keywords is found in "The NASTRAN Statement" on page 11 of the *MD/MSC Nastran Quick Reference Guide*. A brief description of a few of the keywords follows:

AUTOASGN

AUTOASGN is used to determine which DBsets are automatically assigned (see the following table). The default is AUTOASGN=7, which specifies that all DBsets are to be automatically assigned.

Value	Default DBsets	Delivery DBsets	DBLOCATEd DBsets
0			
1	X		
2		X	
3	X	X	
4			X
5	X		X
6		X	X
7 (Default)	X	X	X

Note:

1. Default DBsets are the user-default DBsets and any DBsets specified by INIT statements (see Table 4-7).
2. Delivery DBsets contain the Structured Solution Sequences.
3. DBLOCATEd DBsets are the DBsets specified by DBLOCATE statements. See "DBLOCATE" on page 74 of the *MD/MSC Nastran Quick Reference Guide*.

BUFFPOOL, SYSTEM(114)

See the “bpool” command line keyword, (page 49).

BUFFSIZE, SYSTEM(1)

See the “buffsize” command line keyword, (page 49).

IFPBUFF, SYSTEM(624)

See the "ipfbuff" command line keyword (page 50).

PARALLEL, SYSTEM(107)

See the “parallel” command line keyword, (page 78).

SYSTEM(128)

SYSTEM(128) specifies the maximum interval of CPU time (in minutes) between database directory updates to the MASTER DBSET when the INIT MASTER(RAM) option is being used. The default is 5 minutes on all systems. See“DBUPDATE” on page 81 of the *MD/MSC Nastran Quick Reference Guide* for more information.

SYSTEM(198), SYSTEM(205)

See the “rank” keyword, (page 83).

SYSTEM(207)

See the “LOCK” SYS field keyword, (page 95).

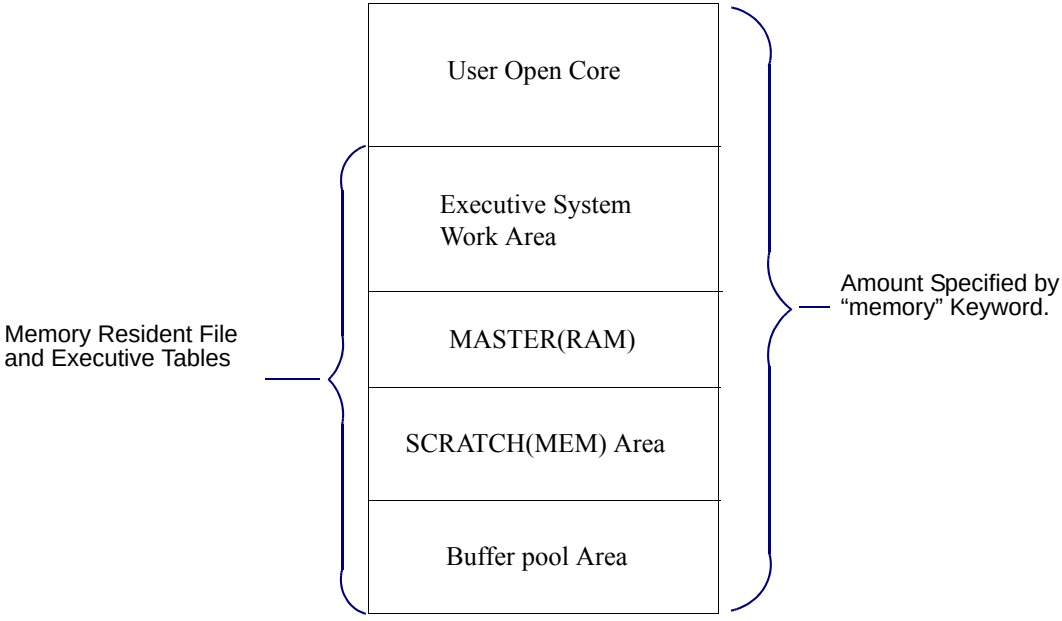
SYSTEM(275)

SYSTEM(275) sets the time-out for an ISHELL program to complete its work. If the value is negative (the default is -1), the ISHELL module will wait until the executable finishes, i.e., there is no time-out. If the value is positive, the ISHELL module will wait for the specified number of seconds.

If the value is zero, the ISHELL module will determine if an executable can be found, and return a zero status if found and a non-zero status if it can’t be found.

Managing Memory

Memory is dynamically allocated at runtime with the “memory” keyword of the nastran command. The memory can be partitioned in a variety of ways (see the memory map at the top of the .f04 file for the actual memory allocation used in a job). To make the most effective choice of the sizing parameters, see the following map of MD/MSC Nastran’s memory:



As can be seen in this diagram, the memory available for use by MD/MSC Nastran modules (user open core) is the amount specified by the “memory” keyword (open core size) less the space required by memory resident files and executive tables. The actual user open core is calculated as follows

```
UserOpenCore = MEM – (EXEC + RAM + SMEM X BUFFSIZE + BUFFPOOL X (BUFFSIZE + 10 ))
```

MEM	The total size of open core. There is no default. Set by the “memory” keyword, (p. 69).
EXEC	The executive system work area. The size is $70409 + 4 \times BUFFSIZE$ words.
RAM	NDDL tables. The default is 30000. Set by the FMS statement INIT MASTER (RAM=*value*).

SMEM	The memory-resident file space for temporary database files. The default is 100. If "mem=max" is specified on a supported SOL sequence, then SMEM will be set to an estimated maximum. See the "MEM" keyword for more details. Set by the FMS statement INIT SCRATCH (MEM=*value*) or the "smemory" keyword, (p. 90).
BUFFSIZE	The maximum BUFFSIZE used for all the DBsets referenced by the job. The default is 8193. Set by the "buffsize" keyword, (p. 49).
BUFFPOOL	The buffer pool area for permanent database files. The default size is 50. Set by the "bpool" keyword, (p. 49).

The INIT statement may be used to size MASTER and SCRATCH memory. Several examples of the INIT statement, along with an explanation of their uses, follow:

1. If the available memory is a critical resource, then using the following selection reduces memory requirements at the expense of increased CPU and wall-clock time.

```
INIT SCRATCH(NOMEM)      $ temporary database files
```

2. Performance gains may be made by increasing the memory-resident area for the scratch and permanent DBset(s) as follows. Note that the default RAM is sufficiently large and need not be increased.

```
NASTRAN BUFFPOOL=70          $ increase permanent DBsets
INIT SCRATCH                 $ increase scratch memory
(MEM=200)
```

3. If disk space is critical, then all DBsets may be deleted at the end of the job by specifying "S" on the INIT MASTER statement as follows:

```
INIT MASTER(S) $ delete DBsets at end of job
```

   This statement is identical to specifying "scratch=yes" on the command line.

4. If disk space is critical, but data recovery restarts are required, then a database may be created that will support data recovery restarts by setting "scratch=mini" on the command line.

```
prod_ver mdnastran example scratch=mini      for MD Nastran or
prod_ver nastran example scratch=mini        for MSC Nastran
```

Managing DBsets

I/O Performance Libraries

Several of the vendors have provided enhanced I/O libraries for use with MD/MSC Nastran database I/O. The specific keywords enabling or controlling these keywords are:

Table 5-1 I/O Performance Library Keywords

System	Keyword
AIX	mio-cachesize (page 72)
HP-UX	use_aio, (page 98
Linux IPF (SGI Altix)	ff_io, (page 59)
Linux 64 (with mio license)	mio-cachesize (page 72)
Solaris, Primepower	sun_io, (page 92)

Please see "Keywords" on page 46 for additional information on these keywords.

Using the SYS Field

The SYS field is used to specify computer-dependent parameters on ASSIGN statements. If your computer does not recognize a particular parameter, it is silently ignored. This keyword is specified as a comma separated list of keyword=value pairs. For example, file locking may be disabled on for a particular DBset with the following statement:

```
ASSIGN =DBALL=mydball.DBALL= SYS='LOCK=NO'
```

A global SYS field for all DBsets can be specified by the "sysfield" keyword, (page 115).

The following tables describe the SYS field parameters. A complete description of parameters and their syntax is available in "SYS Parameter Keywords" on page 101.

All Systems

Keyword	Purpose
lock	Lock database files.

Systems Supporting File Mapping (see Table 4-7)

Keyword	Purpose
mapio	Use the virtual memory system to map database files to memory.
wnum	Specifies the default number of maps used on database files.
wsize	Specifies the default size of maps used on database files.

Systems Supporting Buffered I/O (see Table 4-7)

Keyword	Purpose
buffio	Use intermediate buffers to hold database file records
wnum	Specifies the default number of buffers used for database files
wsize	Specifies the default size of buffers used for database files
raw	RAW=YES to specify that no intermediate buffering of file data is to be done for the next file to be opened/created. Because of restrictions imposed by the operating system on the use of this capability, “RAW=YES” will only be honored when: Buffered or asynchronous I/O is being used. That is, “BUFFIO=YES”or "ASYNC=YES" must also be specified. The record length of the file (i.e., the RECL value specified when the file is created or opened), when converted to bytes, must be an exact multiple of the disk sectorsize (normally 512 bytes) of the disk containing the file. If either of these conditions is not met, “RAW=NO” will be forced. RAW=NO to specify that intermediate buffering of file data is to be allowed for the next file to be opened/created. This is the default.

Systems Supporting Async I/O (see Table 4-7)

Keyword	Purpose
async	Use intermediate buffers to hold database file records, doing predictive read-ahead
wnum	Specifies the default number of buffers used for database files
wsize	Specifies the default size of buffers used for database files
raw	See note for raw keyword in “Systems Supporting Buffered I/O (see Table 4-7)” on page 123.

Using File Mapping

Notes:

1. See Table 4-8 to determine if file mapping is available on your computer.
2. Altix users can use the “ff_io” parameters (page 59) as an alternative to file mapping.

File mapping is a way to tell the operating system to use the virtual paging system to process a file. From the perspective of the process, file mapping effectively changes the file I/O operations from synchronous to asynchronous because the paging functions of the operating system perform the I/O as part its normal virtual memory management. File mapping can be used for both permanent and temporary DBsets.

The “wsize” and “wnum” parameters, described in “SYS Parameter Keywords” on page 101, specify the size of the window mapping the file to memory and the number of windows or maps that will be used for each file. The larger the window, the less often it must be moved when the file is sequentially read or written. Multiple maps allow several I/O streams to be active in the same file.

File mapping is controlled globally using the “sysfield” command line keyword (page 115) and, for individual DBsets, using the ASSIGN statement SYS field or the logical-name capability of the "sysfield" command line keyword. These same statements can be used to specify the number and size of the windows using the "wnum" and "wsize" keywords.

As an example, if file mapping is to be enabled for all files, the “sysfield” keyword in the command initialization or RC file or on the command line is:

```
sysfield=mapio=yes
```

If file mapping is to be disabled for all files, the “sysfield” keyword is:

```
sysfield=mapio=no
```

Enabling file mapping for all but a specified set of DBsets may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=mapio=yes
  ```

  and, in the MD/MSC Nastran data file, specify:

  ```
  ASSIGN logical-name=filename, SYS='MAPIO=NO'
  ```

  for those files to be processed using normal disk I/O processing.
- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=mapio=yes,logical-name(mapio=no)
  ```

If more than one file is to be processed using normal disk I/O processing, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if there are two user DBsets, USER1 and USER2, that are to be processed using normal disk I/O processing, specify:

```
sysfield=mapio=yes,user*(mapio=no)
```

Disabling file mapping for all but a specified set of DBsets may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=mapio=no
  ```

  and, in the MD/MSC Nastran data file, specify:

  ```
  ASSIGN logical-name=filename, SYS='MAPIO=YES'
  ```

  for those files to be processed using file mapping.

- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=mapio=no,logical-name(mapio=yes)
  ```

If more than one file is to be processed using file mapping, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if the scratch DBsets, SCRATCH and SCR300, are to be processed using file mapping, specify:

```
sysfield=mapio=no,scr*(mapio=yes)
```

Using Buffered I/O

Notes:

1. See Table 4-7 to determine if buffered I/O is available on your computer.
2. SGI IA64 Altix users should use the “ff_io” parameters (page 59) as an alternative to buffered I/O.

Buffered I/O instructs MD/MSC Nastran to “buffer” or use intermediate memory areas to hold records of a file before either writing them out to disk or copying them to the MD/MSC Nastran internal areas. The primary purpose for using buffered I/O is to increase data reuse and, in some cases, to increase the actual read/write data lengths beyond that normally used by MD/MSC Nastran. Buffered I/O can be used for both permanent and temporary DBsets.

The “wsize” and “wnum” parameters, described in “SYS Parameter Keywords” on page 101, specify the size of the buffer to be used to hold file records and the number of such buffers to be used. The larger the buffer, the less often actual physical read/write operations are needed when the file is sequentially read or written. Multiple buffers allow several I/O streams to be active in the same file.

Buffered I/O is controlled globally using the “sysfield” command line keyword (page 115) and, for individual DBsets, using the ASSIGN statement SYS field or the logical-name capability of the "sysfield" command line keyword. These same statements can be used to specify the number and size of the buffers using the "wnum" and "wsize" keywords.

As an example, if buffered I/O is to be enabled for all files, the “sysfield” keyword in the command initialization or RC file or on the command line is:

```
sysfield=buffio=yes
```

If buffered I/O is to be disabled for all files, the “sysfield” keyword is:

```
sysfield=buffio=no
```

Enabling buffered I/O for all but a specified set of DBsets may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=buffio=yes
  ```

  and, in the MD/MSC Nastran data file, specify:

  ```
  ASSIGN logical-name=filename, SYS='BUFFIO=NO'
  ```

  for those files to be processed using normal disk I/O processing.
- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=buffio=yes,logical-name(buffio=no)
  ```

If more than one file is to be processed using normal disk I/O processing, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if there are two user DBsets, USER1 and USER2, that are to be processed using normal disk I/O processing, specify:

```
sysfield=buffio=yes,user*(buffio=no)
```

Disabling buffered I/O for all but a specified set of DBsets may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=buffio=no
  ```

  and, in the MD/MSC Nastran data file, specify:

  ```
  ASSIGN logical-name=filename, SYS='BUFFIO=YES'
  ```

  for those files to be processed using buffered I/O.
- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=buffio=no,logical-name(buffio=yes)
  ```

  If more than one file is to be processed using buffered I/O, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if the scratch DBsets, SCRATCH and SCR300, are to be processed using buffered I/O, specify:

  ```
  sysfield=buffio=no,scr*(buffio=yes)
  ```

Using Asynchronous I/O

Notes:

1. See Table 4-7 to determine if asynchronous I/O ("Async I/O") is available on your computer.
2. SGI IA64 Altix users should use the “ff_io” parameters (page 59) as an alternative to asynchronous I/O.

Asynchronous I/O instructs MD/MSC Nastran to use a predictive "read-ahead" algorithm to detect read patterns within a file (either forwards or backwards) and to issue asynchronous reads to bring data in from the file in anticipation of its later use. These reads use “buffers” or intermediate memory areas to hold the records of a file before they are actually used, i.e., copied to the MD/MSC Nastran internal areas. The primary purpose for using asynchronous I/O is to have records already in buffers when they are requested by MD/MSC Nastran through the use of the predictive logic. A secondary purpose, just as for buffered I/O, is to increase data reuse and in some cases, to increase the actual read/write data lengths beyond that normally used by MD/MSC Nastran. Asynchronous I/O can be used for both permanent and temporary DBsets.

The “wsize” and “wnum” parameters, described in “SYS Parameter Keywords” on page 101, specify the size of the buffer to be used to hold file records and the number of such buffers to be used. Because the number of buffers affects how much actual "read-ahead" is possible, it is important that the number of available buffers be as large as possible. Typically, this value should be at least twice the number of expected different read patterns in file (some MD/MSC Nastran operations may be accessing as many as four different portions of the scratch files at a time). More buffers allow more read-ahead and allow several I/O streams to be active in the same file.

Asynchronous I/O is controlled globally using the “sysfield” command line keyword (page 95) and, for individual DBsets, using the ASSIGN statement SYS field or the logical-name capability of the "sysfield" command line keyword. These same statements can be used to specify the number and size of the buffers using the "wnum" and "wsize" keywords.

As an example, if asynchronous I/O is to be enabled for all files, the “sysfield” keyword in the command initialization or RC file or on the command line is:

```
sysfield=async=yes
```

If asynchronous I/O is to be disabled for all files, the “sysfield” keyword is:

```
sysfield=async=no
```

Enabling asynchronous I/O for all but a specified set of DBsets, specifying that sixteen buffers are to be used when it is enabled, may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

  ```
  sysfield=async=yes,wnum=16
  ```

  and, in the MD/MSC Nastran data file, specify:

  ```
  ASSIGN logical-name=filename, SYS='ASYNC=NO'
  ```

for those files to be processed using normal disk I/O processing.

- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

```
sysfield=async=yes,wnum=16,logical-name(async=no)
```

If more than one file is to be processed using normal disk I/O processing, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if there are two user DBsets, USER1 and USER2, that are to be processed using normal disk I/O processing, specify:

```
sysfield=async=yes,wnum=16,user*(async=no)
```

Disabling asynchronous I/O for all but a specified set of DBsets and, for those DBsets, that sixteen buffers are to be used, may be done in either of the following ways:

- using both the “sysfield” keyword and ASSIGN specifications. In the command initialization file, RC file, or on the command line, specify:

```
sysfield=async=no
```

and, in the MD/MSC Nastran data file, specify:

```
ASSIGN logical-name=filename, SYS='ASYNC=YES,WNUM=16'
```

for those files to be processed using asynchronous I/O.

- using the logical-name capability of the "sysfield" keyword. In the command initialization file, RC file, or on the command line, specify:

```
sysfield=async=no,logical-name(async=yes,wnum=16)
```

If more than one file is to be processed using asynchronous I/O, the other logical-names may be specified on the same "sysfield" statement, on subsequent "sysfield" statements or using the "wildcard" capabilities of the logical-name capability. For example, if the scratch DBsets, SCRATCH and SCR300, are to be processed using asynchronous I/O, specify:

```
sysfield=async=no,scr*(async=yes,wnum=16)
```

Interpreting Database File-Locking Messages (UNIX)

All database files are locked using the operating system function “fcntl(2)”. This prevents two or more MD/MSC Nastran jobs from interfering with one another; however, this does not prevent any other program or operating system command from modifying the files.

A read-write (exclusive) lock is requested for every database file that is to be modified. A read-only (shared lock) is requested on every database file that is not modified, e.g., DBLOCATEd databases. If the lock request is denied because another MD/MSC Nastran job is using the file in a potentially conflicting manner, the following fatal error message is written to the .f06 file:

```
bio-function ERROR - STATUS = errno, FILX = i, LOGNAME = logical, NSBUF3 = j
FILE = filename
ERROR MESSAGE IS --
Unable to acquire a lock_type lock.
lock-type-explanatory-text
Process ID pid is holding a conflicting lock.
```

where *lock-type-explanatory-text* is:

- *lock_type* is “read-only”:

```
This operation failed because another process already holds a read-
write lock on this file.
```

- *lock_type* is “read-write”:

```
This operation failed because another process already holds a
read-write or read-only lock on this file.
```

Some systems will deny a file lock because of an internal resource limit. In these cases, the job is allowed to continue, and the following message will be written to the .f06 file:

```
bio-function WARNING - STATUS = errno, FILX = i, LOGNAME = logical, NSBUF3 = j
FILE = filename
ERROR MESSAGE IS --
Unable to acquire a lock_type lock.
computer-specific-text
advisory-text
```

where *computer-specific-text* is:

AIX

```
The file appears to be in a Parallel Filesystem
partition, and file locking is not supported in PFS
partitions.
```

or

```
The system wide maximum number of file locks has
been exceeded.  See ENOLCK in SC23-2198 Call and
Subroutine Reference.
```

HP-UX	`The file appears to be an NFS file, and remote file locking was denied. See ENOLCK in man 2 fcntl for further information.`
Solaris	`The system wide maximum number of file locks has been exceeded. See ENOLCK in man -s 2 fcntl.`
All others	`The system wide maximum number of file locks has been exceeded. See ENOLCK in man 2 fcntl.`

and advisory-text is:

- *lock_type* is “read-only”

```
If another job modifies this file during this run, there is the
potential for incorrect results to occur in this job.
```

- *lock_type* is “read-write”

```
If another job accesses this file during this run, there is the
potential for the file to be damaged and/or incorrect results to
occur in both jobs.
```

Disabling File Locking

File locking can be disabled by:

- Setting “sysfield=lock=no” in an RC file or on the command line; see “Using the Advanced Keywords” on page 115. This affects all DBsets in the job.
- Setting SYSTEM(207) to a nonzero value using the NASTRAN statement; see “Using the MD NASTRAN or NASTRAN Statement” on page 118. This affects all DBsets in the job.

  The following informational message is written to the .f06 file:

```
*** SYSTEM INFORMATION MESSAGE - BIO
    SYSTEM(207).NE.0 - File locking suppressed.
```

- Setting SYS=LOCK=NO on an FMS INIT statement; see “Using the SYS Field” on page 122. This only affects the specific DBset (s).

Interpreting the .f04 File

MD/MSC Nastran writes information to the .f04 file that aids in monitoring and tuning the performance of your job. An overview of the complete .f04 file can be found in Section 9.2, “Output Description,” of the *MD/MSC Nastran Reference Manual*. This section contains more detailed explanations of selected portions of the .f04 file.

Summary of Physical File Information

This summary table describes the physical files used for the DBsets. A sample of this table, located near the top of the .f04 file, is shown below.

```
 S U M M A R Y   O F   P H Y S I C A L   F I L E   I N F O R M A T I O N

ASSIGNED PHYSICAL FILE NAME                                  RECL (BYTES)  MODE  FLAGS
------------------------------------------------------------  ------------  ----  ---
--
/tmp/65872_57.SCRATCH                                              8192   R/W    L
/tmp/65872_57.OBJSCR                                               8192   R/W    L
/tmp/65872_57.MASTER                                               8192   R/W    L
/tmp/65872_57.DBALL                                                8192   R/W    L
/tmp/65872_57.DBALL2                                               8192   R/W    L
/tmp/65872_57.SCR300                                               8192   R/W    L
/MSC.msc691/aix/SSS.MASTERA                                        8192   R/O    L
/MSC.msc691/aix/SSS.MSCOBJ                                         8192   R/O    L

    FLAG VALUES ARE --
      F   FFIO INTERFACE USED TO PROCESS FILE
      H   HPIO INTERFACE USED TO PROCESS FILE
      L   FILE HAS BEEN LOCKED
      M   FILE MAPPING USED TO PROCESS FILE
      R   FILE BEING ACCESSED IN 'RAW' MODE

** PHYSICAL FILES LARGER THAN 2GB FILES ARE NOT SUPPORTED ON THIS PLATFORM
```

In this summary, “ASSIGNED PHYSICAL FILENAME” is the physical FILENAME with any symbols translated; “RECL” is the record length in bytes; “MODE” is the file access mode, R/W is read-write mode, R/O is read-only mode. The “FLAGS” column will contain various letters depending on the capabilities of the platform and user requests, the text below the table indicates flag values that are possible on the specific platform.

In this example, an INIT statement was used to create the DBALL DBset with two files using the logical names DBALL and DBALL2.

Below the summary is a message indicating if large files (see “Using Databases” on page 94) are available on this platform. On AIX, HP-UX, and Solaris, the actual file system containing the file must support large files; this fact is not indicated in the message.

Memory Map

Immediately following the “Summary of Physical File Information” is a map showing the allocation of memory. This map is also described in “Managing Memory” on page 120.

```
** MASTER DIRECTORIES ARE LOADED IN MEMORY.
   USER OPENCORE (HICORE)          =     3804612  WORDS
   EXECUTIVE SYSTEM WORK AREA      =       78605  WORDS
   MASTER(RAM)                     =       30000  WORDS
   SCRATCH(MEM) AREA               =      204900  WORDS (     100 BUFFERS)
   BUFFER POOL AREA (GINO/EXEC)    =       76183  WORDS (      37 BUFFERS)

   TOTAL MD/MSC Nastran MEMORY LIMIT   =     4194300  WORDS
```

In this table “USER OPENCORE” is the amount of memory available to the module for computation purposes; “EXECUTIVE SYSTEM WORK AREA” is the space reserved for the executive system; “MASTER(RAM)” is the space reserved to cache datablocks from the MASTER DBset; “SCRATCH(MEM) AREA” is the space reserved to cache datablocks from the SCRATCH and SCR300 DBsets; “BUFFER POOL AREA” is the space reserved for the buffer pool; “TOTAL MD/MSC Nastran MEMORY LIMIT” is the total space allocated to MD/MSC Nastran’s open core using the “memory” keyword.

Day Log

The Day Log portion of the .f04 is a DMAP execution summary. This log, in table format, contains the vast majority of the information in the .f04. The beginning of the Day Log is shown below:

```
DAY TIME  ELAPSED  I/O MB   DEL_MB   CPU SEC  DEL_CPU   SUB_DMAP/DMAP_MODULE MESSAGES

10:32:16     0:16    13.6       .3       .8       .0    SESTATIC    20  IFPL     BEGN
10:32:16     0:16    13.7       .1       .8       .0    IFPL        29  IFP1     BEGN
10:32:16     0:16    13.7       .0       .8       .0     IFPL        39  XSORT    BEGN
```

In the Day Log, “DAY TIME” is the time of day of the entry; “ELAPSED” is the elapsed time since the start of the job; “I/O MB” is the megabytes of I/O to the databases since the start of the job; “DEL_MB” is the delta I/O since the previous entry; “CPU SEC” is the total CPU seconds since the start of the job; “DEL_CPU” is the delta CPU since the previous entry; “SUB_DMAP/DMAP_MODULE” indicates the DMAP statement being executed; and “MESSAGES” are any messages issued by the module, “BEGN” is the start of the module and “END” is the end.

Note:

1. The “I/O MB” value is computed by multiplying SYSTEM(85), which is incremented by one for each GINO I/O, by BUFFSIZE. This value will lose accuracy if the DBsets do not have the same BUFFSIZE.
2. If SYSTEM(84) is set to 0, the “I/O MB” column will be the number of GINO I/Os.

3. The “I/O MB” column will be scaled by gigabytes and a “G” will be appended after each number if the value is greater than or equal to 100 000.
4. Prior to Version 69, the “I/O SEC” value was computed by multiplying SYSTEM(85) by SYSTEM(84) (a pseudo-I/O rate).

User Information Messages 4157 and 6439

The UIM 4157 text provides decomposition estimates upon completion on the preface of the decomposition module. This message has a counterpart, UIM 6439, which provides actual information from the completed decomposition process. These two messages are interspersed within the Day Log at each decomposition. The following example is from a sparse decomposition.

```
*** USER INFORMATION MESSAGE 4157 (DFMSYN)
    PARAMETERS FOR SPARSE DECOMPOSITION OF DATA BLOCK  KLL     ( TYPE=RDP ) FOLLOW
                     MATRIX SIZE =     726 ROWS            NUMBER OF NONZEROES =     16926 TERMS
          NUMBER OF ZERO COLUMNS =       0        NUMBER OF ZERO DIAGONAL TERMS =       0
               CPU TIME ESTIMATE =       0 SEC                I/O TIME ESTIMATE =       0 SEC
      MINIMUM MEMORY REQUIREMENT =      58 K WORDS             MEMORY AVAILABLE =    6978 K WORDS
    MEMORY REQR'D TO AVOID SPILL =     133 K WORDS          MEMORY USED BY BEND  =      20 K WORDS
    EST. INTEGER WORDS IN FACTOR =      48 K WORDS          EST. NONZERO TERMS =       79 K TERMS
    ESTIMATED MAXIMUM FRONT SIZE =     210 TERMS               RANK OF UPDATE =       6
*** USER INFORMATION MESSAGE 6439 (DFMSA)
    ACTUAL MEMORY AND DISK SPACE REQUIREMENTS FOR SPARSE SYM. DECOMPOSITION
        SPARSE DECOMP MEMORY USED =     133 K WORDS           MAXIMUM FRONT SIZE =     210 TERMS
          INTEGER WORDS IN FACTOR =       8 K WORDS    NONZERO TERMS IN FACTOR =       79 K TERMS
   SPARSE DECOMP SUGGESTED MEMORY =      91 K WORDS
```

The most important elements of the UIM 4157 message are the “MINIMUM MEMORY REQUIREMENT”, which is an estimate of the user open core memory that will allow the decomposition to run, but with heavy spilling to disk. The “MEMORY REQR’D TO AVOID SPILL” will allow the decomposition to run in “in core”, i.e., without spilling to disk. These two values represent the extremes of memory requirements, the memory for optimal CPU performance is between the two. The “ESTIMATED MAXIMUM FRONT SIZE”, a function of the model, affects the memory estimates; the minimum memory is a function of the front size, and the memory to avoid spill is a function of the square of the front size. The “NUMBER OF NONZEROES” is the size of the input matrix, multiply this value by 8 to estimate the size of the input file in bytes. The sum of “EST. INTEGER WORDS IN FACTOR” and “EST. NONZERO TERMS” is the size of the output matrix, multiply the integer value by 4 on all machines, and the nonzero value by 8 to estimate the size of the output file in bytes. The “RANK OF UPDATE” is the number of rows that will be simultaneously updated during the decomposition. This value is set by either the “rank” keyword or SYSTEM(205).

Note: Setting SYSTEM(69)=64 will cause MD/MSC Nastran to terminate after printing UIM 4157. This can be useful for determining a job’s memory and disk space requirements.

In UIM 6439, “SPARSE DECOMP MEMORY USED” states the actual memory used in the decomposition process. Based on the execution of the module, the “SPARSE DECOMP SUGGESTED MEMORY” will result in optimal throughput performance.

Memory and Disk Usage Statistics

These tables are written after the job has completed, and indicate the maximum memory used by any sparse numerical module and the maximum disk used by any module during the job. A sample follows.

```
+---------- SPARSE SOLUTION MODULES -----------+        +------------- MAXIMUM DISK USAGE -------------+
   HIWATER                SUB_DMAP       DMAP              HIWATER                SUB_DMAP       DMAP
   (WORDS)   DAY_TIME       NAME         MODULE              (MB)    DAY_TIME      NAME         MODULE
    517786   04:35:44    SEKRRS     18  DCMP               15.625   04:35:48    SESTATIC  186  EXIT
```

In the left hand table, “HIWATER WORDS” is the maximum amount of open core used by certainsparse numerical modules; “DAY_TIME” is the time of day the module ran. “SUB_DMAP NAME” is the name of the SUBDmap; “DMAP MODULE” indicates the line number and module name that made the maximum request. Similarly, in the right hand table, “HIWATER (MB)” is the maximum amount of disk space used by any module; “DAY_TIME” is the time of day the module ran. “SUB_DMAP NAME” is the name of the SUBDmap; “DMAP MODULE” indicates the line number and module name that made the maximum request.

Database Usage Statistics

These statistics, provided in table format, summarize the I/O activity for the DBsets.

```
*** DATABASE USAGE STATISTICS ***

+------------------ LOGICAL DBSETS ------------------+   +------------------------- DBSET FILES -------------------------+
 DBSET       ALLOCATED   BLOCKSIZE        USED    USED     FILE        ALLOCATED     HIWATER        HIWATER  I/O TRANSFERRED
             (BLOCKS)     (WORDS)     (BLOCKS)      %                  (BLOCKS)    (BLOCKS)          (MB)             (GB)

 MASTER         5000         2048          143    2.86    MASTER          5000          143         1.117             .010
 DBALL        250000         2048            9     .00    DBALL         250000            9          .070             .000
                                                          DBALL2           300            1          .008             .000
 OBJSCR         5000         2048          121    2.42    OBJSCR          5000          121          .945             .003
 SCRATCH      500100         2048           19     .00   (MEMFILE          100           81          .633             .000)
                                                          SCRATCH       250000            1          .008             .000
                                                          SCR300        250000            1          .008             .000
                                                                                                                ============
                                                                                                    TOTAL:             .013
```

This statistical table contains two parallel tables The “LOGICAL DBSETS” table lists each DBset while the “DBSET FILES” tables lists the component files of the DBset. In these tables, “DBSET” is the name of the DBset; “ALLOCATED” is the MD/MSC Nastran DBset size limit in blocks; “BLOCKSIZE” is BUFFSIZE of the DBset minus one. “USED (BLOCKS)” and “USED %” are the number of blocks and percent of the DBset actually used; “FILE” is the file’s logical name associated with the DBset tothe left. Additionally, “ALLOCATED” is the number of blocks allocated by MD/MSC Nastran to the file; while “HIWATER (BLOCKS)” and “HIWATER (MB)” are the number of blocks and megabytes actually used in the file. “I/O TRANSFERRED” is the amount of I/O to the file. The last line of the DBset Files table lists the “TOTAL I/O TRANSFERRED”.

In this example, the MASTER and OBJSCR DBsets are each composed of one file. The DBALL DBset is composed of two files, DBALL and DBALL2; and the SCRATCH DBset has three components, MEMFILE, SCRATCH, and SCR300.

This table can be used to determine if the DBsets and files are appropriately sized and the amount of I/O activity associated with each file. Best elapsed time performance can be obtained if the files with the greatest activity are on different physical devices (and better yet, separate I/O controllers or busses).

Summary of Physical File I/O Activity

This summary describes the physical file I/O for each database file.

*** SUMMARY OF PHYSICAL FILE I/O ACTIVITY ***

ASSIGNED PHYSICAL FILENAME	RECL (BYTES)	READ/WRITE COUNT	MAP WSIZE (NUM)	MAP COUNT
/tmp/65872_57.SCRATCH	8192	1	128KB (4)	1
/tmp/65872_57.OBJSCR	8192	378	128KB (4)	24
/tmp/65872_57.MASTER	8192	1247	128KB (4)	11
/tmp/65872_57.DBALL	8192	26	128KB (4)	1
/tmp/65872_57.SCR300	8192	1	128KB (4)	1
/MSC.msc691/aix/SSS.MASTERA	8192	162	N/A	N/A
/MSC.msc691/aix/SSS.MSCOBJ	8192	202	N/A	N/A

In this summary, “ASSIGNED PHYSICAL FILENAME”, “RECL”, and “MAP WSIZE and NUM” are repeated from the “Summary of Physical FIle Information” table. “READ/WRITE COUNT” is the number of GINO reads and writes that were performed on the file and “MAP COUNT” is the number of times the map window had to be remapped (these columns are only present on systems supporting mapped I/O).

This summary can be used to tune I/O performance. For mapped I/O systems, if the map count approaches the number of reads and writes, the map size and/or the number of maps should be increased. Increasing the number of maps is suggested if a module simultaneously accesses more data blocks or matrices in a file than there are windows. Increasing the size of the windows is suggested if a file contains very large data blocks or matrices. Best elapsed time performance, with or without mapping, can be obtained if the files with the greatest activity are on different physical devices (and better yet, separate I/O controllers or busses).

Running a Job on a Remote System

The nastran command offers a mechanism to run simple jobs on a computer other than the computer you are currently logged onto via the "node" keyword, (page 75). In the descriptions that follow, the "local" node or system is the computer you issue the nastran command on; the "remote" node or system is the computer named by the "node" keyword, i.e., the system where the MD/MSC Nastran analysis will run.

The method used to communicate between the local and remote nodes depends on the operating system on the remote node:

- If the remote node is a UNIX system (or a similar system such as Linux), the "rsh/rcp" communications programs may be used.
- If the remote node is a Windows system (i.e., a system running Windows XP), the "MSCRmtCmd/MSCRmtMgr" communications programs must be used. (See “Installing/Running MSCRmtMgr” on page 143.)

Following are some general requirements for running remote jobs:

- MD/MSC Nastran must be properly installed on the remote system.
- The input data file must be accessible on the local host.
- INCLUDE files must be local-to, or visible-from, the remote system unless the "expjid" keyword is used (or taken by default).
- All default output files, i.e., those without ASSIGN statements, will be written to a directory accessible to the local host.
- In a restart, i.e., a job that uses an existing database, the DBsets must be local-to, or visible-from, the remote system.

If the rsh/rcp communications programs are to be used:

- You must have "remote execution" privileges on the remote system. That is, a password must not be required to execute a remote copy (rcp) or remote shell (rsh or remsh) command. See your system administrator for information on this. You can test this with the following command:

```
remsh <node> [-l <username>] date      # HP-UX only
rsh <node> [-l <username>] date        # All others
```

where "<node>" is the name of the remote node and "<username>" is an alternative username on the remote system if your current username is not valid. For example:

```
rsh node1 date
```

The output from the above command should be a single line containing the current date on node1 in a format similar to:

```
Tue Jul 16 15:05:47 PDT 2002
```

If any other output is present, please determine the source of the output and correct the problem. If you cannot eliminate the output, you will not be able to use the remote execution capabilities of the nastran command for the specified remote node.

If the MSCRmtCmd/MSCRmtMgr communications programs are to be used:

- The MSCRmtMgr program must be running on the remote system, either as an installed and started service or as a console mode program running in a Command Prompt window (started with the "-noservice" command line option). You can test this with the following command:

```
<instdir>\bin\prod_ver mscrmtcmd -h <node> -i    (from Windows)
<instdir>/bin/prod_ver MSCRmtCmd -h <node> -i    (from UNIX)
```

where "`<instdir>`" is the installation directory for the local MD/MSC Nastran installation and "`<node>`" is the name of the remote node. For example:

```
c:\msc\bin\prod_ver mscrmtcmd -h node1 -i    (From Windows)
/msc/bin/prod_ver MSCRmtCmd -h node1 -i      (From UNIX)
```

The output from the above command(s) should be a single line containing configuration information for node1 in a format similar to:

```
1@2@"C:/WINNT40/system32/cmd.exe"    (If node1 is Windows)
2@1@"/bin/ksh"                       (If node1 is UNIX)
2@2@"/bin/bsh"                       (If node1 is Linux)
```

If any other output is present or if the request fails, please determine the source of the output and correct the problem. If you cannot eliminate the output, you will not be able to use the remote execution capabilities of the nastran command for the specified remote node.

Note: Recall that, for remote UNIX nodes, remote executions do not run a "login" shell. That is, your ".profile" or ".login" script is not executed. This is true regardless of the communications programs (rsh/rcp or MSCRmtCmd/MSCRmtMgr) being used.

If the node specified by the "node" keyword is the same as the local node, the "node" keyword is ignored and processing will continue as if "node" had not been defined.

If the local node is a Windows system and if rsh/rcp is to be used, the nastran command attempts to locate the rsh.exe program in the

```
%SYSTEMDRIVE%%SYSTEMROOT%\system32
```

directory before using the search path because "rsh" may be a "restricted shell" program installed as part of a UNIX commands package such as MKS Toolkit.

If the local node is a Windows system, MSC supplies a replacement for the standard Windows rsh.exe program, MSCrsh.exe. This program is a full functional replacement for the standard rsh.exe program with the addition of support for "Toolkit" mode. Toolkit mode requires that the stdin and stdout streams used for communications between the local and remote systems be "binary" data streams. The standard Windows rsh.exe program treats these streams as "text" streams, which is not compatible with Toolkit mode. See the ***MD/MSC Nastran Toolkit User's Guide*** for more information on Toolkit mode. The nastran command will use MSCrsh.exe instead of rsh.exe if it can be found. Also, there are some circumstances where the Windows rsh.exe and rcp.exe commands do not perform reliably. Alternatively, use the MSCrsh.exe program.

The MSCRmtCmd/MSCRmtMgr communications programs may also be used when the remote node is a UNIX system. However, there are no inherent advantages over using the rsh/rcp programs.

When running a remote job, nastran keywords are processed on both the local and remote systems. Keywords that control the job's output and interaction with you are processed on the local system Keywords that specify information about the remote system's installation or that affect the actual analysis are processed on the remote system. MSC suggests that those keywords that specify information about the remote system's installation be defined in conditional Initialization or Runtime Configuration File sections based on the "node" keyword and that those keywords that specify information about the local system's installation be defined in conditional Initialization or Runtime Configuration File sections based the "s.hostname" keyword.

The following table lists some of the keywords that affect remote processing. These keywords are described in detail in “Keywords” on page 46.

Table 5-2 Remote Processing Keywords

Keyword	Purpose
append	Requests the .f06, .f04 and .log files to be concatenated.
batch	Requests the job is to be run in the background. (UNIX only.)
delete	Unconditionally deletes files after job completion.
display	Specifies the DISPLAY for XMONAST. (UNIX only.)
expjid	Specifies data file expansion on the local system.
lsymbol	Specifies logical symbol values to be used on the local system.
ncmd	Specifies an alternate notification command.
node	Specifies the node the job will be processed on.
notify	Requests notification when the job completes.

Table 5-2 Remote Processing Keywords (continued)

Keyword	Purpose
old	Specifies versioning or deletion of previously existing output files.
oldtypes	Specifies additional user file types to be version or deleted.
out	Specifies an alternate output file prefix.
rcmd	Specifies the nastran command path on the remote system.
rostype	Specifies the remote node operating system type.
rrmtuse	Specifies the communication programs to be used.
rsdirectory	Specifies the directory on the remote system to contain MD/MSC Nastran temporary files.
scratch	Specifies the DBsets are to be deleted at job completion
sdirectory	Specifies the directory on the local system to contain MD/MSC Nastran temporary files. If "rsdirectory" is not specified, this directory will also be used on the remote system.
symbol	Specifies logical symbol values to be used on the remote system.
trans	Requests translation of the .xdb file.
username	Specifies an alternate username on the remote host.
xhost	Request xhost(1) to be executed to allow XMONAST to display on the current host. (UNIX only)
xmonitor	Requests XMONITOR to monitor the job's progress. (UNIX only)

The "sdirectory"/"rsdirectory" keywords are special, as the command line, RC files on the current host and RC files on the remote host will all be considered when establishing a scratch directory. As part of its processing, the nastran command may generate temporary files on both the local system (e.g., as part of "expjid" processing) and on the remote system (e.g., the location where temporary RC files are placed and where output files are generated). These files are placed in the "scratch" directories on the local and remote systems. If the "rsdirectory" keyword is not specified, the "sdirectory" location must be valid on both the local and remote systems. (Note that this is not possible if the systems are running different types of operating systems.) All other keywords specifying path/file names will only be scanned on the remote system and must specify path/file names appropriate for that system.

Once "node=*remotenode*" is processed, the following processing takes place:

1. Process the RC files on the local system if the "version" keyword has been defined in the command initialization file or the command line.
2. Process the RC file specified by the "rcf" keyword if it was defined on the command line.
3. Reprocess the command initialization file and any RC files if any contained conditional sections. (See “Resolving Duplicate Parameter Specifications” on page 13 for a more complete description of Command Initialization file and Runtime Configuration file processing.)

4. Determine the full pathname of the input file so that its visibility from *remotenode* can be tested.
5. If the "rmtdeny" utility, i.e., *install-dir*/*prod_ver*/*arch*/rmtdeny on UNIX and *install-dir**prod_ver*\i386\rmtdeny.exe on Windows, exists and is executable, run it and examine its output. If *remotenode* **is** listed, display an error and cancel the job.
6. If the "rmtaccept" utility, i.e., *install-dir*/*prod_ver*/*arch*/rmtaccept on UNIX and *install-dir**prod_ver*\i386\rmtaccept.exe on Windows, exists and is executable, run it and examine its output. If *remotenode* **is not** listed, display an error and cancel the job.
7. Verify that *remotenode* exists and you are able to run a command on that system. This process also determines the communications programs to be used and the *remotenode* operating system type. Although the nastran command can determine this information dynamically, processing may be much faster if you specify the proper information using the "rrmtuse" and/or "rostype" keywords (for example, in an INI or RC file conditional section). The information is set as follows:
8. If the "MSCRmtCmd/MSCRmtMgr" communications programs are selected (by either defining "rrmtuse=mscrmtcmd" or defining "rostype=windows" or dynamically selected), the *remotenode* operating system type is determined automatically.
9. If the "rsh/rcp" communications programs are selected (by either defining "rrmtuse=rsh" or defining "rostype=unix" or dynamically selected), the *remotenode* operating system type is assumed to be UNIX.
10. If both the local node and remote node operating system types are UNIX, create a "touch" file in the specified output file so that its visibility from *remotenode* can be tested.
11. If "rsdirectory" has not been defined or contains multiple values, set it as follows:
12. If "rsdirectory" has been defined but contains multiple values, change its value to the first value.
13. If "sdirectory" has not been set and the local system is Windows, set "rsdirectory" to "c:\tmp" if the *remotenode* operating system is Windows and to "/tmp" otherwise.
14. If "sdirectory" has not been set and the local system is UNIX, set "rsdirectory" to "c:\tmp" if the *remotenode* operating system is Windows and to the path defined by the "TMPDIR" environment variable otherwise.
15. If "sdirectory" has been set "rsdirectory" to the first (or only) value defined by "sdirectory".
16. Ensure "scratch=no" was set if the "dbs" keyword was set.
17. If the "rcmd" keyword was specified, attempt to execute that command on *remotenode*, displaying an error and canceling the job if it fails.

    Otherwise, attempt to execute the pathname of the current nastran command on *remotenode*. If it fails, attempt to run the basename of the current nastran command on *remotenode*. Display an error and cancel the job if both checks fail.
18. Run the remote nastran command identified in the previous step to determine:

    If the directory specified by "rsdirectory" is valid.

    If "scratch=no" is set, if the directory specified by "dbs" is valid.
19. The numeric format of the remote system.

20. The location of the TRANS program on the remote system.

    If both the local and remote modes are UNIX, the following tests are also made:

    If the input data file is visible.

    If the "touch" file is visible.

    If "expjid" was specified, if the "expjid" expand directory is visible.

21. Display an error and cancel the job if an "rsdirectory" was identified on the command line or in a local RC file, but does not exist on the remote node.
22. Display an error and cancel the job if the "dbs" directory was identified on the command line or in a local RC file, but does not exist on the remote node.
23. If a "touch" file was created above, delete it.
24. Make sure a RECEIVE executable exists on the local node if "trans=yes" was specified or "trans=auto" was specified and the numeric formats of the local and remote nodes differ.

If the local system is a UNIX system, the following steps are done in a background process (possibly some time later if "batch=yes" or "after" was specified). If the local system is a Windows system, the following steps are done from within the nastran command itself.

25. Copy the input data file (or the expanded file if "expjid" processing was performed) to the remote system's scratch directory if the remote host could not see the file or if the local and remote operating system types are different.
26. Set the "out" to the remote system's scratch directory if the remote host could not see the output directory or if the local and remote operating system types are different.
27. Copy the remaining keywords on the command line that were not processed to a local RC file in the scratch directory on the remote node.
28. Run the job on the remote node.
29. Process the "old" and "oldtypes" keywords on the local node.
30. If the output directory was not visible from the remote node or if the local and remote operating system types are different, copy the output files (.f04, .f06,.log, .ndb, .pch, .plt) to the directory specified by the "output" keyword and delete the files from the remote node.
31. Process the "append" keyword on the local node.
32. If the output directory was not visible from the remote node or if the local and remote operating system types are different and if an .xdb file was created on the remote node, run the RECEIVE program if required by the "trans" keyword or copy the .xdb file to the directory specified by the "output" keyword and delete the .xdb file from the remote node.
33. Process the "notify" keyword on the local node.

Once the job has completed, the .f06, .f04, .log, .ndb, .op2, .plt, .pch and .xdb files will be present as if the job were run locally. Binary files, i.e., .op2 and .plt, will only be usable on the local node if the local and remote nodes use the same numeric format. The .xdb file will be translated via TRANSMIT and RECEIVE unless "trans=no" was specified.

Note: No attempt is made to copy DBset files between the local and remote systems. If this is required, you must handle this yourself and set the "dbs" keyword as required.

Several examples are provided.

prod_ver `nastran example node=othernode batch=no` (UNIX)

prod_ver `nastran example node=othernode` (Windows)

This job will run on node "`othernode`". The .f04, .f06, .log, .pch, .plt, and .xdb files will be brought back to the current node as if the job were run locally. (Note that Windows systems do not support the use of the "batch" keyword.)

prod_ver `nastran example node=othernode rcmd=/some/path/bin/nast2011`

This job will also run on "`othernode`" (assumed to be a UNIX system) but the path to the nastran command has been specified explicitly.

prod_ver `nastran example node=othernode rcmd=d:/a/path/bin/nast2011`

This job will also run on "`othernode`" (assumed to be a Windows system) but the path to the nastran command has been specified explicitly. Note the use of forward slashes ('/') in the "rcmd" value. If the local system is a Windows system, either forward slash ('/') or back slash ('\') characters may be used. If the local system is a UNIX system, forward slash ('/') characters must be used or the entire rcmd specification must be enclosed in quotes to prevent the shell from interpreting the back slash ('\') characters as "escape" characters. When the rcmd specification is used on "othernode", the forward slash characters will be changed to back slash characters as needed.

prod_ver `nastran example node=othernode dbs=/dbs`

This job will also run on "othernode" (assumed to be a UNIX system) but will use the "`/dbs/example.*`" DBset files. These files must exist on "`othernode`" prior to running this command if this is a restart job. Once the job completes, the DBset files will be left as is.

prod_ver `nastran example node=uxsrv rsdir=/tmp sdir=/scratch`

This example will run a job on UNIX node "uxsrv" using the nastran command in the default PATH with all scratch files on the local system residing in /scratch and all scratch files on the remote system residing in /tmp. Note that the "sdir" and "rsdir" keywords could have been set in an RCF file.

```
prod_ver nastran example node=uxsrv rsdir=
```

This job will use the default scratch directory on "uxsrv".

```
prod_ver nastran example node=uxsrv rsdir= rcmd=/msc/bin/nast2011
```

This job will use the nastran command /msc/bin/nast2011 on "uxsrv".

Installing/Running MSCRmtMgr

The MSCRmtMgr program provides the server-side communications support used by the MSCRmtCmd client-side program. That is, MSCRmtMgr provides functions equivalent to the UNIX rshd/rexec services. MSCRmtMgr is primarily intended for use on Windows XP systems.

For Windows systems, MSCRmtMgr may only be run on Windows XP. MSCRmtMgr may be run as a command-mode program or as a service, providing the same functionality in either case.

Running MSCRmtMgr as a Command-mode Program

This is the simplest way to run MSCRmtMgr but is the least flexible in that MSCRmtMgr must be restarted every time the operating system is restarted. In this mode, MSCRmtMgr is started in a "Command Prompt" window that is left open as long as the Windows system is to act as a server. The command is:

```
<instdir>\bin\prod_ver MSCRmtMgr -noservice
```

The "-noservice" operand is required and tells MSCRmtMgr that it is not to attempt to run as a Windows service program. In this mode, MSCRmtMgr will run using the authorization and access control provided by the currently logged on user. MSCRmtMgr may be terminated using <CNTL-C> or by using the Task Manager.

