Gear AT 2021

Installation and Operations Guide

HEXAGON | MSC Software

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GEAR:V2021:Z:Z:Z:DC-OPS-PDF

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You've heard it before: manufacturing companies today face intense global competition, demanding customers, fragmented markets, increasing product complexity, compressed product cycles, price and profit pressures, strict regulatory and liability environments, systems integration and supply chain issues, skyrocketing costs of testing and physical prototyping, and on and on… What you don't often hear, though, is a strategy for enabling your company to improve your new product development process to meet these challenges. Whether you are delivering airplanes, automobiles, ships, biomedical devices, golf clubs or children's toys to your customers, MSC Software's goal is to help you improve your new product development process, allowing you to be significantly better at your concept development, design, testing, and production activities through the application of VPD. VPD is an environment that uses an integrated combination of both simulation software technology and traditional techniques to design, test, manufacture, and support products. The result is that cost-effective designs that meet all performance, safety, durability, and reliability requirements can be brought to market in less time and for less cost. Adams, as part of VPD, is focused on enhancing your ability to make better product development decisions, explore innovative design alternatives, and consistently get the product right. It is the world's most widely used mechanical system simulation software. It enables you to produce virtual prototypes, realistically simulating the full-motion behavior of complex mechanical systems on your computers and quickly analyzing multiple design variations until an optimal design is achieved. This reduces the number of costly physical prototypes, improves design quality, and dramatically reduces product development time.

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You can reach MSC technical support on the web, by telephone, or e-mail.

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In addition, we provide several excellent sources of online information:

- **SimCompanion** - Find solutions to problems in this repository of troubleshooting tips, examples, and frequently asked questions. To access the SimCompanion, go to: http://simcompanion.mscsoftware.com
- VPD Community - The VPD community is where to go when you are looking for peer support, as well as technical expertise. Many of our consultants, developers, and technical support staff monitor the forums. To sign up for the forums, go to:

  http://forums.mscsoftware.com

  Then:

  - To view the Adams discussions, select Adams.
  - To view product alerts and company news and events, select MSC News.

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Store.mscsoftware.com is the first virtual marketplace where clients can find engineering expertise, and engineers can find the goods and services they need to do their job.

Types of installations

The way you install Gear AT product depends on your needs of using Adams/View or Adams/Car products and your usage of other Adams plugins:

- **User installation directory –** use default or select directory in which to install Gear AT product. This path will be written to MDI_USER_PLUGIN_DIR system or user environment variable. This environment variable is used by Adams plugin manager to locate and load all plugins. Remember that all plugins should be compatible with the one and only Adams versions.
- **Adams installation directory -** Gear AT product will be installed under Adams top directory. This type of installation enables you to use this product with multiple Adams versions on single machine at the same time. The MDI_USER_PLUGIN_DIR environment variable is not appended by the installation path since Adams plugin manager will find Gear AT installation automatically. With this type of installation there is no desktop icon created, no Gear AT folder under Windows Start menu and no uninstaller created for this product stored under your system. You can repair installation by running this installer over existing installation. Uninstallation of this product will be done by Adams uninstaller.

IMPORTANT NOTE:

It is not recommended to install neither Gear AT nor Bearing AT in a common plugin installation directory although it is possible and both plugins would work properly. **However, the uninstaller will remove complete directory including other user plugins you might have installed in the same directory.**

This is true on both platforms, windows and linux. We will remove this limitation in future release.

Adams and related SW specification

The Gear AT is installed as plugin to Adams/View or Adams/Car therefore existing Adams installation of one supported version is prerequisite. The table below outlines the software specifications for Gear AT toolkit.

Operating System	Adams version	Nastran version	Patran version
Windows 7 64-bit	2018.1	2017.0	2017
Windows 10 x64 Pro Version 1803	2019.0	2017.1	2017 (Classic)
SuSE 12 SP1 Linux Enterprise Server (Kernel 3.12.49-11-default)	2019.2	2018.1	2018 (Classic)
SuSE 12 SP2 Linux Enterprise Server (Kernel 4.4.21-69-default)	2020-711253	2018.2	2019
SuSE 12 SP4 Linux Enterprise Server (Kernel 4.12.14- 94.41-default)	2020 FP1-748966	2019.0	2019 Feature Pack 1 Service Pack 1
Red Hat Enterprise Linux 7.3 x64 (Kernel 3.10.0-514)	2021.0.1 , 2021.0.2	2019 Feature Pack 1	2021
Red Hat Enterprise Linux 7.5 x64 (Kernel 3.10.0-862)	2021.1	2020	2021.1
Red Hat Enterprise Linux 7.7 x64 (Kernel 3.10.0- 1062.el7.x86_64)	2021.2 , 2021.2.2	2021.1	2021.2
		2021.2	

You need Nastran or Adams ViewFlex to compute tooth stiffness matrix and gear wheel body flexibility. In case you do not have Nastran installation, make sure you have valid Adams ViewFlex license available. On Linux there is no support of Nastran as FE preprocessor, hence Adams ViewFlex has to be used only. Please note that currently there are supported i8 versions of Nastran only.