Installing and Running MSCRmtMgr as a Windows Service

The MSCRmtMgr program may also be run as a Windows Service program. Doing this requires the Microsoft Windows Resource Kit SC.exe (Services Control) utility program, available from Microsoft, and run from a command prompt. Install MSCRmtMgr as a service using the following command:

```
sc create MSCRmtMgr type= own start= auto
binpath= <instdir>\prod_ver\i386\mscrmtmgr.exe
```

where:

`type= own`	indicates that MSCRmtMgr is to be run in its own process
`start= auto`	indicates that MSCRmtMgr is to be automatically started at boot time. This may also be specified as "`start= demand`".
`binpath= ...`	specifies the full path to the MSCRmtMgr program.

Note the blanks between the equal sign following the option and the actual value. These blanks are required.

Once MSCRmtMgr has been installed as a service, it may be started or stopped using the Services Administrative Tools program or using SC.exe as follows:

To start MSCRmtMgr:

```
sc start MSCRmtMgr -service -name "MSCRmtMgr"
```

To stop MSCRmtMgr:

```
sc stop MSCRmtMgr
```

If MSCRmtMgr is no longer required, it may be deleted as a service using SC.exe as follows:

```
sc delete MSCRmtMgr
```

Note that this will remove MSCRmtMgr as a service but will not actually delete the executable. It may be reinstalled as a service using the command described above.

Running Distributed Memory Parallel (DMP) Jobs

MD/MSC Nastran offers the ability to run certain solution sequences (see the MSC Nastran Quick Reference Guide) in parallel using the Message Passing Interface (MPI), an industry-wide standard library for C and Fortran message-passing programs. MPI programs can be run on SMP computers, NUMA computers, distributed computers, and any collection of computers supported by the MPI package.

Note: Further information on the MPI *standard* can be obtained online at the URL

http://www.mpi-forum.org

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In most cases, MD/MSC Nastran uses the hardware vendor's MPI implementation. While this usually results in the highest performance levels, it also presents a limitation--a DMP job can only run on computers supported by the vendor's MPI package. As an example, you cannot use a mixture of IBM and Sun machines to run a single MD/MSC Nastran DMP job.

The following table lists the hardware and software prerequisites for **every** host that will take part in running an MD/MSC Nastran DMP job:

Table 5-3 DMP System Prerequisites

Platform	System Prerequisites	
AIX	Processor	Any
	OS	AIX 5.3
	MPI	POE 4.2
AMD/Intel Linux	Processor	Any
	OS	RHEL 4.5
	MPI	OpenMPI 1.2.2 HP/MPI 2.2.5 Intel/MPI 3.1
AMD/intel Solaris	Processor	Opteron/EMT64T
	OS	5.10
	MPI	HPC 7.1

Table 5-3 DMP System Prerequisites (continued)

Platform	System Prerequisites	
AMD/Intel Windows	Processor	Opteron/EM64T
	OS	Windows Server 2003 x64 Edition with CCS
	MPI	Intel-MPI
	.NET Framework	All nodes must have the same .NET version. The following environment variable is required to run Nastran with DMP using the "hosts=" option: `Environment Variable: CHKCCS. Value yes` (Note that the value is in lower case)
HP-UX	Processor	PA-RISC 2.0
	OS	HP-UX 11.11, 64-bit
	MPI	No additional software is required.
Solaris	Processor	UltraSPARC
	OS	Solaris
	MPI	HPC 5.0

In the descriptions that follow, the “local” node is the computer you issue the nastran command on, the “master” node is the first computer named by the “hosts” keyword, the “slave” nodes are the remaining systems listed in the “hosts” list.

The following are some general comments and requirements for running MD/MSC Nastran DMP jobs:

1. MD/MSC Nastran must be properly installed on, or accessible to, all the hosts listed by the “hosts” keyword.
2. With the exception of HP-UX systems, the MPI program start command (“dmprun” on HP-UX, “poe” on AIX, “mprun” on Sun, “mpiexec” on Windows, and “mpirun” on others) must be available on the PATH of the local host.
3. For Linux/UNIX systems you must have r-command access to each system you want to access in a distributed job.

   You can test this with the following command:

```
remsh <node> [-l <username>] date  # HP-UX only
rsh <node> [-l <username>] date  # All others
```

where “<node>” is the name of the node and “<username>” is an alternate username on the remote system if your current username is not valid. For example:

```
rsh node1 date
```

The output from the above command should in a single line containing the current date on node1 in a format similar to:

```
Thu Sep 30 13:06:49 PDT 1999
```

If any other output is present, please determine the source of the output and correct the problem. If you cannot eliminate the output, you will not be able to use the distributed execution capabilities of MD/MSC Nastran.

4. On Altix, the use of multiple hosts requires Array Services to be configured for each possible host.
5. On AIX, you must set “resd=no” and “eulib=ip” on the command line or in an RC file. If not, the job may fail to start with the following error message:

```
ERROR: 0031-149  Unable to load shared objects objects required
for LoadLeveler
```

The following system error may be reported when the distributed job has completed:

```
ERROR: 0031-636 User requested child or EOF termination of pm-
command
```

It can be ignored

6. On AIX running on a cluster of workstations, you must set “euidevice=ip” and “resd=yes” on the command line or in an RC file if you run on a cluster of workstations. Also, in AIX systems, the current directory must be visible to all nodes.
7. The input data file must be accessible on the local host.
8. For Windows systems, a working directory accessible to all nodes must be available for use by the CCS Job Scheduler.
9. On Windows systems, all pathnames will be converted, if necessary, to Universal Naming Convention (UNC) format for all accessibility tests. If a pathname has no equivalent UNC name, it will be considered “not accessible”. Also, if “ccsnodesmust=no” is specified, the input data file and output directory must be visible from all nodes specified by the “hosts” keyword.
10. On all systems, you must have write access to the output directory.
11. INCLUDE files must be local-to, or visible-from, each host.

12. All default output files, i.e., those without ASSIGN statements, will be written to a directory accessible to the local host.
13. The scratch directory can be a gbbal or local file system. MSC recommends the scratch directory be local to each host, i.e., you specifyper-host “sdirectory” values. See“Managing Host-Database Directory Assignments in DMP Jobs” on page 155 for more information.
14. The pathname of the nastran command must be the same on all hosts, or on the default PATH of each host, used in the analysis.
15. For Linux/Unix systems you must have “remote execution” privileges on all the hosts listed by the “hosts” keyword. That is, a password must not be required to execute a remote copy (rcp) or remote shell (rsh or remsh) command. See your system administrator for information on this.
16. For Windows systems, you must be running on the “head” node of the Windows Compute Cluster and all of the hosts listed by the “hosts” keyword must be nodes in the same Compute Cluster. Note, however, that the “head” node of the Compute Cluster does not have to be inthe list of hosts specified by the “hosts” keyword.
17. On Windows systems, commands and jobs, including those run on remote hosts, are run using the Windows CCS “QueueJob” interface, waiting for the queued job to complete before continuing, since this interface does not required any special privileges. The only exception to this is when all DMP tasks are to be run on the same node and that node is the “head” node of the CCS cluster. In this case, the CCS Job Scheduler is not used, instead the DMP tasks are run using the mpiexec command directly.
18. If you execute a restart, you must specify the identical values for “dmparalle” and “hosts” as were used on the cold start.
19. In a restart, i.e., a job that uses an existing database, the DBsets must be local-to, or visible-from, the remote system.

Note: For Linux/UNIX systems recall that remote executions do not run a “login” shell. That is, your “.profile” or “.login” script is not executed.

When running a DMP job, nastran keywords are processed on both the local and master/slave systems. Keywords that control the job’s output and interaction with you are processed on the local system. These are:

Table 5-4 DMP Processing Keywords

Keyword	Purpose
adapter_use	AIX: Specifies use of adapter by job.
append	Requests the .f06, .f04, and .log files to be concatenated.
ccsnodesmust	Windows: Specifies whether the hosts listed by the “hosts” keyword *must* be allocated by the CCS scheduler or are only a list of possible nodes.
ccstempdir	Windows: Specifies a network-visible working directory for use by the Windows CCS Job Scheduler

Table 5-4 DMP Processing Keywords (continued)

Keyword	Purpose
cpu_use	AIX: Specifies use of CPU by job.
display	Linux/UNIX: Specifies the DISPLAY for XMONAST.
euidevice	AIX: Specifies adapter device name.
euilib	AIX: Specifies adapter library.
hostovercommit	Requests more tasks per host than CPUs.
hosts	Specifies list of hosts to use. Separate hosts with a comma or with the PATH separator, i.e., ":" on Linux/UNIX and ";" on Windows.
maxnode	AIX: Specifies the maximum number of hosts to use when a pool request is being used. This is required if the hosts have more than one processor and you want more than one DMP task to run on a single host.
mergeresults	Specifies the results from each DMP task are to be merged into the standard files from the master host.
ncmd	Linux/UNIX: Specifies an alternate notification command.
notify	Requests notification when the job completes.
old	Specifies versioning or deletion of previously existing output files.
oldtypes	Specifies additional user file types to be versioned or deleted.
out	Specifies an alternate output file prefix.
rcmd	Specifies the nastran command path on the master/slave systems.
resd	AIX: Requests resource manager assign job.
rmpool	AIX: Pool ID to be used when LoadLeveler Version 2.1 queue submittal is being used to run a DMP job.
rmtdiskmsg	Enables or disables the "sdir and/or dbs disks are remotely mounted" message.
scratch	Specifies the database DBsets are to be deleted at job completion.
sdirectory	Specifies each per-host directory to contain MD/MSC Nastran temporary files. Separate directories with a comma or with the PATH separator, i.e., ":" on Linux/UNIX and ";" on Windows.
slaveout	Specifies the .f04 and .f06 files from the slave tasks are to be appended to the .f04 and .f06 files of the master task.
xhost	Linux/UNIX: Request xhost(1) to be executed to allow XMONAST to display on the current host.
xmonitor	Linux/UNIX: Requests XMONITOR to monitor the master task's progress.

The “sdirectory” keyword is special, as the command line, RC files on the current host, and RC files on the each master and slave host will all be considered when establishing a scratch directory. All remaining keywords are only scanned on the master and slave systems.

Once “dmparallel=*number*” is processed, the following processing takes place:

1. Process the RC files on the local system if the “version” keyword has been defined in the command initialization file or the command line.
2. Process the RC file specified by the “rcf” keyword if it was defined on the command line.
3. Determine the full pathname of the input file so that its visibility from the master and each slave host can be tested. For Windows, this full pathname will be converted to UNC format, if necessary.
4. Create a “touch” file in the specified outputdirectory so that its visibility from the master and each slave host can be tested.
5. If the “dmpdeny” utility, i.e., *install-dir*/msc2011/*arch*/dmpdeny, exists and is executable, run it, and save its output.
6. If the “dmpaccept” utility, i.e.,*install-dir*/*prod_ver*/*arch*/dmpaccept, exists and is executable, run it, and save its output.
7. Ensure “scratch=no” was set if the “dbs” keyword was set.
8. Determine every possible pairing of host and sdirectory by scanning each list in a round-robin order. That is, the first *host* is paired with the first *sdirectory*, the second *host* with the second *sdirectory*, and so on.
9. For Windows systems, if any host specified using the “hosts” keyword is not the head node, then locate a working directory to be used by the CCS Job Scheduler. This working directory must be network-accessible and must be available, in write-mode, to all of the hosts specified using the “hosts” keyword. The directory is located as follows:
   a. If there is a directory specified using the “ccstempdir” keyword, it is used, converting the specified directory to UNC format, if necessary. An error will be generated if this directory cannot be converted to UNC format and processing will be terminated.
   b. If the “ccstempdir” keyword was not specified, a network-accessible directory will be searched for using the following search order:
      i. Check the directory specified by the “sdirectory” keyword.
      ii. Check the directory portion of the location specified by the “out” keyword, either the value explicitly set by the user or the internally generated location.
      iii. Check the current directory.
      iv. Check the directory specified by the “TEMP” environment variable.
      v. Check the directory specified by the “TMP” environment variable.

      If no network-accessible directory could be located using this search, an error will be generated and processing will be terminated.

   Any temporary files needed by the CCS Job Scheduler and by the mpiexec program will be stored in this directory.

10. Execute the following steps for each *host-sdirectory* pair determined above until *host-sdirectory* pairs have been assigned to each of the tasks requested by the "dmparallel" keyword or no more *host-sdirectory* pairs are available. Steps a. through i. are executed only once per *host-sdirectory* pair.
    a. Verify that *host* exists. For Linux/UNIX systems, verify that you are able to run a command on that system. For Windows systems, verify that host is a member of the Compute Cluster.
    b. If the "rcmd" keyword was specified, attempt to execute that command on *host*, display an error and cancel the job if it fails.
    c. Otherwise attempt to execute the pathname of the current nastran command on *host*. If it fails, attempt to execute the basename of the current nastran command on *host*. Display an error and cancel the job if both checks fail. For Windows systems, these pathnames are converted to UNC format, if necessary, before they are used.
    d. For Windows systems, if the "rcmd" keyword is specified, its value must be suitable for *all* specified hosts. Normally, this means it must be specified in UNC format. It is not automatically converted to UNC format.
    e. Run the remote nastran command identified in the previous step to determine: if the input data file is visible; if the "touch" file is visible; if the "sdirectory" (if identified on the local system) exists; if the "dbs" directory (if identified on the local system) exists; the "sdirectory" value in the RC files defined on *host*; and finally the numeric format of *host*.
    f. Drop this *host-sdirectory* pair from further consideration if a scratch directory was identified on the command line or in a local RC file and that specified a list of directories, but the sdirectory does not exist on *host*.
    g. For Windows, if "ccsnodesmust=no" is specified, drop this *host-sdirectory* pair from further consideration if either the input file or the output directory is not visible on *host*.
    h. Display an error and cancel the job if the numeric format of *host* differs from the numeric format of the local host or if the operating system type of *host* differs from the operating system type of the local host, i.e., you cannot mix Linux/UNIX hosts with Windows hosts.
    i. Display an error and cancel the job if the directory specified by a "dbs" keyword on the command line or in a local RC file does not exist on *host*.
    j. Assign the current host-sdirectory pair to the next task; save the "sdirectory" value and the per-host visibility flags and "rcmd" value.
11. Display an error and cancel the job if one or more of the tasks requested by the "dmparallel" keyword have not been assigned.
12. Delete the "touch" file created above.
13. For Linux/UNIX systems, the remaining steps are done in a background process (at possibly some time later) if "batch=yes" or "after" was specified. For Windows, if "ccsnodesmust=no" is specified, note that none of the copy steps that send files to or from hosts are done because all files must be visible.
    a. Copy the input data file to the scratch directory of any host that could not see the input data file.

b. Set “out” to the host-specific scratch directory value of every host thatcould not see the output directory.

c. Copy the remaining keywords on the command line that were not processed to a local RC file in the “out” directory. Copy this RC file to the host-specific scratch directory on any host that could not see the output directory.

d. Process the “old” and “oldtypes” keywords on the local node.

e. Run the DMP job using the system’s MPI startup command. Note that each task will write to task-specific names. For Windows systems, the MPI startup command will be scheduled using the CCS job scheduler unless all tasks are to be run on the same node and that node is the “head” node.

f. If the master task could not see the output directory, copy the output files (.f04, .f06, .log, .ndb, .pch, .plt) from the master node to the output directory (the directory specified by the “output” keyword) and delete the files from the master node.

g. Process the “append” keyword on the local node.

h. For Linux/UNIX systems, process the “notify” keyword on the local node.

Once the job has completed, the .f06, .f04, .log, .ndb, .op2, .plt, .pch, and .xdb files from the master task will be present as if the job were run locally.

Note: No attempt is made to copy DBset files between the local and master/slave systems. If this is required, you must handle this yourself and set the “dbs” keyword appropriately.

Determining Hosts Used by DMP Jobs

The examples that follow use the Linux/UNIX syntax. Nevertheless, unless specifically noted otherwise, the discussion and examples are applicable to Windows. The only change needed in the examples to make them applicable to Windows is to replace the colon (‘:’) separator character with a semi-colon (‘;’) separator character. Alternatively, you may use a comma (‘,’) as a separator character on any platform.

The nastran command uses the following hierarchy to determine the list of hosts to use:

1. The nastran command “hosts” keyword on the command line
2. System-dependent environment variable.

   AIX: MP_HOSTFILE

   HP UNIX: DMPI_HOSTFILE.
3. The nastran command “hosts” keyword in an RC file.
4. AIX: The MP_RMPOOL environment variable.
5. The local host.

Consider the following examples:

```
prod_ver nastran example dmparallel=4
```

This job will run on the local host.

```
prod_ver nastran example dmparallel=4 hosts=node1:node2:node3:node4:node5
```

This job will run on the first four available nodes from the set “node1”, “node2”, “node3”, “node4”, “node5”.

```
prod_ver nastran example dmparallel=4 hosts=my.host.list
```

This job will read the file “my.host.list”.

The nastran command provides a simple host allocation method. If a host listed by the “hosts” keyword is unavailable, it will be skipped and the next host considered. As long as at least the number of processors specified by the “dmparallel” keyword are available on one or more of the listed hosts, the job will be allowed to run.

Hosts (AIX)

The “hosts” keyword can now coexist with the LoadLeveler queue submittal process if your distributed jobs must be submitted via IBM’s LoadLeveler. To submit a job via LoadLeveler, the “hosts” keyword must use the syntax “host=@queue_name”.

Note: This uses features of the nastran command’s standard queue submittal process, but you do not set the queue keyword.

Example:

```
prod_ver nastran example dmp=4 hosts=@ll
```

In this example, four hosts will be assigned by LoadLeveler after the nastran command submits the job to queue “ll”.

To use this feature, you must define queue submittal commands in an RC file using the “submit” keyword.

Example:

```
submit=ll=ll_submit %job%
```

The previous example nastran command will submit a job to the “ll” queue using the site’s “ll_submit” command.

Note: You may also need to modify the <install-dir>/bin/nast2011.dmp file if job queuing information must be embedded in the job stream.

A hypothetical example is included.

THE SAMPLE QUEUING INFORMATION MAY NOT WORK WITH YOUR SITE’S QUEUING REQUIREMENTS

Pool Request (AIX)

A pool request can be specified using the “hosts” keyword with either of the following forms:

```
hosts=@pool1:@pool2:...:@pooln
hosts=@pool
```

where *pooli* or *pool* is a number. The second form assigns all tasks to the specified pod number. See your system administrator for information on the pools available at your site.

```
prod_ver nastran example dmparallel=4 hosts=@1:@1:@2:@2
```

This job runs two tasks each on pools 1 and 2.

```
prod_ver nastran example dmparallel=4 hosts=@3
```

This job runs all tasks on pool 3.

If you are using LoadLeveler Version 2.1 or greater to process your pool request you may also need to use the “maxnode” keyword. This is required if you want more than one DMP task to run on a single host.

This job runs eight tasks on four hosts from pool 1. This assumes that the hosts have at least two processors.

nastran Command “hosts” Keyword (Distributed Jobs Under LSF)

The “hosts” keyword will default to the value set by LSF when running as a distributed job and no other value for “hosts” was set on the command line or in an RC file.

Example:

```
bsub -n 4 prod_ver nastran example dmp=4
```

This job will use four hosts selected by LSF. Note, the number of tasks appears twice: once for use by LSF, and once for use by MD/MSC Nastran.

Managing Host-Database Directory Assignments in DMP Jobs

The performance of the disk subsystem containing the permanent and SCRATCH DBsets can have a significant impact on MD/MSC Nastran performance. In the case of a DMP job, the impact can be even greater if multiple tasks are using the same file system. For SCRATCH DBsets, there are two ways in which this can be handled: one by specifying host-specific scratch directory values in an RC file and one by specifying a list of scratch directories using the “sdirectory” keyword. For DBsets, you may specify a list of DBset locations using the “dbs” keyword. When the list method is used to specify multiple scratch directories or DBsets, the entries are paired with the “host” keyword specified host names in a round-robin order. With these capabilities, you can finely control the use of disk I/O access paths byyour job.

In the case of SCRATCH DBsets, the simplest method of specifying individual directory paths for each host is to use the RC file method, reserving the “sdirectory” list method for situations where you are assigning multiple DMP tasks to a single host and you want to separate the SCRATCH DBsets, placing each on a separate file system. The following is an example of an RC file that defines the default SCRATCH directory for each node in a four-node configuration with node names “node1”, node2”, “node3” and “node4”. This example assumes that the MD/MSC Nastran installation directory is available to and is used by each node. The following would, typically, be included in the RC file in the “conf” directory, noting that the technique is available on all platforms, where customizing the node-specific SCRATCH directory pathnames being the only change needed:

```
# Define node-specific scratch directories
[ s.hostname = node1 ]
sdir=/node1/scratch

[ s.hostname = node2 ]
sdir=/node2/scratch

[ s.hostname = node3 ]
sdir=/node3/scratch

[ s.hostname = node4 ]
sdir=/node4/scratch
```

Note that none of the “sdirectory” keyword values should be in “list” format, that is, contain multiple directories separated by a comma or colon (Linux/UNIX) or semi-colon (Windows) unless you wish that specification to be used whenever DMP processing is requested and when you are sure that the list will match the order in which host names are specified in the “hosts” keyword.

The following examples show the effect of the round-robin ordering. These examples are the Linux/UNIX syntax. Nevertheless, unless specifically noted otherwise, the discussion and examples are applicable to Windows. The only change needed in the examples to make them applicable to Windows is to replace the colon (‘:’) separator character with a semi-colon (‘;’) separator character. Alternatively, you may use a comma (‘,’) as a separator character on any platform. Also, for Windows, round-robin ordering is ignored if “ccsnodesmust=no” is specified since the host on wich a particular DMP task will run is unpredictable.

```
prod_ver nastran example dmparallel=4 hosts=a:b sdirectory=/aa:/ba:/ab:/
bb dbs=/aa:/ba:/ab:/bb
```

This example will assign the following host-sdirectory pairs (assuming hosts “a” and “b” each have at least two processors):

Task	Host	Scratch Directory	DBS Directory
1	a	/aa	/aa
2	b	/ba	/ba
3	a	/ab	/ab
4	b	/bb	/bb

If directory “/ba” was not available for writing by you on host “b”, the tasks assignments would be (assuming host “a” has at least three processors):

Task	Host	Scratch Directory	DBS Directory
1	a	/aa	/aa
2	a	/ab	/ab
3	b	/bb	/bb
4	a	/aa	/aa

Managing Files in DMP Jobs

Note: AIX: If a pool host assignment is requested, the input file and output directory must be global to all hosts in the pool — this will not be validated by the nastran command.

Windows: If "ccsnodesmust=no" is specified, the input file and output directory must be global to all requested hosts. This is validated by the nastran command after converting each to UNC format, if necessary.

When an MD/MSC Nastran DMP job is running, the input file is directly read by each MPI task that can read the file, e.g., via NFS. Each host that cannot read the input file will read a local copy of the file that is copied, via rcp(1) or scp(1) for Linux/UNIX or using MSC developed utilities on Windows, to the job's scratch directory ("sdirectory" keyword) before the job begins.

A similar check is made for the output directory. Any host that can write to the output directory ("out" keyword) will directly write its .f04, .f06, .log and other default output files to that directory. Any host that cannot see the output directory will write its default output files to the job's scratch directory. For Linux/UNIX systems, these files will then be copied, again via rcp(1) or scp(1) for Linux/UNIX or using MSC developed utilities on Windows, back to the output directory at the end of the job.

Note: The nastran command will perform these tests by converting your pathname value to an absolute pathname. As a result, a path that varies depending upon the host will be labeled as unreadable. On Windows, your pathname value will be converted to UNC format, if necessary.

If the "sdirectory" keyword is not specified on the command line or in an RC file on the local host or is not specified in list format, i.e., with multiple directory specifications separated by commas or colons (Linux/UNIX) or semi-colons (Windows), each master or slave host will use its own scratch directory. This directory is determined on the master and each slave host by examining its command initialization file and version-specific RC files if the "version" keyword was defined.

DO NOT use an ASSIGN statement for any file that will be written by MD/MSC Nastran in a Distributed Memory Parallel (DMP) job. Instead, use the "sdirectory" and "dbs" keywords to specify names of the SCRATCH and permanent DB Sets.

DMP Performance Issues

In addition to the normal performance issues associated with a serial or SMP job, a DMP job adds communication bandwidth as a critical performance characteristic. The basic communications channels, are:

- Shared memory - SMP and NUMA systems.
- Interconnect, adapter, or switch - NUMA and distributed systems.
- High-speed special-purpose network, e.g., HIPPI - all systems.

- TCP/IP network - all systems.

The performance of any MD/MSC Nastran job is very much dependent on CPU, memory subsystem, and I/O subsystem performance. A Distributed Memory Parallel (DMP) job on an SMP or NUMA system is extremely sensitive to I/O subsystem performance since each task independently accesses the I/O subsystem.

You are especially encouraged on SMP and NUMA systems to partition your scratch directory and database assignments on DMP jobs using the “sdirectory” and “dbs” nastran command keywords.

Example:

```
prod_ver nastran example dmp=4 sdir=/scr1:/scr2:/scr3:/scr4\
dbs=/dbs1:/dbs2:/dbs3:/dbs4
```

The following assignments will be made in this job:

Task	sdirectory	dbs
1	/scr1	/dbs1
2	/scr2	/dbs2
3	/scr3	/dbs3
4	/scr4	/dbs4

The preceding example will perform substantially better than the following job, which uses the default assignments for the “sdirectory” and the “dbs” keywords.

Example:

```
prod_ver nastran example dmp=4
```

While the ultimate effect of the communications channel on job performance is dependent upon the solution sequence, for best overall job performance, you should try to use the fastest communications channels available.

Additional DMP tuning information may be available in the “Read Me” file

```
install-dir/prod_ver/README.txt
```

on UNIX, or

```
install-dir\prod_ver\readme.txt
```

on Windows.

HP-UX Systems

HP has created a web site that lists many tuning parameters specific to MD/MSC Nastran performance. The URL is

```
http://www.hp.com/go/msc
```

Windows Systems

Currently, MD/MSC Nastran DMP only runs on Windows Compute Cluster Systems (CCS). On these systems, DMP tasks are scheduled using the CCS job scheduler. As of the date of this documentation (April, 2011), the only parameter used by the CCS job scheduler to allocate tasks to hosts (the CCS term for "hosts" is "nodes") is the number of processors (logical CPUs) needed for a job. For relatively small MD/MSC Nastran DMP jobs, this may not be an issue but for large MD/MSC Nastran DMP jobs, having significant disk space and memory requirements, this can be a severe restriction. The only way to force the CCS job scheduler to assign tasks to all requested hosts is to tell it that the total number of processors required for the DMP job is the sum of all processors (logical CPUs) available on all of the requested nodes. The result of this is that the CCS job scheduler will run the DMP job only when no other jobs (whether MD/MSC Nastran jobs or jobs queued by other applications) are running on the requested hosts and will not assign jobs to these nodes while the MD/MSC Nastran DMP job is running.

The way you tell MD/MSC Nastran which of the job scheduling methods to use is through the use of "ccsnodesmust" keyword. By default ("ccsnodesmust=yes"), MD/MSC Nastran tells the CCS job scheduler that an MD/MSC Nastran DMP job is to run using all requested nodes. This can be changed, however, by specifying "ccsnodesmust=no". In this case, MD/MSC Nastran tells the CCS job scheduler that the number of processors needed is just the value of the "dmparallel" keyword. The list of nodes to be used is the value of the "hosts" keyword but there is not guarantee that the CCS job scheduler will use all of the nodes, although none the DMP tasks will be run on any nodes not in the hosts list. Note, however, that the input file and output directory must be visible from all specified hosts since the host on which a particular DMP task is run is unpredictable.

This is, perhaps, best illustrated by considering the following examples. In these examples, assume that the Windows Cluster has four nodes (named n1, n2, n3 and n4), each with two dual core CPUs and with 1,000 GB disk space available on each node in a local scratch file system.

Example 1

Four DMP jobs are to be run, each requiring approximately 100GB disk space and each to be run with "dmparallel=4" specified. Since the total resources required by these jobs does not exceed the total resources available on any single mode, the following procedure could be used:

- Submit the jobs in four separate Command Prompt windows, using the following command in each window (modifying the job name appropriately):

```
msc20111 nastran <jobname> dmp=4 hosts=n1,n2,n3,n4
ccsnodesmust=no <other options as appropriate>
```

Each job will be submitting telling the job scheduler that four processors are required. Assuming no other jobs are running on the cluster, these jobs will be run concurrently, where the job scheduler determines which nodes are to be used for each job. Note, however, that MD/MSC Nastran will ignore any per-task "sdirectory" or "dbs" requests since the node on which a DMP task is run is unpredictable.

Example 2

One DMP job is to be run with four DMP tasks, each task required approximately 600GB disk space. The DMP job is expected to run about 10 hours. Since it is not possible for more than one DMP task to run on a single node, each DMP task must run on a separate node. The following procedure could be used.

- Submit the job in a Command Prompt window, using the following command, noting that "ccsnodesmust=yes" is the default.

  ```
  msc20111 nastran <jobname> dmp=4 hosts=n1,n2,n3,n4
  <other options as appropriate>
  ```

  The job will be submitted telling the job scheduler that 16 processors (or 32 processors if hyperthreading is supported and enabled on each node) are required. If there are any other jobs, the job scheduler will not start this job until all other jobs have finished running.

It is important to note that there is no way the jobs in the two examples can be run at the same time, even though there are enough resources in the cluster to support this. The current version of the CCS job scheduler only considers "number of processors required" in scheduling jobs.

Alternatives to OpenMPI on Linux

Linux provides three methods of DMP. Open/MPI is the default. There are also implementations of HP/MPI and Intel/MPI. There has been no performance advantages gained by either of these, but they are provided to users at the hardware vendor's request.

To run with HP/MPI add the following parameters to the command line:

```
hpmpi=yes
```

To run with Intel/MPI add the following parameters to the command line:

```
intelmpi=yes
```

Configuring and Running SOL 600

Hardware and Software Requirements

The table below shows the default version of MPICH used for SOL 600 on supported platforms. For LINUX, both HP/MPI and Intel/MPI are provided.

Vendor	OS	Hardware	Default MPI	Also Works On
HP (64-bit) [4]	HPUX 11.11	PA2.0	HP MPI 2.0	
HP (64-bit) [4]	HPUX 11.23	Itanium 2	HP MPI 2.2	
IBM (64-bit)[4]	AIX 5.3	Power 6	MPICH[1]	
SGI (Altix 64-bit)[2, 4, 10]	Linux 2.6.5-7.139-sn2	Itanium 2 (Propack 4.0)	SGI MPT 1.11.1	
Sun (64-bit)[4, 10]	Solaris 10	UltraSparc III	MPICH[1]	
Sun (64-bit)[4, 10]	Solaris 10	x86	SUN HPC 7.1	
Linux (32-bit)[8, 9]	RedHat AS 4.5	Intel Pentium or equiv.	HP MPI 2.3[5]	
Linux (64 bit)[4, 8]	RedHat AS 4.5	Itanium 2	HP MPI 2.2.5.1[5]	
Linux (64-bit)[4, 8]	RedHat AS 4.5	Intel EM64T	Intel MPI 3.1[6]	AMD Opteron, SuSE 10, RedHat 5
Intel (32-bit)[8, 9]	Windows XP SP3	Intel Pentium or equiv.	Intel MPI 3.1	Vista 32, Windows 7, Intel 11.0, Intel 11.1[12]
Intel (64-bit)[4, 8, 9]	Windows Server 2003 x64	Intel EM64T	Intel MPI 3.1[7]	Windows XP 64, Vista 64, Windows 7, Intel 11.0, Intel 11.1[12]

[1] Hardware MPI version also available (via *maintain in /tools* directory).
[2] Supports Solver 6.
[3] Supports multi-threading.
[4] Supports true 64-bit version.
[5] Supports the Intel MPI 3.1
[6] Supports the HP MPI 2.3
[7] Supports the Microsoft MPI 1.0 (SP1).
[8] Supports the PARDISO Solver
[9] Supports the MUMPS Solver
[10] DMP (network DDM) is not supported
[11] Microsoft Visual Studio 2005 must be installed
[12] Newer version of Intel Fortran Version 11.1 and Microsoft Visual Studio 2008 is not supported

Use the maintain script in the tools directory to switch between the two MPI options. To use the Intel/MPI, do the following:

1. Create a `.mpd.conf` file in your home directory with the following line:

   `secretword=<your mpd password>`

   where `<your mpd password>` can be any arbitrary string.

   Change mode of the `.mpd.conf` file to 600 using the chmod command.

2. Setup a mpd.hosts file in your home directory containing the nades of the nodes to be used. Put one name per line, e.g.

   node1

   node2

   node3

Although no specific hardware requirements exist for MD/MSC Nastran torun in shared memory parallel or distributed memory parallel mode, it is preferable to have fast network connections between the machines if more than one machine is used. It is recommended that the network should have a speed of at least 100 MBit per second. If only two machines are to be used, youcan use a hub or a cross-over cable to connect them. If more than two machines are to be used, a switch is preferable. TCP/IP is used for communications.

Compatibility

MD/MSC Nastran supports connection of homogeneous networks with machines of the same type. Two machines are compatible if they can both use the same executables. Some examples of compatible machines are:

1. Several machines with exactly the same processor type and O/S.
2. One HP J-Class/HPUX-11.x and one HP C-Class/HPUX-11.x.

Definitions

1. Root machine: The machine on which the job is started.
2. Remote machine: Any machine other than the root machine that is part of a distributed parallel run on the network.
3. Shared installation: MD/MSC Nastran is installed in an NFS shared directory on one machine only. Other machines can access the executables since the directory is shared.
4. Distributed installation: MD/MSC Nastran isinstalled on all machines. Each machine accesses its own versions of the executables.
5. Distributed execution: SOL 600 is run on multiple machines that are connected with a network. Each machine loads the executables either from shared or local directories and then executes them.
6. Shared Memory Execution: More than one processor is used to run a parallel execution of SOL 600 on the same physical computer.
7. Shared I/O: MD/MSC Nastran reads and writes data in an NFS shared directory. Each executable running on the network reads and writes to the same directory.
8. Distributed I/O: MD/MSC Nastran reads and writes data in a directory located on each machine. You must make the input available in each directory before the analysis and collect the results files after the analysis.
9. NFS – Network File System.

Network Configuration

MD/MSC Nastran only needs to be installed on the root machine where the installation directory is shared via NFS (shared installation). It can also be installed on the remote Machines, which then use their own executables (distributed installation). The root machine is the one on which the SOL 600 job is started. The remote machines can be located anywhere as long as they are connected to the network. The working directory on each machine can be a shared directory on any machine on the network (shared I/O) or it can be a local directory on the hard disk of each machine in the analysis (distributed I/O). "User Notes" on page 174 in this chapter provide instructions for specifying the working directory to use.

Installation Notes

This part describes the specific steps needed to install and set up a network version of SOL 600.

For shared memory parallel, there are no specific installation steps necessary. When running the job, all that is necessary is to add one input line to the Bulk Data of the form:

```
PARAMARC,ID,,NP
```

where ID is an arbitrary integer and NP is the number of processors to be used (can not exceed the number on the computer).

For distributed parallel, install MD/MSC Nastran on the root machine and, if needed, on the remote machines. MD/MSC Nastran only needs to be installed on the root machine if it is a shared installation. There is nothing special that needs to be done related to the installation itself for the network version.

In order to run parallel jobs on machines connected over the network, jobs have to be set up properly. If any of the remote hosts do not have MD/MSC Nastran installed, the installation directory on the root machine needs to be shared using NFS or some other mechanism so that all executables are available from the remote machines. **Users need to be able to connect between the machines using *rlogin* without having to provide a password**.

For some computer systems such as SUN, IBM SP, and Itanium 2, it is necessary to activate hardware MPI. To do that, change to the ~/tools directory (for example /usr/nastran/*prod_ver*/marc/hpuxiaipf/marc2011/tools), make a backup copy of the original include file, then run the maintain program. At the first prompt, enter 2 (Maintenance utilities). At the next prompt, enter 2.1 (Modify MPI setting of Marc). At the next prompt, enter the desired type of MPI for your system (for example, 2.1.5 for HP MPI). If it is not obvious which version of MPI to use, enter 1.2.1 to select MPICH. Then enter 0 as many times as necessary to exit the maintain program.

IBM SP machines may require special handling. Some use various types of special network switches and forms of communication software such as IBM's loadleveler. If your system uses loadleveler, manually edit the include file in the ~/tools directory to choose the proper switch name and change other quantities. Be sure to make a backup of the original include file before editing. If you are an IBM expert, you might be able to do this from the comments in the include file. If not, contact MSC technical support for help. Once the modified include file is setup, the IBM system will automatically choose which nodes to use, depending on the workload of the machine and a hostfile will not be required. You can bypass the loadleveler by using the Maintain program to choose Hardware MPI (which is POE for IBM) and setup a hostfile, as described below for other computer systems.

Assume that there are two machines with hostnames host1 and host2 that are to be used in a parallel job over the network. MD/MSC Nastran has been installed on host1 and the job is to be started from this machine. A hypothetical naming convention is used for shared directories where a directory name on any machine starts with */nfs/hostname*, where *hostname* is the name of the machine on which the directory is located.

First, test the installation for single processor execution. Change to an empty directory, copy pt6003.dat from the Nastran ~/tpl directory to the empty directory. Execute the single processor job using the command

```
nastran pt6003 scratch=yes
```

The job should complete normally and produce a file pt6003.marc.sts with an exit code (near the end of the file) of 3004. A file named pt6003.f06 should be produced with displacements and no FATAL errors or Severe Warning messages.

Next, test the installation for shared memory multi-processor execution. Copy pt6003.dat to pt6003p.dat. Edit pt6003p.dat and add the following lines after BEGIN BULK and before ENDMODEL

```
param,marctemp,0

param,marcoutr,1

PARAMARC,123,,2
```

Save the modified input file and execute the job using the command:

```
nastran pt6003p scratch=yes
```

This job should produce files such as 1pt6003p.marc.dat, 1pt6003p.marc.out, 2p6003p.marc.dat, 2pt6003p.marc.dat, pt6003p.marc.sts and pt6003p.f06. The pt6003p.marc.sts file should be similar to the previous pt6003.marc.sts file with exit code 3004. The pt6003p.f06 file should have displacements that are nearly identical to those in the pt6003.f06 file.

Next, test the installation for distributed memory multi-processor execution. Copy pt6003p.dat to pt6003pp.dat Change the SOL 600 Executive Control statement to read as follows:

```
SOL 600,106 path=3 outr=f06
```

Copy pt6003p.f06 to a file named marc.pth. Edit marc.pth and search for the string “executed”. Delete all lines from the beginning up to and including that line. Skip down one line and delete all other lines so that only one line remains in the file. The one line should look similar to :

/usr/nastran/*prod_ver*/marc/hpuxiaipf/marc2011/tools/run_marc –jid pt6003p.marc.dat –nps 2 –v no –iam nanl –b no

Change this line to read as follows:

/usr/nastran/*prod_ver*/marc/hpuxiaipf/marc2011/tools/run_marc –jid pt6003pp.marc.dat –nps 2 –v no –iam nanl –ho hostfile –b no

Save the marc.pth file. It needs to be in the same directory as the MD/MSC Nastran input file, pt6003pp.dat

Next, setup a hostfile (which we will name hostfile) with two processors for the two machines you wish to use. The hostfile would have the following lines:

host1 1

host2 1 shared_directory_for_files shared_directory_where_marc_is

The "shared_directory_where_marc_is" should be of the form:

/usr/nastran/*prod_ver*/marc/hpuxipf/marc2011r1

Run the pt6003pp model the same as was done for the pt6003p model. The same files as produced by the pt6003p model should be produced. The values in the last column (max displacement) of the pt6003pp.marc.sts file should be the same as those for pt6003.marc.sts and pt6003p.marc.sts. The displacements in pt6003pp.f06 should also be the same as for pt6003.f06 and pt6003p.f06.

Running shared memory is much easier than distributed memory parallel and should be faster as well, however, the computers cost more.

How to Run a Network Job

This section assumes that MD/MSC Nastran has been successfully installed on at least one of two machines that are to be used in a distributed analysis, and that the appropriate SOL 600 licenses are in order. Assume that host1 is the host name of the machine on which the job is to be started (the root machine). The host name of the other machine (the remote machine) is host2.

Verify that the two machines are properly connected. From host1, access host2 with `rlogin host2` If a password needs to be provided to do the remote login, this has to be taken care of. If the `rlogin` is not possible without providing a password, a network run will not be possible. Be sure that both host1 and host2 appear in your .rhosts files in your root directory. If they are present, see the *"Troubleshooting"* section.

In order to perform an analysis over a network, a "*host file"* needs to be created by the user. This file defines which machines are to be used, how many processes are to run on each, what working directory should be used, and where the Marc executable can be found on each machine. No specific name or extension is used for the host file except that the name *jobid.host* must be avoided since it is used internally.

Specification of the Host File

The host file has the following general format:

```
host1 n1
host2 n2 workdir2 installdir2
host3 n3 workdir3 installdir3
```

Each line must start at column 1 (no initial blanks). Blank lines and lines beginning with a # (number symbol) are ignored. The first entry is the host name of a machine to be used in the analysis. The root machine must be listed first and each machine must only occur once.

The second entry specifies the number of processes to run on the machine specified in the first entry. The sum of the number of processes given in the host file must equal the number of domains used. In a five-domain job, it is required that `n1+n2+n3=5`.

The third entry specifies the working directory to use on this host. This is where the I/O for this host takes place. The results files for this machine are created in this directory.

The fourth entry specifies where the version of Marc that this host should use is located. This entry can be omitted if the name is the same on all machines (which could be a shared directory on host1 with the same name from host2 and host3). The directories in the third and fourth entries will be used from the respective host. To check the correctness of the host file specification, log in to the respective machine and list the directories as specified in the host file. For the host file given above, do:

```
rlogin host2
ls workdir2
ls installdir2
```

The second line should show the working directory to use on host2 and the third line the installation directory that will be used by host2. The different domains of the job are associated with the different machines as follows. Suppose a five-domain job `test` is run using a host file defined as

```
host1 2
host2 1 workdir2 installdir2
host3 2 workdir3 installdir3
```

with appropriate definitions of the third and fourth entries, indicated below. (Note: SOL 600 usually works with a Marc “single file” parallel input file that is the same as a single processor input file. Internally, Marc will create six input files associated with this job: `test.dat, 1test.dat, ..., 5test.dat` and move them to thecorrect computer locations). Domains 1 and 2 will be associated with host1, domain3 with host2 and domains 4 and 5 with host3.

Shared I/O

Suppose a job is to be run on host1 and host2. A shared directory on host1 is to be used for I/O and from host2 its name is /nfs/host1/workdir (assuming a hypothetical naming convention for shared directories which starts with /nfs/hostname). The installation directory is assumed to have the same name on both machines. The host file for a two processor job would simply be

```
host1 1
host2 1 /nfs/host1/workdir
```

To verify the workdir given, do `rlogin host2 ; ls /nfs/host1/workdir`. The directory seen should be the same one as the working directory on host1.

Distributed I/O

If the user wants to have the I/O to be local on host2, specify the host file as

```
host1 1
host2 1 /usr/people/myjob
```

The I/O on host2 will now take place in the directory /usr/people/myjob on the hard disk of host2. For this case, the input files are transferred to /usr/people/myjob on host2 before the job is started, and the results files are transferred back after the analysis for postprocessing. This transfer of files is done automatically. It is also possible to use only two entries in the host file. This requires that both the working directory and the installation directory have the same names on all machines.

Shared vs. Distributed I/O

For jobs with very large post or restart files, it is sometimes more efficient to use distributed I/O. With distributed I/O, the input files and the post files are located on the host's local disks. Marc by default automatically transfers the input files and the post files to and from the remote host if required.

Jobs with User Subroutine

User subroutines are fully supported using shared memory as well as distributed parallel.

The Fortran file with the subroutine is located in the working directory on the root machine. Marc automatically creates the executable and makes it available on all remote hosts. There is no need to modify the host file if it is correct for a job without a user subroutine. If the working directory is shared for all remote hosts and only compatible machines are used in the analysis, the user subroutine is compiled on the root machine and the executable is available in the shared working directory. If a remote host is using a local working directory, the executable will be automatically copied over to the remote machine using remote copy (`rcp`). Marc automatically knows if a directory is shared or local. If incompatible machines are used, the compilation is done on each machine separately. If a shared working directory is used, the host name is appended to the name of the executable. For local directories, the new executable is placed in the local working directory. This is all done automatically.

Solver

Solver type 6 (hardware provided sparse) is available on HP and SGI. No specific input is needed for its use in a parallel analysis. Marc makes use of the parallel features of these solvers. However, the use of a hardware solver is not recommended in a network run. The equation solution is performed on the root machine by starting multiple processes. This is done in order to utilize the parallel performance of the solver (which is using multithreading). This is efficient on a single parallel machine, but if the root machine of a network run does not have the number of processors available, it will not be efficient.

Solver types 0 (direct profile), 2 (sparse iterative), 4 (sparse direct), and 8 (multifrontal sparse) are supported in parallel. Out-of-core solution is only supported in parallel for Solver 8.

The option OOC,,1 (or OOC,0,1) which equates to MD/MSC Nastran Bulk Data entry param,marcoocc,2 is not presently supported with DDM.

Troubleshooting

Check that:

1. The network connection between the hosts is working by using the command `SLQJ KRVW`.
2. A remote login using the command `UORJLQ` can be done between the hosts without providing a password. If not, add all hosts to your .rhosts file in your login directory or contact your system administrator.
3. The host names used in the hostfile are correct. It should be the same as the output from the command `hostname` on the respective host.
4. The working and installation directories on the host file are correct. Log onto the remote host, change directory to these directories to verify the host file content.

Error messages:

1. The error message "`semget failed...`" at job start-up means that the communication environment is not clean. This can be checkedwith the Unix command`ipcs`. If entries belonging to specific users except `root` show up, they may need to be removed. Run the script `tools/mpiclean`

Note: This will kill all parallel jobs currently running under the current user. Only entries belonging to the current user are deleted.

Other:

1. On some machines, sometimes there are files called `p4_shared_arena_xxxx`, with `xxxx` being some number, left in `/var/tmp.` These can eventually fill up the disk and should be removed.

SOL 600 Parallel Processing on Windows

Hardware and Software Requirements

For 32-bit Windows platforms, the only MPI supported is provided by the Intel MPI 3.1 for Windows.

For 64-bit Windows EM64T platforms, the default MPI is also the Intel MPI 3.1 for Windows.

The other MPI option for the 64-bit Windows platforms is MS/MPI using the Microsoft CCS utilities.

To switch from the default Intel/MPI to MS/MPI, perform the following tasks:

1. Go to the marc bin directory and type:
   ```
   copy marc.exe_msmpi marc.exe
   ```
2. Go to the marc lib directory and type:
   ```
   copy mdsrc.lib_msmpi mdsrc.lib
   ```
3. Go to the marc tools directory and edit (“write”) the include.bat file.

   Change:
   ```
   set MPITYPE=intel-mpi
   rem set MPITYPE=ms-mpi
   ```
   to
   ```
   rem set MPITYPE=intel-mpi
   set MPITYPE=ms-mpi
   ```

All the required components as listed in the `include.bat` file in the marc tools directory need to be installed. Microsoft CCS SP1 (676 build) or above is required to run DMP.

In particular, as shown in the include file, the following is needed to run parallel jobs.

```
C:\Program Files\Microsoft Compute Cluster Pack\bin\mpiexec.exe
```

The `mpiexec.exe` and `msmpi.dll` are included in the Microsoft Compute Cluster Pack or CCP which are on a separate CD from the operating system. If the files do not exist in your system, got to http://www.microsoft.com/hpc and get information on how to download or order CDs (there is a link on the left called “How to Buy”.)

Please turn off the Windows firewall in your cluster and shared marc directory with a general permission to all users.

The host file for using the MS/MPI has a slightly different format than that for the Intel/MPI. A “headnode” field is added where the “headnode” is the UNC name of the node where the Microsoft Job Scheduler is installed.

```
host1 n1 workdir1 installdir1 neadnode
host2 n2 workdir2
host3 n3 workdir3
```

For both `workdir` and `installdir`, use the UNC directory names as echoed by typing `net share` on your system.

For example,

```
sv-emt1 2 \\sv-emt1\test1 \\sv-emt1\marc2011r1 \\sv-emt
sv-emt2 2 \\sv-emt2\test2
```

The DMP job will be run using two processors on node `sv-emt1` in the shared directory `test1` and 2 processors on node `sv-emt2` in the shared directory `test2` and the Microsoft Job Scheduler is installed in node `sv-emt`.

Please note that the version of MS/MPI used to do the mar build requires that all processors within your cluster be allocated (automatically done by the `run_marc.bat` script) even for running a job that requires less than the total number of processors in the system.

Although no specific hardware requirements exist to run SOL 600 in parallel, it is preferable that for distributed parallel processing to have fast network connections between the machines. It is recommended that the network should have a speed of at least 100 MBit per second. If only two machines are to be used, a hub or a cross-over cable can be used to connect them. If more than two machines are to be used, a switch is preferable. TCP/IP is used for communications. Refer to the include.bat file in the tools directory for requirements on O/S, compilers, etc. for running SOL 600 on Windows.

Definitions

1. Root machine: The machine on which the job is started.
2. Remote machine: Any machine other than the root machine that is part of a distributed run on the network.
3. Shared installation: MD/MSC Nastran is installed in a UNC shared directory on one machine only. Other machines can access the executables since the directory is shared.
4. Distributed installation: MD/MSC Nastran isinstalled on all machines. Each machine accesses its own set of executables.
5. Distributed execution: MD/MSC Nastran is run on multiple machines that are connected with a network. Each machine loads the executables either from shared or local directories and then executes them.
6. Shared I/O: Data is read and written to a UNC shared directory. Each executable running on the network reads/writes to the same directory.
7. Distributed I/O: Data is read and written to a directory located on each machine.

   Transfer of data files and post files between the root machine and remote machines is done automatically.
8. UNC – Uniform Naming Convention.

Network Configuration

MD/MSC Nastran only needs to be installed on the root machine where the installation directory is UNC shared (shared installation). MD/MSC Nastran can also be installed on the remote machines, which then use their own executable (distributed installation). The root machine is the one on which the job is started.

The remote machines can be located anywhere as long as they are connected to the network. The working directory on each machine can be a shared directory on any machine on the network (shared I/O) or it can be a local directory on the hard disk of each machine in the analysis(distributed I/O). The User Notes describes how to specify what working directory to use.