Patran is optional for the flex tooth FE model revision.

NOTE:

The table with supported SW versions is supposed to be read column-wise. It means that any combination of the SW versions listed in the table is supported.

Supported linux platform depends on the version of Adams for which the Gear AT 2021 is installed.

For more information, please read relevant sections of *Adams Installation and Operations Guide* document or visit MSC Platform Support web page.

Installing Gear AT

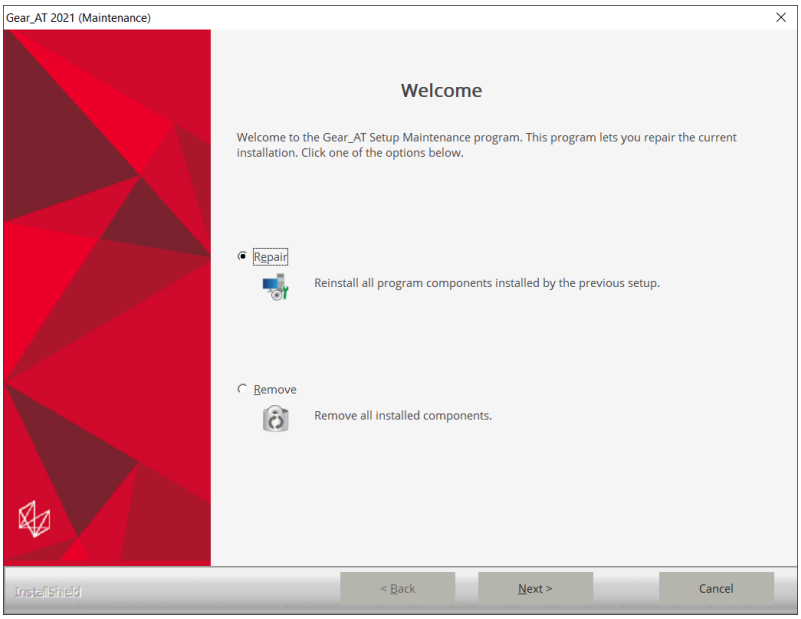
Following sections explain how to install Gear AT on Windows and Linux.

1 Installing on Windows

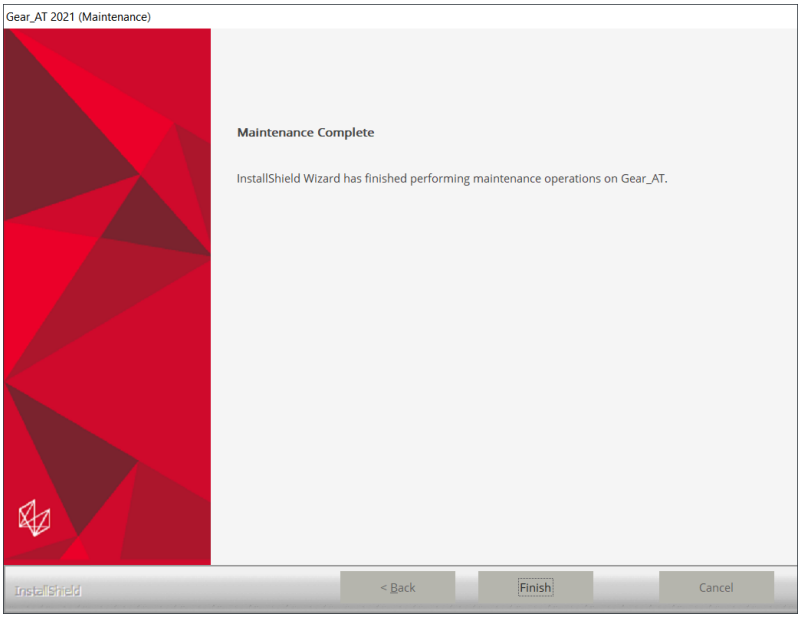
Open Windows Explorer and browse to your Gear AT file location and run (double click) the executable file **gear_at_2021_win64.exe**.

Updating

If an instance of current Gear AT version is already installed, you can either repair or remove the old instance. This installation does not touch previous versions of Gear AT

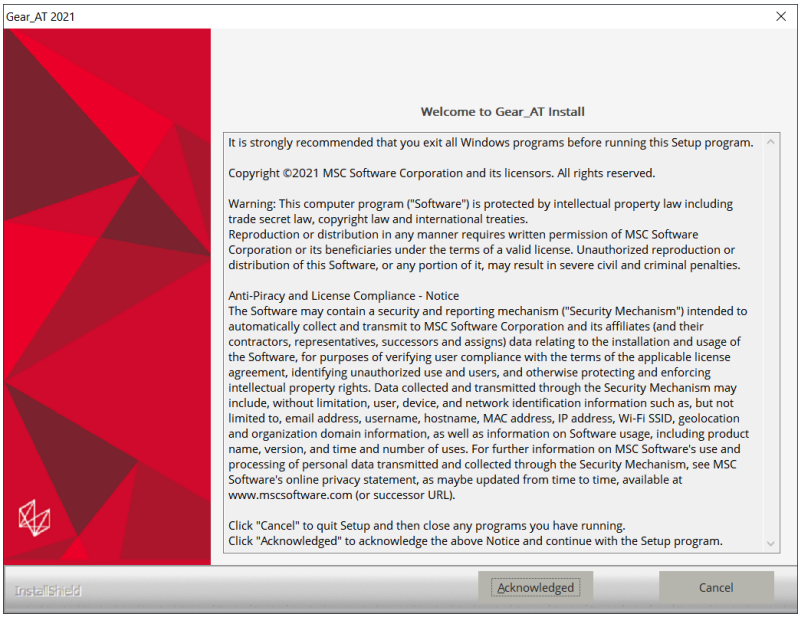


Select **Finish** to complete the process and run the **gear_at_2021_win64.exe** again.



Welcome page

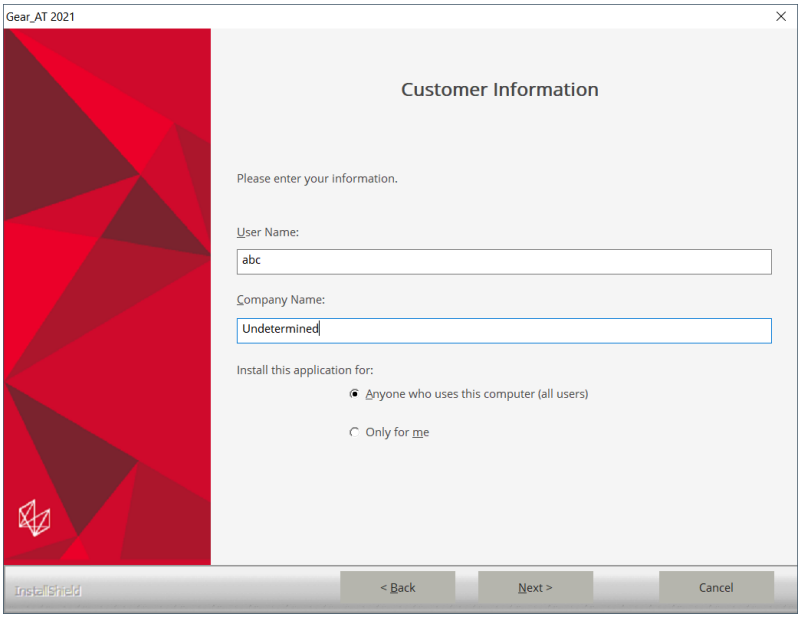
Next screen shows the Welcome page. Select **Next** > button to continue or **Cancel** button to exit without installing.