Installation Notes

This section describes the specific steps needed to install and set up a network version of SOL 600.

Steps 1–4 Must be performed as Administrator or a user having administrator privileges.

Step 1: Install MD/MSC Nastran on the root machine. The installation directory must be

shared such that it is available on the remote machines.

Step 2: To install Intel/MPI, do the following:

For the root machine, find the ~\tools directory, for example

`d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\tools`

Find the file `intel-mpi.bat` in the tools directory. Using notepad or some other ASCII editor, change the contents from the default specified to

set MPI_ROOT=`d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\intel_mpi`

or similar directory depending on where you installed MD/MSC Nastran

a. Root machine:
b. Use My Computer and find the location of the ~\intel_mpi\bin directory (for example)
   `d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\intel_mpi\bin`
c. Perform steps e to i below
   Non-Root machines:
d. Change to the shared directory
   `d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\intelmpi\sys\bin`
   where sys is one of linux32, linux64, linuxipf, win32 or win64
e. Type: wmpiregister

f. Enter a valid login username and password when prompted. Also enter the domain name if that is how you login to the system, or use "local" if you do not login through a domain. Note that the installation program does NOT verify that the password you entered is valid, so make sure that you enter exactly as the login password (either the local machine login or the domain login). Note: If you change your system login password you must repeat steps e and f. If you upgrade your Nastran version, you must repeat steps a to f.

g. Type: ismpd -install

   On Windows systems, "ismpd -install" usually only provides one parallel run. If the same parallel job is run again or if a different is run, an error will be found in jid.marc.log indicating that mpi did not start. To overcome this, add the following line to the batch file used to run Nastran SOL 600 runs:

   `d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\intelmpi\sys\bin-ismpd -install`

h. Change to the shared directory

   `d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\intel_mpi\lib of the root machine`

i. Copy impi.dll to your Windows\system32 directory

Step 3: Make sure that the installation directory on the remote host is properly shared. Use My Computer and locate the directory to be shared. Right click on the directory and choose Sharing. Choose Share As and give it a Share Name (this is the UNC name) and click OK.

Note: The UNC name may have a maximum of 10 characters and the name of the shared directory may have a maximum of 30 characters. If necessary, a directory higher up in the path can be shared (for instance, `d:\MSC.Software` instead of `d:\MSC.Software\MSC_Nastran\`*prod_ver*`\marc\tools`). It is sufficient that either of the above or any path in-between be shared.

Step 4: Test the installation for single processor execution: Change to an empty directory, copy pt6003.dat from the Nastran ~/tpl directory to the empty directory. Execute the single processor job using the command

nastran pt6003 scratch=yes

The job should complete normally and produce a file pt6003.marc.sts with an exit code (near the end of the file) of 3004. A file named pt6003.f06 with displacements and no FATAL errors or Severe Warning messages.

Step 5: If you have a multi-processor PC, test the installation for shared memory parallel execution: (If you do not have multiple processors on you machine, perform the next steps up to "execute the job" and skip to the next step. Copy pt6003.dat to pt6003p.dat. Edit pt6003p.dat and add the following lines after BEGIN BULK and before ENDMODEL

param,marctemp,0

param,marcoutr,1

PARAMARC,123,,2

Save the modified input file.

Execute the job using the command:

nastran pt6003p scratch=yes

This job should produce files such as 1pt6003p.marc.dat, 1pt6003p.marc.out, 2p6003p.marc.dat, 2pt6003p.marc.dat, pt6003p.marc.sts and pt6003p.f06. The pt6003p.marc.sts file should be similar to the previous pt6003.marc.sts file with exit code 3004. The pt6003p.f06 file should have displacements that are nearly identical to those in the pt6003.f06 file.

Step 6: Test the installation for multi-processor, distributed execution.

Copy pt6003p.dat to pt6003pp.dat Change the SOL 600 e

Executive Control statement to read as follows:

SOL 600,106 path=3 outr=f06

Create a file named marc.pth which has the complete command to execute Marc in parallel. The file must contain one line that looks similar to the following:

```
d:\MSC.Software\MSC_Nastran\prod_ver\marc\tools \run_marc –jid
pt6003pp.marc.dat –nps 2 –v no –iam nanl –ho hostfile –b no
```

Save the marc.pth file. It needs to be in the same directory as the MD/MSC Nastran input file, pt6003pp.dat.

Next, setup a hostfile (which we will name hostfile) with two processors for the two machines you wish to use. The hostfile will have the following lines:

host1 1 shared_directory_for_files shared_directory_where_marc_is

host2 1

The “shared_directory_for_files” as well as “shared_directory_where_marc_is” need to be in UNC format.

For example, enter “shared_directory_where_marc_is” in the form:

\\host1\MSC.Software\MSC_Nastran*prod_ver*\marc

Run the pt6003pp model using the command

nastran pt6003p scratch=yes

The same files as produced by the pt6003p model should be produced and the values in the last column (max displacement) of the pt6003pp.marc.sts file should be the same as for pt6003.marc.sts and pt6003p.marc.sts. The displacements in pt6003pp.f06 should also be the same as for pt6003.f06 and pt6003p.f06.

If the job stalls or hangs at start-up time, exit it by typing `control-C` in the window in which it was started. See "User Notes" in this chapter.

User Notes

This section assumes that MD/MSC Nastran, including Intel/MPI, has been successfully installed on two machines that are to be used in a distributed analysis and that the appropriate MSC licenses are in order. Assume that host1 is the host name of the root machine from which the job is to be started and the host name of the other machine (the remote machine) is host2.

How to Run a Network Job

First, make sure that the two machines are properly connected. From host1, access host2 with Network Neighborhood. If this is not possible, a network run will not be possible. See "User Notes" in this case. In order to perform an analysis over a network, a special file called a *host file* needs to be created by the user. This file defines which machines are to be used, how many processes are to run on each, what working directory should be used, and where the Marc executable can be found on each machine. No specific name or extension is used for the host file except that the name *jobid.host* must be avoided since it is used internally.

Specification of the Host File

The host file has the following general format:

```
host1 n1 workdir1 installdir1
host2 n2 workdir2
host3 n3 workdir3
```

Each line must start at column 1 (no initial blanks). Blank lines and lines beginning with a # (number symbol) are ignored. The first entry is the host name of a machine to be used in the analysis. The root machine must be listed first and each machine must only occur once. The second entry specifies the number of processes to run on the machine specified in the first entry. The sum of the number of processes given in the host file must equal the number of domains used. In a five-domain job, it is required that `n1+n2+n3=5`.

The third entry specifies the working directory to use on this host. This is where the I/O for this host takes place. The MD/MSC Nastran input file for this machine must be in this directory and the results files for this machine are created in this directory. The fourth entry gives the location of the directory where MSC Nastran is installed.

The different domains are associated with the different machines as follows. Suppose a five-domain job `test` is run using a host file, defined as

```
host1 2 workdir1 installdir1
host2 1 workdir2
host3 2 workdir3
```

with appropriate definitions of the third entry, indicated below. Since SOL 600 uses a “single file” parallel input, Marc will create six input files associated with this job such as `test.dat, 1test.dat, ..., 5test.dat`. Domains 1 and 2 will be associated with host1, domain3 with host2 and domains 4 and 5 with host3.

Shared I/O

Suppose a job is to be run on host1 and host2. A shared directory on host1 is to be used for I/O. The UNC sharename for this directory is assumed to be `dir7`. The host file for a two processor job would simply be

```
host1 1
host2 1 \\host1\dir7
```

To verify the work directory given, enter Network Neighborhood from `host2` and click through `host1 -> dir7`. The directory seen should be the same one as the working directory on host1.

It is also possible to use only two entries for each host in the host file (host name and number of processes). This requires that the working directory is shared and that the sharing information is up to date in the file `tools\marc.net` (see above where marc.net is created).

Distributed I/O

If the user wants to have the I/O to be local on host2, specify the host file as

```
host1 1
host2 1 \\host2\dir5
```

The I/O on host2 will now take place in the directory `D:\users\dir5` on the hard disk of host2. For this case, the input files are transferred to `D:\users\dir5` on host2 before the job is started, and the results files are transferred back after the analysis for postprocessing. This transfer of files is done automatically.

Shared vs. Distributed I/O

For jobs with very large post or restart files, it is sometimes more efficient to use distributed I/O. With distributed I/O, the input files, and the post files are located on the host's local disks. Marc, by default, automatically transfers the input files and the post files to and from the remote host if needed. To run a job using distributed I/O, specify a local directory in the host file:

```
host1 2
host2 1 \\host2\workdir
```

Jobs with User Subroutine

User subroutines are available. If local directories are used on remote hosts (distributed I/O), the new executable will be transferred automatically to the remote host if necessary.

Solver

Solver type 6 (hardware provided sparse) is not available on the Microsoft Windows platform. Solver types 0 (direct profile), 2 (sparse iterative), 4 (sparse direct), and 8 (multifrontal sparse) are supported in parallel. Out-of-core solution is only supported in parallel for Solver 8.

The option OOC,,1 (or OOC,0,1) which equates to MD/MSC Nastran Bulk Data entry param,marcoocc,2 is not presently supported with DDM.

Troubleshooting

Check that:

1. Your user ID is recognized by the local or remote hosts. Also check that the password you entered during the Intel/MPI installation process is the same as that for the local system or the domain. The installation process does not verify that the password you entered is the same as the machine or domain login password.

   Also note that your password must not have any spaces in it or else the Intel/MPI installation process will not handle your password correctly.

   If you change your login password, you must register Intel/MPI by using:

   wmpiregister.exe
2. The remote hosts have permission to read from and write to the root host. In particular, check that the sharing is giving full access; that is, not being restricted to read only.
3. Your licenses including parallel processing are valid.
4. The host names are valid.

Running a Parallel Job when not Connected to the Network

If you disconnect your system from the network and want to run a parallel job on that system, you will have to install the Microsoft Loopback Adapter. Follow these steps.

1. Go to Control Panel, Add/Remove Hardware.
2. Select the hardware task you want to perform:

   ```
   Add/Troubleshoot a device
   ```
3. Choose a Hardware Device:

   ```
   Add a new device
   ```
4. Do you want Microsoft Windows to search for your new hardware?

   ```
   No, I want to select the hardware from a list
   ```
5. Select the type of hardware you want to install:

   ```
   Network adapters
   ```
6. Select Network Adapter:

   ```
   Manufacturers: Microsoft
   Network Adapter: Microsoft Loopback Adapter
   ```

It will now install the loopback adapter. You will have to enable/disable the loopback adapter as you remove/connect your machine to the network.

Running a Parallel job on Windows XP System when not a Member of a Domain

If you will be running a parallel job on a Windows XP system that is not a member of a domain, you will have to modify a registry entry.

Using *regedt32*, look for the following key:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa
"forceguest" : REG_DWORD : 00000001
```

If you find this key, change the `REG_DWORD` value to 0. The name may also appear as ForceGuest. If you do not have this registry entry, your system will function properly.

Running a Parallel Job on Windows XP SP2

After you install or upgrade to Windows XP SP2, the RPC protocol does not permit anonymous requests to the RPC Endpoint Mapper, but requires client requests to be authenticated. This will cause an "Access is Denied" error when you attempt to run a parallel job. To workaround this problem:

1. Run **gpedit.msc** from a command prompt.
2. Select **Computer Configuration**, expand **Administrative Templates** and expand **System**.
3. Click **Remote Procedure Call**.
4. Double click **RPC Endpoint Mapper Client Authentication**. Change the value to **Enabled**.

Configuring and Running SOL 700 (MD Only)

Hardware and Software Requirements

By default, SOL 700 parallel runs for UNIX uses platform native MPI versions. The exceptions are Linux where Open MPI 1.2.5 and HP MPI 02.02.07.00 are provided and Windows 32 where MPICH Version 2 from Argonne National Laboratory is provided. (These are included on the MD Nastran installation.) Although no specific hardware requirements exist for MD Nastran to run distributed memory parallel mode, it is preferable to have fast network connections between the machines if more than one machine is used. It is recommended that the network should have a speed of at least 100 MBit per second. If only two machines are to be used, you can use a hub or a cross-over cable to connect them. If more than two machines are to be used, a switch is preferable. TCP/IP is used for communications.

Compatibility

MD Nastran supports connection of homogeneous networks with machines of the same type. Two machines are compatible if they can both use the same executables. Some examples of compatible machines are:

1. Several machines with exactly the same processor type and O/S.
2. One HP J-Class/HPUX-11.0 and one HP C-Class/HPUX-11.0.

Definitions

1. Root machine: The machine on which the job is started.
2. Remote machine: Any machine other than the root machine that is part of a distributed parallel run on the network.
3. Shared installation: MD Nastran is installed in an NFS shared directory on one machine only. Other machines can access the executables since the directory is shared.
4. Distributed installation: MD Nastran is installed on all machines. Each machine accesses its own versions of the executables.
5. Distributed execution: SOL 700 is run on multiple machines that are connected with a network. Each machine loads the executables either from shared or local directories and then executes them.
6. Shared I/O: MD Nastran reads and writes data in an NFS shared directory. Each executable running on the network reads and writes to the same directory.
7. NFS – Network File System.

Network Configuration

MD Nastran only needs to be installed on the root machine where the installation directory is shared via NFS (shared installation). It can also be installed on the remote Machines, which then use their own

executables (distributed installation). The root machine is the one on which the SOL 700 job is started. The remote machines can be located anywhere as long as they are connected to the network. The working directory on each machine can be a shared directory on any machine on the network (shared I/O) or it

can be a local directory on the hard disk of each machine in the analysis (distributed I/O). “User Notes” on page 174 in this chapter provide instructions for specifying the working directory to use.

Installation Notes

This part describes the specific steps needed to install and set up a network version of SOL 700. For distributed parallel, install MD Nastran on the root machine and, if needed, on the remote machines. MD Nastran only needs to be installed on the root machine if it is a shared installation. There is nothing special that needs to be done related to the installation itself for the network version. In order to run parallel jobs on machines connected over the network, jobs have to be set up properly. If any of the remote hosts do not have MD Nastran installed, the installation directory on the root machine needs to be shared using NFS or some other mechanism so that all executables are available from the remote machines. **Users need to be able to connect between the machines using rlogin without having to provide a password.** For some platforms, special attention requiring root access are required to make SOL 700 jobs run which will be described in the next section.

Platform Specific MPI Configurations

HPUX11 RISC 2.0 & HPUX Itanium2

Linux X8664 & Linux i386 & Linux Itanium2 (HP MPI)

In order to properly run SOL 700 on both these platforms, the MPI directory must be made available in the PATH. The proper HP MPI will be delivered with the MD Nastran installation and is automatically installed with the SOL 700 package. The user should set MPI_ROOT and add this to the PATH of each machine in the cluster in the .cshrc file:

```
setenv MPI_ROOT …/msc/msc2011/dyna/linux8664/hpmpi
set path = ($path $MPI_ROOT/bin )
```

After proper login the user can verify if the path is properly set by:

```
<> mpirun -version

The response should be (on Linux X8664):

mpirun: HP MPI 02.02.05.00 Linux x86-64
major version 202 minor version 5
```

The machine is now ready to be used for SOL 700. The working directory does not have to be a shared directory.

AIX

A full installation of the POE program must be installed before SOL 700 can be run on this platform. This POE installation must be obtained from the platform vendor. Once installed, no further actions are required by the user.

The working directory (the full path) must either exist or by NFS mounted on the remote machines.

SOLARIS

A full installation of the HPC program must be installed before SOL 700 can be run on this platform. This installation must be obtained from the platform vendor. Once installed, no further actions are required by the user.

The working directory (the full path) must either exist or by NFS mounted on the remote machines.

User Notes

This section assumes that MD Nastran, including the MPI, has been successfully installed on two machines that are to be used in a distributed analysis and that the appropriate MSC licenses are in order.

Assume that host1 is the host name of the root machine from which the job is to be started and the host name of the other machine (the remote machine) is host2.

First, make sure that the two machines are properly connected. (On Windows: from host1, access host2 with Network Neighborhood.) If this is not possible, a network run will not be possible.

Command Line Option

SOL 700 may be run parallel in a manner similar to standard DMP parallel. If a user specifies dmp700=n (where n is the number of processors) and does not have a sol700.pth file, then a temporary file is created using the hosts specified by HOSTS= either in the command line or RC file. The sol700.pth file is used if PATH=3 is specified on the SOL 700 entry.

PATH=3 Option

In order to perform an analysis over a network, a special file called a *hostfile* needs to be created by the user. This file defines which machines are to be used, how many processes are to run on each, what working directory should be used, and where the Marc executable can be found on each machine. No specific name or extension is used for the host file except that the name *jobid.hostfile* must be avoided since it is used internally.

Specification of the Hostfile

The hostfile has the following general format:

```
host1 n1 workdir1 exe1
host2 n2 workdir2 exe2
host3 n3 workdir3 exe3
```

Each line must start at column 1 (no initial blanks). Blank lines and lines beginning with a # (number symbol) are ignored. The first entry is the host name of a machine to be used in the analysis. The root machine must be listed first and each machine must only occur once. The second entry specifies the number of processes to run on the machine specified in the first entry. The default is 1 cpu for each machine. The sum of the number of processes given in the hostfile will be equal the number of domains used. In a five-domain job, it is will be n1+n2+n3=5.

The third entry specifies the working directory to use on this host. This entry is ignored for SOL 700, as all I/O occurs on the working directory of the root machine.

The fourth entry specifies the location of the executable including to the full path to the executable. For the first entry (the root machine), the MD Nastran Installation can figure out automatically which exe to take. The default for all subnodes is the same location as the location of the exe on the root machine. In case the subnodes have a different MD Nastran installation location, this can be specified here. In case `exe2`, `exe3`, etc. are used, `n2`, `n3` and `workdir2`, `workdir3` are required input and can not be skipped. In case the location of theexecutables on the remotemachines is exactly the same as on the root machine, the workdir and the exe location can be omitted from the hostfile.

Example of the Hostfile

The different domains are associated with the different machines as follows. Suppose a five-domain job is run using a hostfile, defined as:

```
host1 2
host2 1
host3 2
```

Domains 1 and 2 will be associated with host1, domain3 with host2 and domains 4 and 5 with host3.

Running an ISHELL Program

The ISHELL module allows you to invoke your own program from DMAP to perform custom processing. Two features are provided to make running your program easier.

The first feature is the ability to construct a full named based on the up-to eight character name provided by DMAP and a list of file-type associations. MD/MSC Nastran will first attempt to find an executable in the current directory using the name as-is from the DMAP call, i.e., all upper-case. On UNIX, if this name cannot be found, another attempt is made by converting the name to all lower-case.

If a name was not found, the Command Processor Associations defined by the “ishellext” keyword will be used to construct additional names by concatenating the DMAP name with each file-type in turn until the name is found or the table is exhausted. The command processor extensions consist of pairs of file-types and commands. On UNIX systems, the default command processor associations are:

File-Type	Command Processor
null	directly execute
.sh	sh
.ksh	ksh
.csh	csh
.pl	perl
.prl	perl

On Windows, the default command processor associations are:

File-Type	Command Processor
.bat	directly execute
.exe	directly execute
.com	directly execute
.pl	perl
.prl	perl

Note: While this capability is similar to the Windows “File Type Associations,” it does not use that information.

These tables are processed in the order shown.

If none of the names exist in the current working directory, MD/MSC Nastran will resort to the second feature design to assist in using the ISHELL module, the “ishellpath” keyword. If this keyword is set,

MD/MSC Nastran will repeat the search described above for each of the directories listed by the keyword. To aid in using this keyword, the nastran command will set the default value for “ishellpath” as the directory containing the input data file if you have not set the keyword on the command line, via the MSC_ISHELLPATH environment variable, or in an RC file.

If a file has still not been found in either the current working directory or any of the directories listed by the “ishellpath” keyword, the system PATH will be searched. Finally, if a suitable file was not found, a UFM will be issued.

A sample ISHELL job is provided by the files TPLDIR/cc705:qaishell.dat, TPLDIR:QAISHELL, and TPLDIR:qaishell.pl. The ISHELL call is

```
.
.
.
ISHELL//'QAISHELL'/S,N,IRTN/
NOINT/NOREAL/NOCMPX/NOCHAR/NOUNIT/
INT1/INT2/INT3/INT4/
REAL1/REAL2/REAL3/REAL4/
CMPL1/CMPL2/CMPL;3/CMPL4/
STRING1/STRING2/STRING3/STRING4/
/UNIT1/UNIT2/UNIT3/UNIT4 $
.
.
.
```

For the following example, assume the nastran command provides the default value for the “ishellpath” keyword, i.e., the directory containing the input data file.

prod_ver `nastran qaishell`

On UNIX, the following names will be checked (assuming the default command processor associations): QAISHELL, qaishell, QAISHELL.sh, qaishell.sh, QAISHELL.ksh, qaishell.ksh, QAISHELL.csh, qaishell.csh, QAISHELL.pl, qaishell.pl, QAISHELL.prl, and finally qaishell.prl. Since the file “QAISHELL” exists in the same directory as the input file, it will be found after first looking for the names in the current working directory.

On Windows, the following names will be checked (assuming the default command processor associations): QAISHELL.BAT, QAISHELL.EXE, QAISHELL.COM, QAISHELL.PL, and finally QAISHELL.PRL. Since the file “qaishell.pl” exists in the same directory as the input file, it will be found after first looking for the names in the current working directory.

Defining Command Processor Associations

The nastran command treats each specification of the “ishellext” keyword as either an addition to, modification of, or deletion from, the current definition. For example, using the default command processor associations, specifying

```
ishellext=tcl=wish
```

will add a new processor, “wish”, for the file-type “.tcl”, after the last currently defined processor. Specifying

```
ishellext=pl=
```

will delete the current association of “perl” for the file-type “.pl”. Finally,

```
ishellext=sh=ksh
```

will replace the “sh” definition for the “.sh” file type on UNIX.

To change the processing order, delete the current entry and then respecify it (to append it to the end of the table). For example, to force UNIX systems to find “qaishell.pl” before “QAISHELL”, specify

```
ishellext=.=,.=''
```

Note that this first deletes the null processor “.=”, and then re-specifies it as “.=””.

```
ishellext=.='',sh=sh,ksh=ksh,csh=csh,pl=perl,prl=prl
ishellext=bat='',exe='',com='',pl=perl,prl=perl
```

These two examples are the default associations for UNIX and Windows respectively.

Special Considerations (Windows)

On Windows, all executable files must have a non-null file type; this is why the “QAISHELL” script cannot be used on Windows, even if you have a Korn shell installed.

You may need to define “CMD.EXE” on Windows as the command processor for certain “.exe” files. Examples include 16-bit compiled Basic programs.

Finally, you can use a hash mark, “#”, in place of the equals sign on Windows to facilitate setting the processor association in a “.bat” file. For example,

```
ishellext#bat#'',exe#'',com#'',pl#perl,prl#perl
```

is an alternate definition of the default Windows association.

Using the ISHELL-INCLUDE Statement (“!”)

The ISHELL module provides a way to dynamically alter the instruction stream of a running DMAP, making it easier to integrate your own programs, and simplifying the task of customizing MD/MSC Nastran. The ISHELL-INCLUDE statement (“!”) extends the ISHELL feature to the instruction stream of the input file. This capability is derived by merging the features of both the ISHELL and the INCLUDE statements (by first executing the external program and then including the output in the input stream). The format is:

! *embedded shell command.*

! *continuations are indicated simply by the presence*

! *of another “!” in the first non-blank position of the next line.*

! *all characters following the “!” are passed to the appropriate*

! *shell for evaluation.*

The *shell* (or command processor) is determined by the MSC_ISHELLEXT environment variable, or by the *ishellext* keyword from the command line or RC file (see “Running an ISHELL Program” for more details). On UNIX systems, the command processor associated with the *null* file type is used for the ISHELL-INCLUDE statement. In most cases this requires one of the following keyword assignments to be added to the command line:

```
ishellext=.=/bin/csh        # for csh scripts
ishellext=.=/bin/ksh        # for ksh scripts
ishellext=.=/bin/sh         # for sh scripts
ishellext=.=perl            # for perl scripts
```

Note: The ISHELL-INCLUDE statement is currently not supported for Windows.

Like the INCLUDE statement, the ISHELL-INCLUDE statement can appear anywhere in the input file. However, the output (captured from “stdout”) must be appropriate to the section in which it will be included (i.e. the final input stream must constitute a valid MD/MSC Nastran input file). Unlike the INCLUDE statement, nested ISHELL-INCLUDE statements are not supported.

The processing of an embedded shell script is done as follows:

1. The entire script is extracted and written to a temporary file.
2. If the ISHELL-INCLUDE occurs within a DMAP alter, the processing is delayed until the DMAP compiler is invoked.
3. Otherwise, the input file processing is suspended, and the external program is executed. Output from the external program is captured to another temporary file which is immediately opened and included into the input stream.

4. Once the reading of the entire output is completed, processing of the input file is resumed.

The following additional processing steps are done for an embedded shell script located within a DMAP alter:

1. The DMAP statements that are selected by the alter are extracted to an external file named: “ishell.stdin”.
2. If stdout is written to, then that output is included in the alter; otherwise, “ishell.stdin” is read. This allows an interactive program like “vi” to simply save the modified input buffer, and it is automatically included in the alter.

An immediate benefit of the ISHELL-INCLUDE statement is the ability to customize the MD/MSC Nastran job to dynamically record (and/or respond) to the run time environment. The following example captures the value of a few environment variables as comments in the f06 file:

example.dat:

```
echooff                 $ removes copy of the ishell script below from the f06
 ! echo "echoon"        # just the results from the shell will be echoed
! echo “$”
! echo “$             License File: `printenv MSC_LICENSE_FILE`"
! echo “$  Job was run on host: `printenv HOST`"
! echo “$             Nastran Version: `printenv MSC_VERSD`"
! echo “$  Temporary Directory: `printenv MSC_SDIR`"
! echo “$                TMPDIR: `printenv TMPDIR`"
! echo "$                Scratch: `printenv MSC_SCR`"
! echo "$                   User: `printenv USER`"
! echo "$                Display: `printenv DISPLAY`"
! echo "$                   Base: `printenv MSC_BASE`"
! echo "$                   Path: `printenv MSC_JID`"
! echo "$                Memory: `printenv MSC_MEM`"
! echo "$             Assign File: `printenv MSC_ASG`"
! echo "$                   Shell: `printenv SHELL`"
! echo "$             Ishell Ext: `printenv MSC_ISHELLEXT`"
! echo "$             Ishell Path: `printenv MSC_ISHELLPATH`"
! echo "$              Ishell File: $0"
! echo "$ "
```

The example above should be executed with /bin/csh as the command processor:

> nastran example.dat scr=yes **ishellext=.=/bin/csh**

Improving Network File System (NFS) Performance (UNIX)

The Network File System (NFS) is software allowing file systems on remote computers to appear as if they were mounted on the local computer. There are two daemons that handle NFS traffic: “nfsd” handles file system access requests by the local computer to remotely mounted file systems; “biod” handles requests by remote computers to access local file systems.

These daemons have been designed so that multiple executing copies of each daemon increase NFS traffic capacity. Two of the possible causes of poor NFS performance are a lack of sufficient daemons to handle NFS requests made by the local computer to remotely mounted file systems (nfsd), or a lack of sufficient daemons to handle NFS requests of local file systems by remote computers (biod). The default number of daemons for nfsd and biod is typically four of each. This default is usually fine for a stand alone workstation used by one person. If you or others are accessing many remote file systems or run many MD/MSC Nastran jobs accessing file systems on file servers or remote workstations, you may need to increase the number of nfsd and biod daemons on both systems to increase NFS performance.

If you are running three or more MD/MSC Nastran jobs accessing disks on remote computers via NFS, MSC.Software recommends increasing both nfsd and biod daemons above the standard defaults. A good starting point is twelve (12) nfsd daemons and eight (8) biod daemons per CPU on client and server computers, respectively.

Your system administrator can change both system’s configurations to start additional NFS daemons. The administrator can also monitor network statistics with “nfsstat” to ensure network traffic is being handled efficiently. Additional daemon tuning may be necessary for your specific network needs.

Creating and Attaching Alternate Delivery Databases

MD/MSC Nastran uses the Structured Solution Sequences (SSS), located in *install_dir*/*prod_ver*/*arch* on UNIX and *install_dir**prod_ver**arch* on Windows, to specify the default solution sequences. You may modify and store a tailored solution sequence by creating a new delivery database. This procedure is also useful to eliminate unwanted solutions from the delivery database or add additional solution sequences.

The following files are delivered in the *install_dir*/*prod_ver*/nast/del/ directory on UNIX and *install_dir**prod_ver*\nast\del\ on Windows:

Filename	Description
buildsss	UNIX script used to build delivery database
buildsss.bat	Windows BAT file to build delivery database
*.dmap	SubDMAP source
*.dck	SubDMAP source that must be preprocessed by MSCFPP
*.ddl	NDDL source

Using MSC-Supplied Source

To rebuild the delivery database using the MSC-supplied source, the following procedure is used:

1. Change the working directory to an empty work directory. For example,

   ```
   cd $HOME/new-del
   ```

   on UNIX, or

   ```
   cd %HOMEDRIVE%%HOMEPATH%\new-del
   ```

   on Windows.
2. Rebuild the delivery database.

   prod_ver `buildsss`

Upon completion of this procedure, the delivery files SSS.MASTERA, SSS.MSCOBJ, and SSS.MSCSOU are created. These files are attached with the “delivery” keyword, (p. 54).

These files may be installed in the master architecture directory (if you have write access) with the command:

```
cp SSS.* install_dir/prod_ver/arch
```

on UNIX, or

```
copy SSS.* install_dir\prod_ver\arch
```

on Windows.

Using Modified Source

To build a modified delivery database, use the following procedure.

1. Change the working directory to an empty work directory. For example,

   ```
   cd $HOME/new-del
   ```

   on UNIX, or

   ```
   cd %HOMEDRIVE%%HOMEPATH%\new-del
   ```

   on Windows.
2. Copy the subDMAP and NDDL source files that are to be modified to the current directory.

   ```
   cp install_dir/prod_ver/nast/del/subDMAP.dmap .
   cp install_dir/prod_ver/nast/del/subDMAP.dck .
   cp install_dir/prod_ver/nast/del/nddl.ddl .
   ```

   on UNIX, or

   ```
   copy install_dir\prod_ver\nast\del\subDMAP.dmap .
   copy install_dir\prod_ver\nast\del\subDMAP.dck .
   copy install_dir\prod_ver\nast\del\nddl.ddl .
   ```

   on Windows where *subDMAP* and *nddl* are the specific files to be modified.
3. Modify the desired subDMAP and/or NDDL source files using a text editor.

4. Rebuild the delivery database.

   prod_ver `buildsss src=.`

Upon completion of this procedure, the delivery files SSS.MASTERA, SSS.MSCOBJ, and SSS.MSCSOU are created. These files are attached with the “delivery” keyword (page 54).

These files may be installed in the master architecture directory (if you have write access) with the command:

```
cp SSS.* install_dir/prod_ver/arch
```

on UNIX, or

```
copy SSS.* install_dir\prod_ver\arch
```

on Windows.

6 Using the Utility Programs

- Overview
- ESTIMATE
- F04REPRT
- HEATCONV
- MSCACT
- MSGCMP
- MultiOpt (MD Only)
- NEUTRL
- OP4UTIL
- OPTCONV
- PLOTPS
- RCOUT2
- RECEIVE
- TRANS
- XMONAST (UNIX)
- XNASTRAN (UNIX)
- Building the Utilities Delivered in Source Form

Overview

This chapter describes how to use the various MD/MSC Nastran utility programs. Table 6-1 groups these utilities by function.

Table 6-1 Utility Program Functions

Utility	Function
ESTIMATE	Estimates system requirements of an MD/MSC Nastran job and suggests performance improvements.
F04REPRT	Perl script to summarize or compare .f04 files.
HEATCONV	Reformats MD/MSC Nastran Version 67 heat-transfer and optimization data files into current formats.
OPTCONV	
MSCACT	Accumulates and summarizes MD/MSC Nastran accounting data.
MSGCMP	Compiles the message catalog.
MultiOpt	
NEUTRL	Converts MD/MSC Nastran plot files to PostScript or neutral format.
MSCPLOTPS	MSCPLOTPS is very similar to PLOTPS in that it reads plotting commands from a single MD/MSC Nastran binary- or neutral-format plot file. The primary difference is that MSCPLOTPS automatically determines the format of the input file.
OP4UTIL	OP4UTIL may be used to validate, copy or reformat binary files created using the MD/MSC Nastran OUTPUT4 module.
OPTCONV	OPTCONV may be used to reformat an existing optimization Bulk Data file used in MSC.Nastran prior to Version 68 into a format compatible with Version 68 or later.
PLOTPS	PLOTPS reads plotting commands from a single MD/MSC Nastran binary- or neutral-format plot file and produces a file that can be printed on a PostScript device.
RCOUT2	Converts neutral-format OUTPUT2 files to binary format.
RECEIVE	Moves results database (XDB) files between dissimilar computers.
TRANS	
XMONAST	Graphical user interface that submits and monitors MD/MSC Nastran jobs on UNIX systems.
XNASTRAN	

Sections “ESTIMATE” on page 195 through “XNASTRAN (UNIX)” on page 236 describe each utility (in alphabetical order), and present applicable keywords and examples. “Building the Utilities Delivered in Source Form” on page 239 contains instructions on how to build the source code utilities.

ESTIMATE

ESTIMATE may be used to estimate the memory and disk requirements for MD/MSC Nastran jobs and make suggestions on improving the performance of these jobs. ESTIMATE will read the input data file and estimate the job's memory and disk requirements. The ESTIMATE program is most accurate in predicting the requirements of static analyses that do not have excessive output requests. The memory requirements for normal modes analyses using the Lanczos method are reasonably accurate; however, the disk requirements are dependent upon the number of modes, this is a value that ESTIMATE cannot determine. Memory and disk requirements for other solutions are less accurate.

The basic format of the "estimate" command is

```
util_ver estimate input_file [keywords]
```

where *input_file* is the name of the data file. If the file type of the input data file is ".dat", it may be omitted from the command line.

ESTIMATE processes keywords using the following precedence to resolve conflicts when keywords are duplicated (with 1 representing the highest precedence):

1. The Bulk Data file.
2. The command line.
3. The nastran INI and RC files (if "nastrc=yes" is specified).
4. *data-file-directory*/.estimaterc on UNIX, or *data-file-directory*\estimate.rcf on Windows, where *data-file-directory* is the directory containing the input data file.
5. $HOME/.estimaterc on UNIX, or %HOMEDRIVE%%HOMEPATH%\estimate.rcf file on Windows.
6. estimate.ini in the directory containing the ESTIMATE executable.

Please be aware that the Bulk Data file can only contain statements that are accepted by MD/MSC Nastran. The following keywords will be recognized by ESTIMATE when they appear in the Bulk Data file on NASTRAN statements:

```
buffpool, buffsize, real
```

Note: "buffsize=estimate" is NOT accepted on a NASTRAN statement.

The following Case Control statements will be recognized by ESTIMATE when they appear in the bulk data file:

```
adapt, method, mpc, sp
```

Note: If these statements appear multiple times, e.g., in subcases, only the first occurrence of each case control statement will be recognized.

Similarly, the nastran INI and RC files can only accept keywords that are accepted by the nastran command. The following nastran command keywords will be recognized by ESTIMATE when they appear in nastran RC files if and only if "nastrc=yes" is also set:

```
bpool, buffsize, memory, real, realdelta, smemory, version
```

The full set of ESTIMATE utility keywords can ONLY appear on the ESTIMATE command line or in the ESTIMATE RC files, e.g., ".estimaterc" on UNIX and "estimate.rcf" on Windows.

Keywords

adapt adapt=*number* Default: None

Selects an ADAPT set for adaptivity jobs if an ADAPT Case Control command is not present or multiple ADAPT Case Control commands are present in the data file. By default, ESTIMATE will choose the first ADAPT found.

bpool bpool=*value* Default: 37 (all others)

Same as MD/MSC Nastran keyword, see “bpool” on page 49. This keyword cannot appear in an ESTIMATE RC file if “nastrc=yes” is specified.

buffsize buffsize=*number* Default: 8193

Same as MD/MSC Nastran keyword, see “buffsize” on page 49. This keyword cannot appear in an ESTIMATE RC file if “nastrc=yes” is specified.

dballco dballco=*value* Default: 1

Allows you to scale DBALL estimates. This scale factor is applied before the "dballmin" value, that provides a lower bound for DBALL estimates.

Example: *util_ver* `estimate example dballco=2`

This will double the DBALL disk estimate and then apply the "dballmin" lower bound.

Example: *util_ver* `estimate example dballco=0.5`

This will halve the DBALL disk estimate. An estimate less than than the lower bound specified by "dballmin" will be set to the lower bound.

dballmin dballmin=*value* Default: 1mb

Allows you to define the lower bound for all DBALL estimates. This bound is applied after the "dballco" value, that multiplies the actual estimate by a "conservatism" factor.

Example: *util_ver* `estimate example dballmin=2mb`

This will set the minimum DBALL disk estimate to 2 MB.

dskco dskco=*value* Default: 1

Allows you to define a factor to scale total disk estimates. This scale factor is applied before the "dskmin" value, that provides a lower bound for total disk estimates.

Example: *util_ver* `estimate example dskco=2`

This doubles the total disk estimate and then applies the "dskmin" lower bound.

Example: *util_ver* `estimate example dskco=0.5`

This will halve the total disk estimate. An estimate less than the lower bound specified by "dskmin" will be set to the lower bound.

dskmin dskmin=*value* Default: 1mb

Allows you to define the lower bound for all total disk estimates. This bound is applied after the "dskco" value, that multiplies the actual estimate by a "conservatism" factor.

Example: *util_ver* `estimate example dskmin=2mb`

This will set the minimum total disk estimate to 2 MB.

enable The “enable” keyword can be used to explicitly enable rules. This may be useful to enable a rule that was automatically suppressed when a value was assigned. For example, the following command will now calculate the estimated memory requirements for a job even though a value for memory was specified on the command line:

Example: *util_ver* `estimate example memory=5mb enable=10`

estimatedof estimatedof=yes,no Default: No

Indicates if the number of degrees of freedom are to be estimated. By default, ESTIMATE will count the DOF. This process takes time, but it is generally more accurate. Specifying “estimatedof=no” will result in a less accurate, but faster, estimate of the DOF. The presence of any MESH entries in the Bulk Data will force “estimatedof=yes”.

memco memco=*number* Default: 1.0

Allows you to specify a constant factor that is either more or less conservative than the default.

Example: *util_ver* `estimate example memco=2`

This setting will double the memory estimate.

memmin memmin=value Default: 16mb

Allows you to define the lower bound for all memory estimates. This bound is applied after the "memco" value, that multiplies the actual estimate by a "conservatism" factor.

Example: *util_ver* `estimate example memmin=8mb`

This will set the minimum memory estimate to 8 MB.

memory memory=*size* Default: 4MW

Same as MD/MSC Nastran keyword, see "memory" on page 69. This keyword cannot appear in an ESTIMATE RC file if "nastrc=yes" is specified.

method method=*number* Default: None

Selects a METHOD for dynamics jobs if a METHOD Case Control command is not present or multiple METHODCase Control commands are present in the data file. By default, ESTIMATE will choose the first METHOD found.

mode mode=*keyword* Default: suggest

Selects the program operating mode. Specifying "mode=estimate" will result in memory and disk estimates only. Specifying "mode=suggest", the default, will estimate memory and disk requirementsfor the current job configuration, suggest modifications to improve the performance, and provide estimates for the memory and disk requirements of the suggested configuration. Specifying "mode=modify" does all that "mode=suggest" does plus actually make the suggested changes to your data file. See "out" to specify the new data file's name and information on organizing your input file.

Note: If "mode=modify" is specified, and ESTIMATE detects errors in the input file or encounters valid Bulk Data that is not understood by ESTIMATE, the program will revert to "mode=suggest".

Example: *util_ver* `estimate example mode=estimate`

The memory and disk requirements for the current job are displayed.

Example: *util_ver* `estimate example`

The memory and disk requirements for the current job, suggestions for improving performance, and memory and disk requirements for the suggested configuration are displayed.

Example:

```
util_ver estimate example
mode=modify
```

The memory and disk requirements for the current job, suggestions for improving performance, and estimates of memory and disk requirements for the suggested configuration are displayed. If, and only if, modifications to "example.dat" are suggested, the original input file is versioned (given indices) and the revised data file is written to "example.dat".

mpc mpc=*number* Default: None

Selects an MPC if an MPC Case Control command is not present or multiple MPC Case Control commands are present in the data file. By default, ESTIMATE will choose the first MPC found.

nastrc nastrc=yes,no Default: Yes

The "nastrc" keyword allows you to select the type of RC file processing invoked by the ESTIMATE utility. Setting "nastrc=yes", the default, will process the standard MD/MSC Nastran RC files before the standard ESTIMATE RC files, i.e., $HOME/.estimaterc and "*data-file-directory*/.estimaterc" on UNIX, and %HOMEDRIVE%%HOMEPATH\estimate.rcf and "*data-file-directory*/estimate.rcf" on Windows, are processed. Setting "nastrc=no" will only process the standard ESTIMATE RC files.

out out=*pathname* Default: input filename

Specifies the name of the output file if "mode=modify" is specified and modifications of the data file are actually required. By default, the original file is versioned (given indices) and the revised data file is written to the original input file's name. See "Using Filenames and Logical Symbols" on page 79

Example:

```
util_ver estimate example
mode=modify
```

If modifications to "example.dat" are suggested, the original input file is versioned (given indices) and the revised data file is written to "example.dat".

Example:

```
util_ver estimate example
mode=modify \
out=modified
```

The revised data file is written to "modified".

Note: In order to minimize the amount of data duplicated between the original input file and the modified file, MSC recommends that the Bulk Data that is not subject to modification by ESTIMATE (i.e., all Bulk Data except PARAM and EIGRL entries) be placed in an INCLUDE file.

An example of the recommended input file organization is:

```
NASTRAN statements
FMS statements
Executive
CEND
Case Control
BEGIN BULK
PARAM,...
$
EIGRL,...
$
INCLUDE file.bulk
$
ENDDATA
```

pause pause=*keyword* Default: No

Pause ESTIMATE before exiting to wait for the “Enter” or “Return” key to be pressed. This can be useful when ESTIMATE is embedded within another program. The values are “fatal”, “information”, “warning”, “yes”, and “no”. Setting “pause=yes” will unconditionally wait; “pause=fatal” will only wait if a fatal message has been issued by ESTIMATE; “pause=information” and “pause=warning” will similarly wait only if an information or warning message has been issued. The default is “pause=no”, i.e., do not wait when ESTIMATE ends.

real real=*value* Default: See text.

Same as MD/MSC Nastran keyword, see “real” on page 84. This keyword cannot appear in an ESTIMATE RC file if “nastrc=yes” is specified.

realdelta realdelta=*value* Default: See text.

Same as MD/MSC Nastran keyword, see “realdelta” on page 84. This keyword cannot appear in an ESTIMATE RC file if “nastrc=yes” is specified.

report report=*keyword* Default: Normal

Specifies the program’s report format. The“report=normal” format is intended to be read by you. The “report=keyword” format is intended to be read by a program.

scr300co scr300co=*value* Default: 1

Allows you to define a factor to scale SCR300 estimates. This scale factor is applied before the "scr300min" value, that provides a lower bound for SCR300 estimates.

Example:
```
util_ver estimate example
scr300co=2
```

This will double the SCR300 disk estimate and then apply the "scr300min" lower bound.

Example:
```
util_ver estimate example
scr300co=0.5
```

This will halve the SCR300 disk estimate.An estimate less than the lower bound specified by "scr300min" will be set to the lower bound.

scr300min scr300min=value Default: 1mb

Allows you to define the lower bound for all SCR300 estimates. This bound is applied after the "scr300co" value, that multiplies the actual estimate by a "conservatism" factor.

Example:
```
util_ver estimate example
scr300min=2mb
```

This will set the minimum SCR300 disk estimate to 2 MB.

scratchco scratchco=*value* Default: 1

Allows the user to define a factor to scale SCRATCH estimates. This scale factor is applied before the "scratchmin" value, that provides a lower bound for SCRATCH estimates.

Example:
```
util_ver estimate example
scratchco=2
```

This will double the SCRATCH disk estimate and then apply the "scratchmin" lower bound.

Example:
```
util_ver estimate example
scratchco=0.5
```

This will halve the SCRATCH disk estimate. An estimate less than the lower bound specified by "scratchmin" will be set to the lower bound.

scratchmin scratchmin=*value* Default: 1mb

Allows you to define the lower bound for all SCRATCH estimates. This bound is applied after the "scratchco" value, that multiplies the actual estimate by a "conservatism" factor.

Example:
```
util_ver estimate example
scratchmin=2mb
```

This will set the minimum SCRATCH disk estimate to 2 MB.

smemory smemory=*size* Default: 100 (all others)

Same as MD/MSC Nastran keyword, see "smemory" on page 90. This keyword cannot appear in an ESTIMATE RC file if "nastrc=yes" is specified.

spc spc=*number* Default: None

Selects an SPC if an SPC Case Control command is not present or multiple SPC Case Control commands are present in the data file. By default, ESTIMATE will choose the first SPC found.

suppress suppress=*list* Default: None

Specifies rules that are to be suppressed when "mode=suggest" or "mode=modify" is specified. See "Rules" on page 203 for the list of rules. If no value is specified, i.e., "suppress=", then any rules previously suppressed are enabled. Multiple rules can be suppressed by using the keyword multiple times or by specifying a comma-separated list.

Example:

```
util_ver estimate example
suppress=1
```

Suppress rule 1, the rule controlling BUFFSIZE.

Examples:

```
util_ver estimate example
suppress=1,6
util_ver estimate example
suppress=1 suppress=6
util_ver estimate example
suppress=2 suppress= \
 suppress=1,6
```

Suppress rules 1 and 6.

verbose verbose=yes,no Default: No

Specifies the amount of information to be displayed. Specifying "verbose=yes" will generate a much larger amount of output. The additional information includes a more detailed summary of the input file, the parameters used in estimating the memory and disk requirements, and the estimates for the original file, even when "mode=suggest" or "mode=modify" is specified.

version version=*string* Default: 2006

Specifies the version of MD/MSC Nastran for which the estimates are to be targeted. The version will affect the estimated memory requirements and the actions of various rules, see "Rules" on page 203. This keyword cannot appear in an ESTIMATE RC file if "nastrc=yes" is specified.

wordsize wordsize=*number* Default: 32

64 if mode = i8 supported

Specifies the word size of the estimate's target computer. By default, ESTIMATE's calculations will be appropriate the current computer. This keyword may be used to specify estimates for a computer with a different word size. A comma-separated list of values may be specified when estimates and suggestions for multiple machines are desired. If "mode=modify" was specified, the modification are based on the last word size specified.

Rules

ESTIMATE has a fixed rule base thatit uses to make suggestions for improvement. Any of the rules may be suppressed with the "suppress" keyword. The current rules are:

1. Set recommended BUFFSIZE.

BUFFSIZE=8193	$DOF \leq 100000$
BUFFSIZE=16385	$100000 < DOF \leq 400000$
BUFFSIZE=32769	$DOF > 400000$

2. Use default BPOOL.

BPOOL=37	$wordsize = 32$
BPOOL=20	$wordsize = 64; version < 70.5$
BPOOL=27	$wordsize = 64; version \geq 70.5$

3. Suppress symmetric decomposition if not enough memory for sparse.
   SYSTEM(166)=0
4. Make all open core available to modules.
   Delete HICORE.

5. Select the sparse solver.

   Delete SPARSE
   Delete USPARE — $density \leq 12.0$
   SPARSE=1
   USPARSE=0 — $density > 12.0$

6. Force default rank size.
   Delete SYSTEM(198)
   Delete SYSTEM(205)
7. Do not sequence.

   PARAM,NEWSEQ,-1 — $version < 69.0$

8. Use default Lanczos parameters.
   EIGRL,...,V1=““
   EIGRL,...,MAXSET=15
9. Use default SMEMORY.

   INIT SCRATCH (MEM=100) — $wordsize = 32$
   INIT SCRATCH (MEM=0) — $wordsize = 64$

10. Use estimated memory size.
    memory=*estimated-memory*
11. Use default RAM.
    INIT MASTER (RAM=30000)
12. Real.
    Delete REAL.
13. Do not use Supermodule.
    Delete PARAM,SM,YES.
14. Do not use Parallel Lanczos.
    Delete NUMSEG.

Examples

The ESTIMATE program can be used in several ways. The default mode will make suggestions on improving the performance of MD/MSC Nastran and estimate the resource requirements of the job assuming the suggested parameters.

util_ver `estimate example`

To get an estimate of the job using the current parameters, use the command:

util_ver `estimate example` **`mode=estimate`** *`other_estimate_keywords`*

To have a new input file generated with the suggested changes, use the command:

util_ver `estimate example` **`mode=modify`** *`other_estimate_keywords`*

To run MD/MSC Nastran with the memory estimated by ESTIMATE, use:

util_ver `nastran example` **`memory=estimate`** *`other_nastran_keywords`*

F04REPRT

The F04REPRT utility is a Perl script that will summarize and/or compare .f04 files. The utility can determine the CPU time consumed by various MD/MSC Nastran modules, i.e., as a DIAG 49 replacement, or compare the relative performance of one or more jobs under various configurations.

Notes:

1. You must have Perl installed on your system to use this utility. Perl is available from numerous sources, including the URL

   http://www.perl.com

   This is not an MSC.Software Corporation site and MSC has no control over the site's content. MSC cannot guarantee the accuracy of the information on this site and will not be liable for any misleading or incorrect information obtained from this site.
2. Previously, MD/MSC Nastran's DIAG 49 provided a summary of CPU time spent in various modules. That DIAG has been removed, and replaced by this utility.

The basic format of the F04REPRT command is

util_ver `f04reprt.pl -s [options]` ***pathname*** `[`***pathname*** `...]`

or

util_ver `f04reprt.pl -d [options] old1 new1 [oldn newn...]`

where "-s" selects the summary mode, "-d" selects the comparison mode, *options* are zero or more of the options listed below, *pathname* is a pathname, and *oldi* and *newi* are pathnames. If a pathname is a directory, all .f04 files in the directory are summarized/compared.

Note: Alternatively, you can run F04REPRT with the command

```
perl install-dir/prod_ver/util/f04reprt.pl arguments ...
```

on UNIX, or

```
perl install-dir\prod_ver\util\f04reprt.pl arguments ...
```

on Windows if perl is in your PATH. UNIX users can also use the command