Customer info

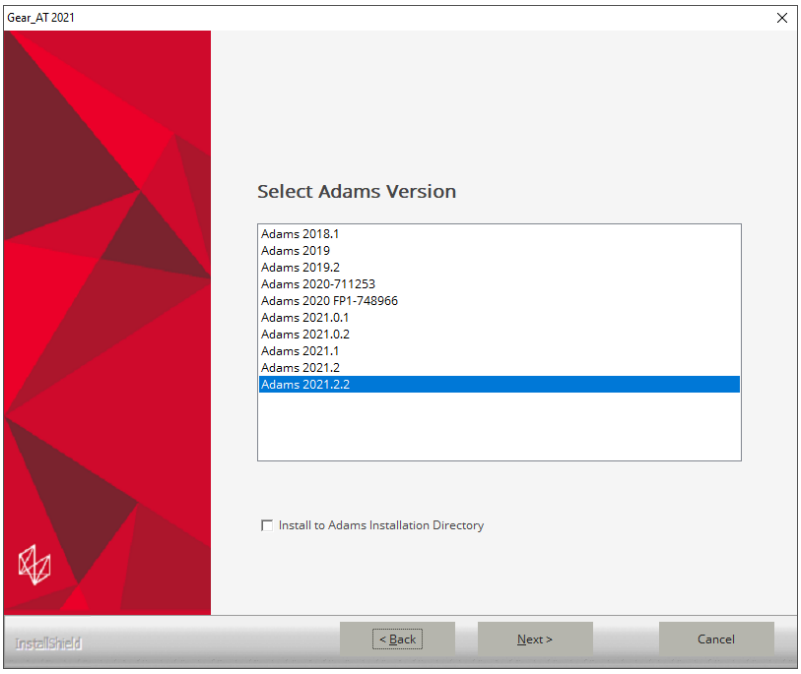
In the Customer Information window, enter your user and company name, and then select one of the following:

- **Anyone who uses this computer (all users) -** Anyone logged on to this machine can run Gear AT
- **Only for me -** A user must be logged on using the user name and password that was used at the time of installation.



Adams Version

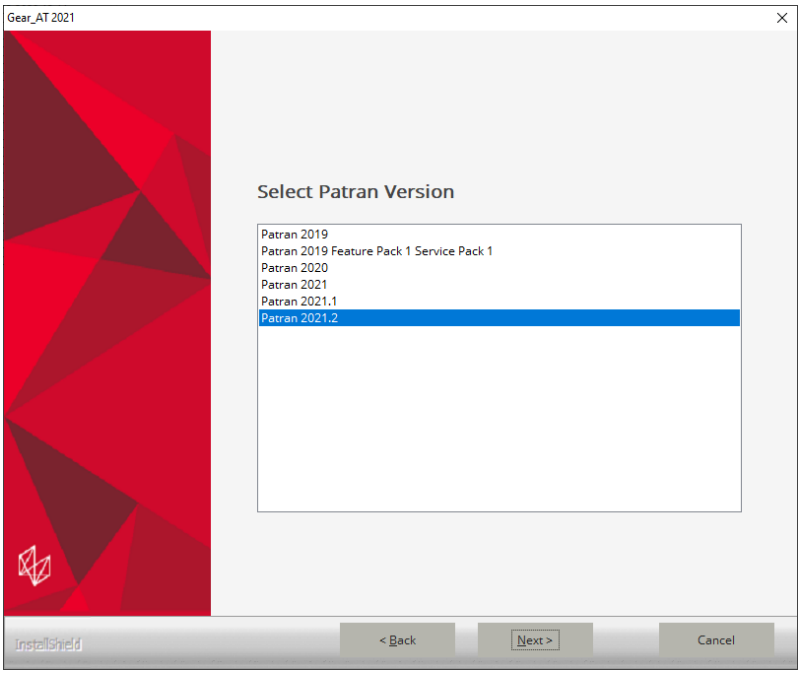
In this step you choose one of the valid Adams versions, the list is based by the installed ones. If the list is empty, please cancel the installation of Gear AT and install the most recent Adams version first. Make sure you select the same Adams version during Bearing AT installation in case you plan to use both toolkits. The list of currently supported Adams versions is shown on the figure below.



If you prefer to install Gear AT directly under Adams, you can select Adams version of your choice and set the Install to Adams Installation Directory check box on.

Patran version

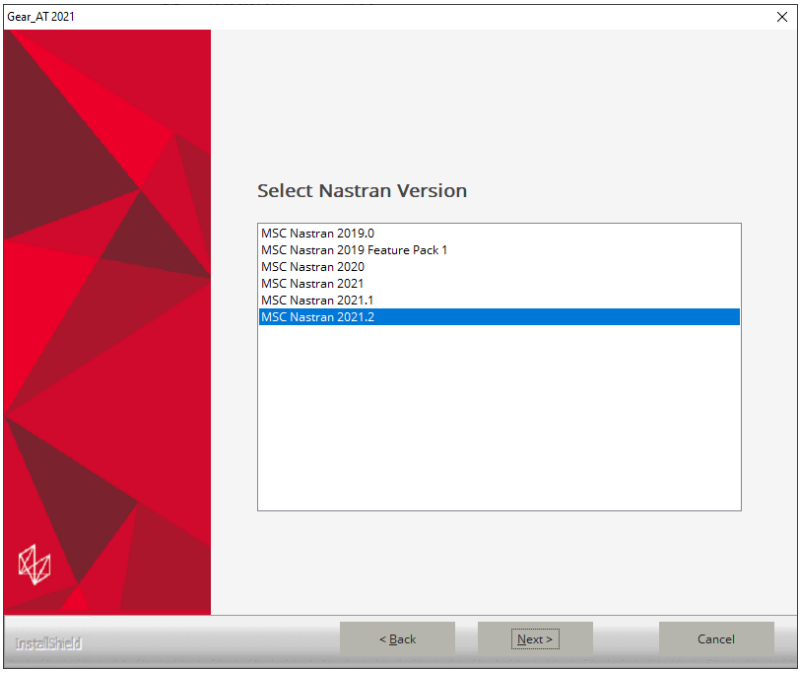
Next step is to make choice of Patran version if installed.



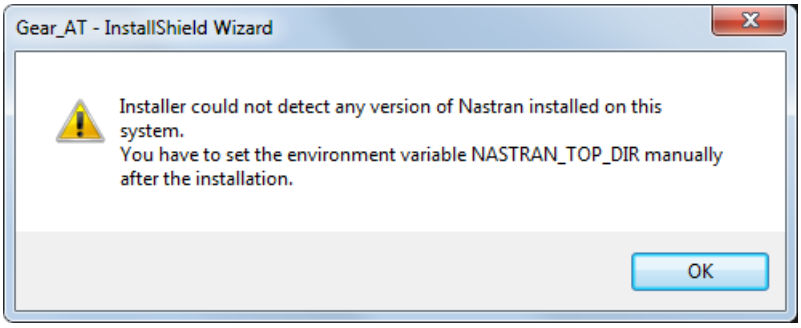
Eventually you can use arbitrary version of MSC.Apex. To make your preference of the FE mesh viewer, after the installation go to the *Gear_AT_Install_Dir/gear_at* (as defined later during installation) and edit the value of the **mesh_viewer** variable in the *gear_at_ini.cmd* configuration file – for more information, please read section **Gear AT initialization** in chapter **Running MSC.Gear AT**.

Nastran version

Select preferred Nastran version to be used with Gear AT for FE preprocessing. In case you do not have Nastran installation, make sure you have valid Adams ViewFlex license available. Please note that currently there are supported i8 versions of Nastran only, limited to the list shown on the figure below.

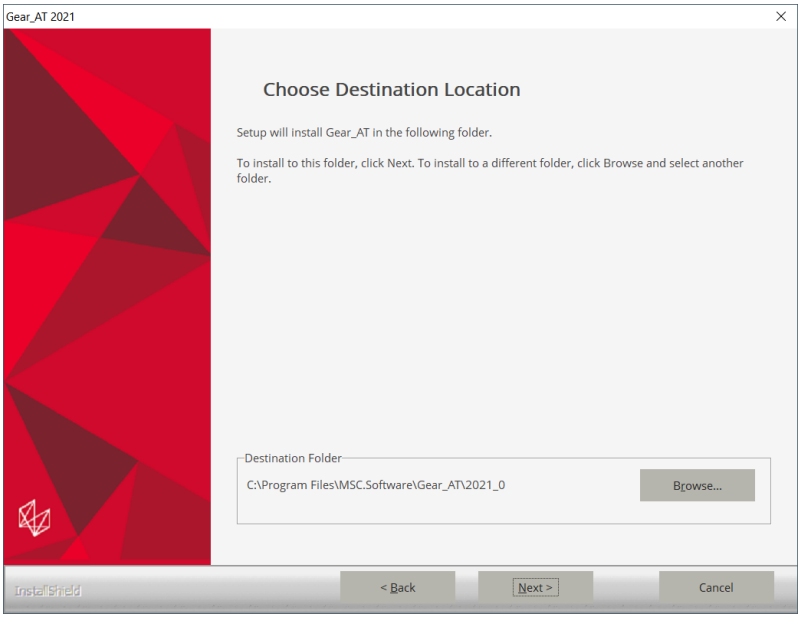


You can proceed with the installation of Gear AT without Nastran and install it later, but you have to set up NASTRAN_TOP_DIR environment variable manually. This variable should point to the Nastran installation directory, e. g. *c:\MSC.Software\MSC_Nastran\2021.2*