```
install-dir/prod_ver/util/f04reprt.pl arguments ...
```

if your Perl executable is /usr/local/bin/perl, or the "shbang" line was updated to the appropriate path.

Running F04REPRT without any arguments will display a help message explaining the utility's options.

Options

-c -c Default: No

Indicates module times are to be accumulated in a single entry, rather than separate entries for each module occurrence

-d -d Default: None

Requests a comparison (difference) between each pair of *oldi* and *newi* pathnames specified on the command line. If only one pair of pathnames are specified, the "-d" is optional.

-e Specifies that module elapsed times are to be used forordering entries instead of CPU times.

-f -f *c* Default: Space

Specifies a field separator character to separate field in the comparison report. This character may be inclosed in either single or double quotes to protect it from the command shell.

-m -m *number* Default: 0.05

Specifies the minimum CPU time threshold for comparisons or summaries. CPU times less than this threshold will be ignored.

-o -o *file-type* Default: None

Specifies an output file-type. If specified, each comparison or summary report will be written to a separate file in the current working directory with the name *basename.ext* where *basename* is the base name of the *pathname* or *oldi*.

If not specified, output will be written to stdout with each report separated by a form feed "Ctrl-L" character.

-r -r *number* Default: 5

Specifies the delta percentage used for "FASTER" and "SLOWER" comments in comparison (-d) output.

Any old versus new comparisons that exceed this delta from 100%,eg., $(delta < 95\%)$ or $(delta > 105\%)$, will print the appropriate comment.

-s -s Default: None

Requests a summary report for each*pathname* specified on the command line. If only one pathname is specified, the "-s" is optional.

-x -x *file-type* Default: f04

Specifies an alternate input file type.

Examples

util_ver `f04reprt.pl example`

If "./example" on UNIX, or ".\example" on Windows, is a subdirectory of the current directory, F04REPRT will write a summary report to stdout for every .f04 file in the directory. Otherwise, if "./example.f04" on UNIX, or ".\example.f04", on Windows is a file, a summary report of the one file is written to stdout.

util_ver `f04reprt.pl old new`

If "old" and "new" are subdirectories of the current working directory, F04REPRT will generate lists of the .f04 files in each directory. Comparisons will be made between each pair of files with the same name in the two directories. Non-.f04 files and unpaired .f04 files, i.e., .f04 files that exist in either "old" or "new" but not both, will be ignored. Otherwise, if "old.f04" and "new.f04" are files, then a comparison of these two files will be displayed.

HEATCONV

HEATCONV may be used to reformat an existing heat-transfer Bulk Data file used in MD/MSC Nastran prior to Version 68 into a format compatible with Version 68 or later. The operations performed by this program are described in the *MSC.Nastran Release Notes for Version 68*. The basic format of the "heatconv" command is

util_ver `heatconv` *`input_file`* [*`keywords`*]

where *input_file* is the name of the heat-transfer data file. If the file type of the old data file is ".dat", it may be omitted from the command line.

Keywords

output output=*pathname* Default: input_file

This option specifies the name of the reformatted data file. By default, the old output file is renamed by appending the file type ".old"; the new file is the original name of the input file. If an output file is specified using this option, the original input filename is unchanged.

Examples

To execute the program, enter the following command:

util_ver `heatconv example`

The Version 68-compatible output is written to

```
example.dat
```

The original data file is renamed to example.dat.old.

MSCACT

MSCACT may be used to generate usage reports from the accounting files generated by MD/MSC Nastran when the “acct=yes” keyword is used. The basic format of the “mscact” command is

util_ver `mscact [keywords] acc-file [acc-file ...]`

where *acc-file* are the names of the accounting file(s) to be summarized.

Note: The keywords only affect files listed after the keyword.

Keywords

perfile perfile=yes,no Default: No

Specifies the summary is to be printed on a per file basis. If “perfile=yes” is specified, a summary of each file will be individually printed. By default, the summary will include all files.

sortby sortby=*keyword* Default: Name

Sort the report as specified by the keyword. The keywords are:

Keyword	Sort Order
count	Sort by third report column.
cpu	Sort by second report column.
name	Sort by first report column.
none	Do not sort report; report is ordered as found in data file.

Setting “sortby=none” produces a report very similar to the previous versions of this utility.

summary summary=*keyword* Default: None

Selects the type of summary. If "summary=none" is specified, the total CPU for all entries will be displayed. Otherwise, one of the following summary types may be selected:

Keyword	Type of Summary
acdata	By acdata
acid	By account ID (acid)
date	By execution date
jid	By job name
product	By product name
sol	By SOL
user	By user name
version	By product name and version

Note: Prior to MSC.Nastran V70.5, the UNIX syntax "-s keyword" was used; V70.5 dropped support for that syntax.

Examples

All of the following examples assume your current working directory is the MD/MSC Nastran accounting directory, i.e., `install_dir/acct` on UNIX and `install_dir\acct` on Windows.

To summarize accounting data across all files:

```
util_ver mscact file1 file2
 file1 file2:
  Total: cpu-sec count
```

where *filei* are the filenames, *cpu-sec* is the total CPU seconds across all files, and *count* is the number of entries accumulated across all files.

To summarize accounting data from individual files:

```
util_ver mscact perfile=yes file1 file2
 file1:
  Total:cpu-sec count
 file2:
  Total:cpu-sec count
```

where *filei* is the name of each file, *cpu-sec* is the total number of CPU seconds, and *count* is the number of entries in each file.

To summarize accounting data in individual files by user:

```
util_ver mscact summary=user perfile=yes file1 file2
 file1:
  user1:cpu-sec1 count1
  user2:cpu-sec2 count2
   ...
  Total:cpu-sec count
 file2:
  user1:cpu-sec1 count1
  user2:cpu-sec2 count2
   ...
  Total:cpu-sec count
```

where *filei* are the filenames of each file, *useri* are the names, *cpu-seci* are the total CPU seconds for each user, *counti* are the number of entries accumulated for each user, *cpu-sec* is the number of total CPU seconds, and *count* is the number of entries in each file.

Accounting File Format

A separate file is created for each month of each year and is named

```
install_dir/acct/mscyymm.acc
```

on UNIX and

```
install_dir\acct\mscyymm.acc
```

on Windows where *yy* are the last two digits of the year and *mm* is the month (01 to 12). Each month's file is independent of every other file.

The accounting file begins with three header records followed by detail records, one detail record for each MD/MSC Nastran job run during the given month and year. Comments, indicated by a hash mark "#" as the first character of the line, may be placed anywhere in the file after the header records.

Detail records (any non-comment line after the third line) include the following data:

1. The day the job was started (i.e., Sun., Mon., Tue., Wed., Thu., Fri., or Sat.).
2. The month the job was started (i.e., Jan., Feb., Mar., Apr., May, Jun., Jul., Aug., Sep., Oct., Nov., or Dec.).
3. The date of the month the job was started (i.e., 01 through 31).
4. The time the job was started (i.e., hh:mm:ss, where hh is 00 through 23, mm is 00 through 59, and ss is 00 through 59).
5. The time zone (i.e., the "TZ" environment variable).
6. The year the job was started (four digits).
7. The name of the user running the job.
8. The job's output filename.
9. The analysis application, e.g., MD/MSC Nastran.
10. The version of the application (e.g., 70.5).
11. The SOL used by the job (e.g., 101, 2011).
12. The total CPU time, in seconds, of the job (from the .f04 file).
13. The cumulative CPU time, in seconds, of all detail records up to and including this record.
14. The cumulative CPU time, in minutes, of all detail records up to and including this record.
15. The account ID as specified by the nastran command's "acid" keyword.
16. The account data as specified by the nastran command's "acdata" keyword.

Note: The cumulative times (fields 13 and 14) are for historical purposes only. These values are ignored.

MSCPLOTPS

MSCPLOTPS is very similar to PLOTPS in that it reads plotting commands from a single MD/MSC Nastran binary- or neutral-format plot file and produces a file that can be printed on a PostScript device. The primary difference is that MSCPLOTPS automatically determines the format of the input file, i.e., whether it is a binary- or a neutral-format plot file, and supports plot files generated on any platform and in any processing mode. Otherwise, the processing capabilities of the two programsare the same. Except as noted below, the use of MSCPLOTPS is the same as the use of PLOTPS. Please see “PLOTPS” on page 224 and replace the word plotps with mscplotps. The basic format of the “mscplotps” command is:

util_ver `mscplotps` *`input_plot_file`* `[keywords]`

where *input_plot_file* is the name of the plot file generated by MD/MSC Nastran or NEUTRL. A neutral-format plot file can be read from stdin by specifying “-” as the filename. If the extension of the input file is “.plt” or “.neu”, the extension may be omitted from tine *input_plot_file* specification.

All keywords are the same as for PLOTPS except that the “format” keyword is optional. If it is specified, the specified type will be checked against the actual type, a warning message issued if the types do not match, and the “format” specification ignored.

Note: MSCPLOTPS command is only used on UNIX systems.

MSGCMP

MSGCMP compiles a text message file and generates a binary message catalog. The basic format of the command is

util_ver `msgcmp` *`text_file`* [*`message_catalog`*]

where *text_file* is the name of an existing text message file or is "-" to read from stdin, and *message_catalog* is the optional name of the message catalog that will be written. The type of the text file must be ".txt". If a message catalog is not named, the message catalog will be written in the local directory as "*text_file*.msg". The message catalog can be tested using the "msgcat" keyword (p. 73).

The utility can also regenerate a text file from an existing message catalog using the command

util_ver `msgcmp` *`message_catalog`*`.msg` [*`text_file`*]

where *message_catalog*.msg is the name of an existing message catalog and *text_file* is the optional name of a text file that will be written. The type of the message catalog must be ".msg" and must be entered on the command line. If a text file is not named, the text file is written to stdout.

The text source file for the standard message catalog is

`install_dir``/`*prod_ver*`/util/analysis.txt`

on UNIX and

`install_dir``\`*prod_ver*`\util\analysis.txt`

on Windows. The standard message catalog is

`install_dir``/`*prod_ver*`/`*`arch`*`/analysis.msg`

on UNIX and

`install_dir``\`*prod_ver*`\`*`arch`*`\analysis.msg`

on Windows.

Examples

The following command will compile the message catalog from a text file named "myfile.txt"

util_ver `msgcmp myfile`

The message catalog will be named "myfile.msg". This catalog may be used with the nastran command

util_ver `nastran myjob` **`msgcat=myfile.msg`** *`other_nastran_keywords`*

Note: Message catalogs are machine dependent. "Binary File Compatibility" identifies the systems that are binary compatible; binary compatible systems can use multiple copies of the same message file.

MultiOpt (MD Only)

The MultiOpt (Multiple Model Optimization) utility enables the combination of two or more related optimization tasks into a single combined optimization task. MultiOpt is available only in MD Nastran and is not available with MSC Nastran. The MSC Toolkit driven process executes each of the separate optimization tasks up to the point of obtaining the design sensitivities. The designtasks from the separate models are then merged and a combined optimization is performed. The results of the optimization are partitioned to the separate models and the process is repeated until a converged solution is achieved, the specified number of design cycles have been executed or it is determined it is fruitless to attempt further design iterations.

The most basic way to invoke MultiOpt is using a command line of the following form:

```
md20111 MultiOpt nastran n deck1.dat …
deckn.dat coef c1 c2 ..cn mem m1 m2..scr=sopt [options]
```

A more flexible form of the input, which supports all of the standard features, and also allows for running jobs in parallel across different machines is:

```
md20111 Multiopt file.xml
```

Where file.xml is of the form:

```
<?xml version="1.0" ?>
<rc name="MultiOpt" >
<path name="/nastran" />
<Job name="deck1" coef = "c1" blocking="bopt" node="platform1 " mem="m1"
scr="sopt" args=" " />
<Job name="deck2" coef = "c2" blocking="bopt" node="platform2" mem="m2"
scr="sopt" args=" " />
<Merge mem="mm" scr="sopt" args=" " />
</rc>
```

where:

Option	Description
nastran	A name to invoke the relevant Nastran executable (e.g., /nast/bin/nast2011)
N	Number of models to be merged ($1 < n < 6$)
Jobname=	For the xml form, indicates the subsequent data is a job name
deck1.dat	Name of the first input data model
deck*n*.dat	Name of the *nth* input data model
coef coef=	A flag to indicate the following input is objective weighting coefficients For the xml form, indicates the subsequent data is a coefficient for this model
c1	Coefficient that provides the objective weighting for the first model (Default = 1.0)
c2	Coefficient that provides the objective weighting for the second model (Default = 0.0)

Option	Description
Cn	Coefficient that provides the objective weighting for the nth model (Default = 0.0)
Mem Mem=	A flag to indicate the following input are memory requests for the individual models. If this flag is not used all models require the same amount of memory. For the xml form, indicates the subsequent data is a memory request for this model
m1	Memory for the first model and also for the merge operation in the basic MultiOpt invoking
m2	Memory for the second model
mn	Memory for the nth model
Mm	Memory for the merge operation
Node="*platform*"	For the xml form, indicates the this job is to be run on the indicated computer. Default is to run on the local platform
Blocking="*bopt*"	For the xml form, indicates whether that job is to be run in parallel or serially. Blocking =yes (Default) runs the job serially while blocking=no enables running the job in parallel.
Scr="*sopt*"	Option for scr=yes or no. Scr=yes is recommended.
args="value"	Any command line option of the form args=value that is a valid Nastran command line option.

Additional guidance on the use of the MultiOpt utility can be found in "Special Topics" in Chapter 2 of the *Design Sensitivity and Optimization User's Guide*.

To run MultiOpt, you must set the environment variable MSC_LICENSE_FILE to either:

a. The location of an MSC license server (using the port@host format); or

b. The fully-qualified path name of a local license file.

Special Requirements for using MultiOpt on Windows Platforms:

For the MD Nastran 2011 release of MultiOpt on windows platforms there are three environment variables that need to be set by the user:

For both windows 32 and 64 bit operating systems, the following environment variables need to be set:

```
set SCA_SERVICE_CATALOG={Nastran_install_path}\prod_ver\res\SCAServiceCatalog.xml
set SCA_RESOURCE_DIR={Nastran_install_path}\prod_ver\res
```

For windows 32 bit operating systems, the following environment additional variable needs to be set:

```
set PATH={Nastran_install_path}\prod_ver\win32\lib;%PATH%
```

For windows 64 bit operating systems, the following environment additional variable needs to be set:

```
set PATH={Nastran_install_path}\prod_ver\win64\lib;%PATH%
```

For windows 32 bit operating systems with standard installation, the required commands are:

```
set PATH=install_dir\prod_ver\md20111\win32\lib;%PATH%
set SCA_SERVICE_CATALOG=C:\MSC.Software\MD_Nastran\20111\md20111\res\SCAServiceCata
  log.xml
set SCA_RESOURCE_DIR=install_dir\prod_ver\md20111\res
```

For windows 64 bit operating systems with standard installation, these are the commands

```
set PATH=install_dir\prod_ver\md20111\win64\lib;%PATH%

set SCA_SERVICE_CATALOG=install_dir\prod_ver\md20111\res\SCAServiceCata       log.xml
set SCA_RESOURCE_DIR=install_dir\prod_ver\md20111\res
```

NEUTRL

NEUTRL converts a binary-format plot file into a neutral-format plot file. The basic format of the "neutrl" command is

util_ver `msgcmp myfile`

where *binary_plot_file* is the name of a binary plot file. If the file type of the plot file is ".plt", it may be omitted from the command line.

Keywords

dump	dump=yes,no	Default:	no
	This option enables a raw print of each plot command to be made before it is processed. This print is used for debugging purposes only.		
output	output=*pathname*	Default:	*binary_plot_file*.neu
	This option specifies the name of the neutral-format file. If "out=—" is specified, the neutral plot file is written to stdout. By default, the output file is the name of the input file with the new type ".neu".		
verbose	verbose=yes,no	Default:	yes *Output is a disk file.*
			no *Output is stdout.*
	This option specifies whether processing messages are to be written.		

Examples

To execute the program, enter the following command:

util_ver `neutrl example1`

The name of the output file is

`example1.neu`

OP4UTIL

OP4UTIL may be used to validate, copy or reformat binary files created using the MD/MSC Nastran OUTPUT4 module. It may also be used to “dump” the contents of any binary format file. The basic format of the "op4util" command is:

```
util_ver op4util <options> <file names>
```

This program is used as follows:

To generate a usage/help message:

```
util_ver op4util
util_ver op4util -h[elp]
util_ver op4util -?
```

To copy a file:

```
util_ver op4util -c[opy] [-v[erbose]] <from_fname> <to_fname>
```

To dump a file or files:

```
util_ver op4util -d[ump] [-v[erbose]] <fname_1> [... <fname_n>]
```

To convert a file from big-endian to little-endian or vice-versa:

```
util_ver op4util [-x[change]] [-v[erbose]] [-m nnn] <from_fname> <to_fname>
```

To convert a file from one endian format to a specified endian format:

```
util_ver op4util <endian_opt> [-v[erbose]] [-m nnn] <from_fname> <to_fname>
```

To query a file or files to determine their format:

```
util_ver op4util -q[uery] [-v[erbose]] <fname_1> [... <fname_n>]
```

To validate (test) a file or files, i.e., to check their validity as OUTPUT4 files:

```
util_ver op4util -t[est] [-v[erbose]] [-m nnn] <fname_1> [... <fname_n>]
```

Keywords

-?	Requests that usage information be written to stdout. This is the same as the `-h` option.
-c[opy]	Requests the copy option. This option copies the file specified by `<from_fname>` to the file specified by `<to_fname>`, overwriting any existing file and creating a new file if it does not exist. This option does not validate `<from_fname>` or change its format in any way.
-d[ump]	Requests the file dump option. This option lists the contents of each file, including record number and record length information, in both hexadecimal and character formats. Just as will the -query option, it checks each of the files specified by `<fname_1>` to `<fname_n>` to see if it is a valid binary file and reports its endian. The file need not be a valid OUTPUT4 file.
-h[elp]	Requests that usage information be written to stdout.
-m nnn	This parameter is only required when the -test, -xchange or <endian_opt> options fail because of memory allocation errors. The nnn value is the size of the memory to be used, in MB, and must be in the range 1 to 2047. The blank between the `-m` and the `nnn` value is optional.
-q[uery]	Requests the file query option. This option checks each of the files specified by `<fname_1>` to `<fname_n>` to see if it is a valid binary file and reports its endian. It does not test the actual file data to see if the file is a valid OUTPUT4 file.
-t[est]	Requests the file validate (test) option. This option reads each of the file specified by `<fname_1>` to `<fname_n>`, checking for a valid binary format file containing matrices in the proper OUTPUT4 format.
-v[erbose]	Requests "verbose" output. Normally, the -copy, -test, -xchange, and `<endian_opt>` options do not generate any output and the -query and -test options only write out a single line about each of the files they process. In verbose mode, program headers and detailedfile descriptions are generated, and the -test, -xchange and `<endian_opt>` options will list the matrices in the files along with their format and size.
-x[change]	Requests the endian conversion option. `<from_fname>` will be checked to see if it is a valid binary file and, if it is, is copied to the file specified by `<to_fname>`, checking the data format as it copies the file and converting the data from the `<from_fname>` endian to the opposite endian. That is, if `<from_fname>` is a big-endian file, `<to_fname>` will be a little-endian file and vice-versa. On long-word systems, the integer length of the input file will be preserved. On short-word systems, long-word integer input files will be converted to short-word output files having the opposite endian from the input file.

<endian_opt>	Requests the endian conversion option. This option is very similar to the -xchange option except that the endian of `<to_fname>` is explicitly specified. If `<to_fname>` is to have big-endian format, `<endian_opt>` must be `-b[igendian]` or one of the following synonyms: `-aix`, `-hpux`, or `-sol[aris]`. If `<to_fname>` is to have little-endian format, `<endian_opt>` must be `-l[ittleendian]` or one of the following synonyms: `-linu[x]` or `-wind[ows]`. If `<from_fname>` already has the desired endian format, a copy will be performed instead. On long-word systems, <endian_opt> may have "64" appended to one of the valid options to indicate that the -xchange output format is to be a "long-word" format. For example, `-aix64` will request a long-word big-endian format file.

If more than one processing option is specified, the last one specified is the one that will be in effect.

The default options (if one of -c, -h, -q, -t, -x, -? or -b, -l or one of their synonyms are not specified) are

-h	If there are no file name options
-q	If one or more than two file name options are specified
-x	If exactly two file name options are specified.

Error messages such as those describing invalid command options are written to stderr.

Examples:

1. Copy file `infile_1.op4` to `test_file.op4`:
   util_ver `op4util -c infile_1.op4 test_file.op4`
2. Copy file `infile_big_endian.op4` to `infile_little_endian.op4`, changing its endian:
   util_ver `op4util -xch infile_big_endian.op4 infile_little_endian.op4`
3. Copy file `input_file.op4` to `win_file.op4`, forcing `win_file.op4` to have Windows (little-endian) format. Also, generate verbose messages about the conversion process:
   util_ver `op4util -wind -v input_file.op4 win_file.op4`
4. Dump files `input_file.op4` and `input_file.op2`, generating verbose messages about the file formats:
   util_ver `op4util -dump-v input_file.op4 input_file.op2`

OPTCONV

OPTCONV may be used to reformat an existing optimization Bulk Data file used in MSC.Nastran prior to Version 68 into a format compatible with Version 68 or later. The operations performed by this program are described in the *MSC.Nastran Release Notes for Version 68*. The basic format of the "optconv" command is

```
util_ver optconv input_file [keywords]
```

where *input_file* is the name of the dynamic-optimization data file. If the file type of the old data file is ".dat", it may be omitted from the command line.

Keywords

output	output=*pathname*	Default:	input-file

This option specifies the name of the reformatted data file. By default, the old output file is renamed by appending the file type ".old"; the new file is the original name of the input file. If an output file is specified using this option, the original input filename is unchanged.

Examples

To execute the program, enter the following command:

```
util_ver optconv example
```

The Version 68-compatible output is written to

```
example.dat
```

The original data is renamed to example.dat.old.

PLOTPS

PLOTPS reads plotting commands from a single MD/MSC Nastran binary- or neutral-format plot file and produces a file that can be printed on a PostScript device. The basic format of the "plotps" command is

util_ver `plotps` *`input_plot_file`* `[`*`keywords`*`]`

where *input_plot_file* is the name of the plot file generated by MD/MSC Nastran or NEUTRL. A neutral-format plot file can be read from stdin by specifying "-" as the filename. The plot file type ".plt" does not have to be specified on the command line.

Keywords

begin	begin=*number*	Default:	1
end	end=*number*	Default:	999999
	Plots a selected range of plot frames.		
color	color=yes,no	Default:	No
	Enables or disables color pens. Setting "color=no", the default, will assign a solid line to pen 1 and various dashed lines to pens 2, 3, and 4. Setting "color=yes" will assign black to pen 1, red to pen 2, green to pen 3, and blue to pen 4. All text and axes will always be written with a solid black pen.		
cscale	cscale=*number*	Default:	1.0
	Specifies a scale factor for all characters and special symbols on the plot. By default, characters and special symbols are 9 points (about 0.125 inch). The scale value, if specified, is also applied to characters and special symbols.		
	The "cscale" value is critical to the correct imaging of the plot if "optimizestrings=yes" was specified. In general, you must specify the same "cscale" value as was specified in the original MD/MSC Nastran job that generated the PLT file.		
dump	dump=yes,no	Default:	No
	Enables a raw print of each plot command before it is processed. This print is used for debugging purposes only.		
format	format=*keyword*	Default:	Binary
	Specifies the input file format. If the file type of the input file is ".neu" or the plot file is read from stdin, then "format=neutral is assumed.		
height	height=*number*	Default:	10.0 inches

Specifies the printable page height. The actual page is assumed to be 1 inch larger.

optimizestrings optimizestrings=yes,no Default: Yes

Indicates the string optimization feature is to be enabled.This feature can result in a substantial reduction in plot file size, printer memory requirements, and print speed.

If "optimizestrings=no" is set, PLOTPS will draw each character individually, at the expense of PS file size and the memory and time needed by your PostScript printer to image the file.

output output=*pathname* Default: *plot-file*.ps

Specifies the name of the PostScript output file. If a neutral-format plot file is read from stdin, the default output filename is "plotps.ps". If "out=—" is specified, the PostScript output is written to stdout. By default, the output file is named the name of the input file with the new type ".ps".

rotate rotate=*keyword* Default: Automatic

Controls the orientation of the generated image. If "rotate=automatic" is specified, the program orients the image so that the long direction of the image is aligned with the long direction of the page. If "rotate=no" is specified, the image is generated with the horizontal axis aligned with the bottom edge of the page. If "rotate=yes" is specified, the image is generated with the horizontal axis aligned with the right edge of the page.

scale scale=*number* Default: 1.0

Specifies a scale factor for all elements of the plot.

Note: The program will not attempt to print a multipage image if this option is used to enlarge the image beyond the size of the available page.

verbose verbose=yes,no Default: Yes *Output is a disk file*

No *Output is stdout.*

Specifies whether processing messages are to be written.

width width=*number* Default: 7.5 inches

Specifies the printable page width. The actual page is assumed to be 1 inch larger.

Note: The **begin**, **end**, **dump**, **format** and **output** keywords are not allowed for PostScript plot generation in MD/MSC Nastran. That is, these keywords may not be specified on the SYS= describer or in the SYFIELD keyword for the PLOT logical name.

Examples

To translate a binary-format plot file named example1.plt into PostScript, use

```
util_ver plotps example1
```

The name of the output file is

```
example1.ps
```

To translate a neutral-format plot file named example2.neu into PostScript, use

```
util_ver plotps example2.neu
```

The name of the output file is

```
example2.ps
```

Using the String Optimization Feature

When the string optimization feature functions correctly, you can realize a substantial reduction in the size of the PostScript file and a commensurate reduction in the memory and time needed by your PostScript printer to image the file. However, there are some cases where the feature does not function correctly, and generates an incorrect plot image.

The “cscale” value used in the MD/MSC Nastran job that generated the PLT file is critical to the correct operation of the “optimizestrings” feature. In general, you need to specify the same value in the PLOTPS run. There are some cases, however, where the value should be left at the default, i.e., 1.0. You can determine this by imaging and printing the first frame of the PLT file with the following two commands:

```
util_ver plotps plt-file end=1 out=value.ps cscale=cscale-value
util_ver plotps plt-file end=1 out=default.ps
```

where *plt-file* is the MD/MSC Nastran PLT file and *cscale-value* is the CSCALE value used in the MSC Nastran job that generated the file. A visual comparison of the two PostScript images will identify the correct setting. In general, it will be the first command, i.e., the one that set the CSCALE value to the MD/MSC Nastran job’s value.

RCOUT2

RCOUT2 is used to convert a neutral-format OUTPUT2 file generated by MD/MSC Nastran into a binary-format OUTPUT2 file. Since MD/MSC Nastran can read and write binary-format and neutral-format OUTPUT2 files, this utility is generally used to construct a binary OUTPUT2 file for a third-party program that can only read a binary OUTPUT2 file. The basic format of the “rcout2” command is

util_ver `rcout2` *`neutral_output2_file`* [*`keywords`*]

Keywords

output	output=*pathname*	Default:	*neutral_file*.op2

This option specifies the name of the binary OUTPUT2 file. By default, the output file is the name of the input file with the new type “.op2".

Examples

To execute the program, enter the following command:

util_ver `rcout2 example`

The name of the output file is

```
example.op2
```

RECEIVE

RECEIVE converts a neutral results database file (NDB) into a binary results database file (XDB). The basic format of the “receive” command is

```
util_ver receive neutral_xdb_file [keywords]
```

where *neutral_xdb_file* is the name of the NDB file. If “-” is specified as the neutral format database file, the file is read from stdin. If the file type of the NDB file is “.ndb”, it may be omitted from the command line.

Note: Prior to MSC.Nastran V70, the file type was “.ntrl”; V70 changed this to the more portable “.ndb”.

Keywords

output	output=*pathname*	Default:	*neutrl_xdb_file*.xdb
	This option specifies the name of the binary results database file. By default, the output file is the name of the input file with the new type “.xdb”. If the neutral format database file was read from stdin, the default output filename is “receive.xdb”. A binary XDB file cannot be written to stdout.		
verbose	verbose=yes,no	Default:	Yes*Output is a disk file* No*Output is stdout.*
	This option specifies whether processing messages are to be written.		

Examples

To execute the program, enter the following command:

```
util_ver receive example
```

The name of the output file is

```
example.xdb
```

On UNIX systems, an XDB file can be transferred directly from a remote system with the following command

HP-UX

```
$ remsh node prod_ver trans binary_xdb_file out=- \
| prod_ver receive - out=binary_xdb_file
```

All Others

```
$ rsh node prod_ver trans binary_xdb_file out=- \
| prod_ver receive - out=binary_xdb_file
```

See the rsh(1) man page for further information.

TRANS

A results database file (XDB) may be exchanged between computer systems that have binary file compatibility as displayed in Table 6-2. Otherwise, the TRANS utility is required. TRANS converts an XDB file that is generated by MD/MSC Nastran to an equivalent character file that can be sent across a network to another computer. RECEIVE converts the character file back into an XDB file for postprocessing.

Binary File Compatibility

The following table lists the compatibility of binary files between various computer systems supported by current or previous versions of MSC products. Note that not all of thesecombinations have been tested by MSC. Please report any compatibility problems encountered to your MSC representative.

MD/MSC Nastran	Architecture			Postprocessor Platform						
	IEEE	Byte Order	Word Size	HP Alpha	Compaq VAX	HP	IBM pSeries	SGI	Sun SPARC	Intel
HP HP-UX	Yes	Big	32	TR Copy[1]	TR	Copy	Copy	Copy	Copy	TR Copy[1]
IBM pSeries AIX	Yes	Big	32	TR Copy[1]	TR	Copy	Copy	Copy	Copy	TR Copy[1]
SGI IRIX	Yes	Big	32	TR Copy[1]	TR	Copy	Copy	Copy	Copy	TR Copy[1]
Sun SPARC Solaris	Yes	Big	32	TR Copy[1]	TR	Copy	Copy	Copy	Copy	TR Copy[1]
Intel Linux32, LinuxIPF Linux64 Solaris8664 Windows	Yes	Little	32	Copy	TR	TR Copy[1]	TR Copy[1]	TR Copy[1]	TR Copy[1]	Copy

Notes:

1. Copy[1] indicates that using the 2001.0.1 or later released version of the DBIO library, the XCB files produced by MD/MSC Nastran can be transferred between the systems without using the TRANS and RECEIVE programs.
2. Copy indicates that XDB files can be transferred between the systems without using TRANS and RECEIVE.
3. TR indicates that XDB files must be transferred between the systems using TRANS and RECEIVE.

The first column on the left of the table lists various platforms that run MD/MSC Nastran. The second and third columns list basic architectural features of the computer, specifically whether the computer conforms to ANSI/IEEE Standard 754-1985 (the *IEEE Standard for Binary Floating-Point Arithmetic)* and byte ordering (big endian or little endian) used by the computer. The remaining columns list postprocessor platforms.

Running TRANS

TRANS converts a binary results database file (XDB) into a neutral results database file (NDB) that may be copied to any other computer. The basic format of the "trans" command is

```
util_ver trans binary_xdb_file [keywords]
```

where *binary_xdb_file* is the name of the XDB file. An XDB file cannot be read from stdin. If the file type of the XDB file is ".xdb", it may be omitted from the command line.

Keywords

alphabet	alphabet=*number*	Default:	64
	Choose the 48- or 64-character conversion table.		
output	output=*pathname*	Default:	*binary_xdb_file*.ndb
	This option specifies the name of the neutral format database file. If "out=-" is specified, the neutral-format database file will be written to stdout. By default, the output file name is the input file name with the new type ".ndb". (Prior to MSC.Nastran V70 the type ".ntrl" was used; V70 changed this to the more transportable ".ndb".)		
verbose	verbose=yes,no	Default:	Yes *Output is a disk file* No *Output is stdout.*
	This option specifies whether processing messages are to be written.		

Examples

To execute the program, enter the following command:

```
util_ver trans example
```

The name of the output file is

```
example.ndb
```

On UNIX systems, an XDB file can be transferred directly to a remote system with the following commands:

HP-UX

```
prod_ver trans binary_xdb_file out=- \
    | remsh node [-l user] prod_ver receive - out=binary_xdb_file
```

All others

```
prod_ver trans binary_xdb_file out=- \
    rsh node [-l user] prod_ver receive - out=binary_xdb_file
```

See the remsh(1) or rsh(1) man pages for further information.

XMONAST (UNIX)

XMONAST is a simple OSF/Motif GUI to monitor MD/MSC Nastran jobs. The Motif runtime libraries along with an X-capable terminal/monitor are required to run XMONAST. The basic format of the "xmonast" command is:

```
util_ver xmonast list_of_files &
```

XMONAST is a point-and-click text file viewer that can view the output of your MD/MSC Nastran job as it progresses. The viewer can be started in three ways:

- From the command line:

  ```
  util_ver xmonast list_of_files &
  ```

  where *list_of_files* are text files that will be displayed. XMONAST will read stdin if "-" is specified.
- From the nastran command (with manual termination of XMONAST):

  ```
  util_ver nastran input_file... xmon=yes
  ```

  where only the .log file will be displayed. From the nastran command (with automatic termination of XMONAST when the MD/MSC Nastran job ends):

  ```
  util_ver nastran data_file ... xmon=kill
  ```

  where only the .log file will be displayed.

See the "xmonast" keyword (page 100) for more details on these methods.

The selected files will be displayed in scrollable windows. Once the entire file as it currently exists has been displayed, XMONAST will enter an infinite loop waiting for additional text. This process will continue until the "Exit" push button is selected, or until the MD/MSC Nastran job has completed if XMONAST is started from the nastran command with "xmon=kill".

You may temporarily suspend updates to the scrollable windows (e.g., to browse the output) by selecting the "Pause Output" push button. To resume output, select the same button, now labeled "Continue Output".

If a .log file is being displayed, the "Kill Job" push button may be used to cancel a running MD/MSC Nastran job. This will send an interrupt kill signal (SIGKILL) to your MD/MSC Nastran job. Unless started by "xmon=kill", you may still scroll through the output data files after terminating a job.

To exit XMONAST, select the “Exit” push button or select “File --> Exit” from the menu bar.

Menu Bar Commands

File	Re-Open Files	Rereads the input files from the beginning (does not function for stdin).
	Exit	Writes various resources to “$HOME/Xmonast” and exits XMONAST.
Kill	Sure Kill	Sends signal SIGKILL (9) to the MD/MSC Nastran job. This command is only enabled if an MSC.Nastran Version 68.1 (or later) .log file is being displayed in one of the panes. If more than one .log file is being displayed, only one of the jobs will be killed.
Help	Online Documentation	Starts the online documentation application. The command used by XMONAST to start the application is specified by the “Xmonast*docname” resource. The default value is “mne”, i.e., the MD/MSC Nastran Encyclopedia (a separately installed product).
	Program Version...	Displays the program version in a pop-up window. Press the “OK” button to dismiss the pop-up window.

Buttons

Pause Output	Suspends output to the panes so that they can be examined. The button will change to “Continue Output” while the output is paused. Pressing “Continue Output” will resume output to the panes.
Kill	Sends signal SIGKILL (9) to the MD/MSC Nastran job. The button is only enabled if an MSC.Nastran V68.1 (or later) .log file is being displayed in one of the panes. If more than one .log file is being displayed, only one of the jobs will be killed.
Exit	Writes the current resource settings to “$HOME/Xmonast” and exits.

Examples

To monitor the .f06, .f04, and .log files of an already running job named example, use:

```
prod_ver xmonast example.f06 example.f04, example.log &
```

To run an MD/MSC Nastran job named example in the background and monitor the .log file as the job progresses, use:

```
prod_ver nastran example batch=yes xmonast=yes
```

XMONAST will continuously display the .log file until the “Exit” push button is selected.

Resources

The default resource file, “/usr/lib/X11/app-defaults/Xmonast”, and, if it exists, your resource file, “$HOME/Xmonast”, are read at application startup. Your resource file is completely rewritten if XMONAST is terminated using the “File->Exit” menu item or the “Exit” button at the bottom of the window. Your resource file is not written if you terminate XMONAST using the “window->Close” menu item. Documentation of the XMONAST resources can be found in the standard MSC resource file, “*install_dir*/*prod_ver*/*arch*/Xmonast”.

XNASTRAN (UNIX)

XNASTRAN is a simple OSF/Motif Graphical User Interface to submit MD/MSC Nastran jobs. The Motif runtime libraries along with an X-capable terminal/monitor are required to run XNASTRAN. The basic format of the "xnastran" command is:

prod_ver xnastran &

The XNASTRAN command allows you to select the input file, set job options (i.e, command line keywords), and submit the job to MD/MSC Nastran.

Menu Bar Commands

File	Exit	Exits XNASTRAN.
Setup	MD/MSC Nastran Version...	Allows you to enter the "MD/MSC Nastran Version Label" defining the product name, the default is "MD/MSC Nastran V2006" and the "Run Command" that submits a job, the default is "/usr/bin/*prod_ver* nastran". The "Select File" button will bring up a standard file selection tool allowing you to find the run command file. The "Accept" button will accept the changes and cancel the dialog, the "Cancel" button will cancel the dialog with making any changes, and the "Help" button will bring up a help window; select the "Close" button to dismiss the help dialog.
	System Default	Resets various defaults, including the window size, the "MD/MSC Nastran Version Label", and the "Run Command".
	Save	Writes all the current settings, including the various entries, to the "$HOME/Xnastran" resource file. These values will be reloaded the next time you enter XNASTRAN.
Help	Online Documentation	Starts the online documentation application. The command used by XNASTRAN to start the application is specified by the "Xnastran*docname" resource. The default value is "mne", i.e., the MD/MSC Nastran Encyclopedia (a separately installed product).
	Program Version...	Displays the program version in a pop-up window. Select the "OK" button to dismiss the pop-up window.

Main Window Items

Each item in the main window includes a "Help" button. Selecting the help item will bring up a short help dialog; the dialog is dismissed with the "Close" button.

The items in the main window are listed below as they appear from the top of the window to the bottom.

Input Data FIle	This subpane allows you to enter the name of the input file using the keyboard or with a file selection tool if the “Select File” button is selected.
Scratch Directory	This subpane allows you to enter the name of the scratch directory using the keyboard or with a directory selection tool if the “Select Directory” button is selected. This sets the “sdirectory” keyword.
Database Prefix	This subpane allows you to enter the prefix of the database files using the keyboard. This sets the “dbs” keyword; if the text field is empty, the “dbs” keyword is not set.
Monitor Output	This subpane allows you to start the XMONAST utility to monitor the .f06, .f04, and .log files. This sets “xmon=yes” or “xmon=no”.
Background Process	This subpane allows you to run the job in the background. This sets “batch=yes” or “batch=no”.
Combine Files	This subpane allows you to append the .f06, .f04, and .log files into a single OUT file. This sets “append=yes” or “append=no”.
Delete Databases	This subpane allows you to delete the user databases at the completion of the MD/MSC Nastran job or select a “mini” database. This sets “scratch=yes”, “scratch=no”, or “scratch=mini”.
Display News	This subpane allows you to display the MD/MSC Nastran system news in the .f06. This sets “news=yes” or “news=no”.
Print Output Files	This subpane allows you to print the .f06, .f04, and .log files at the completion of the MD/MSC Nastran job. This sets “prt=yes” or “prt=no”.
Send Notification	This subpane allows you to receive notification when the MD/MSC Nastran job completes. This sets “notify=yes” or “notify=no”.
Save Previous	This subpane allows you to version old output files before the MD/MSC Nastran job begins. This sets “old=yes” or “old=no”.
Output Prefix	This subpane allows you to enter the prefix of the output files using the keyboard. This sets the “out” keyword; if the text field is empty, the “out” keyword is not set.
Start Time	This subpane allows you to select a job starting time using the keyboard. This sets the “after” keyword; if the text field is empty, the “after” keyword is not set.
Queue Name	This subpane allows you to select the starting time of the job using the keyboard. This sets the “after” keyword.

Advanced Keywords	This subpane allows you to enter any additional keywords using the keyboard. You must enter the complete text of any keywords to be set. If the text field is empty, no additional keywords are set.
Memory Size	This subpane allows you to enter the memory allocation using the keyboard. The pop-up menu allows you to select the units modifier, i.e, none, “Kb”, “Kw”, “Mb”, “Mw”, “Gb”, “Gw”. This sets the “memory” keyword.
Submit MD/MSC Nastran	This button submits the job using the parameters displayed in the window.

Resources

The default resource file, “/usr/lib/X11/app-defaults/Xnastran”, and, if it exists, your resource file, “$HOME/Xnastran”, are read at application startup. Your resource file is completely rewritten if you select the “Setup->Save” menu item. Documentation of the XNASTRAN resources can be found in the standard MSC resource file, “*install_dir*/*prod_ver*/*arch*/Xnastran”.

Building the Utilities Delivered in Source Form

Several of the utilities (i.e., PLOTPS, NEUTRL, RCOUT2, and MSCACT) are delivered in source and executable form. The source code allows these utilities to be customized or built for other platforms. A script and makefile are provided to build and install these utilities. The script determines the architecture of current platform and invokes the make utility to perform the actual compilation, link, and installation.

The utility program source files are located in

install_dir/*prod_ver*/util

on UNIX and

*install_dir**prod_ver*\util

on Windows. This directory is an optional component of the MD/MSC Nastran installation. This directory includes the following files:

Table 6-2 Utility Program Source Files

File	Description
acnaspat.pl	
ld.F	Source for RCOUT2 Utility Routines.
libfmsc.F	Source for FORTRAN Utility Library Routines.
makefile	Makefile to Build Source Utility Programs.
mattst.F	Source for Sample OUTPUT4 File Reader TABTST (see “Building and Using TABTST” on page 259).
mscact.c	Source for MSC Accounting Programs.
neutrl.F	Source for NEUTRL Utility.
ngtarg.F	Source for Command Line Utilities.
plotps.F	Source for PLOTPS Utility.
rcout2.F	Source for RCOUT2 Utility.
tabtst.F	Source for Sample OUTPUT2 File Reader MATTST (see “Building and Using MATTST” on page 253).
util	Script to Build Source Utility Programs.

Three steps are required to build and install the source utilities. Make sure that you are in the utility program source directory, i.e., *install_dir*/*prod_ver*/util on UNIX and *install_dir**prod_ver*\util on Windows.

1. The first step compiles and links all of the source utility programs. Enter the command

   util_ver `util build`

   If only one utility is to be built, use the name of the utility (i.e., “mscact,” “neutrl,” “plotps,” or “rcout2") instead of “build”. For example,

   util_ver `util plotps`

   will only build the PLOTPS utility.
2. After the programs are generated in the current directory, you can install the executable programs into the architecture directory for your computer (i.e., *install_dir*/*prod_ver*/*arch* on UNIX and *install_dir**prod_ver**arch* on Windows). Enter the command

   util_ver `util install`

3. The third step deletes all object files and temporary files created by the “make” process. Enter the command

   util_ver `util clean`

The building and installation process can be repeated if you want to build the utilities for other computer architectures at your site.

To build the utilities on another computer that does not have MD/MSC Nastran installed, copy the complete utilities directory to the other computer. Since the *util_ver* command will not be available, you must run the util script directly. Before you do, however, set the environment variable *MSC_ARCH* to the name of a supported architecture as shown in Table 3-1. The “install” option cannot be used.

7 Building and Using the Sample Programs

- Overview
- Building and Using BEAMSERV
- Building and Using DDLPRT
- Building and Using DDLQRY
- Building and Using DEMO1
- Building and Using DEMO2
- Building and Using DR3SERV
- Building and Using MATTST
- Building and Using SMPLR
- Building and Using a Spline Server
- Building and Using TABTST
- Beam Server Source Files
- DRESP3 Server Source Files
- MSC.Access Source Files

Overview

This chapter describes how to build and use the various MD/MSC Nastran sample programs. The sample programs are grouped by function as follows:

Program	Function
BEAMSERV	Implements user-defined bar and beam elements for MD/MSC Nastran.
DDLPPRT **DDLQRY** **DEMO1** **DEMO2** **SMPLR**	Reads and displays XDB results database files. These sample programs are part of MSC.Access and demonstrate how to use the database library routines.
DR3SERV	Implements user-defined responses for MD/MSC Nastran.
MATTST **TABST**	Reads and displays OUTPUT2 and OUTPUT4 files.
SPXSRVA	Implements user-defined splines for MD/MSC Nastran

Descriptions on building and using the sample programs follow in alphabetical order.

Building and Using BEAMSERV

BEAMSERV implements a user-defined beam element for MD/MSC Nastran.

Note: The sample beam server source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Unlike the other sample programs, a beam server is not a stand alone program that runs from the command line. Instead, the beam server is started and controlled by MD/MSC Nastran. In the current implementation, communications between MD/MSC Nastran and the beam server are accomplished through pipes, with MD/MSC Nastran reading and writing BEAMSERV's stdout and stdin units, respectively.

Notes:

1. The MD/MSC Nastran job invoking the beam server and the beam server itself may run on different computers but they have to be network mounted.
2. Your program may not read from stdin (FORTRAN logical unit 5) nor write to stdout (FORTRAN logical unit 6).
3. The beam server cannot write to the .f06, .f04, or .log files of the MD/MSC Nastran job that started the beam server.
4. Debugging must be accomplished by writing to a disk file, or connecting to the running beam server executable with a debugger (this may not be available on all systems, and debug compiler options should be used).

Building BEAMSERV

The BEAMSERV program source files are located in the directory

```
install_dir/prod_ver/nast/beamlib/src/beamserv
```

on UNIX and

```
install_dir\prod_ver\nast\beamlib\src\beamserv
```

on Windows (see "Beam Server Source Files" on page 261).

To build the program, change the working directory to the beamlib directory and enter the command:

```
scons opt=yes beamserv
```

It will create beamserv on UNIX or beamserv.exe on Windows and store it in the `$APPS_LOCAL/arch/bin/` directory. To learn more about the build environment, please consult "SCASCons Build System" on page 403 of the *SCA Framework User's Guide*.

Alternatively, you may copy the entire beamlib directory to another location, change the working directory to ~`new_path/beamlib/` and issue the command:

```
scons opt=yes beamserv
```

Using BEAMSERV

MD/MSC Nastran is made aware of the beam server by the "gmconn" keyword and an external evaluator connection file. Entries in the connection file for piped communications are formatted as follows:

```
evaluatorname,pipe,pathname
```

where *evaluatorname* is the evaluator name defined on the CONNECT FMS statement and *pathname* is the pathname of the beam server executable.

Note: The evaluator name on the CONNECT FMS statements and in the external evaluator connection file must match exactly, including character case. To use a mixed or lower case group name, the name on the CONNECT FMS statement must be in quote marks; the name in the external evaluator connection file is never quoted.

To use the sample beam server and data file, create the file "samp_eval" with the following line:

```
LOCBMLS,pipe,pathname
```

where *pathname* is the pathname of the beam server built above, e.g., `$APPS_LOCAL/arch/bin/beamserv` on UNIX or `$APPS_LOCAL\arch\bin\beamserv.exe` on Windows.

MD/MSC Nastran is then run using the following command:

```
prod_ver nastran sample gmconn=samp_eval
```

Building and Using DDLPRT

DDLPRT illustrates the mass retrieval of data from the MSC.Access Data Definition Language (DDL) database.

Building DDLPRT

The DDLPRT program source code is in the file "ddlprt.F" (see "MSC.Access Source Files" on page 263). To build the program, change the working directory to the access directory and type the command:

```
SCONS opt=yes ddlprt
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/access on UNIX and *install_dir**prod_ver*\access on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the SCONS command.

Using DDLPRT

DDLPRT is run with the "ddlprt" command. The format of the "ddlprt" command is

util_ver `ddlprt [ddl_xdb_file] [keywords]`

If the DDL XDB file is not specified, the program uses the default MSC.Access DDL file, *install_dir*/*prod_ver*/*arch*/dbc.xdb on UNIX and *install_dir**prod_ver**arch*\dbc.xdb on Windows. The optional keywords are:

print=*print_file*	Default: *ddl_xdb_file*.prt This keyword specifies the name of the print file documenting the format of every MSC.Access relation. By default, the print file uses the basename of the input DDL XDB file with the new file type ".prt". Note, the size of this file is approximately one megabyte.
toc=*table_of_contents_file*	Default: *ddl_xdb_file*.toc This keyword specifies the name of the print file's table of contents. By default, the toc file uses the basename of the input XDB file with the new file type ".toc".

To execute the program, enter the command:

util_ver `ddlprt`

The program displays the filename, version, and compilation date of the DDL file as well as the names of the print and table of contents files. Once these files are generated, the program exits. The print and table of contents files may then be printed once DDLPRT has completed.

Building and Using DDLQRY

DDLQRY illustrates the interactive retrieval of data from the MSC.Access Data Definition Language (DDL) database.

Building DDLQRY

The DDLQRY program source code is in the file "ddlqry.F" (see "MSC.Access Source Files" on page 263). To build the program, change the working directory to the access directory and type the command:

```
SCONS opt=yes ddlqry
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/access on UNIX or *install_dir**prod_ver*\access on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the SCONS command.

Using DDLQRY

DDLQRY is run with the "ddlqry" command. The format of the "ddlqry" command is

```
util_ver ddlqry [ddl_xdb_file]
```

If a file is not specified, the program uses the default MSC.Access DDL file, *install_dir*/*prod_ver*/*arch*/dbc.xdb on UNIX and *install_dir**prod_ver**arch*\dbc.xdb on Windows.

The program displays the filename, version, and compilation date of the DDL file and prompts you for the name of a DDL object:

```
Enter Object Name (null to quit)
```

After you enter the name of each object, the format of the object is displayed. The program repeats the prompt until a blank line is entered.

Building and Using DEMO1

DEMO1 prints information about a results database (XDB) file produced by MD/MSC Nastran.

Note: The sample program source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Building DEMO1

The DEMO1 program source code is in the file "demo1.F" (see "MSC.Access Source Files" on page 263). To build the program, change the working directory to the access directory and type the command:

```
scons opt=yes demo1
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/access on UNIX or *install_dir**prod_ver*\access on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the SCONS command.

Using DEMO1

DEMO1 is run using the "demo1" command. The installed version of the program is run with the command:

util_ver `demo1`

You are prompted for the input graphics database filename.

```
Enter the database path name:
```

Running MD/MSC Nastran with a101x.dat (in *install_dir*/*prod_ver*/access) produces a101x.xdb that may be used as input to this program.

Building and Using DEMO2

DEMO2 prints information about a results database (XDB) file produced by MD/MSC Nastran.

Note: The sample program source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Building DEMO2

The DEMO2 program source code is in the file "demo2.F" (see "MSC.Access Source Files" on page 263). To build the program, change the working directory to the access directory and type the command:

```
scons opt=yes demo2
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/access on UNIX or *install_dir**prod_ver*\access on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the SCONS command.

Using DEMO2

DEMO2 is run using the "demo2" command. The installed version of the program is run with the command:

util_ver `demo2`

You are prompted for the input graphics database filename.

```
Enter the database path name:
```

Running MD/MSC Nastran with a61x.dat (in *install_dir*/*prod_ver*/access) produces a101x.xdb that may be used as input to this program.

Building and Using DR3SERV

DR3SERV implements user-defined responses for MD/MSC Nastran.

Note: The sample DRESP3 server source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Unlike the other sample programs, a DRESP3 server is not a stand alone program that runs from the command line. Instead, the DRESP3 server is started and controlled by MD/MSC Nastran. In the current implementation, communications between MD/MSC Nastran and the DRESP3 server are accomplished through pipes, with MD/MSC Nastran reading and writing DR3SERV's stdout and stdin units, respectively.

Notes:

1. The MD/MSC Nastran job invoking the DRESP3 server and the DRESP3 server itself may run on different computers but they have to be network mounted.
2. Your program may not read from stdin (FORTRAN logical unit 5) nor write to stdout (FORTRAN logical unit 6).
3. The DRESP3 server cannot write to the .f06, .f04, or .log files of the MD/MSC Nastran job that started the DRESP3 server.
4. Debugging must be accomplished by writing to a disk file, or connecting to the running dresp3 server executable with a debugger (this may not be available on all systems, and debug compiler options should be used).

Building DR3SERV

The DR3SERV program source files are located in the directory

`install_dir/`*`prod_ver`*`/nast/dr3/src/dr3serv`

on UNIX and

`install_dir``\`*`prod_ver`*`\dr3srv`

on Windows (see "DRESP3 Server Source Files" on page 262).

To build the program, change the working directory to the dr3 directory and enter the command:

```
scons opt=yes dr3serv
```

where dr3serv is the target program. This command will create program, dr3serv on UNIX or dr3serv.exe on Windows and store it in the `$APPS_LOCAL/arch/bin/` directory. To learn more about the build environment, please consult "SCASCons Build System" on page 403 of the *SCA Framework User's Guide*.

Alternatively, you may copy the entire dr3 directory to another location, change the working directory to ~new_path/dr3 and issue the command:

```
scons opt=yes dr3serv
```

To build another server program, say dr3serva, change the working directory to dr3 directory and enter the same build command with a new target name:

```
scons opt=yes dr3serva
```

Using DR3SERV

MD/MSC Nastran is made aware of the DRESP3 server by the "gmconn" keyword and an external evaluator connection file. Entries in the connection file for piped communications are formatted as follows:

evaluatorname,pipe,*pathname*

where *evaluatorname* is the evaluator name defined on the CONNECT FMS statement and *pathname* is the pathname of the DRESP3 server executable.

Note: The evaluator name on the CONNECT FMS statements and in the external evaluator connection file must match exactly, including character case. To use a mixed or lowercase group name, the name on the CONNECT FMS statement must be in quote marks; the name in the external evaluator connection file is never quoted.

To use the sample DRESP3 server and data file, create the file "samp_eval" with the following line:

```
myrsp,pipe,pathname
```

where *pathname* is the pathname of the DRESP3 server built above, e.g., of the DRESP3 server built above, e.g., `$APPS_LOCAL/arch/bin/dr3serv` on UNIX or `$APPS_LOCAL\arch\bin\dr3serv`.exe on Windows.

MD/MSC Nastran is then run using the following command:

```
util_ver nastran sample gmconn=samp_eval
```

Building and Using MATTST

MATTST reads a binary format OUTPUT4 matrix.

Note: The sample program source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Building MATTST

The MATTST program source code isin the file "mattst.F" (see "Building the Utilities Delivered in Source Form" on page 239). To build the program, change the working directory to the util directory and type the command:

```
util_ver util mattst
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/util on UNIX or *install_dir**prod_ver*\util on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the command:

```
util_ver ./util mattst
```

on UNIX, or

```
util_ver .\util mattst
```

on Windows. Note, the directory specification is required in this circumstance.

Using MATTST

MATTST is run with the "mattst" command. The installed version of the program is run with the command:

```
util_ver mattst
```

You are prompted for the number of matrices.

```
Please enter the number of matrices:
```

You are prompted for the input filename.

```
Please enter the INPT4 FILENAME:
```

You are prompted for the output binary filename.

```
Please enter the output binary filename:
```

You are prompted for the output text filename.

```
Please enter the output text filename:
```

Running the MD/MSC Nastran job “DEMODIR:um54.dat” produces a file, “um54.f11”, that may be used as input to this program.

Building and Using SMPLR

SMPLR reads a results database (XDB) file produced by MD/MSC Nastran.

Note: The sample program source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Building SMPLR

The SMPLR program source code is in the file "smplr.F" (see "MSC.Access Source Files" on page 263). To build the program, change the working directory to the access directory and type the command:

```
scons opt=yes smplr
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/access on UNIX or *install_dir**prod_ver*\access on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the SCONS command.

Using SMPLR

SMPLR is run using the "smplr" command. The installed version of the program is run with the command:

util_ver `smplr`

You are prompted for the input filename.

```
Enter the database name to process:
```

Running MD/MSC Nastran with a101x.dat (see "MSC.Access Source Files" on page 263) produces a101x.xdb that may be used as input to this program.

Building and Using a Spline Server

A spline server implements user-defined spline methods for MD/MSC Nastran.

Note: The sample spline server source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Unlike the other sample programs, a spline server is not a stand-alone program that runs from the command line. Instead, the spline server is started and controlled by MD/MSC Nastran. In the current implementation, communications between MD/MSC Nastran and the spline server are accomplished through pipes, with MD/MSC Nastran reading and writing the spline server's stdout and stdin units, respectively.

Note:

1. The MD/MSC Nastran job invoking the spline server and the spline server itself may run on different computers but they have to be network mounted.
2. Your program may not read from stdin (FORTRAN logical unit 5) nor write to stdout (FORTRAN logical unit 6).
3. The spline server cannot write to the .f06, .f04, or .log files of the MD/MSC Nastran job that started the spline server.
4. Debugging must be accomplished by writing to a disk file, or connecting to the running spline server executable with a debugger (this may not be available on all systems, and debug compiler options should be used).

Building SPXSERVA

The spxserva program source files are located in the directory

install_dir/*prod_ver*/nast/spline_server/src/spxsrva

on UNIX and

*install_dir**prod_ver*\nast\spline_server\src\spxsrva

on Windows (see Spline Server Source Files).

To build the program, change the working directory to the spline_server directory and enter the command:

```
scons opt=yes spxserva
```

where spxsrva is the targeted program. This command will create program, spxsrva on UNIX or spxsrva.exe on Windows and store it in the $APPS_LOCAL/arch/bin/ directory. To learn more about the build environment, please consult "SCASCons Build System" on page 403 of the *SCA Framework User's Guide*.

Alternatively, you may copy the entire spline_server directory to another location, change the working directory to ~new_path/spline_server and issue the command:

```
scons opt=yes spxsrva
```

Using the Spline Server

MD/MSC Nastran is made aware of the spline server by the "gmconn" keyword and an external evaluator connection file. Entries in the connection file for piped communications are formatted as follows:

evaluatorname,pipe,*pathname*

where *evaluatorname* is the evaluator name defined on the CONNECT FMS statement and *pathname* is the path name of the spline server executable.

Note: The evaluator name on the CONNECT FMS statements and in the external evaluator connection file must match exactly, including character case. To use a mixed or lowercase group name, the name on the CONNECT FMS statement must be in quote marks; the name in the external evaluator connection file is never quoted.

To use the sample spline server and data file, create the file "samp_eval" with the following line:

```
EXTSPLN,pipe,pathname
```

where *pathname* is the path name of the spline server built above, e.g., *my/path/to*/spxserva or ./spxserva on UNIX and *my\path\to*\spxserva or .\spxserva on Windows.

MD/MSC Nastran is then run using the following command:

util_ver `mdnastran sample gmconn=samp_eval` for MD Nastran

util_ver `nastran sample gmconn=samp_eval` for MSC Nastran

Spline Server Source Files

The spline server program source files are located in the spline server source directory, i.e., *install_dir*/*prod_ver*/nast/spline_server/src/spxsrva on UNIX and *install_dir**prod_ver*\nast\spline_server\src\spxsrva on Windows. This directory is an optional component of the MD/MSC Nastran installation.

There are source files for two example spline servers: spxserva and spxservb. The spxserva program is implemented entirely in the C programming language. The spxservb program uses a mix of the C and Fortran programming languages.

Table 7-1 lists files contained in the SPXSERVA directory

Table 7-1 Spline Server spxserva Sample Program Source Files

File	Description
SConscript	File that is used by scons to guide the build
sxmsg.c	Sample source for the spline server.
sxsevda.c	Sample source for the spline server.

Table 7-2 lists files contained in the SPXSERVB directory

Table 7-2 Spline Server spxservb Sample Program Source Files

File	Description
SConscript	File that is used by scons to guide the build
mkgmat.F	Sample source for the spline server.
spxaport.h	Sample source for the spline server.
sxmsg.c	Sample source for the spline server.
sxsevdb.c	Sample source for the spline server.
sxsevdb.h	Sample source for the spline server.
spxaport.h	Sample source for the spline server.

Building and Using TABTST

TABTST reads a binary format OUTPUT2 file (do not confuse this program with RCOUT2, described in "RCOUT2" on page 227).

Note: The sample program source code is only provided as a simple example illustrating basic concepts. It is not intended to be a complete or usable program.

Building TABTST

The TABTST program source code is in the file "tabtst.F" (see "Building the Utilities Delivered in Source Form" on page 239). To build the program, change the working directory to the util directory and type the command:

```
util_ver util tabtst
```

If you do not have write access to the source directory, *install_dir*/*prod_ver*/util on UNIX or *install_dir**prod_ver*\util on Windows, copy the entire directory to another location, change the working directory to the new location, and issue the command:

```
util_ver ./util tabtst
```

on UNIX, or

```
util_ver .\util tabtst
```

on Windows.

Note: The directory specification is **required** in this circumstance.

Using TABTST

TABTST is run with the "tabtst" command. The installed version of the program is run with the command:

```
util_ver tabtst
```

You are prompted for the input filename.

```
Please type the INPUT2 filename:
```

You are prompted for the output filename.

```
Please type the output filename:
```

Running the MD/MSC Nastran job “TPLDIR/basic:tabtsta.dat” produces a file, “tabtsta.f11”, that may be used as input to this program.

Beam Server Source Files

The beam server program source files are located in the beam server source directory, i.e., `install_dir/`*`prod_ver`*`/nast/beamlib/src/beamserv` on UNIX and `install_dir\`*`prod_ver`*`\nast\beamlib\src\beamserv` on Windows. This directory is an optional component of the MD/MSC Nastran installation.

Table 7-3 lists files contained inthis directory. The "Arbitrary Beam Cross-Section (ABCS)" in Chapter 4 of the *MD Nastran Linear Static Analysis User's Guide* can replace this Beam Server.

Table 7-3 Beam Server Sample Program Source Files

File	Description
SConscript	File used by SCons to guide the build
brtuc.F	Sample source for the beam server
brtug.F	Sample source for the beam server
brtui.F	Sample source for the beam server
brtup.F	Sample source for the beam server
bsbrc.F	Sample source for the beam server
bsbrg.F	Sample source for the beam server
bsbri.F	Sample source for the beam server
bsbrp.F	Sample source for the beam server
bsgrq.F	Sample source for the beam server
bsmsg.F	Sample source for the beam server
bsbrt.F	Sample source for the beam server
bscon.F	Sample source for the beam server
mevbr.F	Sample source for the beam server
msbrc.F	Sample source for the beam server
msbrg.F	Sample source for the beam server
msbri.F	Sample source for the beam server

DRESP3 Server Source Files

The DRESP3 server program source files are located in the DRESP3 server source directory, i.e., `install_dir/`*`prod_ver`*`/nast/dr3/src/dr3erv` on UNIX and `install_dir\`*`prod_ver`*`\nast\dr3\src\dr3serv` on Windows. This directory is an optional component of the MD/MSC Nastran installation.

Table 7-4 lists files contained in this directory

Table 7-4 DRESP3 Server Sample Program Source Files

File	Description
SConscript	File used by SCons to guide the build.
r3sgrt.F	Sample source for the DRESP3 server.
r3svald.F	Sample source for the DRESP3 server.
r3svals.F	Sample source for the DRESP3 server.

Each server requires a separate source directory. In this delivery, 18 server directories are installed for 18 sample problems. For example, the source files, SConscript, r3sgrta.F, r3svalda.F and r3svalsa.F for server dr3erva are stored in ~`install_dir/`*`prod_ver`*`/nast/dr3/src/dr3serva` directory.

MSC.Access Source Files

The MSC.Access sample source files are located in the MSC.Access source directory *install_dir*/*prod_ver*/access on UNIX and *install_dir**prod_ver*\access on Windows. This directory is an optional component of the MD/MSC Nastran installation. The src directory contains one subdirectory for each the six sample programs, listed in Table 7-5 through 7-?.

Table 7-5 Access Program ddladd Source Files

File	Description
SConscript	File that is used by scons to guide the build
ddladd.F	Main source file for program ddladd
ld2001.F	Subroutine source file for program ddladd
ld2004.F	Subroutine source file for program ddladd
ld66.F	Subroutine source file for program ddladd
ld67.F	Subroutine source file for program ddladd
ld675.F	Subroutine source file for program ddladd
ld68.F	Subroutine source file for program ddladd
ld681.F	Subroutine source file for program ddladd
ld69.F	Subroutine source file for program ddladd
ld70.F	Subroutine source file for program ddladd
ld705.F	Subroutine source file for program ddladd
ld706.F	Subroutine source file for program ddladd
ld707.F	Subroutine source file for program ddladd

Table 7-6 Access Program ddlprt Source Files

File	Description
SConscript	File that is used by scons to guide the build
ddlprt.F	Demonstration database dictionary print program

Table 7-7 Access Program ddlqry Source Files

File	Description
SConscript	File that is used by scons to guide the build
ddlqry.F	Demonstration database dictionary query program

Table 7-8 Access Program demo1 Source Files

File	Description
SConscript	File that is used by scons to guide the build
demo1.F	Source for sample MD/MSC Nastran database reader.

Table 7-9 Access Program demo2 Source Files

File	Description
SConscript	File that is used by scons to guide the build
demo2.F	Source for sample MD/MSC Nastran database reader.

Table 7-10 Access Program smplr Source Files

File	Description
SConscript	File that is used by scons to guide the build
smplr.F	Source for sample MD/MSC Nastran database reader.

A Configuring the Runtime Environment

- Specifying Parameters
- User-Defined Keywords
- Resolving Duplicate Parameter Specifications
- Customizing Command Initialization and Runtime Configuration Files
- Symbolic Substitution

Specifying Parameters

Nastran execution is controlled by a variety of parameters, either keywords or special Nastran statements, both required and optional. The purpose of this section is to describe how and where these parameters may be specified, not to describe these parameters in detail. This is done in subsequent sections. The Nastran parameters may be specified on the command line, in a command initialization (INI) file, in runtime configuration (RC) files and, for some parameters, from environment variables. The information from these sources is consolidated at execution time into a single set of values. Much of this information is passed to analysis processing in a **"control file"**, built using the templates ("Customizing the Templates" on page 68). (The records in this control file are echoed to the .log file.) Examples of INI and RC files are given in the "User-Defined Keywords" on page 8 and "Customizing Command Initialization and Runtime Configuration Files" on page 16.

Command Initialization and Runtime Configuration Files

Although the purposes of the INI and RC files are somewhat different, the format of each file is the same. All INI and RC files are processed twice, once (the "first" pass) to extract parameters (keywords and other information) that are to be used for all Nastran jobs, and once (the "second" pass) to extract parameters specific to a particular job. This is accomplished by separating the INI and RC files into a series of "sections" identified by a "section header" and "subsections" within sections, identified by a subsection "header." There are two types of sections: "unconditional" and "conditional." Subsections are always "conditional."

- An unconditional section is one that starts with the name of the section enclosed in square brackets ("`[",]`"). Section names may not contain any embedded blanks but may be separated from the square brackets by any number of blanks. As currently implemented, there are three valid unconditional names: "`General`", "`Solver`" and "`Nastran`". (These section names are case-insensitive.) In addition, there is an implicit "unnamed" section that consists of all parameters in the INI or RC file that appear before the first named section or subsection. There is no special meaning assigned to any of the unconditional sections. Their use is optional; the section names are intended to be used for descriptive purposes.
- A conditional section or subsection is one that starts with an expression in the form:

  ```
  <keyword><operator><value>
  ```

  enclosed in section header identification characters. For a conditional section, the section header identification characters are square brackets ("`[",]`"), just as for unconditional sections. For a subsection, the section header identification characters are "less than" and "greater than" ("`<",">`") characters. Keywords and values may not contain any embedded blanks but may be separated from each other and from the enclosing section header identification characters (the square brackets or "less than"-"greater than" characters) by any number of blanks. In the expression:

`<keyword>` represents any valid internal keyword (see “Keywords” on page 46) or user-defined keyword (see “User-Defined Keywords” on page 8).

`<operator>` specifies the comparison to be performed between `<keyword>` and `<value>` as follows:

=	equal (either string or numeric)
!	not equal (either string or numeric)
!=	not equal (either string or numeric)
<	numerically less than
<=	numerically less than or equal
>	numerically greater than
>=	numerically greater than or equal

`<value>` specifies the appropriate keyword value to be used in the comparison.

Keywords and values may be specified in any case.

Parameters in unconditional sections, but not in subsections (which are always conditional) within unconditional sections, are processed on the first pass through an INI or RC file. On the second pass, these parameters are ignored (they are not reprocessed). Parameters in conditional sections and subsections are ignored on the first pass. Parameters in conditional sections and subsections whose expressions evaluate to "true" are processed on the second pass through an INI or RC file, thus allowing conditional expressions to reference all of the valid keywords. Note that for subsections within conditional sections, both the conditional expression for the section *and* the conditional expression for the subsection must evaluate to "true" before parameters in the subsection are processed.

Parameter specifications in, either unconditional or conditional sections, may be continued, if necessary, by specifying a backslash (“\”) character as the last non-blank character of the line. Note for Windows users, if the parameter value itself ends with a backslash, the statement must have additional characters, such as a comment, after the value specification. For example, a specification such as:

```
sdir=e:\
```

will not work properly. Instead, write the statement as:

```
sdir=e:\ $ Specify the scratch directory
```

In addition to parameters, INI and RC files may contain “comment” records. There are two types of comment records: ignored and printed.

- Ignored comments are records that start with a semi-colon (";") or pound sign ("#"). These records are completely ignored. When running in Windows, there is a special form of ignored comments that may be specified in an INI file (but not in RC files). These are records that start with "REM", short for "REMARK". The test for "REM" is case-insensitive.
- Printed comments are records that start with the currency symbol ("$"). These records are passed on as part of the analysis information but are otherwise ignored.

Note: Although sectioning within INI and RC files was first introduced in MD/MSC Nastran 2004, valid INI and RC files from prior versions of Nastran are fully compatible with this new format. Since sections were not supported in previous versions (except for INI files on Windows, which allowed unconditional sections), all parameters will be in the "unnamed" implicit section (or, on Windows, in named unconditional sections) and will be processed on the first pass through the file. No information will be extracted from these files on the second pass.

The list below specifies the INI and RC files that MD/MSC Nastran uses. Any or all of these files may be ommitted. Table A-1 lists the keywords that are generally set in the unconditional sections of the command initialization file. Table A-2 lists the keywords that are generally set in RC files.

- Command Initialization (INI) File

  This file is used to define keywords that are to be set whenever the nastran command is executed. Typical keywords in the unconditional sections include the installation base directory and the version of MD/MSC Nastran. Conditional sections and subsections might include keywords such as "rcmd" and "rsdirectory" in sections that are conditional upon the value of the "node" keyword.

  UNIX: *install_dir*/*prod_ver*/*arch*/nastran.ini

  At installation time, this name is linked to *install_dir*/bin/nast2011.ini

  Windows: *install_dir**prod_ver*\i386\nastran.ini or *install_dir*\bin\nastran.ini

Starting with MD/MSC Nastran 2011, there are two possible RC files that may be defined in each of the locations that are searched for RC files. The first name is a version independent name and the second name is a version dependent name, where the version number is indicated by <*vernum*> in the file name and the version number for MD/MSC Nastran 2011 is 2011.

- System RC Files

  These files are used to define parameters that are applied to all MD/MSC Nastran jobs using this installation structure. Many of the parameters that might be specified in the INI file could, alternatively, be specified in this file.

  UNIX: *install_dir*/conf/nastran.rcf and

  install_dir/conf/nast<*vernum*>rc

  Windows: *install_dir*\conf\nastran.rcf and

  install_dir\conf\nast<*vernum*>.rcf

- Architecture RC Files

  This files are used to define parameters that are applied to MD/MSC Nastran jobs using this architecture.

  UNIX: *install_dir*/conf/*arch*/nastran.ini and
  install_dir/conf/*arch*/nast<*vernum*>rc

  Windows: *install_dir*\conf*arch*\nastran.rcf and
  install_dir\conf*arch*\nast<*vernum*>.rcf

- Node RC Files

  These files are used to define parameters that are applied to MD/MSC Nastran jobs running on this node. Alternatively, the parameters in this file could be specified in a conditional section in one of the previous files, using *nodename* as the value of the "s.hostname" keyword in the conditional expression.

  UNIX: *install_dir*/conf/net/*nodename*/nastranrc and
  install_dir/conf/net/*nodename*/nast<*vernum*>rc

  Windows: *install_dir*\conf\net*nodename*\nast2011.rcf and
  install_dir\conf\net*nodename*\nast<*vernum*>.rcf

- User RC Files

  These files are used to define parameters that are applied to MD/MSC Nastran jobs run by an individual user.

  UNIX: $HOME/.nastranrc and
  $HOME/.nast<*vernum*>rc

  Windows: %HOMEDRIVE%%HOMEPATH%\nastran.rcf and
  %HOMEDRIVE%%HOMEPATH%\nast<*vernum*>.rcf

- Local RC Files

  These files should be used to define parameters that are applied to Nastran jobs that reside in the input data file's directory. This RC file is in the same directory as the input data file. If the "rcf" keyword (page 83) is used, this local file is ignored.

  UNIX: .nastranrc and
  .nast<*vernum*>rc

  Windows: nastran.rcf and
  nast<*vernum*>.rcf

Please note that the UNIX shorthand "~", to refer to your or another user's home directory, cannot be used in an RC file. In addition, environment variables are only recognized within the context of a logical symbol definition.

Also, note that, on UNIX systems, the leading period (“.”) on the User RC Files and Local RC Files file names cannot be deleted even if alternate names are specified using the “a.urc” and “a.urcb” keywords as described below.

The file names listed above may be changed by the user using the “a.rc”, “a.rcb”, “a.urc” and “a.urcb” keywords, noting that the directories in which the files are located may not be changed.

- The “a.rc” keyword can be used to change the names of the version dependent RC file names for the System RC Files, the Architecture RC Files and the Note RC File. The default for this keyword is “nast<*vernum*>rc” for UNIX and “nast<*vernum*>.rcf” for Windows.
- The “a.rcb” keyword can be used to change the names of the version-independent RC file names for the System RC Files, the Architecture RC Files and the Node RC Files. The default for this keyword is “nastranrc” for UNIX and “nastran.rcf” for Windows.
- The “a.urc” keyword can be used to change the names of the version dependent RC file names for the User RC Files and the Local RC Files. For UNIX, the default for this keyword is the value of the “a.rc” keyword with a leading period (“.”) added. For Windows, the default for this keyword is the value of the “a.rc” keyword.
- The “a.urcb” keyword can be used to change the names of the version-independent RC file names for the User RC Files and the Local RC Files. For UNIX, the default for this keyword is the value of the “a.rcb” keyword with the leading period (“.”) added. For Windows, the default for this keyword is the value of the “a.rcb” keyword.

In addition to keyword specifications, the following MD/MSC Nastran statements (from the NASTRAN and FMS Sections) may appear in RC files and conditional sections in an INI file: NASTRAN, ACQUIRE, ASSIGN, CONNECT, DBCLEAN, DBDICT, DBDIR, DBFIX, DBLOAD, DBLOCATE, DBSETDEL, DBUNLOAD, DBUPDATE, DEFINE, ECHOOFF, ECHOON, ENDJOB, EXPAND, INCLUDE, INIT, PROJ, RESTART and RFINCLUDE. Except for minimal checking of the NASTRAN and PARAM statements, the syntax of these statements is not validated These records are simply passed on for use in Nastran analysis processing.

INI files and RC files also may contain PARAM statements that specify values that affect Nastran analysis processing. The values associated with PARAM names may be specified using PARAM statements in INI files and RC files or by using PARAM keywords, defined using the PARAM keywords feature as described in “User-Defined Keywords” on page 8. PARAM statements must be specified in "free-field format", i.e., in the Case Control PARAM format (PARAM,name,value), not in Bulk Data fixed-field format. Please see “Parameters” in Chapter 5 of the *MD/MSC Nastran Quick Reference Guide* for more information on PARAM names and statements and their usage.

Environment Variables

Several keywords may have their values set from associated environment variables. When this is the case, the environment variable takes precedence over any INI or RC file keyword specification. A command-line specification will over-ride the environment variable specified value. This same precedence rule applies to user-defined keywords that may have their initial values taken from environment variables, as described in the next section. A list of the keywords and their associated

environment variables, along with a description of each keyword, may be obtained by using the following command:

```
prod_ver nastran help env
```

User-Defined Keywords

In addition to the internally defined keywords (see “Keywords” on page 46), Nastran allows users to define their own keywords. There are two classes of user-defined keywords:

- General keywords. These are intended for use in INI file or RC file conditional section clauses, in user modifications to the run template files (nastran.dmp, nastran.lcl, nastran.rmt or nastran.srv) and, for UNIX, in customized queue commands (“submit” keyword)..
- PARAM keywords. These are keywords associated with a PARAM name. Using descriptive keywords to set a PARAM value may be more convenient than specifying the PARAM statement in an RC file. Also, keywords are not limited to a maximum of eight characters, as PARAM names are, and may be more descriptive of the action being affected or requested.

User-defined keywords are supported by the "help" and "whence" functions.

General Keywords

These keywords are defined in the file specified by the "0.kwds" keyword. The default file names are:

UNIX:	*install_dir*/*prod_ver*/*arch*/nastran.kwds
	At installation time, this name is linked to *install_dir*/bin/nast2011.kwds
Windows:	*install_dir**prod_ver*\i386\nastran.kwds or *install_dir*\bin\nast2011.kwds
	The file used is the *first* one found.

The records in this file consist of:

- Comment records. These are records that start with a comment character (hash, '#', semi-colon, ';', or currency symbol, '$') and are completely ignored.
- Blank or null records. These records are ignored.
- Keyword records. These records consist of the keyword name along with an optional value descriptor and comment in the form:

```
keyword_name[,attributes] : value_descriptor comment
```

where:

keyword_name	is the name to be assigned to the user keyword. This name may not contain any embedded blanks and may not be the same as any internal keyword or previously specified user-defined keyword. It is also case-insensitive except in the case when its initial value may be set from an environment variable with the same name.

`attributes`	specifies optional attributes to be assigned to the keyword defined by keyword-name. Currently, the only defined attribute is: `argv` keyword and its value is to be added to the "r.argv" keyword value Any number of blanks may separate `keyword_name`, the separating command and the attributes specification.
`value_descriptor`	is optional. If specified, it should be as described in "Value Descriptors" on page 10 and may not contain any embedded blanks. If this field is not present, the separating colon may be omitted.. The default value descriptor is `"string"`. This field may also specify that the initial value of this keyword be taken from an environment variable with the same name.
`comment`	is an optional comment field. If present, it must be separated from `value_descriptor or keyword_name` by blanks or must begin with a comment character.

There may be any number of leading blanks in the record and before and after the separating colon.

General keywords and the values assigned to them only affect Nastran processing if:

- there are customized INI and RC files that have conditional sections, using these keywords in expressions, that specify other keywords and statements (e.g., NASTRAN and PARAM statements) that modify Nastran processing to meet the requirements of a user's site and installation.
- they are used in customized templates ("Customizing the Templates" on page 68).
- for UNIX systems, they are used in customized queue commands defined using the "submit" keyword ("Customizing Queue Commands (UNIX)" on page 64).

PARAM Keywords

These keywords are defined in the file specified by the "0.params" keyword The default file names are:

UNIX:	*install_dir*/*prod_ver*/*arch*/nastran.params
	At installation time, this name is linked to *install_dir*/bin/nast2011.params
Windows:	*install_dir**prod_ver*\i386\nastran.params or *install_dir*\bin\nast2011.params
	The file used is the *first* one found.

The records in this file consist of:

- Comment records. These are records that start with a comment character (hash, '#', semi-colon, ';', or currency symbol, '$') and are completely ignored.
- Blank or null records. These records are ignored.
- Keyword-name records. These records consist of the keyword name, the associated PARAM name, along with an optional value descriptor and comment in the form:

  keyword_name : param_name : value_descriptor comment

  where:

`keyword_name`	is the name to be assigned to the PARAM keyword. This name is case-insensitive, may not contain any embedded blanks and may not be the same as any internal keyword, general user-defined keyword or previously specified PARAM keyword.
`param_name`	is the PARAM name to be associated with `keyword_name`. This name is case-insensitive, may be a maximum of eight characters, must begin with an alphabetic character and may not contain any embedded blanks. Also, it may not be the same as any previously specified PARAM name.
`value_descriptor`	is optional. If specified, it should be as described in Value Descriptors and may not contain any embedded blanks. If this field is not present, the separating colon may be omitted. The default value descriptor is "`string`".
`comment`	is an optional comment field. If present, it must be separated from `value_descriptor` or `param_name` by blanks or must begin with a comment character.

  There may be any number of leading blanks in the record and before and after the separating colons.

Keyword names that are the same as PARAM names are allowed, as long as the keyword name is not an internal or general user-defined keyword name.

Values associated with PARAM names, whether set using PARAM keywords or set using PARAM statements (statements having the form PARAM,*name*,*value*), directly affect Nastran analysis processing.

Value Descriptors

Value descriptors enable limited syntax checking for values assigned to general and PARAM user-defined keywords. For general keywords, they may also specify that the initial value of the keyword be set from the value associated with the environment variable having the same name as the keyword. There

are two types of syntax checking available: value must be one of a list of entries or value must be numeric. Also, the two forms can be combined. These are specified as follows:

List: `{"val1","val2",...,"valn"}`

That is, the acceptable values are enclosed in double quotes (") and separated from each other by commas. The specification, including the various acceptable values, may not contain any embedded blanks. Values are case-insensitive and any partial specification is acceptable and will be replaced by the full value. For example, if a keyword may only have the values "preliminary", "check" and "final", the value descriptor would be:

```
{"Preliminary","Check","final"}
```

and a value specification of "`Ch`" would be accepted and replaced by "`check`".

Numeric: `number`

Values will be checked to see if they are valid numbers, either integer or floating point. For example, valid keyword value specifications could be: "`1`", "`-3.247`", "`4.e-5`". "`3.75.4`", "`4.24x`" and "`-4-5`" are invalid specifications.

Note: This checking does *not* support the NASTRAN "`nnnseee`" numeric format, where the 'e' between the number and the signed exponent ("`seee`") is missing.

Complex value: `number,number`

This format is only supported for PARAM keyword value descriptors. Values will be checked to see if they consist of two valid numeric values, separated by a comma.

Combined: `{"val1","val2",...,"valn",number}`

Note: This "combined" format does not support complex numbers.

In addition, for general keywords, if the value descriptor starts or ends with the string "`env`", specified in any case and separated from the rest of the value descriptor with a comma (unless the value descriptor is only "`env`"), the keyword value will be set using the value associated with the environment variable having the same name as the keyword. The environment value will be subjected to the same syntax-checking rules that an INI file, RC file or command line specification would be, with a warning message generated if syntax checking fails. This occurs even if the keyword is specified on the command line. Note that, for UNIX systems, since environment variable names are case-sensitive, the keyword name must be specified exactly the same as the environment variable name. This is the only time that the keyword name is case-sensitive. For Windows systems, since environment variable names are not case-

sensitive, this restriction does not apply. Keyword values set from environment variables over-ride keyword values set in INI or RC files but do not over-ride keyword values set on the command line.

If a value descriptor is omitted or is not one of these formats, no syntax checking will be performed.

Examples:

1. The following value descriptor would accept a value of "test", "final" or a number:

   ```
   {"Test","Final",Number}
   ```

   Acceptable values would be: `te` (replaced by test), `FIN` (replaced by final), `7, 14.5, 3.e-4, -5`
2. The following value descriptor would accept only the strings "abc", "def", "ghi" and "glm":

   ```
   {"abc","def","ghi","glm"}
   ```

   Acceptable values would be: `g` (replaced by `ghi`), `aB` (replaced by `abc`), `gl` (replaced by `glm`), `D` (replaced by `def`)
3. The following value descriptor, only valid for a PARAM keyword, would only accept a complex number specification:

   ```
   number,number
   ```

   Acceptable values would be: `1,2, 7.54,3.14`
4. The following value descriptors, only valid for a general keyword, would accept only the strings "qrs", "test", and "xyz". In addition, the value descriptor requests that the keyword value be set from the environment.

   ```
   enV,{"qrs","test","xyz"}
   ```

   or

   ```
   {"qrs","test","xyz"},Env
   ```

   Acceptable values would be: `q` (replaced by qrs), `xY` (replaced by xyz), `T` (replaced by test)

Resolving Duplicate Parameter Specifications

Nastran processing information is obtained by scanning the various INI and RC files, the system environment, and the Nastran command line in the following order:

1. Nastran command line, first pass. Only "program options", i.e., "-*x*" options, are processed during this command line scan. For example, this is when the "-i *ini_file_name*" program option is processed.
2. Environment variables, first pass. During this pass, the only keywords whose values are set are those that may only be specified as environment variables. This includes keywords such as HOME (for UNIX), HOMEDRIVE and HOMEPATH (for WINDOWS) and PWD.
3. INI file, first pass, if this file exists. During this pass, only unconditional sections are processed. Generally, the only keywords processed in this pass are: 0.kwds, 0.params, accmd, acvalid, rcmd, rsdirectory, sysmsg and version (although rcmd and rsdirectory probably should be in conditional sections scanned during the second pass).
4. Environment variables, second pass. During this pass, only those keywords that may only be set in global sections of the INI file or as environment variables are processed. This includes keywords such as MSC_ARCH, MSC_BASE and MSC_VERSD.
5. Nastran command line, second pass. The only general use keywords processed during this command line scan are: dmparallel, jid, jidpath, jidtype, node, pause, rcf, username, version and whence. The processing of other command line keywords is deferred until later command line scans.

This is the time that the user-defined keyword definition files (for both general use and PARAM keywords), if any, are processed and the keyword specifications defined by these files are added to the keywords tables. The keywords defined in these files may be used just as internal keywords are used. (See “User-Defined Keywords” on page 8.)

6. System RC files, first pass, if these files exist. During this pass, only unconditional sections are processed.
7. Architecture RC files, first pass, if these files exist. During this pass, only unconditional sections are processed.
8. Node RC files, first pass, if these files exist. During this pass, only unconditional sections are processed.
9. User RC files, first pass, if these files exist. During this pass, only unconditional sections are processed.
10. Local RC files, first pass, if these files exist. During this pass, only unconditional sections are processed.
11. Environment variables, third pass. During this pass, only "general" user-defined keywords that have been flagged to be set from environment variables are processed. (This pass will be skipped if there are no "general" user-defined keywords.)

12. Nastran command line, third pass. Only "general" user-defined keywords are processed during this command line scan. (This pass will be skipped if there are no "general" user-defined keywords.)

At this point, all keyword values that can be used in conditional section expressions are known.

13. INI file, second pass, if this file exists and has conditional sections. During this pass, only the conditional sections are processed.
14. System RC files, second pass, if these files exist and have conditional sections. During this pass, only the conditional sections are processed.
15. Architecture RC files, second pass, if these files exist and have conditional sections. During this pass, only the conditional sections are processed.
16. Node RC files, second pass, if these files exist and have conditional sections. During this pass, only the conditional sections are processed.
17. User RC files, second pass, if these files exists and have conditional sections. During this pass, only the conditional sections are processed.
18. Local RC files, second pass, if these files exist and have conditional sections and if they are not ignored. During this pass, only the conditional sections are processed.
19. Environment variables, fourth pass. During this pass, all keywords that may be set from environment variables and that have not been processed previously are now processed.
20. Nastran command line, fourth pass. All keywords not processed during the previous passes are now processed. For example, this is when user-defined PARAM keyword specifications are processed.

At this point, all information necessary to generate the "control file" has been collected. This file is generated when the "script templates" (see “Customizing the Templates” on page 68) are processed.

21. NASTRAN, FMS and PARAM statements in the input file.

If duplicate keywords are encountered, the *last* specification found is the one used. That is, the above list specifies the precedence order, from lowest precedence (number 1) to highest (number 21). The only case in which the last keyword specification is not used is when keywords are "locked", i.e., when a specification of the form

```
lock=keyword
```

is processed. After this "lock" request is processed, any requests to set `keyword`, whether from INI files, RC files, environment variables or command line arguments, are quietly ignored. That is, processing proceeds as if any `keyword` specifications specified after the "`lock=keyword`" request do not exist. Once a keyword has been "locked,” there is no way to "unlock" it. (Note that it is valid to "lock" the `lock` keyword itself.)

If duplicate NASTRAN and FMS statements are encountered, they are simply passed on for use in Nastran analysis processing in the order in which they were encountered.

Thus, the general rule for resolution is:

- Information specified in NASTRAN input data files always takes precedence over any other values.
- Command line parameters have the next highest precedence.
- Environment variables associated with keywords and that have non-null values are next.
- RC file parameter specifications are next.
- INI file parameter specifications are last.

Generally, the only exceptions to this precedence ordering are "general" user-defined keyword specifications. The command line values take precedence over values specified in unconditional INI file and RC file sections but have lower precedence than values specified in conditional INI file and RC file sections. Because the primary purpose for general user-defined keywords is for conditional section selection, changing a general user-defined keyword in a conditional section *may* lead to unexpected results. Such specifications should be used withcare. Also, because user-defined PARAM keywords on the command line are not processed until the last command line scan, PARAM keywords should not be used in INI file and RC file conditional section expressions since command line specified values will not be in effect when these expressions are evaluated.

Because PARAM values may be specified either using PARAM statements or using PARAM keywords, they require further explanation. PARAM statements and PARAM keywords referring to the same PARAM name are considered equivalent definitions for the PARAM name. As such, the last specification, regardless of whether it was a PARAM statement or a PARAM keyword, is the one that is used to establish the value associated with the PARAM name.

Customizing Command Initialization and Runtime Configuration Files

Table A-1 lists the keywords that are generally set in the unconditional sections of the command initialization file.

Table A-1 Command Initialization File Keywords

Keyword	Purpose
0.kwds	Alternate name for user-defined keywords definition file.
0.params	Alternate name for PARAM keywords definition file
acct	Enables job accounting, see **"**Enabling Account ID and Accounting Data" on page 43**.**
acvalid	Activates account ID validation, see **"**Enabling Account ID Validation" on page 43**.**
MSC_BASE	Defines the installation base directory. Normally this is defined as an environment variable by the *prod_ver* command.
version	Specifies the default version of Nastran to be run.

Most of the command line keywords can be set in any of the RC files. Table A-2 lists keywords that are generally set in the system, architecture, or node RC files:

Table A-2 RC File Keywords

Keyword	Preferred RC File	Purpose
accmd	System	Command line to invoke accounting logger program.
acct	System	Enables job accounting.
acvalid	System	Enables account ID (acid) validation.
authorize	System	Specifies the licensing method.
lock	Any	Prevent further changes to a keyword's value.
memory	Node	Specifies a default memory allocation
memorymaximum	Node	Specifies a maximum "memory" request.
ncmd	Architecture	Specifies the notify command when "notify=yes" is set.
news	System	Controls the display of the news file at the beginning of the .f06 file.
post	Architecture	UNIX: Specifies commands to be run after each job is completed.

Table A-2 RC File Keywords (continued)

Keyword	Preferred RC File	Purpose
ppcdelta	Architecture	UNIX: Specifies the value that is subtracted from the "CPU" keyword value to determine the NQS per-process CPU time limit.
ppmdelta	Architecture	UNIX: Specifies the value that is added to the "memory" keyword value to determine the NQS per-process memory limit.
pre	Architecture	UNIX: Specifies commands to be run before each job begins.
prmdelta	Architecture	UNIX: Specifies the value that is added to the "ppm" value to determine the NQS per-request (per-job) memory limit.
qoption	Architecture	UNIX: Specifies a string of additional queuing options to be set in the queue submittal command.
rcmd	Any	Specifies the remote Nastran command to be used when "node" is specified. Should be in a conditional section using "node" in the conditional expression.
real	Node	Specifies the "REAL" parameter to limit virtual memory usage.
rsdirectory	Any	Specifies the scratch directory to be used when "node" is specified. Should be in a conditional section using "node" in the conditional expression.
scratch	Any	Specifies the default job status as scratch or permanent.
sdirectory	Node	Specifies a default scratch directory.
submit	Architecture	UNIX: Defines queues and their associated submittal commands.
sys*n*	Any	Specifies system cells. Can also be specified using the synonym keywords, e.g., buffsize is equivalent to sys1.

Examples

The following (relatively simplistic) examples illustrate how unconditional and conditional sections could be used.

Example 1:

Assumptions: There are three computer nodes, sysnode1, sysnode2 and sysnode3, that may be accessed.

On sysnode1:

- MD/MSC Nastran R3 and MD/MSC Nastran 2011 are installed:
  - MD/MSC Nastran R3 is accessed using "/local/msc/bin/nast2008"
  - MD/MSC Nastran 2011 is accessed using "/local/msc/bin/nast2011"
  - The scratch directory is /local/temp

On sysnode2:

- Only MD/MSC Nastran R3 is installed and is accessed using "/local1/msc/bin/nast2008"
- The scratch directory is /local1/temp

On sysnode3:

- MD/MSC Nastran R3 and MD/MSC Nastran 2011 are installed:
  - MD/MSC Nastran R3 is accessed using "/local2/msc/bin/nast2008"
  - MD/MSC Nastran 2011 is accessed using "/local2/msc/bin/nast2011"
- The scratch directory is /local2/temp

All of this information could be specified in an INI file, identical on all three nodes, as follows:

```
;
; This is the MD/MSC Nastran Command Initialization File
; The default version is to be set to 2011.
;
version=2011.0

; Define conditional sections giving the appropriate sdir
; values when MD/MSC Nastran is run locally.

[ s.hostname  =  sysnode1 ]
sdir=/local/temp
[ s.hostname  =  sysnode2 ]
sdir=/local1/temp
[ s.hostname = sysnode3 ]
sdir=/local2/temp

; Define conditional sections giving the appropriate
; remote access keywords when a "node" value,
; requesting remote execution, is specified.
;
[ node = sysnode1 ]
rsdir=/local/temp
< version = 2008.0 >
rcmd=/local/msc/bin/nast2008
< version = 2011.0 >
rcmd=/local/msc/bin/nast2011
```

```
[ node = sysnode2 ]
rsdir=/local1/temp
< version = 2011.0 >
rcmd=/local1/msc/bin/nast2011

[ node = sysnode3 ]
rsdir=/local2/temp
< version = 2008.0 >
rcmd = /local2/msc/bin/nast2008
< version = 2011.0 >
rcmd=/local2/msc/bin/nast2011

;
; This is the end of the Command Initialization file
;
```

Alternatively, the information could be split between an INI file and a system RC file, identical on all three nodes, as follows:

In the INI file:

```
;
; This is the MD/MSC Nastran Command Initialization File
; The default version is to be set to 2011.
;
version=2011.0

; Define conditional sections giving the appropriate
; remote access keywords when a "node" value,
; requesting remote execution, is specified.
;
[ node = sysnode1 ]
rsdir=/local/temp
< version = 2008.0 >
rcmd=/local/msc/bin/nast2008
< version = 2011.0 >
rcmd=/local/msc/bin/nast2011

[ node = sysnode2 ]
rsdir=/local1/temp
< version = 2011.0 >
rcmd=/local1/msc/bin/nast2011

[ node = sysnode3 ]
rsdir=/local2/temp
< version = 2008.0 >
rcmd = /local2/msc/bin/nast2008
< version = 2011.0 >
rcmd=/local2/msc/bin/nast2011

;
; This is the end of the Command Initialization file;
```

In the system RC file, identical on all three nodes:

```
;
; This is the MD/MSC Nastran system RC file.
;
; Define conditional sections giving the appropriate sdir
; values when MD/MSC Nastran is run locally.