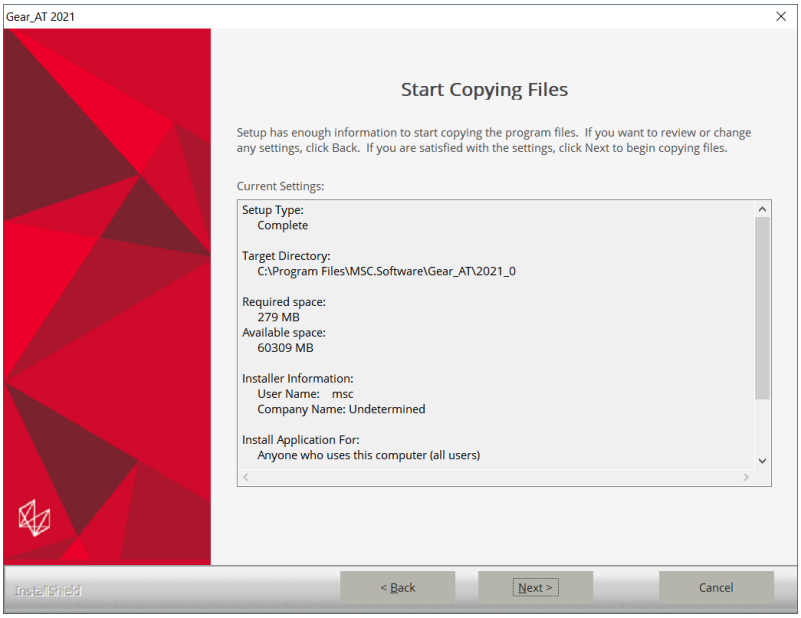
Installation Folder

In the install location window select the destination folder. This folder is referred to as *Gear_AT_Install_Dir* throughout this manual. In case you opted to install Gear AT under Adams, the Gear_AT_Install_Dir path is automatically determined from system registry which points to Adams installation directory hence this page is skipped.



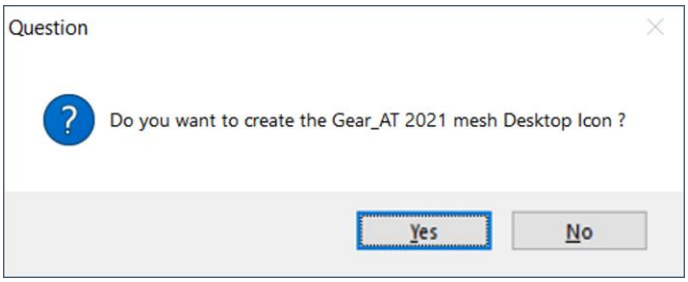
Review Settings

Confirm the installation settings and then select **Next** to begin the installation.

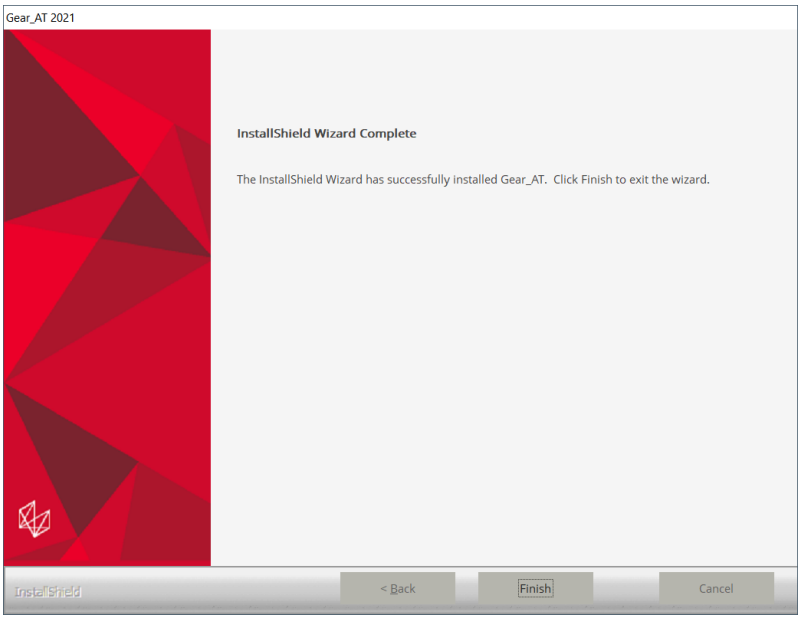


Completion

Before the Setup is complete you are prompted to create a desktop icon.



Setup completion window appears as shown below. Select **Finish**.



2 Installing on Linux

Go to the directory of the Gear AT installer location and open the terminal. Executing the installation binary may require adding execution privilege:

```
chmod +x gear_at_2021_linux64.bin
```

Start the installation program **gear_at_2021_linux64.bin**. For example:

```
./gear_at_2021_linux64.bin
```

or you can make the installation in console mode:

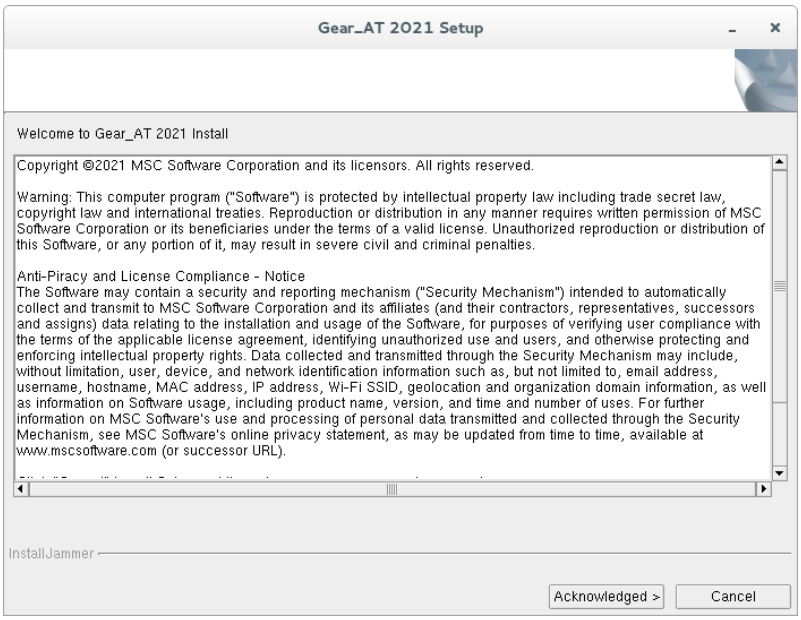
```
./gear_at_2021_linux64.bin --mode console
```

Installing

You will see a confirmation dialog box. Select **Yes** button to begin the installation.

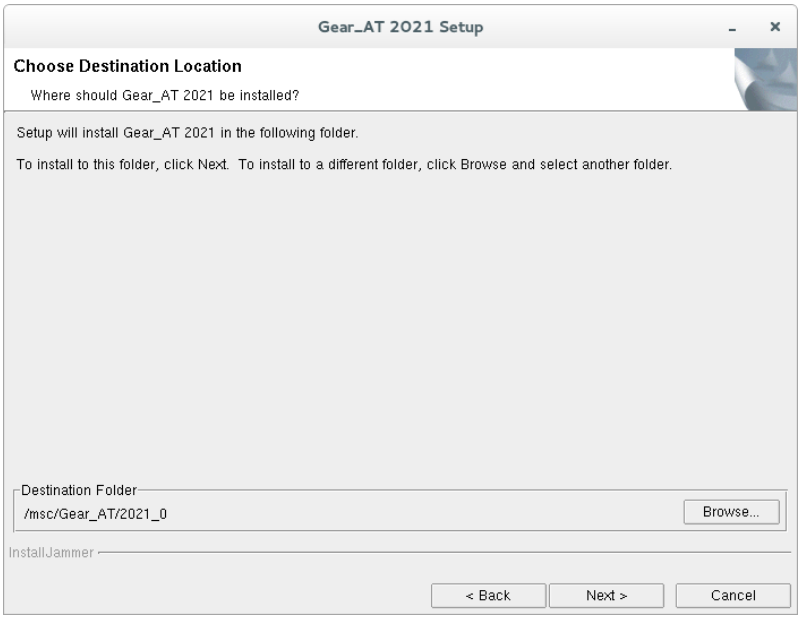
Welcome page

Next screen shows the Welcome page. Select **Acknowledged >** button to continue or **Cancel** button to exit without installing.