[ s.hostname  =  sysnode1 ]
sdir=/local/temp
[ s.hostname  =  sysnode2 ]
sdir=/local1/temp
[ s.hostname = sysnode3 ]
sdir=/local2/temp

;
; This is the end of the system RC file
;
```

Example 2:

Assumptions: User keywords defining "run type" and "data complexity" are needed and AUTOSPC, AUTOSPCR, BAILOUT and ERROR PARAM values are to be set based on these keywords.

The nastran.kwds file could be:

```
; User Keywords
Runtype:{"prelim","development","final"};Analysis stage
     Level :    number       # Data complexity level
     ;
```

The nastran.params file could be:

```
; PARAM keywords

Set_AutoSPC : AutoSPC   : {"Yes","No"}
Set_AutoSP_CR    : AUTOSPCR : {"yes","no"}
Bailout_Value : bailout : number
Set_Error : Error : number

;
```

Then, the system RC file could contain:

```
; RC file
[ runtype = prelim ]
set_autospc = yes
bailout_value = -1
set_error = 0
set_autosp_cr = yes

[ runtype = development ]
set_autospc=yes
bailout_value=0
set_error=-1
```

```
[runtype=final]
set_autospc=no
param,bailout,0
param,error,-1
param,autospcr,no

[level < 3]
; basic data complexity parameters
[level >= 3]
<level>8>
; advanced data complexity parameters

<level<=8>
; intermediate data complexity parameters

; End of RC file
```

Symbolic Substitution

Introduction

Symbolic Substitution is a capability added to Nastran (starting with Version 2007) that allows a user to effectively modify a Nastran data file using command line and RC file keyword specifications without actually editing the file. This capability is very similar to "environment variable" expansion that happens in various command prompt shells such as the Linux/UNIX Bourne, Korn and C shells and the Windows Command Prompt shell when scripts are processed. It is also analogous in some ways to the capabilities provided by programming language preprocessors, for example, the CPP preprocessor used by the various C/C++ compilers. The key feature of symbolic substitution is that these modifications do *not* affect the actual data file but present the data read from the data file to the processing program as if it was the modified data that was being processed.

Generally, symbolic substitution means that a data record is scanned to see if it contains special data strings (that identify the "symbolic" variables) that specify "symbolic substitution" requests. If such strings are found, the record is modified to replace the special data strings with user-defined substitution (replacement) strings (the values currently associated with the "symbolic" variables, i.e., the variable "values") and it is this modified record that is actually processed. This symbolic substitution happens before any other processing of the record occurs, thus making it transparent to the rest of the program processing the data record. In the case of Nastran, this symbolic substitution processing will happen immediately after a record is read from the Nastran data file and before any other processing (with the possible exception of special processing required to satisfy licensing requirements) is performed.

Simple Examples

Two very simple examples illustrate how this capability could be used in Nastran data files. Note that the details of the syntax are completely described in the following sections and may be ignored for now. Also note that the examples do not deal with things such as managing the output from multiple Nastran runs. These issues, involving, among other techniques, using command line or RC file keywords such as "`out=`", "`append=`" and "`old=yes`", are beyond the scope of this document.

Example 1:

Suppose you want to make several tests where the thickness of a PSHELL element is to be varied. You could do this by defining the thickness of the PSHELL element as a "symbolic variable" (identified using the string "`%thickness%`"), setting a default value (using the "`%defrepsym`" statement) and specifying the desired thickness on the command line (using the "`REPSYM=`" keyword). A very simple data file (`sym.dat`) could be (where most of the BULK entries are in an include file named "`model.bdf`", not shown here):

```
%defrepsym thickness=5.0
SOL 103
CEND
TITLE = 1st perturbation, t = %thickness%
ECHO = NONE
```

```
SUBCASE 1
   METHOD = 100
   SPC = 1
   DISP = ALL
BEGIN BULK
EIGRL,100,,,6
PARAM,POST,0
PARAM,GRDPNT,0
$PBEAML Properties
PBEAML   2       1               I
         70.0    60.0    60.0    3.3     5.      5.
$
$PSHELL Properties
$
pshell,1,1,%thickness%,1,,1
$
include 'model.bdf'
enddata
```

If the test is run using the following command line:

```
nast2008 sym repsym=thickness=1.0 ...
```

the test will run as if the "`TITLE`" and "`pshell`" records are:

```
TITLE = 1st perturbation, t = 1.0
```

and

```
pshell,1,1,1.0,1,,1
```

If the test is run using the following command line:

```
nast2008 sym repsym=thickness=3.5 ...
```

the test will run as if the "`TITLE`" and "`pshell`" records are:

```
TITLE = 1st perturbation, t = 3.5
```

and

```
pshell,1,1,3.5,1,,1
```

If the test is run without specifying any REPSYM setting for "`thickness`", e.g., using the following command line:

```
nast2008 sym ...
```

the test will run as if the "`TITLE`" and "`pshell`" records are:

```
TITLE = 1st perturbation, t = 5.0
```

and

```
pshell,1,1,5.0,1,,1
```

Example 2:

Suppose you have a test that contains two superelements, where the only difference between the data for each superelement is the area of a PBAR element. Instead of having two different definitions, you could have a single definition of the data in an include file, where the area of the PBAR is specified as a symbolic variable. The include file (called "`bar.bdf`") could be:

```
%defrepsym area=1.
grid,2,,1.0,0.0,0.0
grid,3,,2.0,0.0,0.0
grid,4,,3.0,0.0,0.0,,123456
cbar,2,2,2,3,0.,1.,0.
cbar,3,2,3,4,0.,1.,0.
pbar,2,2,%area%,1.,1.,1.
mat1,2,1.e7,,.3
```

and the actual input file could be:

```
sol 101
cend
title=simple part se
echo=both
subcase 1
load=1
disp=all
elforce=all
begin bulk
grid,1,,0.0,0.0,0.0
grid,2,,1.0,0.0,0.0
cbar,1,1,1,2,0.,1.,0.
pbar,1,1,1.,1.,1.,1.
mat1,1,1.e7,,.3
force,1,1,,1.,1.,1.,1.
$
begin super=1
%setrepsym area=1.
include 'bar.bdf'
$
begin super=2
%setrepsym area=2.
include 'bar.bdf'
enddata
```

The first "`include 'bar.bdf'`" statement will be processed as if the `pbar` record is

```
pbar,2,2,1.,1.,1.,1.
```

and the second "`include 'bar.bdf'`" statement will be processed as if the `pbar` record is

```
pbar,2,2,2.,1.,1.,1.
```

Detailed Specifications

The use of the Symbolic Substitution capability is defined by a number of “rules”. These “rules” are given in the following sections and provide the complete specification. Following the rules, there is information about requesting report information and about error handling. Finally, there are some (again simple) examples showing usage.

Symbolic Substitution Rules

The following rules define the symbolic substitution user interface. The descriptions start with the rules for variable naming, followed by the rules for defining the replacement width information, followed by the various keywords and statements used to control symbolic substitution.

Variable Naming

The rules for naming symbolic substitution variables are:

- Symbolic variable names are not case-sensitive, are a maximum of 32 characters long and may not contain leading, trailing or embedded blanks or special characters. Variable names must start with an alphabetic character or underscore ('_'), followed by 0 or more alphabetic, numeric or underscore characters. For example:
  - The variable name "VaRiaBLe1" is the same as "VARIABLE1" and "variable1"
  - The following variable names are valid:
    - abcdef
    - _abc123
    - Name1_Name2_Name3
  - The following variable names are not valid:
    - 123abc Does not start with an alphabetic character or underscore
    - a bcd Contains an embedded blank
    - abc& Contains an invalid character ('&')
    - /def Does not start with an alphabetic character or underscore
- Unless symbolic variable values are quoted, they are not case-sensitive and may not contain leading, trailing or embedded blanks or percent ("%') characters. The quoting rules are given below.

Substitution Field Width Specification

The ability to control the appearance of any symbolic substitution is an important requirement when generating data for a program such as Nastran. The result of a symbolic substitution request is identified

as a *field*. Substitution field width information can be taken by default, specified in the data file or specified using command line and/or RC file keywords. These methods are explained below.

The rules for defining substitution field width information are:

- Symbolic variable substitution is, by default, *exact*. That is, the number of characters occupied by the symbolic symbol replacement is exactly the same as the replacement value. However, this default replacement processing can be controlled by specifying the substituted field *width*, the field *precision* and the *justification* within the field. This information is specified using the syntax

  `-w.p`

  where the '`-`', '`w`' and '`p`' are all optional and have the following meanings.

  - The field width specification (`w`) defines the *minimum* number of characters the field is to have as a decimal integer value. If the replacement value has fewer characters than the field width, it will be padded with spaces on the left (by default) or on the right (if the left justification flag is specified). If the replacement value has more characters than the field width and if no precision value was specified, the entire replacement string will be used. A field width value of 0 (zero) is equivalent to omitting the width specification. Note that a negative width value will be processed as if the "left-justification" flag was specified (see below) since a negative field width is meaningless.
  - The field precision specification (`p`) defines the *maximum* number of characters the field is to have. The format is a period (`.`) followed by a decimal integer value. If the replacement value length exceeds the precision value, only the last `p` (by default) or the first `p` (if the left justification flag is set) characters of the replacement value will be used. A field precision value of 0 (zero) (or a negative value) is equivalent to omitting the precision specification.
  - If both field width and field precision are specified and are positive, the precision value cannot be less than the width value. If it is, it will be reset to the field width.
  - The '`-`' character is the "left-justification" flag and specifies that the replacement value is to be left-justified within the field. If this character is omitted, the replacement value will be right-justified within the field.
- For example, the width, precision and justification of a typical field in the Bulk Data portion of a Nastran data file is:

  `-8.8`

  meaning that the field is exactly eight characters wide and that data is to be left-justified within the field. For a wide-format Bulk Data record, this specification would be:

  `-16.16`

  The specification for an exact replacement, i.e., where the replaced field is exactly the size of the replacement value, is:

  `0.0`

- To simplify width specification for Nastran widths, the following (case-insensitive) synonyms for common widths are available and may be used wherever a width specification can be used:

`exact`	is equivalent to `0.0`
`bulk`	is equivalent to `-8.8`
`wide`	is equivalent to `-16.16`

It is very important to note that there are two distinct portions to a Nastran data file, that part that is before the first `BEGIN` statement and that has "free format", and that part that is after the first `BEGIN` statement (the Bulk Data Section) and often has fixed format fields. Because of this, two different sets of field width information are maintained for use when field width information is not explicitly specified as part of a symbolic substitution request, one for use before the first `BEGIN` statement and one for use after the first `BEGIN` statement.

Defining Variable Values and Width Information

Symbol names and associated values and symbol width specifications may be set using keywords on the command line or in RC files and may be set using special statements in the Nastran data file itself. Each keyword and statement is explained in detail.

Using Command Line or RC File Keywords

Setting Variable Value Using REPSYM

Symbolic variables and associated values may be set on the Nastran command line or in RC files using the keyword

```
repsym=<varname>=<varvalue>
```

where `<varname>` specifies the name of the symbolic variable and `<varvalue>` specifies the value to be associated with the variable name. For example,

```
repsym=abc=1.23e-5
```

Setting Variable Width Information Using REPWIDTH

Symbolic variable substitution default width information may be set on the Nastran command line or in RC files using the keyword

```
repwidth=<widthinfo1>,<widthinfo2>
```

where `<widthinfo1>` specifies the default width information for the portion of the Nastran data file before the `BEGIN` statement and `<widthinfo2>` specifies the default width information for the portion of the Nastran data file after the `BEGIN` statement. Each is specified using a `-w.p` specification or as one of the synonyms, as described previously. If either width specification is omitted, the current default for that section is not changed. Note that the separating comma is required if the Bulk Data Section width value is to be set, i.e., if `<witdhinfo2>` is specified. For example,

```
repwidth=12,bulk
```

specifies that symbolic substitution default width is to be 12.0 before the BEGIN statement is encountered and -8.8 after the BEGIN statement is encountered and

```
repwidth=,bulk
```

specifies that symbolic substitution default width is to be EXACT (or 0.0, the default) before the BEGIN statement is encountered and -8.8 after the BEGIN statement is encountered.

Just as with other Nastran command line or RC file keywords, the REPSYM and REPWIDTH keywords are not case-sensitive.

Using Special Statements in a Nastran Data File

Setting Values Using setrepsym

Symbolic variables and associated values may be set in a Nastran data file using the following statement:

```
%setrepsym <varname>=<varvalue>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following <varvalue>, where the start of the comment is indicated by a ' $' (blank, currency symbol). The setrepsym string is not case-sensitive and at least one blank must separate this string from the <varname> specification. For example,

```
%setrepsym abc=1.23e-5
```

Clearing ("Unsetting") Values Using unsetrepsym

A symbolic variable value set using the %setrepsym statement may cleared ("unset") in aNastran data file using the following statement:

```
%unsetrepsym <varname>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following <varname>, where the start of the comment is indicated by a ' $'. The unsetrepsym string is not case-sensitive and at least one blank must separate this string from the <varname> specification. For example, to clear the variable abc, use

```
%unsetrepsym abc
```

Setting Default Values Using defrepsym

Default variable values can be set in a Nastran data file using the following statement:

```
%defrepsym <varname>=<varvalue>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following <varvalue>, where the start of the comment is indicated by a ' $'. The defrepsym string is not case-sensitive and at least one blank must separate this string from the <varname> specification. The specified value will be used *only* if a value for <varname> was not previously set, i.e., by a repsym keyword on the command line or in an RC file or by a %setrepsym statement previously specified in the data file that has not been unset by a %unsetrepsym statement. For example,

```
%defrepsym abc=2.46e+2
```

Clearing ("Unsetting") Default Values Using undefrepsym

The default value for a symbolic variable may cleared ("unset") in a Nastran data file using the following statement:

```
%undefrepsym <varname>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following <varname>, where the start of the comment is indicated by a ' $'. The undefrepsym string is not case-sensitive and at least one blank must separate this string from the <varname> specification. For example, to clear the default value associated with variable abc, use

```
%undefrepsym abc
```

Setting Width Information Using setrepwidth

Symbolic variable substitution default width information may be set in a Nastran data file using the following statement:

```
%setrepwidth <widthinfo1>,<widthinfo2>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following <widthinfo2>, where the start of the comment is indicated by a ' $'. The setrepwidth string is not case-sensitive and at least one blank must separate this string from the width specifications. There may not be any blanks within the width specifications. <widthinfo1> specifies the width information for the portion of the Nastran data file before the BEGIN statement and <widthinfo2> specifies the width information for the portion of the Nastran data file after the BEGIN statement. Each is specified using a -w.p specification or as one of the synonyms, as described above. If either width specification is omitted, the current width information for that section is not changed. Note that the separating comma is required if the Bulk Data Section width value is to be set, i.e., if <widthinfo2> is specified. For example,

```
%setrepwidth 0.0,wide
```

specifies that the symbolic substitution width specification is to be 0.0 before the BEGIN statement and is to be -16.16 after the BEGIN statement.

Clearing ("Unsetting") Width Information Using unsetrepwidth

Symbolic variable substitution width information set using the %setrepwidth statement may be cleared in a Nastran data file using the following statement:

```
%unsetrepwidth
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following the unsetrepwidth string, where the start of the comment is indicated by a ' $'. The unsetrepwidth string is not case-sensitive and must be followed by at least one blank. This statement does not have any arguments and clears both width specifications.

Setting Default Width Information Using defrepwidth

Default symbolic variable substitution width information may be set in a Nastran data file using the following statement:

```
%defrepwidth <widthinfo1>,<widthinfo2>
```

where the '%' character *must* be in column 1 and nothing else may appear in the record (except for optional comments following <widthinfo2>, where the start of the comment is indicated by a ' $'. The defrepwidth string is not case-sensitive and at least one blank must separate this string from the width specifications. There may not be any blanks within the width specifications. <widthinfo1> specifies the default width information for the portion of the Nastran data file before the BEGIN statement and <widthinfo2> specifies the default width information for the portion of the Nastran data file after the BEGIN statement. Each is specified using a -w.p specification or as one of the synonyms, as described above. If either width specification is omitted, the current width information for that section is not changed. Note that the separating comma is required if the Bulk Data Section width value is to be set, i.e., if <widthinfo2> is specified. For example,

```
%defrepwidth 0.0,wide
```

specifies that default symbolic substitution is to be 0.0 before the BEGIN statement and is to be -16.16 after the BEGIN statement.

Clearing ("Unsetting") Default Width Information Using undefrepwidth

Default symbolic variable substitution width information may be cleared in a Nastran data file using the following statement:

```
%undefrepwidth
```

where the '%' character *must* be in column 1 and nothing else may appear in the record except for optional comments following the undefrepwidth string, where the start of the comment is indicated by a‘ $'. The undefrepwidth string is not case-sensitive and must be followed by at least one blank. This statement does not have any arguments and clears both default width specifications.

General Information For Special Statements

The %setrepsym, %unsetrepsym, %defrepsym, %undefrepsym, %setrepwidth, %unsetrepwidth, %defrepwidth and %undefrepwidth statements are deleted, logically, from the data file and will never be processed by the rest of Nastran unless an error is encountered while they are being processed. This is discussed in the “Error Handling” on page 34.

Requesting Symbolic Substitution

Symbolic variable substitution will occur when a string having the form

```
%<varname>,<widthinfo>:<varvalue>%
```

is found anywhere within a Nastran data file, except that this string may *not* span records, i.e., the substitution request must be on a single record (line). The leading and trailing '%' characters are required as is the <varname> field. The <widthinfo> field is optional. If it is omitted, the comma (,) separating it from the <varname> field may be omitted and the rules for determining what width

specification will be used are discussed below. The <varvalue> field is optional and provides a way of specifying a default value, i.e., the "local default value", as described below. If it is omitted, the colon (:) separating it from the <varname> (or <widthinfo>) field may be omitted. The rules for determining what symbolic value will be used as the substitution value are discussed below. For example, if the symbolic variable abc is to be replaced by its current value with no special processing (or if default width processing is to be used), the substitution request would be:

```
%abc%
```

If the symbolic variable is to be replaced by its current value, with the minimum field width to be 12 characters and with the value always to be left-justified, the substitution request would be:

```
%abc,-12%
```

Quoting Rules For Symbolic Variable Values

- If a symbolic variable value is case-sensitive, if it contains leading, trailing or embedded blanks or if it contains percent characters, tab characters or other special characters, it must be quoted. (Note that "escape" sequences such as '\t' or '\n' are not given any special treatment; that is, they are left as is.)
  - If the value is part of a repsym keyword command-line specification, the quoting rules of the command shell being used apply.
  - If the value is part of arepsym keyword specified in anRC file, it must be enclosed in single quotes (').
  - If the value is part of a%setrepsym or %defrepsym record or if it specified as the "local default value" in a symbolic substitution request, quoting a symbolic variable value means enclosing the value in one of the following pairs of characters:

Starting Quote Character	Ending Quote Character
"	"
'	'
/	/
\	\
[	]
{	}
(	)

If the first non-blank character encountered in a variable value specification is one of the starting quote characters, the variable value *must* be ended by the associated ending quote character. The actual variable value will be the (possibly null) string between (but not including) the starting and ending quote characters. If the variable value starts with one of the starting quote characters, it must be quoted using an alternate quote character.

General Rules For Symbolic Variable Substitution

- Nested symbolic substitution is not supported. Even if the value associated with a symbolic variable name is, itself, in the format of a symbolic variable substitution request, that request will be ignored. That is, after symbolic variable substitution has occurred, the substituted string is *not* re-scanned.
- Determining what symbolic variable value will be used when a variable substitution request is encountered depends on where the variable value associated with the specified variable name was set. The *first* value encountered in the following hierarchy is the value that will be used:
  - A value specified in the Nastran data file using the `%setrepsym` statement, if there is one active, i.e., if it has not been deactivated by a `%unsetrepsym` statement.
  - A value specified on the Nastran command line or in RC files using the `repsym` keyword.
  - As part of the variable symbol substitution request, using the local default value, if there is one.
  - A value specified in the Nastran data file using the `%defrepsym` statement, if there is one active, i.e., if it has not been deactivated by a `%undefrepsym` statement.

  This precedence follows normal Nastran ordering, i.e., "the data file wins," while still providing great flexibility. Also, the ordering of the last two items in this hierarchy allows a user to set all defaults except for special cases and follows the idea that the specification "closest" to the use is the one used. If no replacement value is found, the substitution request will be ignored and the record will be unchanged.
- Determining what symbolic width specification will be used when a variable substitution request is encountered depends on where the width information has been specified and on the part of the Nastran data file that is being processed, i.e., is the variable substitution request before or after the first `BEGIN` statement. The *first* width specification value encountered in the following hierarchy is the specification that will be used:
  - A value specified in the symbolic substitution request itself, i.e., if a `<widthinfo>` entry was specified as part of the symbolic substitution request.
  - A value specified on a `%setrepwidth` statement corresponding to the current section in the Nastran data file, if there is one active, i.e., if it has not been deactivated by an `%unsetrepwidth` statement.
  - A value specified on the Nastran command line or in RC files using the `repwidth` keyword corresponding to the current section in the Nastran data file.
  - A value specified in the Nastran data file using the `%defrepwidth` statement corresponding to the current section in the Nastran data file, if there is one active, i.e., if it has not been deactivated by a `%undefrepwidth` statement.
  - The program default value of exact (`0.0`).

  This precedence also follows normal Nastran ordering, i.e., "the record wins followed by the data file wins," while still providing great flexibility.
- When running in licensing "Interlock" mode, i.e., in CRC validation mode, the following restrictions will be in effect. If a restriction is violated, Nastran processing will be terminated.

- The `%setrepsym`, `%unsetrepsym`, `%defrepsym` and `%undefrepsym` statements are not allowed. Also, specifying a default value within the symbolic substitution request is not allowed. That is, symbolic variable values may only be set using the `repsym` keyword on the command line or in an RC file. Note that the `%setrepwidth`, `%unsetrepwidth`, `%defrepwidth` and `%undefrepwidth` statements *are* allowed.
- A maximum of two symbolic substitution specifications are allowed per record and a maximum of ten symbolic substitution requests are allowed in the entire input data file.
- Interlock CRC calculations will be made on the input record *before* symbolic substitution occurs. Note that any alterations to the record made as part of the CRC calculation processing will not affect symbolic substitution processing.

Requesting Symbolic Substitution Replacement Information Using REPINFO

- A report of what symbolic substitutions were made is generated at the end of Nastran processing, with the level of detail in the report controlled by an "information level" flag set using the

  `repinfo=`*n*

  `keyword, where` *n* is an integer number that specifies the level of detail desired. The meanings the various values for n are as follows:

0	suppress the report altogether
1	report the various values assigned using the `repsym` keyword
2	same as 1 except add the various values assigned using the `setrepsym` statement
3	same as 2 except add the various values assigned using the `defprepsym` statement
4	same as 3 except add the various values assigned as local default values
5	same as 1 except add all locations where the specified `repsym` value was used
6	same as 2 and 5 except add all locations where the specified `setrepsym` value was used
7	same as 3 and 6 except add all locations where the specified `defrepsym` value was used
8	same as 4 and 7 except add all locations where local default values were used.

  The report is written to the .f06 file. If there is not enough dynamic memory available to save the report information, the `repinfo` level may be reduced. When running in Nastran, the default is `repinfo=1`. Otherwise, `repinfo=0` will be forced.
- Just as with other Nastran command line or RC file keywords, the `REPINFO` keyword is not case-sensitive.

Error Handling

If an error is encountered processing a `setrepsym`, `unsetrepsym`, `defrepsym`, `undefrepsym`, `setrepwidth`, `unsetrewidth`, `defrepwidth` or `undefrepwidth` statement, a comment string will be added to the record giving the error information and the record will be passed to Nastran (or the application reading the data file) as if the record was a normal Nastran data record. If an error is encountered in a record containing a symbolic substitution request, the symbolic substitution request will not be processed and, if `repinfo=1` or greater is in effect, a message giving information about the error will be written to the .log file. It is expected that the statements in error will not be valid Nastran statements and so will be flagged as an error.

Examples

1. The value on an "OPTION" statement is to be settable using the command line, taking a default value of "OPT1val" (case-sensitive) if no command line value is set. The OPTION statement could be

   ```
   OPTION=%Option:'OPT1val'%
   ```

   and the command line parameter that would be used to set OPTION to a different value, OP2VAL (not case-sensitive), would be

   ```
   RepSym=Option=op2val
   ```

2. An INCLUDE file contains records that are to be used four times in the Bulk Data Section of a Nastran data file, with the only difference being the value in Field 3 of one record. The first time the file is used, this field must contain the value 1.234, the second time this field must contain the value 4.567 and the last two times this field must contain the value -12.578. In all cases, the replacement field must be eight characters wide and the data must be left-justified in the field. Assuming that the symbolic variable is DATFL3 and that the include file name is incl.data, this could be done as follows:

   In the include file, specify the following statements before the record to be modified:

   ```
   %DefRepSym datfl3=-12.578
   ```

   then the record to be modified could be specified as follows:

   ```
   FL1      FL2      %datfl3%FL4      FL5      FL6
   ```

   and, for completeness, specify the following record after the record to be modified:

   ```
   %Undefrepsym datfl3
   ```

   Then the data file would contain:

   ```
   . . .
   %setrepsym DATFL3=1.234
   %DefRepWidth  ,bulk
   include 'incl.data'
   . . .
   %setrepsym DATFL3=4.567
   include 'incl.data'
   %Unsetrepsym datfl3
   . . .
   include 'incl.data'
   ```

```
. . .
include ‘incl.data’
```

B Glossary of Terms

3060	A User Fatal Message indicating that authorization to run MD/MSC Nastran has been denied (see "Managing MD/MSC Nastran Licensing" on page 33).
6080	A User Warning Message indicating that timing blocks must be generated for your computer (see "Generating a Timing Block for a New Computer" on page 61).
acct	MSC accounting file directory, "*install_dir*/acct" on UNIX and "*install_dir*/acct" on Windows. Also, the program (*install_dir*/*prod_ver*/*arch*/acct on UNIX and *install_dir**prod_ver**arch*\acct.exe on Windows) that updates the current month's accounting data file. See MSCACT for the program source.
architecture RC files	The RC files residing in the "*install_dir*/conf/*arch*" directory on UNIX and in the "*install_dir*\conf*arch*" directory on Windows. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files and Table 3-1 for a listing of architecture names.
archive	A test problem library (*install_dir*/*prod_ver*/misc/archive on UNIX and *install_dir**prod_ver*\misc\archive on Windows) that contains test decks that are no longer part of either the DEMO or TPL libraries. These files may be incompatible with MSC.Nastran V70.5 or may use features that are no longer supported.
ASSIGN	A File Management Section (FMS) statement that is used to assign physical files to DBsets or FORTRAN files.
authorize	Command line and RC file keyword that is used to set the authorization code required to run MD/MSC Nastran.
basename	The part of a pathname exclusive of the directory and file type (e.g., the basename of /temp/myfile.dat. is "myfile").
buffer pool	A disk cache of GINO blocks.
BUFFPOOL	The NASTRAN statement keyword that sets the size of the buffer pool (see "The NASTRAN Statement" on page 11).
BUFFSIZE	One plus the number of words in a GINO physical record. Also, the NASTRAN statement keyword that sets the default buffer size (see "The NASTRAN Statement" on page 11).
conf	The MSC configuration file directory (*install_dir*/conf on UNIX and *install_dir*\conf on Windows) contains the system, architecture, and node RC files and other site-specific files.
counted license	A counted license is a FLEXlm license that limits the number of concurrent executions of MD/MSC Nastran. Counted licenses always require a FLEXlm license server.

daemon	A UNIX program that runs in the background and provides services to the operating system and to users. Daemons are generally started when the system is bootstrapped and terminate when the system shuts down.
dat	Default input data file type.
DBALL	Default DBALL DBset file type. The DBALL DBset contains your model and results.
DBL700	Specifies that SOL 700 will use double precision. This keyword is only used if PATH=3 is specified on the SOL 700 entry and no sol700.pth file exists. The default is dbl700=no. Note that significant performance degradation will occur if "dbl700=yes" is specified.
DBset	Database file set.
DDLPRT	Utility program that prints the contents of the results database (XDB) data definition language database (*install_dir*/*prod_ver*/*arch*/dbc.xdb on UNIX and *install_dir**prod_ver**arch*\dbc.xdb on Windows) and illustrates the batch recovery of the data definition language.
DDLQRY	Utility program that prints the contents of the results database (XDB) data definition language database (*install_dir*/*prod_ver*/*arch*/dbc.xdb on UNIX and *install_dir**prod_ver**arch*\dbc.xdb on Windows) and illustrates the interactive recovery of the data definition language.
del	Delivery database library,
DEMO	The demonstration problem library (*install_dir*/*prod_ver*/nast/demo on UNIX and *install_dir**prod_ver*\nast\demo on Windows) contains a selection of MD/MSC Nastran input files that are documented in the MD/MSC Nastran *Demonstration Problem Manual*.
DEMO1	Sample program that prints information from a graphics database file.
DEMO2	Sample program that prints information from a graphics database file.
DMAP	Direct Matrix Abstraction Program, which is the programming language of the MD/MSC Nastran solution sequences.
DMP	Distributed Memory Parallel. In MD/MSC Nastran, DMP execution is enabled by the "dmparallel" keyword.
DMP700	Specifies the number of hosts for an SOL 700 run. This keyword is only used if PATH=3 is specified on the SOL 700 entry and no sol700.pth file exists. The default hosts are the same for MD/MSC Nastran.
doc	Documentation file directory.
EAG FFIO	Engineering Applications Group Flexible File I/O, an asynchronous database I/O library on linuxipf systems. See the ff_io keyword, (p. 59)
ESTIMATE	Utility that estimates memory and disk requirement of a data file and make suggestions on improving the performance of MD/MSC Nastran.

F04	The F04 file is created by MD/MSC Nastran and contains a module execution summary as well as a database information summary. The F04 file has the file type".f04".
F06	The F06 file is created by MD/MSC Nastran and contains the numerical results of the analysis. The F06 file has the file type ".f06".
file locking	A mechanism to prevent multiple MD/MSC Nastran jobs from interfering with one another. For example, two jobs attempting to write to the same DBset interfere with one another, whereas two jobs reading the delivery database do not interfere with one another.
file mapping	A mechanism to use the system's virtual paging system to access a file. MD/MSC Nastran can use file mapping to access GINO files. See Table 4-7 for a listing of systems that support file mapping.
FMS	File Management Section of the input file, which is used to attach and initialize DBsets and FORTRAN files.
gentim2	MD/MSC Nastran job that determines the timing constants for your computer.
GINO	The MD/MSC Nastran database subsystem.
GINO block	A block of data transferred by GINO.
HEATCONV	Utility program that converts pre-MSC.Nastran V68 heat-transfer data files to the MSC.Nastran Version 68 format.
HIPPI	High Performance Parallel Interface. An ANSI standard (ANSI X3T9.3 document number X3T9.3/90-043, 1990) interface used in high-performance environments.
IEEE	Institute of Electrical and Electronics Engineers, Inc. A professional society. The floating point formats and, to a lesser extent, algorithmsused on most MD/MSC Nastran computers are defined by IEEE Standard 754.
IFPBUFF	Specifies the physical record size, in words, of MD/MSC Nastran IFPStar database. The physical I/O sizeis IFPBUFF-1 words. The maximum value of IFPBUFF is 65537 words.
INCLUDE	A general MD/MSC Nastran input file statement that inserts an external file into the input file. INCLUDE statements may be nested.
INIT	The INIT statement is part of the File Management Section (FMS) and is used to create a temporary or permanent DBset.
large file	A file on a 32-bit system that can be 2 gigabytes or larger. All files on a 64-bit system can be large files. See Table 4-7 for a listing of systems that support large files.
local RC files	The RC files residing in the directory containing the input data file. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files.

LOG	The LOG file is created by MD/MSC Nastran and contains system information as well as system error messages. The LOG file has the file type ".log".
MASTER	Default MASTER DBset file type. The MASTER DBset contains the names of other database members and indices.
MATTST	Sample program that reads the OUTPUT4 matrix files.
mem700	The default memory (in MegaWords) used the dynamic portion of SOL 700 runs. This keyword is only used if PATH=3 is specified on the SOL 700 entry and no sol700.pth file exists.
memory	Command line keyword that is used to define the amount of memory allocated for open core.
MPI	Message Passing Library. An industry-standard library for message passing programs.
MPL	The module properties list is a table that defines the properties of DMAP modules.
MSC.ACCESS	FORTRAN-callable subroutine library that reads and writes results database (XDB) files.
MSCACT	Utility program that generates accounting reports. The source for this utility and the accounting file update program are maintained in the same file (*install_dir*/*prod_ver*/util/mscact.c on UNIX and *install_dir**prod_ver*\util\mscact.c on Windows).
MSGCMP	Utility program that compiles a text file to create a message catalog.
NAO	The Network Authorization Option of MD/MSC Nastran. The implementation in MSC.Nastran Version 70.5 is not compatible with earlier versions of NAO.
ndb	Default neutral-format results database file type.
neu	Default neutral-format plot file type. Only created by NEUTRL.
NEUTRL	Utility program that converts binary plot (.plt) files to neutral plot (.neu) files.
node RC files	The RC files residing in the "*install_dir*/conf/net/*nodename*" directory on Unix and "*install_dir*\conf\net*nodename*" directory on Windows. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files.
NUSR	The node-locked license enforcement of the maximum number of users concurrently running MD/MSC Nastran. See "Enabling Account ID Validation" on page 43 for additional information.
on2	Default neutral-format OUTPUT2 file type.
op2	Default binary-format OUTPUT2 file type.

open core	Amount of working memory in words.
OPTCONV	Utility program that converts pre-MSC.Nastran V68 optimization and design-sensitivity data files to the MSC.Nastran Version 68 format.
pch	Default punch file type.
PLOTPS	Utility program that converts binary (.plt) or neutral (.neu) plot files to PostScript (.ps) files.
plt	Default binary-format plot file type.
ps	Default PostScript plot file type.
RC file	Runtime configuration file that is used by MD/MSC Nastran to control execution parameters.
RCOUT2	Utility program that converts a neutral OUTPUT2 (.on2) file to a binary OUTPUT2 (.op2) file.
RECEIVE	Utility program that converts neutral results database (.neu) files to binary results database (XDB) files.
RFA	Rigid-format alter library, "*install_dir*/*prod_ver*/nast/rfa" on UNIX and "*install_dir**prod_ver*\nast\rfa" on Windows. (This directory is now empty.)
SCR300	Default SCR300 DBset file type.
SCRATCH	Default SCRATCH DBset file type.
sdir	Keyword that is used to set the directory for temporary scratch files produced by MD/MSC Nastran.
SMEM	Scratch memory area for memory-resident database files.
smemory	Command line keyword to set SMEM.
SMP	Shared Memory Parallel. In MD/MSC Nastran, SMP execution is enabled by the "parallel" keyword.
SMPLR	Sample program that reads graphics database files.
SSS	Structured Solution Sequences. The delivery database files (SSS.MASTERA, SSS.MSCSOU, and SSS.MSCOBJ) are found in "*install_dir*/*prod_ver*/*arch*" on UNIX and "*install_dir**prod_ver**arch*" on Windows; the source files are found in "*install_dir*/*prod_ver*/nast/del" on UNIX and "*install_dir**prod_ver*\nast/del" on Windows.
SSSALTER	Additional alter and error corrections library, "*install_dir*/*prod_ver*/misc/sssalter" on UNIX and "*install_dir**prod_ver*\misc\sssalter" on Windows.
SUN_IO	An asynchronous database read library on Solaris systems. See the "sun_io" keyword, (p. 92).

SYS	An ASSIGN statement parameter that is used to specify special machine-dependent information. File locking and file mapping of database files are controlled through the SYS parameter.
sysfield	The global SYS parameter that can be specified on the command line or in an RC file.
system RC files	The RC files residing in the "*install_dir*/conf" directory on UNIX and in the "*install_dir*\conf" directory on Windows. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files.
SYSTEM(x)	System cells that are used by MD/MSC Nastran to control analysis parameters.
TABTST	Sample program that reads binary-format OUTPUT2 files.
TPL	The test problem library (TPL, *install_dir*/*prod_ver*/nast/tpl on UNIX and *install_dir**prod_ver*\nast\tpl on Windows) contains a general selection of MD/MSC Nastran input files showing examples of most of the MD/MSC Nastran capabilities, in general, these files are not documented.
TRANS	Utility program that converts binary results database (XDB) files to neutral results database (.neu) files.
type	The part of the pathname exclusive of the directory and basename (e.g., the file type of myfile.dat is ".dat").
UFM	A User Fatal Message that describes an error severe enough to terminate the program.
UFM 3060	A User Fatal Message indicating that authorization to run MD/MSC Nastran has been denied (see "Using the "mscinfo" Command (UNIX)" on page 32).
UIM	A User Information Message that provides general information.
uncounted license	An uncounted license is a FLEXlm license that allows any number of concurrent executions of MD/MSC Nastran on a given node. An uncounted license does not require a FLEXlm license server.
user RC files	The RC files residing in the "$HOME" directory on UNIX and in the "%HOMEDRIVE%%HOMEPATH%" directory on Windows. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files.
util	Utility program library, "*install_dir*/*prod_ver*/util" on UNIX and "*install_dir*\/*prod_ver*\util" on Windows.
UWM	A User Warning Message that warns of atypical situations. You must determine whether a problem exists in the analysis.

UWM 6080 A User Warning Message indicating that timing blocks must be generated for your computer (see "Generating a Timing Block for a New Computer" on page 61).

version A file is "versioned" by appending a dot followed by a version number to the file's name. The latest version of a file does not have a version number, all earlier versions do, with the oldest having the smallest version number and the latest having the highest version number.

XDB The XDB file is created by MD/MSC Nastran and contains results information for use by various post-processing programs. See the "POST" parameter in "Parameters" on page 679 of the *MD/MSC Nastran Quick Reference Guide* for further information on generating XDB files. XDB files are not versioned. The XDB file has the file type ".xdb".

C Keywords and Environment Variables

- Keywords
- SYS Parameter Keywords
- Environment Variables
- Other Keywords
- System Cell Keyword Mapping

Keywords

The following is a complete list of the keywords that may be used on the command line or placed into RC files as appropriate.

Keywords that use yes/no values accept partial specification and case-independent values. For example, “yes” may be specified as “y”, “ye”, or “yes” using uppercase or lowercase letters.

acct acct=yes,no Default: No

Indicates solution accounting is to be performed. The new “lock” keyword may be used to ensure that all jobs have solution accounting enabled.

For example, the following RC file lines force all jobs to use accounting:

Example:

```
acct=yes
lock=yes
```

The first line turns accounting on. The second line ensures accounting is on for every job; see the “lock” keyword for more details.

acdata acdata=*string* Default: None

Specifies site defined accounting data. See your system administrator to determine if and how this keyword is to be used. See “Enabling Account ID and Accounting Data” on page 43 for additional information.

acid acid=*string* Default: None

Specifies the site defined account ID for this job. See your system administrator to determine if and how this keyword is to be used. See “Enabling Account ID and Accounting Data” on page 43 for additional information.

acvalid acvalid=*string* Default: None

Note: This keyword can only be set in the command initialization file, see the sections titled “Enabling Account ID and Accounting Data” on page 43 and “Specifying Parameters” on page 2 in Appendix A.

Indicates account ID validation is to be performed. If “acvalid” is not defined, or is null, then no checks are made of the account ID. If “acvalid” is defined, then account ID validation is performed. “Enabling Account ID and Accounting Data” on page 43 contains more information on defining this keyword.

adapter_use (AIX)

adapter_use=*keyword* Default: See text

Specifies how the node's adapter is used in the IBM Parallel Environment for AIX. The legal values are "dedicated" and "shared".

The default is "adapter_use=dedicated" if "euilib=us", otherwise it is "adapter_use=shared".

This keyword may also be set with the *MP_ADAPTER_USE* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

after (UNIX)

after=*time* Default: None

Holds the job's execution until the time specified by *time*. See the description of the "at" command in your system documentation for the format of *time*.

Example:

```
prod_ver nastran example after=10:00
```

The job is held until 10:00 AM.

append

append=yes,no Default: No

Combines the F04, F06, and LOG files into a single file after the run completes. If "no" is specified, the files are not combined. If "yes" is specified, the files are combined into one file with the type ".out".

Example:

```
prod_ver nastran example append=yes
```

The F04, F06, and LOG files are combined into a file named "example.out".

application

application=NASTRAN

Specifies the application to be run.

Note: This keyword should always be set to "NASTRAN", and may only be specified on the command line or in the command initialization file. See "Specifying Parameters" on page 2 in Appendix A.

attdel

attdel=*number* Default: 0 (enables automatic assigning)

Controls automatic assignment of the delivery database. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

autoasgn

autoasgn=*number* Default: 7 (all)

Controls automatic assigning of DBsets. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

authinfo authinfo=*number* Default: 0

Specifies the amount of information written to the LOG during authorization processing. Values greater than zero indicate additional information is to be written.

authorize authorize=*spec* Default: UNIX: *install_dir*/conf/authorize.dat

Windows: *install_dir*\conf\authoriz.dat

Selects the licensing method for MD/MSC Nastran. The spec can take on several forms. They include:

authorize=FLEXlm-license-spec
FLEXlm licensing has been selected. Please see "Automatically Starting a FLEXlm Server" on page 37 for information on specifying a FLEXlm license.

authorize=pathname
This specifies either a FLEXlm license file, see the above reference, or a node-lock authorization code, see "Using Node-locked Authorization Codes" on page 42 for information on specifying a node-locked authorization code. If only a directory is specified, the program assumes that either "authorize.dat" or "license.dat" is in the specified directory.

Example: *prod_ver* `nastran example auth=myauthfile`

The job runs using the node-locked authorization code in "myauthfile".

authqueue authqueue=*number* Default: 20

All systems: Specifies the time in minutes to wait for a seat to become available. If the seat becomes available before this specified time period expires, the job will be allowed to continue. If not, the job will be terminated.

Note: When a job is waiting for a seat to become available, it consumes computer resources such as memory, swap file space, disk space, etc. Too many jobs waiting for licenses could have a severe impact on the system.

Example: *prod_ver* `nastran example auth=myauthfile`

The job runs using the node-locked authorization code in "myauthfile". If a seat is not available within 20 minutes of the start of the job, the job terminates.

Example: *prod_ver* `nastran example auth=myauthfile authqueue=10`

The job is run using the node-locked authorization code in "myauthfile". If a seat is not available within 10 minutes of the start of the job, the job will be terminated.

batch batch=yes,no Default: Yes

(UNIX) Indicates how the job is to be run. If "yes" is specified, the job is run as a background process. If "no" is specified, the job is run in the foreground. If the "aft" or "queue" keywords are specified, the batch keyword is ignored. Jobs submitted with "batch=yes" will run under nice(1).

Note: If the job is already running in an NQS or NQE batch job, the default is "no".

Example: *prod_ver* `nastran example batch=no`

The job is run in the foreground.

bfgs bfgs=*number* Default: 0

Selects strategies of BFGS updates for the arc-length methods in non-linear analysis. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

bpool bpool=*value* Default: 37

Specifies the number of GINO and/or executive blocks that are placed in buffer pool.

Example: *prod_ver* `nastran example bpool=100`

Space for 100 GINO buffers is reserved for the buffer pool.

buffpool buffpool=*number* Default: 37

Specifies the number of GINO and/or executive blocks that are placed in the buffer pool. This keyword is a synonym for the "bpool" keyword. See the description of the "bpool" keyword for more information.

buffsize buffsize=*value* Default: 8193

Specifies the physical record size, in words (1 word = 8 bytes when mode = i8; 4 bytes on all others), of all MD/MSC Nastran DBsets except those specified with INIT statements and MSCOBJ. The physical I/O size is BUFFSIZE-1 words.

If "buffsize=estimate" is specified, ESTIMATE will be used to determine *value*.

See "Estimating BUFFSIZE" on page 89 for recommended BUFFSIZE values based on model size.

BUFFSIZE must reflect the maximum BUFFSIZE of all DBsetsattached to the job including the delivery database, which is generated with a BUFFSIZE of 8193. If you generate your own delivery database, this default may be different. The maximum value of BUFFSIZE is 65537 words. BUFFSIZE must be one plus a multiple of the disk block size. The disk default block size may be determined with the "system" special function described in "Using the Help Facility and Other Special Functions" on page 81; specific block size information may be obtained from your system administrator.

Example: *prod_ver* `nastran example buffsize=16385`

The BUFFSIZE is set to 16385 words.

ipfbuff ifpbuff=value Default: 1024

Specifies the physical record size, in words, of MD/MSC Nastran IFPStar database. The physical I/O size is IFPBUFF-1 words. The maximum value of IFPBUFF is 65537 words.

Example: prodver nastran example ifpbuff=8193
The IFPBUFF is set to 8193 words.

ccstempdir ccstempdir=*directory* Default:

(Windows)

Specifies a network-visible working (scratch) directory for use by the Windows CCS Job Scheduler. If this keyword is not specified, a search will be made for a suitable directory by looking at: the directory specified by the "sdirectory" keyword, the directory portion of the location specified by the "out" keyword, the current directory, the directory specified by the "TEMP" environment variable or the directory specified by the "TMP" environment variable. A directory is network-visible if it is specified in UNC format or it if can be converted to a UNC name. Processing is terminated if none of these locations specified a network-visible directory and if a suitable directory was not specified using this "ccstempdir" keyword.

config config=*number* Default: Computer dependent

Specifies the configuration (CONFIG) number used by MD/MSC Nastran to select timing constants. You can change this value to select the timing constants of a different computer model. A configuration number of zero is considered undefined by the nastran command. See "Defining a Computer Model Name and CONFIG Number" on page 60 and "Generating a Timing Block for a New Computer" on page 61 for additional information.

constitle constitle=yes, no Default: Yes

(Windows)

Specifies whether or not the console title bar is to be modified to have the job identification. This keyword is only applicable to Windows systems.

cputime (UNIX)

cputime=*cputime* Default: None

Note: The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.

Specifies the maximum amount of CPU time that the complete job is permitted to use when the "queue" keyword is used. This time includes the execution of the driver program, the MD/MSC Nastran executable, plus any commands specified by the "pre" and "post" keywords. See your system's queuing documentation for the format of *cputime*.

The value can be specified as either "*hours*:*minutes*:*seconds*", "*minutes*:*seconds*", or "*seconds*"; it will always be converted to seconds by the nastran command.

Example:

```
prod_ver nastran example
queue=small cputime=60
```

This example defines the maximum CPU time for the complete job as 60 seconds.

Example:

```
prod_ver nastran example
   queue=small cpu=1:15:0
prod_ver nastran example
queue=small cpu=75:0
prod_ver nastran example
queue=small cpu=4500
```

These examples all define the maximumCPU time for the completejob as one hour and fifteen minutes.

cpu_use (AIX)

cpu_use=*keyword* Default: See text

Specifies how the node's CPU is used in the IBM Parallel Environment for AIX. The legal values are "unique" and "multiple".

The default is "cpu_use=unique" if "euilib=us", otherwise it is "cpu_use=multiple".

This keyword may also be set with the *MP_CPU_USE* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

cpyinput

cpyinput=0,1 Default: 0

Indicates the input data file is to be copied to a temporary file before processing. Setting cpyinput=1 will emulate the old MD/MSC Nastran behavior of copying the file, this will consume additional time and disk resources.

dballco dballco=*value* Default: 1

Allows you to scale DBALL estimates. This scale factor is applied before the "dballmin" value, that provides a lower bound for DBALL estimates.

Example:

```
prod_ver estimate example dballco=2
```

This will double the DBALL disk estimate and then apply the "dballmin" lower bound.

Example:

```
prod_ver estimate example dballco=0.5
```

This will halve the DBALL disk estimate. An estimate lessthan than the lower bound specified by "dballmin" will be set to the lower bound.

dballmin dballmin=*value* Default: 1mb

Allows you to define the lower bound for all DBALL estimates. This bound is applied after the "dballco" value, that multiplies the actual estimate by a "conservatism" factor.

Example:

```
prod_ver estimate example dballmin=2mb
```

This will set the minimum DBALL disk estimate to 2 MB.

dbs dbs=*pathname* Default: .

Creates database files (see Table 4-7) using an alternate file prefix. If “dbs” is not specified, database files are created in the current directory using the basename of the input data file as the prefix. If the “dbs” value is a directory, database files are created in the specified directory using the basename of the input data file as the filename.

Note: If “dbs” is specified and “scratch=yes” is specified, a warning will be issued and “scratch=no” assumed.

In the following examples, assume the current directory includes sub-directories “mydir” and “other”, and that an “example.dat” exists in both the current directory and “other”. That is, ./example.dat, ./mydir, ./other, and ./other/example.dat exist on UNIX; and .\example.dat, .\mydir, .\other, and .\other\example.dat exist on Windows.

Example:

```
prod_ver nastran example
```

Database files are created in the current directory with the name “example”, e.g., ./example.DBALL on UNIX; and .\example.DBALL on Windows.

Example:

```
prod_ver nastran other/example
```

Database files are created in the “other” directory with the name “example”, e.g., ../other/example.DBALL on UNIX and .\other\example.DBALL on Windows.

Example: *prod_ver* `nastran example dbs=myfile`

Database files are created in the currentdirectory with the name “myfile”, e.g., ./myfile.DBALL on UNIX and .\myfile.DBALL on Windows.

Example: *prod_ver* `nastran example dbs=mydir`

Database files are created in the mydir directory with the name “example”, e.g., ./mydir/example.DBALL on UNIX and .\mydir\example.DBALL on Windows.

Example: *prod_ver* `nastran example dbs=mydir/myfile`

Database files are created in the mydir directory with the name “myfile”, e.g., ./mydir/myfile.DBALL on UNIX and .\mydir\myfile.DBALL on Windows.

Example: *prod_ver* `nastran example dmp=4 host=a:b:c:d dbs=/aa:/bb:/cc:/dd`

This example will set the “dbs” directory to “/aa” on host a, “/bb” on host b, “/cc” on host c, and finally “/dd” on host d.

Note: The use of distinct per-task database directories can have a significant impact on elapsed time performance of DMP jobs on SMP and NUMA systems.

dbverchk dbverchk=0, 1 Default: 0 (check is performed)

Specifies whether or not database version checking is to be skipped. See the “nastran Command and NASTRAN Statement” on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

delete delete=yes, no, all, jid, *list* Default: No

Note: This keyword is only intended to be used when MD/MSC Nastran is running in server mode or is embedded within an other application. The deletion occurs before the post commands are run.

Unconditionally delete files after an MD/MSC Nastran job completes. Specifying "delete=yes" will delete the F04, F06 and LOG files when the job completes; "delete=all" will delete the F04, F06, LOG, NDB, OP2, PCH, PLT and XDB files when the job completes. You can also specify a list of file types, e.g., "delete=f04,log,plt" will only delete the F04, LOG and PLT files. Note that, on UNIX systems, this list of file types is *case-sensitive*. That is, "delete=master" will delete files with an extension of "master" but not files with an extension of "MASTER" and "delete=MASTER" will delete files with an extension of "MASTER" but not files with an extension of "master".

Example: *prod_ver* `nastran example delete=op2,plt`

After the MD/MSC Nastran job has completed, the "example.op2" and "example.plt" files will be unconditionally deleted. These files are normally kept if they are not empty.

Example: *prod_ver* `nastran example delete=plt,MASTER,DBALL`

After the MD/MSC Nastran job has completed, the "example.plt", "example.MASTER" and "example.DBALL" files will be unconditionally deleted. Normally, the "example.plt" file will kept if it is not empty and the "example.MASTER" and "example.DBALL" files are kept unless "scratch=yes" was specified.

delivery delivery=*pathname* Default: MSCDEF

Specifies an alternate delivery database option. See "Creating and Attaching Alternate Delivery Databases" on page 190 for further information on alternate delivery databases.

The special pathname "MSCDEF" indicates the standard MD/MSC Nastran delivery database.

Example: *prod_ver* `nastran example del=mysss`

The job runs using a solution sequence from the delivery database "mysss.MASTERA".

diag diag=*flag*,*flag*,... Default: None

Sets MD/MSC Nastran diagnostics. This keyword may also be set with the DIAG Executive Control Statement. See "DIAG" on page 113 of the *MD/MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword. The diagnostics set using this keyword are in addition to any diagnostics set with the DIAG statement in the input file.

Example: *prod_ver* `nastran example diag=5`

The MD/MSC Nastran job is run with DIAG 5 set.

diaga diaga=*number* Default: None

Set MD/MSC Nastran diagnostic flags 1-32. The value specified over-rides any previous "diag=n" values where n is in the range 1 to 32. These diagnostics are set in addition to any diagnostics set via the Executive Control "DIAG" statement in the input data file. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

diagb diagb=*number* Default: None

Set MD/MSC Nastran diagnostic flags 33-64. The value specified over-rides any previous "diag=n" values where n is in the range 33 to 64. These diagnostics are set in addition to any diagnostics set via the Executive Control "DIAG" statement in the input data file. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

disksave disksave=*number* Default: 0 (no save)

Specifies Lanczos High Performance Option controlling whether or not the matrix/vector multiply is saved in a scratch file. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

display display=*display_name* Default: Current display

(UNIX)

Specifies a display for XMONAST. This keyword may also be set with the *DISPLAY* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

distort distort=*number* Default: 0 (terminate run)

Specifies element distortion fatal termination override. Applies to all p-elements and the TETRA h-elements. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

dmparallel dmparallel=*number* Default: 0

(See Table 5-3)

Specifies the number of tasks for a Distributed Memory Parallel (DMP) analysis. This value may only be set on the command line.

The value must be null or zero to cancel DMP processing, or a number greater than zero to enable DMP processing.

See "Running Distributed Memory Parallel (DMP) Jobs" on page 145 for additional information.

Example: *prod_ver* `nastran example dmp=4`

The job is run with four DMP tasks.

dskco dskco=*value* Default: 1

Allows you to define a factor to scale total disk estimates. This scale factor is applied before the "dskmin" value, that provides a lower bound for total disk estimates.

Example: *prod_ver* `estimate example dskco=2`

This doubles the total disk estimate and then applies the "dskmin" lower bound.

Example:

```
prod_ver estimate example
dskco=0.5
```

This will halve the total disk estimate. An estimate less than the lower bound specified by "dskmin" will be set to the lower bound.

dskmin dskmin=*value* Default: 1mb

Allows you to define the lower bound for all total disk estimates. This bound is applied after the "dskco" value, that multiplies the actual estimate by a "conservatism" factor.

Example:

```
prod_ver estimate example
dskmin=2mb
```

This will set the minimum total disk estimate to 2 MB.

euidevice euidevice=*device-name* Default: css0

(AIX)

Specifies the communications adapter to use in the IBM Parallel Environment for AIX. This keyword is used when “euilib=ip” has been specified. The specified device must exist as a character special device in /dev.

The default is “euidevice=css0”.

This keyword may also be set with the *MP_EUIDEVICE* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

euilib euidevice=us,ip Default: us

(AIX)

Specifies the CSS library implementation to use in the IBM Parallel Environment for AIX. Setting “euilib=us” will select the User Space (US) CSS; “euilib=ip” will select the Internet Protocol (IP) CSS.

The default is “euidevice=css0”.

This keyword may also beset with the *MP_EUILIB* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

executable executable=*pathname* Default: Computer dependent

Specifies the name of an alternate solver executable. This keyword overrides all architecture and processor selection logic. If a directory is not specified by *pathname* and the file does not exist in the current directory, the default architecture directory is assumed.

Example:

```
prod_ver nastran example
exe=analysis.um
```

The job runs using the executable “analysis.um”. Since a directory was not specified, this file must exist in either the current directory or *install_dir*/*prod_ver*/*arch* on UNIX or *install_dir**prod_ver**arch* on Windows.

expjid expjid=no, yes, auto, *pathname* Default: Auto

Specifies whether or not the input file is to be "expanded" or not, that is, whether or not the input file is to be read and all "include" files processed. If "expjid=no" is specified, the input file will be used directly.

If "expjid=yes" is specified, the input file will be expanded and stored in the location specified by "out", with an extension of "exp" added.

If "expjid=*pathname*" is specified, the input file will be expanded and stored in the location specified by *pathname*. If *pathname* specifies a directory, the expanded file will be stored using the base name of the input file, with an extension of "exp" added. If *pathname* specifies a file name without an extension, and extension of "exp" will be added.

If "expjid=auto" is specified (or taken by default):

- If "node" is specified, the input file will be expanded only if it is not visible from the remote node.
- If "node" is not specified, the input file will not be expanded, i.e., processing will be as if "expjid=no" was specified.

If the input file is expanded:

- If "node" is specified, the expanded file will be copied (if necessary) to the remote node for processing and will be deleted from both the remote and local nodes at the completion of processing.
- If "node" is not specified, processing will terminate without actually invoking the MD/MSC Nastran analysis program and without storing any other files.

extdefault extdefault=logname1(ext1),logname2(ext2),... Default: None

Changes the default extension(s) associated with the specifiedlogical name(s). The logical name (lognamei) specification is case-insensitive. For UNIX/Linux systems, the extension (exti) is casesensitive; for Windows systems, it is not. This keyword may be specified as often as necessary and the values will be comma-separated and appended. If the same logical name is specified more than once, the extension in the last specification will be the one used.

`Example: extdefault=plot(myplot),punch(mypunch)`

changes the default extension assigned to logical name PLOT from "plt" to "myplot" and the default extension assigned to logical name PUNCH from "pch" to "mypunch".

Restrictions:

1. Only FORTRAN files identified as "Assignable" may have their default extension changed . See Table 2-1 in the MSC.Nastran Quick Reference Guide, Volume 1.
2. The extension may not be one of the reserved extensions. These reserved extensions are: f06, f04, log, MASTER, DBALL, OBJSCR, SCRATCH and SCR300.
3. Extensions must be from one- to eight-characters long.

f04 f04=*number* Default: 4

Specifies FORTRAN unit number for Execution Summary Table. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

f06 f06=*number* Default: 6

Specifies FORTRAN unit number for standard output file. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

fastio fastio=*number* Default: 0 (UNPACK/PACK)

Specifies Lanczos High Performance Option controlling input/output in orthogonalization/normalization routines. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

fbsmem fbsmem=*number* Default: See the *MD Nastran Quick Reference Guide*.

Reserves memory for faster solution of the Lanczos method of eigenvalue extraction. This keyword may also be set with the "sys146" command line keyword. See the *MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

fbsopt fbsopt=*number* Default: See the *MD Nastran Quick Reference Guide*.

Selects the forward-backward substitution methods. This keyword may also be set with the "sys70" command line keyword. See the *MD Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

ff_io ff_io=yes,no,append Default: Yes

Indicates EAG FFIO is to be enabled. EAG FFIO can provide a substantial elapsed-time performance increase.

If "ff_io=yes" is set and "ff_io_opts" is not set, a default value for the FF_IO_OPTS environment variable will be determined. This value will: include both the default permanent and scratch DBsets; use the cache size specified by the "ff_io_cachesize" keyword; consider the device geometries of the disks containing the "dbs" and "sdirectory" directories.

If "ff_io=append" is set, the calculated FF_IO_OPTS value will be appended to the user's FF_IO_OPTS value.

If "ff_io=no" is specified, any values for FF_IO_OPTS and FF_IO_DEFAULTS will be suppressed, and EAG FFIO will be disabled.

ff_io_cachesize ff_io_cachesize=*size* Default: 1MW

(SGI/Altix - Linux/IPF)

Specifies the size of the EAG FFIO cache only if "ff_io=yes" is set and neither the "ff_io_opts" keyword nor the FF_IO_OPTS environment variable is set. This value will be added to the "prm" and "ppm" values.

The minimum cache size is 512 000 words.

The *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85.

Example:

```
prod_ver nastran example
ff_io=yes
ff_io_cachesize=2mw
```

The job is run with a 2 MW EAG FFIO cache.

ff_io_defaults (SGI/Altix - Linux/IPF)

ff_io_defaults=*string* Default: None

Specifies the EAG FFIO default options to be used. This value must be a valid FFIO specification string; no error checking is performed before MD/MSC Nastran starts.

This keyword may also be set by the FF_IO_DEFAULTS environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

ff_io_opts (SGI/Altix - Linux/IPF)

ff_io_opts=*string* Default: See "ff_io"

Note: Because of the difficulty in setting the FF_IO_OPTS value, especially the striping partitions, you are strongly urged to remove any FF_IO_OPTS settings you may have been using.

Specifies the EAG FFIO options to be used. This value must be a valid EAG FFIO specification string; no error checking is performed before MSC Nastran starts.

This keyword may also be set by the FF_IO_OPTS environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

frqseq

frseq=*number* Default: 0 (equal segments)

Specifies Lanczos High Performance Option controlling exponent for rational function for segment boundaries. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

gmconn

gmconn=*pathname* Default: None

Specifies the name of the external evaluator connection file. External geometric and bar or beam element evaluators may be specified. See the *MSC Nastran Version 69 Release Guide* for additional information on external bar or beam elements. Also, see "Using BEAMSERV" on page 244 for information on running an MD/MSC Nastran job using a beam server.

Example:

```
prod_ver nastran example
gmconn=mybeamserver
```

The job is run with the external evaluators specified in "mybeamserver".

hicore

hicore=*memory_size* Default: *Dependent on "memory" and other keywords*

Specifies maximum working memory. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

hostovercommit hostovercommit=yes,no Default: No

Allows this job to assign more tasks to a host than processors. This does **not** prevent other MD/MSC Nastran jobs or users from using the processors. See also the "hosts" keyword below.

If "hostovercommit=no" is specified, at most one task will beassigned for each processor on the host, i.e., a four processor system can only have four tasks assigned.

If "hostovercommit=yes" is specified, tasks are assigned to hosts in a round-robin order until all tasks are assigned, without regard to the number of processors on the host.

Note: Assigning more tasks to a host than it has processors will impact the elapsed-time performance of your DMP job.

In the following examples, assume that host1 and host2 each have two processors.

Example:
```
prod_ver nastran example dmp=6
hosts=host1:host2 hostovercommit=no
```

The job will not be started because a total of only four processors are available on host1 and host.

Example:
```
prod_ver nastran example dmp=6
hosts=host1:host2 hostovercommit=yes
```

The job will be allowed to start, with three tasks each assigned to host1 and host2.

hosts hosts=*host*:*host*:... Default: See text

hosts=*host*;*host*;...

hosts=*filename*

Defines the list of candidate hosts to be used for a DMP analysis. This list is scanned in a round-robin order until all tasks have been assigned to a host. If "hostovercommit=no" is specified, at most one task will be assigned for each processor on the host, i.e., a four processor system can only have four tasks assigned.

Multiple hosts are specified in the standard manner for the PATH environment variable, that is "hosts=*host1*:*host2*:..." on UNIX and "hosts=*host1*;*host2*;..." on Windows.

The default is the current system.

See "Running Distributed Memory Parallel (DMP) Jobs" on page 145 for additional information.

In the following examples, assume that the current host, host1, and host2 each have two processors.

Example: *prod_ver* `nastran example dmp=2`

The job will be run on the current host.

Example:
```
prod_ver nastran example dmp=3
hosts=host1:host2
```

The first and third tasks will be assigned to host1, the second task will be assigned to host2.

Example:
```
prod_ver nastran example dmp=3
hosts=myhostfile
```

The file ./myhostfile on UNIX and .\myhostfile on Windows will be read to determine the list of hosts to use.

hpio_param

(Linux IPF)

hpio_param=*string* Default: None

Specifies the HPIO control string. The control string is composed of one or more filename-options pairs of the form:

file_template (*p1*:*p2*:*p3*:*p4*:*p5*:*p6*:*p7*)

where:

file_template	Blank separated list of filename templates, there is no default. Examples are "*DBALL" to match all files ending in "DBALL" and "*DBALL *SCR*" to match all files ending in "DBALL" and all files with "SCR" anywhere in the name.
p1	Number of cache pages for each file; the default is 5.
p2	The size of each cache page; the default is "8m" or 8 MB. This value is the number of bytes, or a number followed by "k" for KB, or "m" for MB. If no unit is supplied, the default is "k" for KB.
p3	The maximum number of cache pages to read ahead. The default and minimum is 1. This value must be less than p1. A rule of thumb is $p3 < 0.5 \times p1$.
p4	"nolog" or "log", the default is "nolog". Note, the "log" option is intended for tuning and debugging purposes only, it can generate large amounts of output.

p5	XMU cache working directory, there is no default. The file system containing this directory must be an SFS/H file system.
p6	Number of XMU cache pages, the default is 5. This value must be greater than 0 if p5 is specified.
p7	Number of buffers for XMU cache access, the default is 2.

Note: If invalid XMU fields are specified, a message will be printed in the LOG file and will continue without using HPIO.

The additional main memory consumed by the HPIO facility is:

$(p1 + 1) \times p2 \times n_{files}$ bytes

without the XMU, or

$(p1 + 1 + p7 + 2) \times p2 \times n_{files}$ bytes

with the XMU, where n_{files} is the number of files matched by *file_template*.

The space on the XMU consumed by the HPIO facility is

$p6 \times p2$ bytes

Example:

```
prod_ver nastran example
         hpio_param='*SCR* (9::1)'
```

The job is run with HPIO enabled for all files with SCR in their name, e.g., *sdir*/example.SCRATCH and *sdir*/example.SCR300. HPIO will allocate ten cache pages ($p1 = 9$) of 8 MB per page per file, the cache will readahead one page ($p3 = 1$). Assuming no other files use HPIO, i.e., no other filenames used by the job match the template "*SCR*", an additional 160 MB of memory will be required by this job.

hyperthreads

hyperthreads=yes,no Default: Yes

(Windows)

Species whether or not Intel® HyperThreads logical processors are to be used or not. This keyword is ignored unless HyperThreading is enabled (in the BIOS) and is supported by the operating system. Currently, only WindowsXP Professional and later systems support the full capabilities of HyperThreading, although Windows 2003 Server will utilize HyperThreading logical processors. Normally, "hyperthreads=no" should only be used on systems where multiple MD/MSC Nastran jobs are run concurrently or where "parallel=2" is specified for a single MD/MSC Nastran job. For those systems, it may be useful to specify the "hyperthreads=no" keyword in one of the System RC Files or in one of the Node RC Files.

ishellext ishellext=*value*,*value*,... Default: *See text*.

Defines command processor associations for ISHELL executables. Each value is specified as "*file-type=processor*" where *processor* is the executable used by MD/MSC Nastran to execute an ISHELL program with the specified *file-type*. See "Running an ISHELL Program" on page 182 for information on using an ISHELL program and the default list of processors.

Specify two consecutive quotes, e.g., ishellext=ksh='' to specify a null *processor*, that is, to directly execute the ISHELL program.

Note: You will need protect the quotes from the shell if specified on the command line.

Specify a null *file-type* to define a processor for files without a file type.

Specify ".=""" to specify a null *file-type* and a null *processor*.

Specifying a *file-type* already defined in the table will replace the previous entry; specifying a *file-type* not yet defined in the table will append the new entry to the end of the table, that is, it will be processed last.

Note: On Windows, all executable files must have a non-null *file-type*. This is why "TPLDIR:QAISHELL" executable cannot be used on Windows, but "TPLDIR:qaishell.pl" can.

On Windows, it may be necessary to define "CMD.EXE" as the processor for certain ".EXE" files, e.g., 16-bit compiled Basic program. This can be done with "ishellext=exe=cmd"

Up to twenty associations can be defined.

This keyword may also be set with the *MSC_ISHELLEXT* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

Example:

```
prod_ver nastran example
ishellext=tcl=wish,sh=ksh
```

This example will add one association and replace another. If the ISHELL program name exists with the file type ".tcl", the wish executable will be used; if the ISHELL program name exists with the file type ".sh", the ksh executable will be used. Since neither processor specification included a pathname component, the system PATH will be searched for the executables.

ishellpath ishellpath=*value*:*value*:.. Default: See text.

ishellpath=*value*;*value*;..

Defines a list of directories to search for the ISHELL program if a suitable ISHELL program doesn't exist in the current working directory. If this list is exhausted before finding a suitable ISHELL program, the standard PATH is searched. Multiple paths are specified in the standard manner, that is "ishellpath=/*dir1*:/*dir2*:..." on UNIX and "ishellpath=*dir1*;*dir2*;..." on Windows.

If you have not set a value for "ishellpath", the value will be set to the directory containing the input data file, this automatically handles the common case where the ISHELL program is located in the same directory as the input data file referencing it.

This keyword may also be set with the *MSC_ISHELLPATH* environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

Example: *prod_ver* `nastran TPLDIR:qaishell`

Assuming no RC file set "ishellpath" and the environment variable MSC_ISHELLPATH was not defined, the "ishellpath" value will be set to the directory referenced by "TPLDIR:". MD/MSC Nastran will attempt to locate the ISHELL program in the current working directory, the TPL directory, or in the PATH.

Example: *prod_ver* `nastran example ishellpath=bin`

This example assumes either the current working directory or the bin subdirectory contains the ISHELL program

iter iter=yes, no Default: No (do not execute iterative solver)

Controls execution of iterative solver. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

jid jid=*pathname* Default: None

Specify the name of the input data file. An input file must be defined on the command line. Any command line argument that does not have a keyword is assumed to be the input file; only the last filename is used.

Example: *prod_ver* `nastran this that example`

The input file "example.dat" is used; the tokens "this" and "that" are ignored.

Note: If the input file is specified as "example" and the files "example.dat" and "example" both exist, the file "example.dat" will be chosen. In fact, it is *impossible* to use a file named "example" as the input data file if a file named "example.dat" exists.

jidpath jidpath=*path-spec* Default: None

Specify a list of directories to search if the input data file or any INCLUDE file does not specify a pathname component and does not exist in the current directory. One or more of these directories may include a "wildcard" specification, as described below, requesting sub-directory searching. On UNIX, the directory level separator character is slash ("/"). On Windows , the directory level separator character can be slash ("/") or back-slash ("\").

This keyword may also be set by the MSC_JIDPATH environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

This keyword may not be specified in a conditional section of an RC file.

It is very important to note that the directory list specified by this keyword is *not* cumulative. That is, the directory list specified by this keyword completely replaces the directory list specified by a previous instance of this keyword. However, see the description below about environment variable replacement for an example of how a cumulative definition could be specified.

UNIX example:
```
prod_ver nastran example jidpath=$HOME
```

Windows Example:
```
prod_ver nastran example jidpath=%HOMEDRIVE%%HOMEPATH%
```

These will find the file “example.dat” or “example” if it is located in either the current working directory or your home directory.

Multiple directories are specified using the standard syntax for the PATH environment variable.

Sub-directory searching is requested by specifying the "wildcard" character ("*") as the last directory component of a search path directory. If sub-directory searching is requested, the directory specification up to (but not including) the wildcard specification and *all* of its sub-directories will be searched for the input data file. Note: If there are multiple files in the sub-directories with the same filename, it is unpredictable which file will be located.

Notes:

On UNIX, the "tilde" capability is supported. That is, if a directory in the list starts with a tilde ("~"), it will be replaced with thehome directory of the current user if the tilde is the only character in the directory or if the tilde is followed by a "/". If the tilde is followed by a character string, i.e., has the form "*~name*", the entire "*~name*" specification be replaced by the home directory of user "*name*". If the home directory information cannot be determined, the directory will be skipped.

On UNIX, jidpath specifications on the command line that include any sub-directory searching requests should be enclosed in quotes to prevent the Shell from expanding the wildcard character. Quoting generally is not required for Windows.

For example:

UNIX example: *prod_ver* `nastran example jidpath=/models/a:/models/b`

Windows Example: *prod_ver* `nastran example jidpath=\models\a;\models\b`

If sub-directory searching is to be enabled for the second directory, the specification could be:

UNIX example: *prod_ver* `nastran example jidpath="/models/a:/models/b/*"`

Windows Example: *prod_ver* `nastran example jidpath=\models\a;\models\b\*`

Your specification of this value in RC files can include environment variable references. On UNIX, use the standard shell "$*name*" or "${*name*}" syntax; on Windows use the standard "%*name*%" syntax. This method, for example, could be used to implement a "cumulative" search path specification

For example, if the current keyword value (e.g., "`/new/path`") is to be added to the search path prior to the previous value, on UNIX, the keyword could be specified as:

```
jidpath=/new/path:$MSC_JIDPATH
```

and if it is to be added at the end of the previous value, on Windows, the keyword could be specified as:

```
jidpath=%MSC_JIDPATH%;/new/path
```

jidtype jidtype=*file-type* Default: dat

Specify an alternate default file-type of the input data file and any INCLUDE files.

Example: *prod_ver* `nastran example jidtype=bdf`

This example will set the default file type to “bdf”, i.e., the nastran commandwill look first for a file named “example.bdf”, and if that is not found for the file “example”; if neither file is found, an error will be reported.

If you have not defined a value for the “jidtype” keyword, the nastran command will set the keyword to the actual file type of the input data file.

Example: *prod_ver* `nastran example.bdf`

The nastran command looks for “example.bdf.dat”, if that file does not exist, it then looks for “example.bdf”. Assuming that file exists, and no other value for “jidtype” has been defined, the nastran command sets “jidtype=bdf”.

ldqrkd ldqrkd=*number* Default: 0 (Version 68+ method)

Selects the differential method for CQUAD4 and CTRIA3 elements. See the “nastran Command and NASTRAN Statement” on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

locbulk locbulk=*number* Default: 0 (RESTART FMS statement)

Specifies that special Bulk Data processing is in effect. See the “nastran Command and NASTRAN Statement” on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

lock lock=*keyword* Default: None

The “lock” keyword can be used by a site or a user to prevent modification of a keyword’s value.

For example, the following RC file lines will force all jobs to use accounting by setting the “acct” keyword on and then preventing the keyword from being changed later in an RC file, or on the command line:

Example:
```
acct=yes
lock=acct
```

Once these lines are read, any attempt to set the “acct” keyword later in the same RC file, in an RC file read after this file, or on the command line will be silently ignored. See “RC File Keywords” on page 16 in Appendix A for information on RC file and command line processing.

The “lock” keyword may appear anywhere a keyword is accepted. The lock keyword itself can be locked with “lock=lock”.

Example:
```
authorize=license-spec
lock=authorize
```

Once these lines are read, any attempt to set the “authorize” keyword later in the same RC file, in an RC file read after this file, in the environment via “MSC_LICENSE_FILE” or “LM_LICENSE_FILE”, or on the command line will be silently ignored.

lsymbol	lsymbol=*name=string*	Default:	None
	This keyword has the same general function and syntax as the "symbol" keyword except that it defines a "local" symbolic (or logical) name. Symbols defined using this keyword will not be passed to remote hosts, i.e., to hosts specified by the "node" keyword. When the "node" keyword is not specified, this keyword is synonymous with the "symbol" keyword.		
massbuf	massbuf=*number*	Default:	See the *MD Nastran Quick Reference Guide*.
	Sets half the number of buffers to set aside for storing the mass matrix in memory. This keyword may also be set with the “sys199" command line keyword. See the *MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.		
maxnode	maxnode=*number*	Default:	Value of dmparallel parameter
(AIX)	Specifies the maximum number of hosts to be used when a pool request is being used. It is required if you want more than one DMP task to be assigned to a single host in pool. The default pool processing will only assign one DMP task to each host.		
maxlines	maxlines=*number*	Default:	999999999
	Specifies the maximum number of output lines. See the “nastran Command and NASTRAN Statement” on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.		
memmin	memmin=value	Default:	16mb
	Allows you to define the lower bound for all memory estimates. This bound is applied after the "memco" value, that multiplies the actual estimate by a "conservatism" factor.		
	Example:		*prod_ver* `estimate example memmin=8mb`
	This will set the minimum memory estimate to 8 MB.		
	This keyword may also be set with the MP_NODES environment variable. The environment variable overrides the RC files; the command line overrides the environmental variable.		
memory	memory=*size*	Default:	estimate

Note: See “Determining Resource Requirements” on page 88 for information on estimating a job’s memory requirements.

Specifies the amount of open core memory to allocate. If "memory=estimate" is specified, ESTIMATE will be used to determine *size*. If "memory = max" is specified for SOL 101 or SOL 400 then memory will be set to approximately 75% of physical ram. "Estimate" will be used to estimate the memory needed for the solver. The remaining memory will be assigned to SMEM. This option should only be used by users running on a system by themselves. Multiple users specifying "mem=max" may experience significant performance degradation. Otherwise, the *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85.

If a value was not assigned to the "memory" keyword, or if "memory=estimate" was specified and ESTIMATE failed to provide an estimate, the nastran command will use the value specified by the "memorydefault" keyword. If the "memorydefault" value is null, the nastran command will issue a fatal error and the job will end.

Example: *prod_ver* `nastran example memory=25mw`

The job is run using an open core memory size of 25 MW, or 25600 KW, or 26214400 words.

Example: *prod_ver* `nastran example memory=0.5xPhysical`

If run on Windows, the job is run using an open core memory size of half the computer's physical memory. If run on UNIX and the computer's physical memory was not defined using the "s.pmem" keyword, the job will fail.

memorydefault memorydefault=*size* Default: 8mw

Specifies the default memory size if a null value was defined for the "memory" keyword, or "memory=estimate" was defined and the ESTIMATE utility failed to provide an estimate.

Note: If a null value is defined for "memorydefault" and it is used as described above, the job will not start.

memorymax memorymax=*size* Default: UNIX: 0.8*physical
Windows: 1.2*physical

Specifies the maximum memory size that may be requested. Any request in excess of this will be limited to the "memorymaximum" value. See "Specifying Memory Sizes" on page 85 for MD/MSC Nastran's maximum memory limits.

Note: If *size* includes a reference to "physical" or "virtual", and the value is not known, the "memorymaximum" value will be silently ignored.

In the following examples, assume "memorymaximum=1gb" was set in an RC file.

Example: *prod_ver* `nastran example memory=900mb`

The job is run using an open core memory size of 900MB.

Example:

```
prod_ver nastran example
memory=1200mb
```

The job is run using an open core memory size of 1GB, i.e., the "memorymaximum" value set in the RC file.

mergeresults mergeresults=yes,no Default: Yes

Specifies the results from each DMP task are to be merged into the standard files from the master host.

Setting "mergeresults=yes" will cause the output from all tasks to appear in the output files for the master task. That is, as if the analysis were run with one task.

Setting "mergeresults=no" will cause the output from each tasks to appear task-specific output files. That is, each file will need to be examined to get all results.

Note:

If "mergeresults=no" is specified in a static run the results of the individual domains will not be sent back to the master and the system solution will not be obtained.

The keyword "mergeresults" has no affect on a solution 103 or 111 run.

The only circumstances where "mergeresults=no" is recommended is where xdb files are requested and intended to be attached using Patran in solution 108.

In solution 108, if "mergeresults=no" is specified and "slaveout=yes" is not specified, then the results of the slave processors will be lost.

In solution 108, it is possible to get a through-put advantage by saving communication between the master and slaves when "mergeresults=no" and "slaveout=yes" is specified.

metime metime=*number* Default: -1

Minimum time for execution summary table message. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

mindef mindef=*number* Default: 1 (do not check)

Indefinite Mass Matrix Check flag. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

minfront minfront=*number* Default: Machine dependent

Set the rank minimum front size in the sparse modules. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword. This value may also be set with the "rank" keyword.

mio_cachesize mio-cachesize=size Default: 0

(AIX) Specifies the size of mio cache to be used.

mode mode=i4,i8,ilp64,ilp32,base,no Default: Machine dependent

(AIX, HPUX, HPUXIPF, LINUXIPF, LINUX64, SOLARIS)

Changes the default INTEGER mode for a platform from the default to the specified value, where "ilp64" is equivalent to "i8", "lp64" and "ilp32" are equivalent to "i4" and "base" or "no" specify that the default is to be used. If alternate INTEGER mode is not supported on a particular platform and if this keyword is specified, "User Information Message" is used and this keyword is ignored. This keyword may only be specified in the initialization file or on the command line.

Example: `mode=i8`

Specifies that "i8" INTEGER mode is to be used for this job.

rmode=i4,i8,ilp64,lp64,ilp32,base Default: Machine Dependent

no

Specifies the remote node INTEGER mode. This keyword value is passed to a remote node as its "mode" keyword value. This keyword is ignored unless "node" is specified.

Example: `rmode=i8`

Specifies the "mode=i8" is to be passed to the remote node specified using the "node" keyword.

mperturb mpreturb=*number* Default: 1 (do not perturb)

Set the perturbation factor for indefinite mass matrix. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

mpyad mpyad=*number* Default: See the *MD Nastran Quick Reference Guide*.

Selects/deselects multiplication method selection. This keyword may also be set with the "sys66" command line keyword. See the *MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

msgbell msgbell=yes, no, bell Default: Yes

Specifies whether or not the job completion string will include an audible message ("bell" sound) or not. "Yes" or "bell" says that three "bell" sounds will be appended to the job completion string. "No" suppresses the bell sounds.

msgcat msgcat=*pathname* Default: UNIX: *install_dir*/*prod_ver*/*arch*/analysis.msg

Windows: *install_dir**prod_ver**arch*\analysis.msg

The "msgcat" keyword specifies an alternate message catalog containing the message text used for many MD/MSC Nastran messages. A site or user can modify the message file to include message text that is more appropriate to their operations, compile the new catalog using the MSGCMP utility, and invoke the new catalog using this keyword.

Example:

```
prod_ver nastran example
msgcat=mycat.msg
```

This example will use the file "mycat.msg" as the message catalog. See the sections titled "Customizing the Message Catalog" on page 58 and "MSGCMP" on page 215 for additional information.

Note: Message catalogs are computer-dependent, "Binary File Compatibility", identifies the systems that are binary compatible; binary compatible systems can use the same message file.

nastran nastran *keyword=value* Default: None

Specifies a value for the NASTRAN statement.

Note: This keyword can only be specified in an RC file. If the last character of the keyword value is a comma, or a quote or parenthetic expression is open, the next line in the RC file is considered a continuation. The statement will continue until the quote or parenthetic expression is closed and a line that is not ended by a comma is found.

ncmd ncmd=*command* Default: print *msg* | write *user tty*

Specifies an alternate job completion notification command (see the "notify" keyword). If this keyword is being set on the command line, and *command* contains embedded spaces, enclose *command* in quotes.

If the specified command contains the two-character sequence {}, the sequence is replaced by the text "MD/MSC Nastran job *name* completed".

Note: The following example may not work on your system. The "mail(1)" utility on HP-UX does not accept the "-s" option.

Example:

```
prod_ver nastran example
notify=yes
ncmd="print {} |
mail -s {} $(whoami)"
```

At the end of the job, mail is sent to the user submitting the job. The braces in the “ncmd” value are replaced by the job completion text, and the modified command is run:

```
print "MSC/NASTRAN job example completed" |
mail -s "MSC/NASTRAN job example completed" user
```

Windows example: *prod_ver* `nstran example "ncmd=echo done"`

The word “done” will be printed in the command window when the job completes.

newhess newhess=*number* Default: See the *MD Nastran Quick Reference Guide*.

Requests the complex eigenvalue method. This keyword may also be set with the “sys108" command line keyword. See “EIGC” on page 1776 of the *MD/MSC Nastran Quick Reference Guide*, and the ***MD/MSC Nastran Numerical Methods User’s Guide*** for information on the default value and legal values for this keyword.

news news=yes,no,auto Default: Yes

Displays the news file (*install_dir*/*prod_ver*/nast/news.txt on UNIX and *install_dir**prod_ver*\nast\news.txt on Windows) in the F06 file. If “auto” is specified, the news file is only displayed if it has been modified since the last time it was displayed for you. If “yes” is specified, the news file is displayed in the F06 file regardless of when it was last changed. If “no” is specified, the news file is not displayed in the F06 file.

Example: *prod_ver* `nastran example news=yes`

The news file is displayed in the F06 file after the title page block.

Note: The news file can also be displayed on the terminal by using the command:

prod_ver `nastran news`

nice nice=yes,no Default: no (Windows)
yes (UNIX, batch=yes)
no (UNIX, batch=no)

Species whether or not the priority of the MD/MSC Nastran analysis process should be reduced or not.

For Windows systems, "nice=yes" means that the priority of the analysis process will be changed to one level below standard command priority.

For UNIX systems, the default behavior, as determined by the initial settings for the “-fg” and “-bg” special queue names described in “Customizing Queue Commands (UNIX)” on page 64 is as follows: "nice=yes" means that the analysis process will berun by the "nice" command regardless of the setting of the “batch” keyword, “nice=no” means that the analysis process will not have its priority reduced, regardless of the setting of the “batch”keyword. This behavior may be modified if the default definitions of the “-bg” and “-fg” queue names are changed.

nlines nlines=*number* Default: 50

Specifies number of lines printed per page of output. See the “nastran Command and NASTRAN Statement” on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

node node=*nodename* Default: None

Executes the job on the specified node. This node may be either a UNIX node or Windows XP/Vista/Window 7 node. See “Running a Job on a Remote System” on page 136 for additional information. This keyword may only be specified on the command line.

Use the "username" keyword to specify an alternate user name on the remote node.

Example: *prod_ver* `nastran example node=othernode`

The job is run on the computer named "othernode".

If the remote node is a UNIX node, rsh/rcp processing must be enabled.

If the remote node is a Windows node running Windows XP/Vista/Window 7, the MSCRmtMgr program must be running on that node, either as a started service or as a program running in a command prompt window.

notify notify=yes,no Default: Yes

Sends notification when the job is completed. See the “ncmd” keyword to define an alternate notification command.

Note: If the job is queued using the “queue” keyword, or the job is already running in an NQS batch job, the default is “notify=no”.

Example: *prod_ver* `nastran example notify=yes`

nsegadd nsegadd=*number* Default: 2

Number of segments in the element error table in adaptive analysis. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

numseg numseg=*number* Default: See text.

Sets the number of segments for the Lanczos High Performance Option. See "EIGRL" on page 1786 of the *MD/MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

Note: In a DMP job, the default is the number of tasks specified by the "dmparallel" keyword.

old old=yes,no Default: Yes

Saves previous copies of the F04, F06, LOG, OP2, OUT, PCH, and PLT output files using sequence numbers (additional user-specified file types can be versioned with the "oldtypes" keyword). Sequence numbers are appended to the keyword filename and are separated by a period.

If "yes" is specified, the highest sequence number of each of the output files is determined. The highest sequence number found is incremented by one to become the new sequence number. Then, all current output files that do not include sequence numbers are renamed using the new sequence number as a type.

Example: *prod_ver* `nastran example old=yes`

For example, assume your current working directory contains the following files:

```
v2401.datv2401.f04.1v2401.f06v2401.logv2401.log.1
v2401.f04v2401.f04.2v2401.f06.1v2401.log.1
v2401.log.3
```

Apparently, the user ran the job four times, but deleted some of the files, e.g., v2401.f04.3, v2401.f06.2, and v2401.f06.3. When the job is run again with "old=yes", the files are renamed as follows: v2401.f04 is renamed to v2401.f04.4, v2401.f06 is renamed to v2401.f06.4, and v2401.log is renamed to v2401.log.4. The sequence number 4 is used because it is one greater than the highest sequence number of all of the selected files (the highest being v2401.log.3).

oldtypes oldtypes=*list* Default: None

Specifies additional file types that will be subject to versioning and deletion via the "old" keyword. The items in thelist may be separated by either spaces or commas; they should not includethe leading ".". You may specify file types that do not exist.

Example: *prod_ver* `nastran example oldtypes=xdb,mytype`

The files "example.xdb" and "example.mytype" will be subject to versioning or deletion as specified by the "old" keyword.

This keyword may also be set by the MSC_OLDTYPES environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

out out=*pathname* Default: .

Saves the output files using a different file prefix or in a different directory. If "out" is not specified, the output files are saved in the current directory using the basename of the input data file as a prefix. If the "out" value is a directory, output files are created in the specified directory using the basename of the input data file as the filename.

In the following examples, assume the current directory includes sub-directories "mydir" and "other", and that an "example.dat" exists in both the current directory and "other". That is, ./example.dat, ./mydir, ./other, and ./other/example.dat exist on UNIX; and .\example.dat, .\mydir, .\other, and .\other\example.dat exist on Windows.

Example: *prod_ver* `nastran example`

or: *prod_ver* `nastran other/example`

Output files are created in the current directory with the name "example", e.g., ./example.f06 on UNIX and .\example.f06 on Windows.

Example: *prod_ver* `nastran example out=myfile`

Output files are created in the current directory with the name "myfile", e.g., ./myfile.f06 on UNIX and .\myfile.f06 on Windows.

Example: *prod_ver* `nastran example out=mydir`

Output files are created in the mydir directory with the name “example”, e.g., ./mydir/example.f06 on UNIX and .\mydir\example.f06 on Windows.

Example: *prod_ver* `nastran example out=mydir/myfile`

Output files are created in the mydir directory with the name “myfile”, e.g., ./mydir/myfile.f06 on UNIX and .\mydir\myfile.f06 on Windows.

parallel parallel=*value* Default: 0

Specifies the maximum number of CPUs selected for shared-memory parallel (SMP) processing in several numeric modules. SMP processing reduces elapsed time at the expense of increased CPU time. The default is 0, which specifies no SMP processing. If “parallel=1", the parallel algorithms are used on one processor.

Note: If you need to vary the number of SMP CPUs during a job, you must set either the “parallel” keyword or SYSTEM(107) on a NASTRAN statement to the maximum number of SMP CPUs that will be requested. Some systems cannot process a DMAP request for CPUs in excess of this initial value.

Example: *prod_ver* `nastran example parallel=2`

The job is run in SMP mode on a maximum of two CPUs.

pause pause=keyword Default: no

Pause the nastran command before exiting to wait for the “Enter” or “Return” key to be pressed. This can be useful when the nastran command is embedded within another program. The values are “fatal”, “information”, “warning”, “yes”, and “no”. Setting “pause=yes” will unconditionally wait; “pause=fatal”, “pause=warning”, and “pause=information” will only wait if a fatal, warning, or information message has been issued by the nastran command. The default is “pause=no”, i.e., do not wait when the nastran command ends.

post post=*command_string* Default: None

Runs the specified command after the job has completed and after the F06, F04, and LOG files have been concatenated if “append=yes” is specified. For UNIX, the command must be a valid Korn shell command. The command may pipe the output of one command into another. If the specified command contains embedded spaces, enclose the entire *command_string* in quotes. Each occurrence of the “post” keyword will be concatenated together to form a sequence of commands. Specify a null value, i.e., “post=” to erase all of the previously entered commands. Typical uses of this keyword are to run postprocessing programs or to compress the output files to save space.

UNIX example:

```
prod_ver nastran example
post='gzip example*'
```

At the end of the job, the command "gzip example*" is run to compress all files beginning with "example".

The value of the "out" keyword is available for use by the "post" keyword. The example "post" keyword could also have been written as post='gzip $MSC_OUT.*'. If app=yes was specified, post='gzip $MSC_OUT.out' would only compress the output file.

Windows example:

```
prod_ver nastran example
post="print example.*"
```

At the end of the job, all files named "example.*" will be printed. The output of the post command(s) will be displayed on the command shell window.

See the"Environment Variables" on page 104 for a list of environment variables that may be used in the post command.

Note: In order to allow the "post" keyword to operate on the output files, the standard output from the post commands is not written to the output files.

ppcdelta (UNIX) ppcdelta=*time* Default: None

Note: The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.

Specifies the amount of time to subtract from the specified CPU time to determine the per-process CPU time limit. This subtraction will ensure that MD/MSC Nastran does not consume all of the time allocated to the job.

The value can be specified as either "*hours*:*minutes*:*seconds*", "*minutes*:*seconds*", or "*seconds*", and will always be converted to the number of seconds.

Example:

```
prod_ver nastran example
queue=small cpu=1000
ppcdelta=5
```

The job is submitted to the small queue with a total CPU time limit of 1000 seconds; the MD/MSC Nastran job will be limited to 995 seconds.

ppmdelta (UNIX) ppmdelta=*memory_size* Default: 105% of executable size

Note: The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.

Specifies the amount of memory to add to the “memory” value to determine “ppm”, the per-process memory value. The per-process limit is the total amount of memory that each process may acquire. This includes the executable, open core memory (via the“memory” keyword), disk file buffers, and etc. (Altix systems also include EAG FFIO cache).

The *size* is specified as a memory size, see “Specifying Memory Sizes” on page 85.

If *size* is less than 1000, then “ppmdelta” equals *size* divided by 100 and multiplied by the size of the executable,i.e., 105 specifies the default 105% of executable size.

If *size* is greater than 1000, but less than the size of the executable, then “ppmdelta” equals *size* plus the executable size.

If *size* exceeds the size of the executable, then “ppmdelta” equals *size*.

Example:

```
prod_ver nastran example
queue=small mem=100m
ppmdelta=10m
```

The job is submitted to the small queue with a open core size of 100 MW, and a per-process memory limit of 110 MW.

pre

pre=*command* Default: None

Runs the specified command before the job begins. For UNIX, the command must be a valid Korn shell command. The command may pipe the output from one command to another. If the specified command contains embedded spaces, enclose the entire *command* in quotes. Each occurrence of the “pre” keyword will be concatenated together to form a sequence of commands. Specify a null value, i.e., “pre=” to erase all of the previously entered commands.

UNIX example:

```
prod_ver nastran example \
pre="print Job beginning |
mail $(whoami)"
```

Sends mail to the submitting user immediately before beginning the job.

Windows example:

```
prod_ver nastran example
pre="dir example.*"
```

At the end of the job, a directory listing of all files named “example.*” will be displayed in the LOG file.

See “Environment Variables” on page 104, for a list of environment variables that may be used in a “pre” command.

prmdelta (UNIX)

prmdelta=*size* Default: 5120

Note:	The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.
	Specifies the amount of memory to add to the specified "ppm" value to determine "prm", the per-request or per-job memory value. The per-job limit is the total amount of memory that all processes in the job may acquire. This includes the MD/MSC Nastran process plus any other concurrent or parent processes. The minimum value is 5120. The *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85. Example: *prod_ver* `nastran example queue=small prmdelta=10k` The per-job memory limit is 10 KW larger than the per-process memory limit.
processor	processor=*file_type* Default: Computer dependent Specifies the file type of the solver executable. On some computers, MSC Nastran provides more than one executable. The baseline executable has the filename "analysis" on UNIX and "analysis.exe" on Windows. Other, advanced-architecture executables are named "analysis.*file_type*" on UNIX and "analysis.*file_type*.exe" on Windows, e.g., "analysis.power2" on AIX or "analysis.ultra" on Solaris systems. The nastran command will select the correct executable based on the current computer. In some cases, it may be desirable to use one of the other executables. For example, to run the baseline executable on an advanced system, specify "proc=". To run an advanced-architecture on a new computer not correctly identified by the nastran command, specify "proc=*file_type*".
Note:	This keyword overrides the processor selection logic. Specification of an incompatible executable may cause errors or incorrect operations.
punch	punch=*number* Default: 7 Specifies FORTRAN unit number for PUNCH file. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.
q4skew	q4skew=*number* Default: 30.0 Minimum allowable value of skew for the CQUAD4 element. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.
q4taper	q4taper=*number* Default: 30.0 Maximum allowable value of taper for the CQUAD4 element. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

qclass	qclass=*string*	Default: None
(UNIX)	The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.	
Note:	Defines an optional queue class that can be used in the definition "submit" keyword. It is also used to define the class used when submitting DMP jobs to the AIX LoadLeveler.	
qoption	qoption=*string*	Default: None
(UNIX)		
Note:	The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.	
	Defines the options to add to the queue submittal command. See the "submit" keyword.	
	Example:	*prod_ver* `nastran example queue=small qoption=-mu`
	The job is run with the additional job submission parameter "-mu" if the keyword reference %qopt% was included in the queue's command definition.	
quadint	quadint=*number*	Default: 0 (quadratic)
	Specifies quadratic or linear interpolation for line search method in nonlinear analysis. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.	
queue	queue=*string*	Default: None
(UNIX)		
Note:	The following capability is dependent upon the queue submission commands defined by the "submit" keyword and your queuing system. The capability or examples may not work on your system.	
	Specifies the name of the queue to use for job submittal. This keyword requires the submit keyword to define the available queues and queue submittal commands. See the "submit" keyword.	
	Example:	*prod_ver* `nastran example queue=small`
	This example submits the job to the small queue.	
radlst	radlst=*number*	Default: 0

Print radiation area summary. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

radmtx radmtx=*number* Default: 0

Type of radiation exchange coefficients. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

rank rank=*number* Default: See "System Descriptions" on page 115

Sets both SYSTEM(198) and SYSTEM(205) to the specified value. SYSTEM(198) and SYSTEM(205) set the minimum front size and number of rows that are simultaneously updated, respectively, in sparse symmetric decomposition and FBS. The sparse solver will build a front, a *k* *k* sub matrix, until *k* is at least as large as SYSTEM(198). Once a sufficiently large front has been built, it is updated *m* rows at a time, where *m* is the value of SYSTEM(205).

For best performance, $SYSTEM(205) \geq SYSTEM(198)$. The optimal values for these system cells is problem and processor dependent; the default values for these system cells are set to processor-dependent values.

The actual value used for SYSTEM(205) may be found in the F04 file in the text of USER INFORMATION MESSAGE 4157 as the RANK OF UPDATE value. See Table D-11 for the default values of these system cells.

rcf rcf=*pathname* Default: None

Specifies the name of the local RC file. If this keyword is not specified, the local RC files located in the input data file's directory are used. See "Command Initialization and Runtime Configuration Files" on page 2 in Appendix A for information about the names of these files.

Example: *prod_ver* `nastran example rcf=nast.rcf`

The nastran command will process ./nast.rcf on UNIX, or .\nast.rcf on Windows in lieu of the default local RC files.

rcmd rcmd=*pathname* Default: See text.

(UNIX)

Specifies the path of the nastran command on the remote system when remote processing has been requested via the "node" keyword. If this value is not set, the nastran command will first try its own absolute path on the remote system, if this fails, the path will be removed, i.e., the default PATH of the remote system will be used.

Example: *prod_ver* `nastran example rcmd=/msc/bin/nast2007`

The pathname of the nastran command on the remote system is explicitly defined as /msc/bin/nast2007. If this file does not exist, or is otherwise not executable, the job will fail.

rdbs rdbs=*pathname_prefix* Default: .

Remote Node alternate user database prefix. Overrides "scratch=yes" and "dbs=". If the prefix is a directory, 'jid-basename' is appended. The default on the remote node is "dbs=./'jid-basename'". This keyword is ignored unless "node=" is specified.

rdelivery rdelivery=*pathname*, MSCDEF Default: MSCDEF

Remote Node alternate delivery database prefix or "MSCDEF". This keyword overrides all MSC-supplied solution sequences. See "Creating and Attaching Alternate Delivery Databases" on page 190 for further information on alternate delivery databases. If a directory is not specified, the default delivery database directory is assumed. The default is "rdelivery=MSCDEF. This keyword is ignored unless "node=" is specified.

real real=*size* Default: See text.

Specifies the amount of open core memory that certain numerical modules will be restricted to. This keyword may be used to reduce paging, at the potential expense of spilling. The keyword may also be set with the "sys81" keyword. See the *MSC Nastran Quick Reference Guide* for further information.

The *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85.

On UNIX systems, the default is "0". On Windows systems, the default is calculated using "realdelta".

realdelta realdelta=*size* Default: 12MB

(Windows)

Specifies the difference between physical memory and the "real" parameter if neither "real" nor "sys81" were set.
The *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85.
If *size* is greater than 1000, the value is subtracted from the physical memory size.
If *size* is less than 1000, it is assumed to be a percentage of the physical memory size.

Example: *prod_ver* `nastran example realdelta=50`

The "real" value will be set to 50% of the physical memory if no value has been assigned to "real" or SYSTEM(81).

repinfo repinfo=*info_value* Default: 1

Specifies the Symbolic Substitution report level. This information is printed at the end of the .f06 file, after the "END OF JOB" record. This keyword may be specified in initialization or RC files and on the command line. A value of 0 suppresses the report entirely. The maximum value is 8.

repsym repsym=*name*=*string* Default: None

Defines a Symbolic Substitution variable name and value. This keyword may be specified in initialization or RC files and on the command line. The symbol definition may include references to previously defined symbols or environment variables using the standard "$*name*" or "${*name*}" syntax on UNIX or %*name*% syntax on Windows. For convenience, the character separating the "repsym" and "*name*" specification and the "*name*" and "*string*" specification may be either an equal sign ("=") or a hash mark ("#"). The use of a hash mark allows this keyword to be specified as an argument to a Windows .bat file.

Symbolic Substitution names are processed in the order they are encountered while processing the initialization and RC files and the command line. If a duplicate name is encountered, the new value replaces the previously specified value.

Symbolic names must be 16 characters or less, the value assigned to the symbolic name must be 256 characters or less.

repwidth repwidth=*width_spec* Default: exact,exact

Specifies the width information to be used in Symbolic Symbol substitution. This keyword may be specified in initialization or RC files and on the command line.

resd resd=yes,no Default: Yes

(AIX) Use the Resource Manager to allocate nodes.

This keyword may also be set by the MP_RESD environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

rexecutable rexecutable=*pathname* Default: Computer dependent

Remote Node alternate solver executable. This keyword overrides all architecture and processor selection logic. If a directory is not specified, the default executable directory is assumed. This keyword is ignored unless "node=" is specified.

rgmconn rgmconn=*pathname* Default: None

Remote Node Geometric evaluator connection file. See the description of the "gmconn" keyword for more detailed information. This keyword is ignored unless "node=" is specified.

rmpool rmpool=*number* Default: See your System Administrator.

(AIX) Specifies the pool ID to be used when LoadLeveler Version 2.1 or greater queue submittal is being used to run a DMP job.

This keyword may also be set with the MP_RMPOOL environment variable. The environment variable overrides the RC files; the command line overrides the environment variable.

rmsgcat rmsgcag=*pathname* Default: See msgcat= keyword

Remote Node binary message catalog path name. If a directory is not specified, the default executable directory is assumed. This keyword is ignored unless "node=" is specified.

rdebug rdebug=yes, no, number Default: Yes

This keyword controls what, if any, debug settings ("-d" options) are propagated to a remote node. "Yes" will send all current debug flags (except for "SHELL" and "RSHELL"), "no" will not pass any current debug flags. Specifying a number will set the remote debug flags to that value, where a value of "0" is equivalent to "no". This keyword is ignored unless "node" is specified.

rostype rostype=windows, nt, 1, unix, linux, 2 Default: None

Specifies the remote node operating system type. "Windows", "NT" and "1" are equivalent. "Unix", "Linux" and "2" are equivalent. If this keyword is not specified, the nastran command will attempt to determine the remote node operating system type dynamically. This type code is used to determine the format of the remote commands used, forexample, to test for file existence or to delete temporary files on the remote node. Also, if "rrmtuse" is not specified, this keyword will determine what communications programs are used, where "Windows" is equivalent to "rrmtuse=mscrmtcmd" and "Unix" is equivalent to "rrmtuse=rsh". This keyword is ignored unless "node" is specified.

rrmtuse rmtuse=mscrmtcmd, 1, rsh, 2 Default: None

Specifies which communications programs are to be used to accessthe remote node. "Mscrmtcmd" and "1" are equivalent. "Rsh" and "2" are equivalent. If "rsh" is specified, the remote node will be assumed to be a UNIX system. If this keyword is not specified and if the "rostype" keyword is specified, "mscrmtcmd" will be assumed if the "rostype" value is "windows" and "rsh" will be assumed if the "rostype" value is "unix". This keyword is ignored unless "node" is specified.

rsdirectory rsdirectory=*pathname* Default: See sdirectory= keyword

Remote Node directory for scratch files. This is the default directory for user database files if "scratch=yes". If this keyword is not specified, the "sdirectory" value is used. Please see the description of the "sdirectory" keyword for the default value. This keyword is ignored unless "node=" is specified.

rtimeout rtimeout=*number* Default: 60

Specifies the timeout value, in seconds, to be used by "MSCRmtCmd" (or the program defined by the "s.rmtcmd" keyword) in accessing a remote node. This keyword is ignored unless "node" is specified.

s.rmtcmd s.rmtcmd=*pathname* Default: MSCRmtCmd

Specifies the full pathname to the MSC Remote command used to communicate with Windows or UNIX/Linux systems. This keyword may only be specified in the Initialization file or on the command line. This keyword is ignored unless "node" is specified.

scr300 scr300=*number* Default: 2 (create)

Requests creation of SCR300 partition on SCRATCH DBset. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

scr300co scr300co=*value* Default: 1

Allows you to define a factor to scale SCR300 estimates. This scale factor is applied before the "scr300min" value, that provides a lower bound for SCR300 estimates.

Example: *prod_ver* `estimate example scr300co=2`

This will double the SCR300 disk estimate and then apply the "scr300min" lower bound.

Example: *prod_ver* `estimate example scr300co=0.5`

This will halve the SCR300 disk estimate. An estimate less than the lower bound specified by "scr300min" will be set to the lower bound.

scr300del scr300del=*number* Default: 100

Sets minimum number of blocks of SCR300 partition of SCRATCH DB set at which it is deleted. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

scr300min scr300min=value Default: 1mb

Allows you to define the lower bound for all SCR300 estimates. This bound is applied after the "scr300co" value, that multiplies the actual estimate by a "conservatism" factor.

Example: *prod_ver* `estimate example scr300min=2mb`

This will set the minimum SCR300 disk estimate to 2 MB.

scratch scratch=yes,no,mini,post Default: No

Deletes the database files at the end of the run. If the database files are not required, "scratch=yes" can be used to remove them preventing cluttering of the directory with unwanted files. If "mini" is specified, a reduced size database that can only be used for data recovery restarts will be created. See Chapter 12 of the *MD/MSC Nastran Reference Manual* for further details on the "mini" database. If scratch=post is specified, a reduced size database intended for use by Patran or the toolkit will be created. Scratch=post also performs the actions of NASTRAN INDEX=19.

Example: *prod_ver* `nastran example scratch=yes`

All database files created by the run are deleted at the end of the job in the same way as the FMS statement INIT MASTER(S).

scratchco scratchco=*value* Default: 1

Allows the user to define a factor to scale SCRATCH estimates. This scale factor is applied before the "scratchmin" value, that provides a lower bound for SCRATCH estimates.

Example: *prod_ver* `estimate example scratchco=2`

This will double the SCRATCH disk estimate and then apply the "scratchmin" lower bound.

Example: *prod_ver* `estimate example scratchco=0.5`

This will halve the SCRATCH disk estimate. An estimate less than the lower bound specified by "scratchmin" will be set to the lower bound.

scratchmin scratchmin=*value* Default: 1mb

Allows you to define the lower bound for all SCRATCH estimates. This bound is applied after the "scratchco" value, that multiplies the actual estimate by a "conservatism" factor.

Example: *prod_ver* `estimate example scratchmin=2mb`

This will set the minimum SCRATCH disk estimate to 2 MB.

scrsave scrsave=*number* Default: 0 (do not reuse)

Lanczos High Performance Option that controls reuse of scratch files in segment logic. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

sdball sdball=*size* Default: Computer dependent

Specifies an alternate default size for the DBALL DBset. The computer-dependent default is listed in "Computer Dependent Defaults" on page 125. This default is overridden by an INIT FMS statement. If the value "sdball=estimate" is specified, ESTIMATE will be used to determine a suitable default.

The size is specified as the number of blocks (BUFFSIZE words long) or the number of words or bytes followed by one of the modifiers: "T", "TW", "TB", "G", "GW", "GB", "M", "MW", "MB", "K", "KW", "KB", "W", "B". See ""Specifying Memory Sizes" on page 85 for a description of these modifiers.

Note: No attempt is made to verify if the DBALL DBset can ever grow to the size specified by this keyword.

Example:

```
prod_ver nastran example sdball=1024gb
```

Defines the default size of the DBALL DBset as 1TB.

Example:

```
prod_ver nastran example sdball=.5tb
```

Defines the default size of the DBALL DBset as .5TB or 512GB.

sdirectory sdirectory=*directory* Default: *See text.*

Note: See "Determining System Limits" on page 50 for information on estimating a job's total disk space requirements.

Specifies the directory to use for temporary scratch files created during the run. MD/MSC Nastran can createvery large scratch files, the scratch directory should contain sufficient space to store any scratch files created during a run. You must have read, write, and execute privileges to the directory.

UNIX: The default value is taken from the TMPDIR environment variable if it is set to a non-null value. Otherwise the computer's default temporary file directory is chosen; this is usually /tmp.

Windows: The default value is taken from the TEMP environment variable.

UNIX example:

```
prod_ver nastran example sdir=/scratch
```

Scratch files are created in the /scratch directory.

Windows example:

```
prod_ver nastran example sdir=d:\scratch
```

Scratch files are created in the d:\scratch directory

If a DMP run was selected with *dmparallel* ≥ 1 , unique task-specific scratch directories may be set for each host using the standard PATH separator, i.e, ":" on UNIX and ";" on Windows, to separate entries. The directories will be paired with each host in a round-robin order, that is, the list will be reused if more tasks than directories are specified.

See "Running Distributed Memory Parallel (DMP) Jobs" on page 145 for additional information.

UNIX example:

```
prod_ver nastran example
dmp=4 \
sdir=/scratch1:/scratch2
```

In this example, /scratch1 will be used for the first and third tasks, while /scratch2 will be used for the second and fourth tasks.

slaveout slaveout=yes,no Default: No

Specifies the output files from the slave nodes are to be copied back to the local node.

smaster smaster=*size* Default: Computer dependent

Specifies an alternate default size for the MASTER DBset. The computer-dependent default is listed in "Computer Dependent Defaults" on page 125. This default is overridden by an INIT FMS statement.

The size is specified as the number of blocks (BUFFSIZE words long) or the number of words or bytes followed by one of the modifiers: "T", "TW", "TB", "G", "GW", "GB", "M", "MW", "MB", "K", "KW", "KB", "W", "B". See "Specifying Memory Sizes" on page 85 for a description of these modifiers.

Note: No attempt is made to verify if the MASTER DBset can ever grow to the size specified by this keyword.

Example:

```
prod_ver nastran example
smaster=1024gb
```

Defines the default size of the MASTER DBset as 1TB.

Example:

```
prod_ver nastran example
smaster=.5tb
```

Defines the default size of the MASTER DBset as .5TB or 512GB.

smemory smemory=*value* Default: 100

Specifies the amount of space in open core to reserve for scratch memory.

The size is specified as the number of blocks (BUFFSIZE words long) or the number of words or bytes followed by one of the modifiers: "T", "TW", "TB", "G", "GW", "GB", "M", "MW", "MB", "K", "KW", "KB", "W", "B". See "Specifying Memory Sizes" on page 85 for a description of these modifiers. The value specified using this keyword may be overridden by the FMS statement INIT SCRATCH (MEM=value).

Example: *prod_ver* `nastran example smem200`

This example reserves 200 GINO blocks for scratch memory.

Example: *prod_ver* `nastran example smem=4mw`

This example reserves 4,194,304 words for scratch memory.

Example: *prod_ver* `nastran example smem=2.5mw`

This example reserves 2,621,440 words for scratch memory.

solve solve=*number* Default: -1 (print up to 50 messages)

Controls matrix decomposition. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

sparse sparse=*number* Default: See QRG.

Sparse matrix method selection. This keyword may also be set with the "sys126" command line keyword. See the *MD Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

sscr sscr=*size* Default: Computer dependent

Specifies an alternate default size for the SCRATCH DBset. The computer-dependent default is listed in "Computer Dependent Defaults" on page 125. This default is overridden by an INIT FMS statement. If the value "sscr=estimate" is specified, ESTIMATE will be used to determine a suitable default.

The size is specified as the number of blocks (BUFFSIZE words long) or the number of words or bytes followed by one of the modifiers: "T", "TW", "TB", "G", "GW", "GB", "M", "MW", "MB", "K", "KW", "KB", "W", "B". See "Specifying Memory Sizes" on page 85 for a description of these modifiers.

Note: No attempt is made to verify if the SCRATCH DBset can ever grow to the size specified by this keyword.

Example: *prod_ver* `nastran example sscr=1024gb`

Defines the default size of the SCRATCH DBset as 1 TB.

Example: *prod_ver* `nastran example sscr=.5tb`

Defines the default size of the SCRATCH DBset as .5TB or 512GB.

submit (UNIX)

submit=[*list*=]*definition* Default: None

Defines the command and options used to run a job when the "queue" keyword is specified. The "submit" keyword, only specified in RC files, consists of an optional queue list, followed by the command definition for the specified queues as shown below:

```
submit=list=command
submit=command
```

When specified, the *list* contains one or more "queue" names separated by commas. If a queue list is not supplied, the *command* applies to all queues.

The *command* section of the "submit" keyword value defines the *command* used to run a job when a "queue" keyword is supplied that matches a queue name in the *list*. The *command* can contain keyword names enclosed in percent "%" signs that are replacedwith the value of the keyword before the command is run. A complete description of the *command* is found in "Customizing Queue Commands (UNIX)" on page 64.

sun_io (Solaris)

sun_io=*name*=*string* Default: None

Enables Sun's enhanced library for database I/O.

Note: For maximum performance, the striped file system containing the files subject to SUN_IO should be created with the Veritas File Manager. The BUFFSIZE should match the interleave size of the disk stripe.

The control string is composed of one or more filename-options pairs of the form:

```
p1,p2,p3:file-templates
```

where:

p1	Number of I/O threads; default is $max(n_{cpu}, 8)$. $p1 \geq 0$, setting p1=0 will select default of no read-ahead.
p2	Number of read-ahead buffers per threadB. $p2 \geq 0$, setting p2=0 will select default of 4 MB.
p3	Read-ahead threshold. $p3 \geq 0$. Setting p3=0 will select the default of 256 KB.
file_templates	Colon separated list of filename templates, there is no default. Examples are "*DBALL" to match all files ending in "DBALL" and "*DBALL:*SCR*" to match all files ending in "DBALL" and all files with "SCR" anywhere in the name.

For each of the filenames listed in *file-templates*, $p1$ pages, each of $p2 \times BUFFSIZE$ words, will be read ahead if the number of consecutive reads exceeds $p3$.

The additional main memory consumed by the SUN_IO facility is:

$$p1 \times p2 \times BUFFSIZE \times n_{files} \text{ words}$$

where n_{files} is the number of files matched by *file_templates*.

This keyword may also be set by the MSC_SUN_IO environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable.

Example: *prod_ver* `nastran example 'sun_io=*SCR*'`

This example uses the defaults for *p1*, *p2*, and *p3* on the SCRATCH and SCR300 files.

Example *prod_ver* `nastran example 'sun_io=2,3:*.DBALL:*SCR*'`

This example creates 2 I/O threads, each reading 3 buffers ahead for the DBALL, SCRATCH, and SCR300 files.

symbol symbol=*name*=*string* Default: None

Defines a symbolic (or logical) name used in ASSIGN and INCLUDE statements and in command line arguments. This keyword may be specified in initialization or RC files and on the command line. The symbol definition may include references to previously defined symbols or environment variables using the standard "$*name*" or "${*name*}" syntax on UNIX or %*name*% syntax on Windows. For convenience, the character separating the "symbol" and "*name*" specification and the "*name*" and "*string*" specification may be either an equal sign ("=") or a hash mark ("#"). The use of a hash mark allows this keyword to be specified as an argument to a Windows .bat file.

If "node" is specified, symbolic names defined using this keyword are not used on the local system. Instead the specified values are passed to the remote system. This means that any pathnames must be valid on the remote system. Use the "lsymbol" keyword to specify symbolic names for the local system.

If "node" is not specified, symbolic names defined using the "lsymbol" keyword are processed as if they were defined using the "symbol" keyword.

Symbolic names are processed in the order they are encountered while processing the initialization and RC files and the command line. If a duplicate symbolic name is encountered, thenew value replaces the previously specified value.

Symbolic names must be 16 characters or less, the value assigned to the symbolic name must be 256 characters or less. If the symbolic name used in an ASSIGN or INCLUDE statement or in command line arguments is not defined, it is left in the filename specification as is.

For example, many of the TPL and DEMO input data files have ASSIGN statements such as the following:

```
ASSIGN 'MASTER=DBSDIR:abc.master'
```

The string "DBSDIR:" specifies a symbolic name that is to be replaced by another string. The replaced string is defined by the "symbol=" keyword (or "lsymbol=" keyword if "node" was not specified) in an initialization or RC file, on the command line, or as environment variable. For example,

(UNIX) `symbol=DBSDIR=/dbs`

(Windows) `symbol=DBSDIR=d:\dbs`

When the previous ASSIGN statement is processed, the filename assigned to the logical name MASTER is `/dbs/abc.master` on UNIX and `d:\dbs\abc.master` on Windows. An alternate way of defining symbolic names is through the use of environment variables. For example, typing the following command

```
export DBSDIR=/dbs
```

at a Korn shell prompt, or

```
setenv DBSDIR /dbs
```

at a C-shell prompt, or

```
set DBSDIR=d:\dbs
```

at a Windows shell prompt, is equivalent to the "symbol" keyword definition.

Note: If a symbolic name is defined by both a symbol statement in an RC file and by an environment variable, the symbol statement value will be used.

The section titled "Environment Variables" on page 104 contains a list of environment variables that are automatically created by the nastran command. Of particular interest to the logical symbol feature are the OUTDIR and DBSDIR variables. These variables refer to the directory that will contain the output files (set using the "out" keyword) and the directory that will contain the permanent database files (set using the "dbs" keyword), respectively.

sysfield sysfield=*option,option,...* Default: None

Defines a global SYS value that is applied to Dbsets. Each option must have one of the following formats:

keyword=value

or

LNAMEXP(*keyword=value,keyword=value,...*)

where:

LNAMEXP = specifies a logical name expression using the UNIX/Windows file name specification format

Characters may be specified in any case. Internally, they are converted to upper-case before they are used.

Most characters in a substitution pattern match themselves but you can also use some special *pattern-matching characters* in the pattern.

These special characters are:

* = Matches any string, including the null string.

? = Matches any one character.

[...] = Matches any *one* of the characters enclosed in the square brackets.

`[!...]` = Matches any *one* of the characters enclosed in the square brackets.

Matches any one character *other than* one of the characters that follow the exclamation mark within square brackets.

Inside square brackets, a pair of characters separated by a - (minus) specifies a set of all characters that collate within the range of that pair, as defined by the ASCII collating sequence, so that `[a-dy]` is equivalent to `[abcdy]`.

`keyword=value` = Specifies a keyword and value to be used for the Dbset file. If the entry is part of an option qualified by an `LNAMEXP` expression, the keyword and value will only be used for a Dbset file whose logical name is selected by the expression specified by `LNAMEXP`. Otherwise, the keyword and value will be used for all Dbset files. Note that a null `LNAMEXP` expression will match any logical name.

The "sysfield" keyword may be specified more than once. The options are processed in the order specified on the various specifications. If multiple "keyword=value" options specify the same keyword, the last one encountered is the one that is used. You may use the "whence" keyword to see the "sysfield" keyword values. Also, the "sysfield" keywords are listed in the LOG file.

See the sections titled "Using the SYS Field" on page 122 or "SYS Parameter Keywords" on page 101 for details on the valid keyword options.

Example:

```
prod_ver nastran example
sysfield=lock=no
```

This example disables file locking for all Dbsets.

Example:

```
prod_ver nastran example
sysfield=lock=no
sysfield=scr*(mapio=yes,lock=yes)
```

This example disables file locking for all files and then enables filemapping (`"mapio=yes"`) and turns file locking back on for Dbsets whose logical names start with "SCR". The end result is that file locking is disabled for all Dbsets except those whose logical names start with "SCR" and file mapping and file locking are enabled for Dbsets whose logical names start with "SCR".

sys*n*

sys*n*=*value* Default: None

Sets the SYSTEM(*n*) cell to *value*. This keyword may be repeated any number of times. All non-repeated cells are used, but only the last repeated cell is used. If there is a "name" associated with the SYSTEM(*n*) value, that keyword will also be set to *value*. The System Cell number to System Cell name equivalence is listed in the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide*. The form "system(*n*)=*value*" may be used, but the entire keyword-value string must be quoted when used on a UNIX command line.

Example: *prod_ver* `nastran example sys114=200`

or *prod_ver* `nastran example "system(114)=200"`

These examples set SYSTEM(114) to 200. The second example shows how to quote the parenthetic form. Also, in this example, since SYSTEM(114) has the name "BUFFPOOL", the value of the "buffpool" keyword is also set to 200.

t3skew

t3skew=*number* Default: 30.0

Controls minimum vertex angle for TRIA3 elements at which User Warning Message 5491 is issued. See the *MD Nastran Quick Reference Guide*, Section 1, The NASTRAN Statement, for more information on this keyword.

tetraar

tetraar=*number* Default: 100.0

Specifies maximum allowable aspect ratio of longest to shortest edge for the CTETRA element. See the "nastran Command and NASTRAN Statement" on page 1 of the *MD/MSC Nastran Quick Reference Guide* for more information on this keyword.

trans

trans=yes,no,auto Default: no (local)

auto (remote)

If the "node" keyword is not specified, this keyword indicates the XDB file is to be translated to a neutral-format file using the TRANS utility. The output file will have the file type ".ndb".

UNIX only: If the "node" keyword is specified, this keyword indicates how an XDB file is to be copied back to the local node. If "trans=auto" is specified, the XDB file will be copied using TRANS/RECEIVE if the two computers use different floating point formats or by a binary copy if the floating point formats are the same. If "trans=yes" is specified, the XDB is always copied using TRANS on the remote node and RECEIVE on the local node (this may be needed if the floating point formats are identical but the file formats are not). If "trans=no" is specified, the XDB file will not be copied back

Example: *prod_ver* `nastran example trans=yes`

This example will run MD/MSC Nastran and then convert the XDB file, if written, to neutral format using TRANS.

UNIX example: *prod_ver* `nastran example node=othernode trans=yes`

This example will run MD/MSC Nastran on node othernode and copy the XDB file back using TRANS/RECEIVE.

use_aio use_io=yes,no Default: No

(HP-UX 11)

Enables HP's enhanced library for database I/O. Setting "use_aio=yes" will enable the library for all *.SCRATCH and *.SCR300 files, using $n_{cpu} - 1$ threads to control the asynchronous read-aheads.

This keyword may also be set by the USE_AIO environment variable. The environment variable overrides the RC files, and the command line overrides the environment variable. Setting the environment variable to any non-null value is equivalent to "use_aio=yes"; unset the environment variable to set "use_aio=no".

Example: *prod_ver* `nastran example use_aio=yes`

This example will run MD/MSC Nastran on with HP's AIO library enabled.

The library is controlled by a number of environment variables. They include:

AIO_FLIST	Comma-separated list of filenames. The default is "*.SCRATCH,*.SCR300".
AIO_THREADS	Maximum number of concurrent I/O threads per file.The default is $n_{cpu} - 1$.
AIO_BUFFERS	Maximum number of I/O buffers per file. The default is $n_{cpu} - 1$.
AIO_PATDEPTH	Number of I/Os to detect sequential access. The default is 3.

username username=*name* Default: Current user name

(UNIX)

Specifies an alternate username on the remote host when the "node" keyword is specified. This keyword may only be specified on the command line.

Example: *prod_ver* `nastran example node=othernode user=fred`

This example will run MD/MSC Nastran on node othernode as user "fred".

usparse usparse=*number* Default: See the description below.

Unsymmetrix sparse matrix method selection. This keyword may also be set with the “sys209" command line keyword. See the *MSC Nastran Quick Reference Guide* for information on the default value and legal values for this keyword.

version version=*version_number* Default: *Latest installed version*.

Specifies the version number. The keyword may only be specified on the command line or in the command initialization file.

Example:

```
prod_ver nastran example
version=68.2
```

This example will run MSC.Nastran V68.2 assuming it has been installed in the same installation base directory as this version of MD/MSC Nastran.

whence whence=*keyword_list* Default: None

Displays value and source for listed keywords. This keyword may be used to determine a keyword's value and where it was set. An input datafile (JID) is optional; the job will not be run. If the "node" keyword is specified, the request will be passed to the remote node for processing. Otherwise, information will be displayed for the local node. If multiple "whence" keywords are specified, the keywords in the various keyword lists will be concatenated, except that if a null list is specified, all existing keywords in the accumulated list will be deleted. Any keywords in the "keyword_list" that have the format "sys*n*" will attempt to return the value associated with the System Cell name associated with system cell *n*, if possible. The entries in the "keyword_list" may also request information about a PARAM name. These entries have the format "`p:`*`name`*", where "*`name`*" is the PARAM name (*not* the name of the associated PARAM keyword, if any).

Normally, the output is two lines for each keyword. The first line specifies the "source", i.e., from where the keyword value is obtained; the second line specifies the keyword and its value. The only exception is when the keyword is "symbol", "system" or "j.params". In these cases, there will be multiple lines of keyword value information. If an unknown keyword is specified, a "User Warning Message" will be generated and the keyword will be ignored.

Example:

```
prod_ver nastran iter=yes
whence=sys1,bpool
whence=sscr,iter
```

Assuming that none of these values is modified in configuration files, the output from this request is:

```
MD/MSC Nastran V2007.0 (...) ...
$ internal default
  sys1=8193
$ internal default
```

```
  bpool=37
$ internal default
  sscr=250000
$ command line[1]
  iter=yes
```

xhost xhost=yes,no Default: No

(UNIX) Indicates if the xhost(1) command is to be run. The xhost(1) command may be required if the “node” keyword and either “xmon=yes” or “xmon=kill” are specified. The argument to xhost(1) will be the node specified by the “node” keyword. This keyword is ignored if the “node” keyword is not specified.

xmonast xmonast=yes,no,kill Default: No

(UNIX) Indicates if XMONAST is to be run to monitor the MD/MSC Nastran job. If “xmonast=yes” is specified, XMONAST will be automatically started; you must manually exit XMONAST when the MD/MSC Nastran job has completed. If “xmonast=kill” is specified, XMONAST will start and will automatically exit when the MD/MSC Nastran job has completed.

Example: *prod_ver* `nastran example xmon=kill`

This example runs the XMONITOR utility while the MD/MSC Nastran job is running. Once the job completes, the XMONITOR program is automatically terminated.

SYS Parameter Keywords

The following keywords may be used for DBset files and for DBC Fortran files.

async	async=yes,no,must	Default:	No
(See Table 4-7)	This keyword specifies the file is to be read using asynchronous I/O. If "async=yes" is specified and a memory allocation operation fails, then unbuffered disk I/O will be used. If "async=must" is specified and a memory allocation operation fails, then a fatal error will be issued and the job terminated. See "Using Asynchronous I/O" on page 127 for further information.		
buffio	buffio=yes,no,must	Default:	No
(See Table 4-7)	This keyword specifies the file is to be buffered. If "buffio=yes" is specified and a memory allocation operation fails, then unbuffered disk I/O will be used. If "buffio=must" is specified and a memory allocation operation fails, then a fatal error will be issued and the job terminated. See "Using Buffered I/O" on page 125 for further information.		
lock	lock=yes,no	Default:	No for Delivery DBsets Yes for all others.
(UNIX)	Specifies the file is to be locked when it is opened. Locking a file prevents two or more MD/MSC Nastran jobs from interfering with one another; however, this does not prevent any other program or operating system command from modifying the file. SYSTEM(207) can also be used to globally control DBset locking. Setting SYSTEM(207)=1 will disable locking unless overridden for a specific file by SYS=LOCK=YES on an ASSIGN FMS statement. Setting SYSTEM(207)=0 will enable locking of read-write DBsets unless overridden for a specific file by SYS=LOCK=NO on an ASSIGN FMS statement.		
mapio	mapio=yes,no,must	Default:	No
(See Table 4-7)	This keyword specifies the file is to be mapped. If "mapio=yes" is specified and a mapping operation fails, then normal disk I/O will be used. If "mapio=must" is specified and a mapping operation fails, then a fatal error will be issued and the job terminated. See "Using File Mapping" on page 124 for further information.		

report	report=yes,no	Default:	No
	Requests that a summary report about the number of file operations and other information about the I/O processing done for a particular file be written to the file defined by stderr when the file is closed. In addition, if TIMING=YES is specified, this report will contiain timing information about the various steps involved in the I/O processing. If ASYNC=YES, BUFFIO=YES or MAPIO=YES, the report will contain additional information about the processing specific to these methods.		
timing	timing=yes,no	Default:	No
	Requests that operation timing be enabled for the file. This timing information will be included in the .f04 file and, if REPORT=YES is also in effect, in the report written to stderr.		
wnum	wnum=*number*	Default:	4 (ASYNC=NO) 8 (ASYNC=YES)
(See Table 4-7)	Specifies the number of windows or buffers that will be maintained for each mapped, buffered or asynchronous I/O file. The use of multiple windows or buffers permits multiple I/O streams to target a file (e.g., simultaneously reading one matrix and writing another) without forcing an excessive number of window remap operations or buffered read/writes. The number must be between 1 through 32 inclusive, values outside of this range are ignored without acknowledgement.		
wsize	wsize=*size*	Default:	See text.
(See Table 4-7)	**File Mapping.** Specifies the size of the window mapping the file into memory. The window is that portion of the file that is visible through the map. If the window is the same size as the file, then the entire file is visible. If the window is smaller than the file, then any portion of the file within the window or windows can be directly accessed; the rest of the file cannot be accessed until a window is remapped to include the desired file location. The default is 128KB or 4*BUFFSIZE, whichever is larger.		

(See Table 4-7)

Buffered I/O. Specifies the size of the buffer read from or written to disk. If the buffer is the same size as the file, then the entire file is memory resident. If the buffer is smaller than the file, then any portion of the file within the buffer or buffers can be directly accessed; the rest of the file cannot be accessed until a buffer is read to include the desired file location. The default is 4*BUFFSIZE or 64K, whichever is larger.

(See Table 4-7)

Asynchronous I/O. Specifies the size of the buffer used to hold data read from disk. If the buffer is the same size as the file, then the entire file is memory resident. If the buffer is smaller than the file, then any portion of the file within the buffer or buffers can be directly accessed; the rest of the file cannot be accessed until a buffer is read to include the desired file location. The default is 8*BUFFSIZE or 64KB, whichever is larger.

The total window or buffer size (WNUM value * WSIZE value) is limited to 25% of the available address space or, for Windows, to 25% of the physical memory. The address space limit is displayed by the "limits" special function, see "Using the Help Facility and Other Special Functions" on page 81, as the "Virtual Address Space" limit. If the address space limit or physical memory cannot be determined for a particular platform, a value of 64MB for 32-bit pointer systems and 8GB for 64-bit pointer systems is used as the 25% limit value. If "wsize=0" is specified for a read-only file, the entire file will be mapped or buffered into memory, subject to the 25% address space limit. (The 25% limit can be overridden if the numeric value is specified as a negative number. The 25% test will be suppressed and the actual window size value will be the absolute value of the specified numeric value. It is the user's responsibility to ensure that the specified value is valid and does not cause performance problems.)

The *size* is specified as a memory size, see "Specifying Memory Sizes" on page 85.

If *size* is less than the file's BUFFSIZE, then *size* is multiplied by BUFFSIZE.

Environment Variables

The following environment variables affect the execution of the nastran command.

Table C-1 Environment Variables Affecting the nastran Command

Name	Purpose
DISPLAY	UNIX: The default display for xmonast.
FF_IO_DEFAULTS	Linuxipf: Alternate means to set the “ff_io_default” keyword.
FF_IO_OPTS	Linuxipf: Alternate means to set the “ff_io_opts” keyword.
HOME	UNIX: The user’s home directory.
HOMEDRIVE	Windows: The user’s home drive.
HOMEPATH	Windows: The user’s home directory.
LM_LICENSE_FILE	Alternate means to set the “authorize” keyword.
LOGNAME	UNIX: The user ID.
MP_ADAPTER_USE	AIX: Alternate means to set the “adapter_use” keyword.
MP_CPU_USE	AIX: Alternate means to set the “cpu_use” keyword.
MP_EUIDEVICE	AIX: Alternate means to set the “euidevice” keyword.
MP_EUILIB	AIX: Alternate means to set the “euilib” keyword.
MP_HOSTFILE	AIX: Alternate means to set the “hosts” keyword.
MP_PROCS	AIX: Alternate means to set the “dmparallel” keyword.
MP_RESD	AIX: Alternate means to set the “resd” keyword.
MSC_ARCH	Specifies the MD/MSC Nastran architecture.
MSC_BASE	If set, the script will use this directory as the *install_dir*.
MSC_ISHELLEXT	Alternate means to set the “ishellext” keyword.
MSC_ISHELLPATH	Alternate means to set the “ishellpath” keyword.
MSC_JIDPATH	Alternate means to set the “jidpath” keyword.
MSC_LICENSE_FILE	Alternate means to set the “authorize” keyword.
MSC_NOEXE	If set, the nastran command will build the execution script but will not actually execute it. This may be useful for debugging purposes.
MSC_OLDTYPES	Alternate means to set the “oldtypes” keyword.
MSC_SUN_IO	Solaris: Alternate means to set “sun_io” keyword.
MSC_VERSD	MSC use only.
MSCDBG	Specify debugging flags.

Table C-1 Environment Variables Affecting the nastran Command (continued)

Name	Purpose
TEMP	Windows: If set, this is the default value for the “sdirectory” keyword. If not set, use the system default temporary file directory as the default value.
TMPDIR	UNIX: If set, this is the default value for the “sdirectory” keyword. If not set, use the system default temporary file directory as the default value.
USE_AIO	HP-UX: Alternate means to set “use_aio” keyword.
USER	UNIX: The user’s home directory (if LOGNAME is not set or is a null string).

The following environmental variables are available for use by the “pre” and “post” keywords.

Table C-2 “Pre” and “Post” Keyword Environment Variables

Name	Purpose
DBSDIR	The directory part of MSC_DBS, i.e., the directory that will contain the permanent database files.
DELDIR	Directory containing the solution sequence source files (*install_dir*/*prod_ver*/nast/del on UNIX and *install_dir**prod_ver*\nast/del on Windows).
DEMODIR	Directory containing DEMO library (*install_dir*/*prod_ver*/nast/demo on UNIX and *install_dir**prod_ver*\nast\demo on Windows).
JIDDIR	Directory containing the input file.
MSC_APP	yes,no
MSC_ASG	MSC use only.
MSC_ARCH	The actual architecture used by the nastran command.
MSC_LICENSE_FILE	Licensing value.
MSC_BASE	The actual *install_dir* used by the nastran command.
MSC_DBS	Default prefix of permanent databases.
MSC_EXE	Executable path.
MSC_JID	Input data file path.
MSC_MEM	Open core memory size in words.
MSC_OLD	yes,no
MSC_OUT	Prefix of F06, F04, and LOG files.
MSC_SCR	yes,no

Table C-2 “Pre” and “Post” Keyword Environment Variables (continued)

Name	Purpose
MSC_SDIR	Default prefix of scratch databases.
MSC_VERSD	MSC use only.
OUTDIR	Output file directory.
SSSALTERDIR	Directory containing SSS alters (*install_dir*/*prod_ver*/nast/sssalter on UNIX and *install_dir**prod_ver*\nast\misc\sssalter on Windows).
TEMP	Windows: Temporary directory.
TMPDIR	UNIX: Temporary directory.
TPLDIR	Directory containing TPL library (*install_dir*/*prod_ver*/nast/tpl on UNIX and *install_dir**prod_ver*\nast\tpl on Windows).

Other Keywords

The following keywords are available for use by the nastran command and script templates. You will generally not need to set or use these values.

Table C-3 Other Keywords

Keyword	Purpose
0	Pathname of the nastran command.
0.acceptdeny	Pathname of accept/deny utility used in this job.
0.dmp	DMP job template pathname.
0.dmpaccept	Pathname of dmpaccept utility.
0.dmpdeny	Pathname of dmpdeny utility.
0.ini	Command initialization file pathname.
0.kwds=*filename*	Pathname of User-defined general keywords file
0.lcl	Local job template pathname.
0.params=*filename*	Pathname of User-defined PARAM keywords file
0.rmt	Remote job template pathname.
0.rmtaccept	Pathname of rmtaccept utility.
0.rmtdeny	Pathname of rmtdeny utility.
0.srv	Server job template pathname.
0.tmplt	Alternate template pathname, overrides local/remote template selection logic.
a.addall=*list*	Comma separated list of extensions to be added to the j.all list
a.addapp=*list*	Comma separated list of extensions to be added to the j.app list.
a.addofp=*list*	Comma separated list of extensions to be added to the j.ofp list.
a.addold=*list*	Comma separated list of extensions to be added to the j.old list.
a.appdir	Application specific base pathname relative to MSC_BASE.
a.altmode	The INTEGER mode associated with the alternate architecture.
a.altmodedir	The directory name associated witht he alternate architecture.
a.archdir	Architecture specific base pathname relative to MSC_BASE.
a.estimate	ESTIMATE executable filename relative to “a.archdir”.
a.exedir	Directory part of any file name specified by “executable”.
a.flex	Pathname of default FLEXlm license file.
a.fms	Comma-separated list of FMS keywords recognized in RC files.
a.k	Multiplier for K factor.

Table C-3 Other Keywords (continued)

Keyword	Purpose
a.msgcat	Pathname of default message catalog.
a.news	News filename relative to “a.appdir”.
a.port	Default FLEXlm port number.
a.rc	Versioon dependent RC files base filename. For UNIX, default is “nast<*vernum*>rc” and for Windows, default is “nast<*vernum*>.rcf”.
a.rcb	Version independent RC base filename. Default is the “a.rc” keyword value.
a.receive	RECEIVE executable filename relative to “a.archdir”.
a.release	Release number, same as MD/MSC Nastran version number.
a.sbcm	Pathname of default node-locked authorization code file.
a.solver	Solver executable filename relative to “a.archdir”.
a.sss	Delivery database filename relative to “a.archdir”.
a.tier	MSC internal variable.
a.touch	News file touch pathname.
a.trans	TRANS executable filename relative to “a.archdir”.
a.urc	Version dependent User and Local RC files base flename. For UNIX, will always be prefixed by “.”. For UNIX, default is “nastranrc” and for Windows default is “nastran.rcf”.
a.urcb	Version independent User and Local RC fles base file name. Default is the “a.rcb” keyword value. For UNIX, will always be prefixed by “.”.
a.xmonitor	XMONAST executable filename relative to “a.archdir”.
d.dbsds	Blank separated list of per-task “dbs” directory values of DMP jobs.
d.hosts	Blank separated list of per-task hostnames
d.jidvis	Blank separated list of per-task JID visibility flags.
d.outvis	Blank separated list of per-task output directory visibility flags.
d.rcmds	Blank separated list of per-task “rcmd” values.
d.sdirs	Blank separated list of per-task “sdirectory” values.
d.tid	DMP task ID.
datecmd	Date command. Only used on Windows.
dcmd	Debugger.
debug	Run solver under debugger.
j.all	Blank separated list of file types to be deleted at job completion if “delete=all” is specified.

Table C-3 Other Keywords (continued)

Keyword	Purpose
j.app	Blank separated list of file types to be appended at job completion if “append=yes” is specified.
j.argv	Comma separated list of keywords and values to be added to the r.argv argument list.
j.base	Job basename.
j.command	Job submittal command string.
j.dir	Job directory.
j.env	Job environment variable list.
j.exetype	Specifies type of executable, either “win32” or “win64”. Only used on Windows.
j.expbase	Generated <expjid> base name.
j.expdir	Generated <expjid> directory.
j.expjid	Generated <expjid> file name.
j.ext_xdb	File type associated with logical name DBC files. Built from "dbc(xdb)" as modified using "extdefault".
j.extall	Blank separated list of output file types (extensions) to be deleted at job completion if "delete-all" is specified. Built from "j.all" and "a.addall" as modified using "extdefault".
j.extapp	Blank-separated list of output file types (extensions) to be appended at job completion if "append=yes" is specified. Built from "j.app" and "a.addapp" as modified using "extdefault".
j.extofp	Blank-separated list of output file types that will be deleted at job completion if and only if they are empty. Built from "j.ofp" and "a.addofp" as modified using "extdefault".
j.extofp_old	Blank-separated list of output file types that will be used in "dmparallel" mode to define the files to be merged or deleted. (See "mergeresults".) Built from "j.ofp", "a.addofp" and "oldtypes" as modified using "extdefault".
j.extold	Blank-separated list of output file types that will be versioned ("old=yes") or deleted ("old=no") at job start. Built from "j.old", "a.addold" and "oldtypes" as modified using "extdefault".
j.mode	Generated effective “mode” value in effect. Will be one of ““, “i4” or “i8”.
j.modedir	The directory associated with the “j.mode” value. NULL unless “j.mode” is one of “i4” or “i8”.
j.msg	Job completion message.
j.nascar	List of NASTRAN entries.

Table C-3 Other Keywords (continued)

Keyword	Purpose
j.news	News file pathname.
j.nice	Nice command to be used for commands, set based on "nice" keyword. (UNIX Only).
j.ofp	Blank separated list of file types to be deleted at job completion if and only if they are empty.
j.old	Blank separated list of file types to be versioned or deleted under the “old” keyword.
j.out	Appended output file type.
j.params	Generated list of PARAM statements. Contains the result of INI file, RC file and command line PARAM processing
j.rcfiles	Comma-separated list of RC files.
j.server	MD/MSC Nastran server flag
j.shell	Shell debugging flag.
j.startdate	Job start date-time string.
j.title	Title of XMONAST icon.
j.tty	TTY name.
j.type	Space separated list of file types to be versioned.
j.unique	Job unique name.
job	Job script filename, created in out directory.
log	Pathname of LOG file.
msgdest	System message destination.
nprocessors	Number of processors.
ppc	Per-process CPU time limit.
ppm	Per-process memory limit.
prm	Per-request memory limit.
PWD	Current working directory.
r.altmode	The INTEGER mode associated with the remote mode alternate architecture.
r.altmodedir	The directory name associated with the remote node alternate architecture.
r.argv	List of arguments to be processed on rmt/dmp host.
r.expvis	"expjid" visibility flag for remote job. Value is "yes" or "no".
r.jidvis	JID visibility flag.
r.oscode	Remote system operating system code, 1 = Windows, 2 = UNIX.

Table C-3 Other Keywords (continued)

Keyword	Purpose
r.outvis	Output directory visbility flag.
r.rmtcode	Remote communications protocol, 1 = MSCRmtCmd, 2 = rsh/rcp.
r.rshell	Remote node Shell pathname. Only used when "r.rmtcode" is 1.
s.arch	System architecture name.
s.block	Words per disk block.
s.bpw	Bytes per word.
s.clock	CPU clock frequency.
s.config	CONFIG number.
s.cpu	CPU name.
s.hostname	Simple hostname.
s.hyper	Identifies whether or not HyperThreading is available. Only used on Windows.
s.hyper_use	Specifies how HyperThreading is used for job. Only used on Windows.
s.model	System model name.
s.modeldata	Pathname of site specific model data.
s.nohyper_aff	System CPU affinity mask for use when hyperthreads=no specified. Only used on Windows.
s.nproc	Number of processors.
s.numeric	Encoded numerical format.
s.os	OS name.
s.osv	OS version.
s.pmem	Physical memory, in MB. Only known on UNIX, Solaris, and Windows.
s.proc	Default processor subtype.
s.rawid	Raw configuration number.
s.rcp	Remote file copy command.
s.rsh	Remote shell command.
s.type	System description.
s.vmem	Virtual memory, in MB. Only known on Windows.
tcmd	Timing command.

System Cell Keyword Mapping

The following table lists the System Cell Name - System Cell Number equivalence used by MD/MSC Nastran when processing the sys*n* and whence keywords:

Table C-4 System Cell Name -- System Cell Number

System Cell Name	System Cell Number
attdel	124
autoasgn	133
bfgs	145
buffpool	114
buffsize	1
ifpbuff	624
chexaint	212
config	28
cordm	204
cpyinput	305
dblamkd	155
dbverchk	148
diaga	25
diagb	61
disksave	193
distort	213
f04	86
f06	2
fastio	194
fbsmem	146
fbsopt	70
frqseq	195
hicore	57
iter	216
ldqrkd	170
locbulk	143
massbuf	199
maxset	263

Table C-4 System Cell Name -- System Cell Number

System Cell Name	System Cell Number
metime	20
mindef	303
minfront	198
mperturb	304
mpyad	66
newhess	108
nlines	9
nsegadd	200
numseg	197
parallel	107
punch	64
q4skew	190
q4taper	189
quadint	141
radlst	88
radmtx	87
real	81
scr300	142
scr300del	150
scrsave	196
solve	69
sparse	126
t3skew	218
tetraar	191
usparse	209

D System Descriptions

- Overview
- System Descriptions
- Numerical Data
- Computer Dependent Defaults

Overview

This appendix presents quantitative information for evaluating the processing requirements of MSC Nastran. It includes system descriptions, numerical data, and information on computer dependent defaults.

Binary File Byte Ordering (Endian)

The term "endian" refers to the byte ordering for numeric data used by a particular computer architecture. "Big-endian" specifies that the most significant byte (MSB) of a data element is stored at the lowest byte address, while "little-endian" specifies that the least significant byte (LSB) of a data element is stored at the lowest byte address. Most UNIX platforms are big-endian machines, while all Intel x86 and compatible platforms, e.g., Intel Pentium and AMD Athlon and Opteron, including those running both Windows and Linux, are little-endian machines. Some architectures can be run in either endian mode. For example, the Intel Itanium processor runs in big-endian mode when running HP-UX and in little-endian mode when running Linux or Windows. The diagrams in Section D.3 illustrate the difference between big-endian and little-endian for both integer and floating point data.

System Descriptions

Table D-1 System Description – HP-UX

Item	Description
Supported Model(s)	PA-RISC 2.0
Installed Timing Constants	250, 710, 712, 715, 720, 730, 735, 778, 800, 819, 889, 2200
Operating System(s)	PA-RISC 2.0: HP-UX 11.11
Compilers	HP F90 v3.1 aCC: HP ANSI C++ B3910B A.03.80
Compiler Options	
FORTRAN	+Z +ppu +save +DD64 +Olibcalls +DS2.0W +DA2.0W +Oinfo +O2 +Onolimit +Z
C++	-b -Wl,-B,symbolic -Wl,+s -Wl,+vnocompatwarnings +O2 -AA -mt +DD64 -Wl,+nodefaultrpath -Wl,+n
Word Length	32 bits/64-bits
Build Type	LP-64 (HP-UX 11.11)/ILP-64
Memory Management	Virtual

Table D-2 System Description – Intel – Linux

Item	Description
Supported Model(s)	Intel and Intel-compatible
Installed Timing Constants	Pentium II 400 MHz, Pentium 4 IA64 733 MHz, Intel Nacona, AMD/Opteron
Operating System(s)	RedHat 4.5 (Linux 2.6.9 Kernel)
Compiler	
Linux 32	Intel(R) Fortran Compiler for IA-32, Version 10.1 Build 20080602 Package ID: l_fc_p_10.1.017 Intel(R) C++ Compiler for IA-32, Version 10.1 Build 20080602 Package ID: l_cc_p_10.1.017
Linux 64	Intel(R) Fortran Compiler for Intel(R) 64, Version 10.1 Build 20080602 Package ID: l_fc_p_10.1.017 Intel(R) Fortran Compiler for Intel(R) 64, Version 10.1 Build 20080602 Package ID: l_fc_p_10.1.017

Table D-2 System Description – Intel – Linux (continued)

Item	Description
Linuxipf	Intel(R) Fortran IA-64 Compiler for IA-64, Version 10.1 Build 20080112 Package ID: l_fc_p_10.1.012 Intel(R) C++ IA-64 Compiler for IA-64, Version 10.1 Build 20080112 Package ID: l_cc_p_10.1.012
Compiler Options	
FORTRAN	
Linux 32	-nbs -cm -pad_source -save -zero -axN -Qdyncom XNSTRN -assume byterecl -assume buffered_io -fPIC -w90 -WB -W0 -O2 -fPIC
Linux 64	-nbs -cm -pad_source -save -zero -w90 -WB -W0 -Qdyncom XNSTRN -mp1 -pc80 -O2 -fPIC
Linuxipf	-nbs -cm -pad_source -save -zero -ftz -Qdyncom XNSTRN -assume byterecl -assume buffered_io -mcmodel=large -mp1 -fPIC -mcmodel=large -w90 -WB -W0 -O2 -mcmodel=large -fPIC
C++	
Linux 32	-O2 -Xlinker -retain-symbols-file -shared -Bsymbolic
Linux 64	-O2 -shared -Bsymbolic
Linuxipf	-O2 -shared-intel
Word Length	32 bits
Build Type	IA32: ILP-32 IA64: LP-64
Memory Management	Virtual

Table D-3 System Description – Intel – Windows

Item	Description
Supported Model(s)	Intel and Intel-compatible
Installed Timing Constants	Pentium II 400 MHz
Operating System(s)	Windows XP, Vista, Windows 7
Compiler	

Table D-3 System Description – Intel – Windows

Item	Description
Windows 32	Intel(R) Visual Fortran Compiler for IA-32, Version 10.1 Build 20080602 Microsoft (R) 32-bit C/C++ Optimizing Compiler Version 14.00.50727.762 for 80x86
Windows 64	Intel(R) Visual Fortran Compiler for Intel(R) 64, Version 10.1 Build 20080602 Microsoft (R) C/C++ Optimizing Compiler Version 14.00.50727.762 for x64
Compiler Options	
FORTRAN	
Windows 32	/c /fixed /nologo /nbs /WB /MD /Quppercase /Qdyncom XNSTRN /Qzero /Qsave /O2 /cm
Windows 64	/fixed /nologo /nbs /WB /MD /Quppercase /Qdyncom XNSTRN /Qzero /Qsave /O2 /cm /IC:\Program
C++	
Windows 32	/MD /EHs /O2 /W3 /Wp64 /FC /nologo /D_CRT_SECURE_NO_WARNINGS /DWINNT /DWIN32 /DWIN8632 /D_32BIT_
Windows 64	/MD /EHs /O2 /W3 /Wp64 /FC /nologo
Word Length	32 bits
Build Type	ILP-32
Memory Management	Virtual

Table D-4 System Description – IBM pSeries – AIX

Item	Description
Supported Model(s)	Power4, Power5, Power6
Installed Timing Constants	320H, 375, 390, 39H, 43P, 530, 560, 580, 590, 950, 980E, 990
Operating System(s)	AIX 5.3
Compiler	IBM XL Fortran Enterprise Edition for AIX, V11.1 Version: 11.01.0000.0004 IBM XL C/C++ Enterprise Edition for AIX, V9.0 Version: 09.00.0000.0003

Table D-4 System Description – IBM pSeries – AIX (continued)

Item	Description
Compiler Options	
FORTRAN	-qfixed -qextname -qsigtrap -qnoprint -qalias=intptr:pteovrlp -q64 -qsave -qlist -qpic -qsource -qmaxmem=-1 -qflttrap=ov:zero:inv:en:imp -qarch=pwr3 -qtune=pwr4 -qstrict -O3 -qpic=large
C++	-O2 -brtl -q64 -bbigtoc -bernotok -bnoipath -qmkshrobj -qsuppress=1501-218 -b symbolic
Word Length	32 bits/64 bits
Build Type	LP-64/ILP-64
Memory Management	Virtual

Table D-5 System Description – Sun SPARC – Solaris

Item	Description
Supported Model(s)	UltraSPARC
Installed Timing Constants	UltraSPARC
Operating System(s)	UltraSPARC:Solaris 10
Compilers	Sun Fortran 95 8.3 SunOS_sparc Patch 127000-01 2007/07/18 Sun C 5.10 SunOS_sparc 2009/06/03
Compiler Options	
FORTRAN	-xrecursive -Bstatic -w -ftrap=invalid,overflow,division -xtarget=ultra3 -xarch=sparcvis -m64 -O4 -KPIC
C++	-KPIC -xtarget=ultra3 -xarch=sparcvis -m64 -O
Word Length	32 bits/64 bits
Build Type	LP-64/ILP-64
Memory Management	Virtual

Table D-6 System Description – Sun X8664 – Solaris

Item	Description
Supported Model(s)	Intel and Intel compatible
Installed Timing Constants	Nehalem
Operating System(s)	Solaris 10 (Patch 120754-08 is required)
Compilers	Sun Fortran 95 8.4 SunOS_i386 Patch 141852-01 2009/07/24 Sun C 5.10 SunOS_i386 Patch 142363-06 2010/08/11
Compiler Options	
FORTRAN	-xrecursive -Bstatic -w -ftrap=invalid,overflow,division -m64 -O4 -KPIC
C++	-KPIC -m64 -O -xarch=sse2
Word Length	32 bits/64 bits
Build Type	LP-64/ILP-64
Memory Management	Virtual

Numerical Data

Table D-7 Numerical Data – 32-bit, big endian, IEEE (Intel/AMD)

Item	Description
INTEGER Bit Representation	0 1 31
	S Integer
REAL Bit Representation	0 1 8 9 31
	S Exponent Mantiss
Exponent Range for a REAL Number	±38
Precision of a REAL Variable	6 digits (24 bits)
DOUBLE PRECISION Bit Representation	0 1 11 12 31
	S Exponent Mantissa
	32 63
	Mantissa (continued)
Exponent Range for a DOUBLE PRECISION Number	±308
Precision of a DOUBLE PRECISION Variable	15 digits (53 bits)

Table D-8 Numerical Data – 32-bit, little endian, IEEE (Intel/AMD)

Item	Description
INTEGER Bit Representation	31 30 0
	S Integer
REAL Bit Representation	31 30 23 22 0
	S Exponent Mantiss
Exponent Range for a REAL Number	±38

Table D-8 Numerical Data – 32-bit, little endian, IEEE (Intel/AMD) (continued)

Item	Description
Precision of a REAL Variable	6 digits (24 bits)
DOUBLE PRECISION Bit Representation	63 62 52 51 32
	S Exponent Mantissa
	31 0
	Mantissa (continued)
Exponent Range for a DOUBLE PRECISION Number	±308
Precision of a DOUBLE PRECISION Variable	15 digits (53 bits)

Table D-9 Numerical Data – 64-bit, big endian

Item	Description
INTEGER Bit Representation	0 1 63
	S Integer
REAL Bit Representation	0 1 15 16 63
	S Exponent Mantiss
Exponent Range for a REAL Number	±2644
Precision of a REAL Variable	14 digits (48 bits)
DOUBLE PRECISION Bit Representation	0 1 15 16 63
	S Exponent Mantissa
	64 79 80 127
	(Unused) Mantissa (continued)

Table D-9 Numerical Data – 64-bit, big endian

Item	Description
Exponent Range for a DOUBLE PRECISION Number	±2466
Precision of a DOUBLE PRECISION Variable	28 digits (96 bits)

Computer Dependent Defaults

These tables list the computer-dependent default values for MD/MSC Nastran. The default rank values are listed in Table D-11.

Table D-10 Computer-Dependent Defaults,

Parameter	Input File Settings	Command Line Settings	Default	Comment
BUFFPOOL	`NASTRAN BUFFPOOL=n`	`bpool=n`	37	GINO Blocks
BUFFSIZE	`NASTRAN BUFFSIZE=n`	`buffsize=n`	8193	Max: 65537
BUFFSIZE Increment	`NASTRAN SYSTEM(136)=n`	`sys136=n`	128	Words
DBALL Size	`INIT DBALL , LOGICAL=(DBALL(n))`	`sdball=n`	250000	GINO Blocks
DBS Update Time	`NASTRAN SYSTEM(128)=n`	`sys128=n`	5	
Lanczos HPO	`NASTRAN SYSTEM(193)=n`	`sys193=n`	0	Save
Lanczos HPO	`NASTRAN SYSTEM(194)=n`	`sys194=n`	0	Pack/Unpack
MAXSET	`NASTRAN MAXSET=n`	`sys263=n`	7	
SCRATCH Size	`INIT SCRATCH , LOGICAL=(logname(n)), SCR300=(logname(n))`	`sscr=n`	250000	GINO Blocks
SMEM	`INIT SCRATCH (MEM=n)`	`smem=n`	100	GINO Blocks
Sparse Ordering Method	`NASTRAN SYSTEM(206)=n`	`sys206=n`	4	Prefer Extreme reordering

Table D-11 Computer-Dependent Default Rank Values

Computer Type	Model	SYS198	SYS205
AIX	All	8	64
HP-UX	All	32	32
Linux 32	All	6	64
Linux 64 Nehalem/Xeon I4	All	6	64
Linux 64 Nehalem/Xeon I8	All	27	64
Linux 64 Opteron	All	6	64
Linux ipf	All	27	64

Table D-11 Computer-Dependent Default Rank Values

Solaris	UltraSPARC	30	30
Solaris 8664	All	30	30
Windows (32 bit)	All	6	6
Windows (64 bit)	All	8	8

E Product Timing Data

If User Warning Message 6080 is printed in the .f06 file, please fill out this form and mail it along with machine-readable copies of the gentim2.f04, gentim2.f06, gentim2.log, and gentim2.pch files (see Generating a Timing Block for a New Computer on page 61) to MSC.Software at the address below.

Client:

Site:

Computer:

Model:

Submodel:

Operating System:

Operating Level:

Thank you.

MD/MSC Nastran Client Support
MSC.Software Corporation
2 MacArthur Pl.
Santa Ana, CA 92707