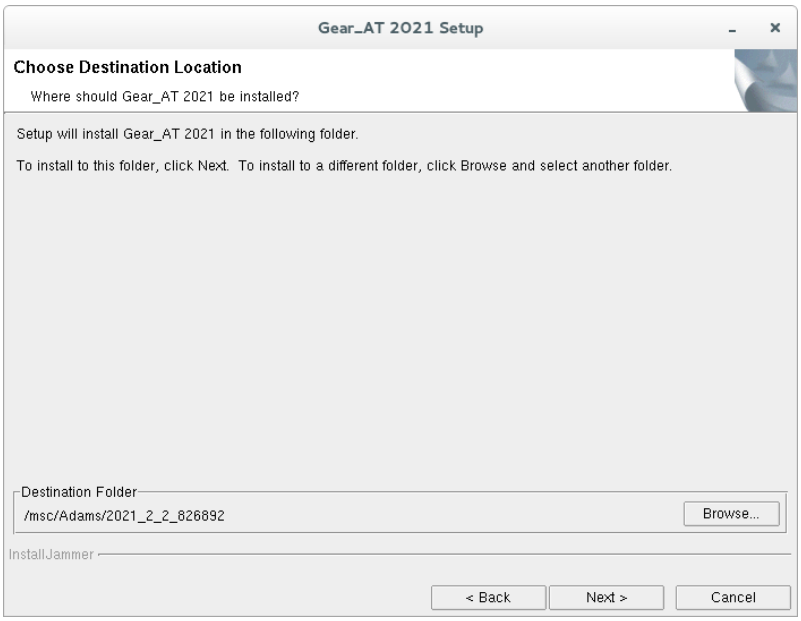


Destination Location

In the install location window select the destination folder. This folder is referred to as *Gear_AT_Install_Dir* throughout this manual. The default path is set to **/msc/Gear_AT/2021_0**

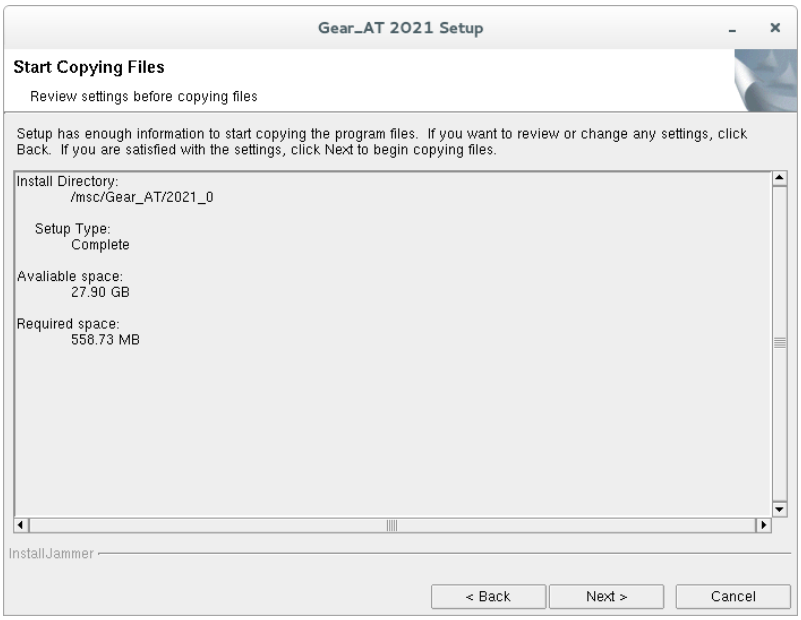


If you prefer to install Gear AT directly under Adams, you can browse to installation path of Adams and make sure to select corresponding Adams version in next step.

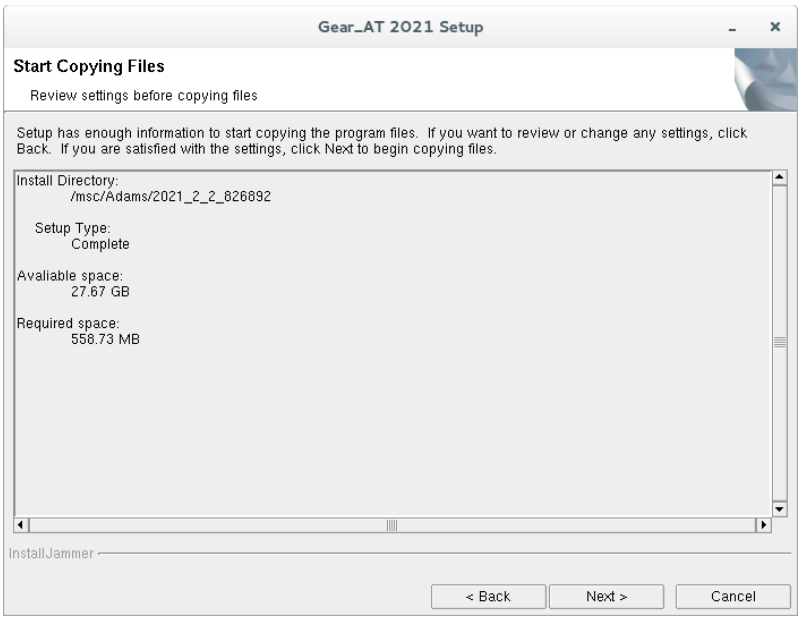


Review Settings

Confirm the installation settings and then select **Next** to begin the installation.



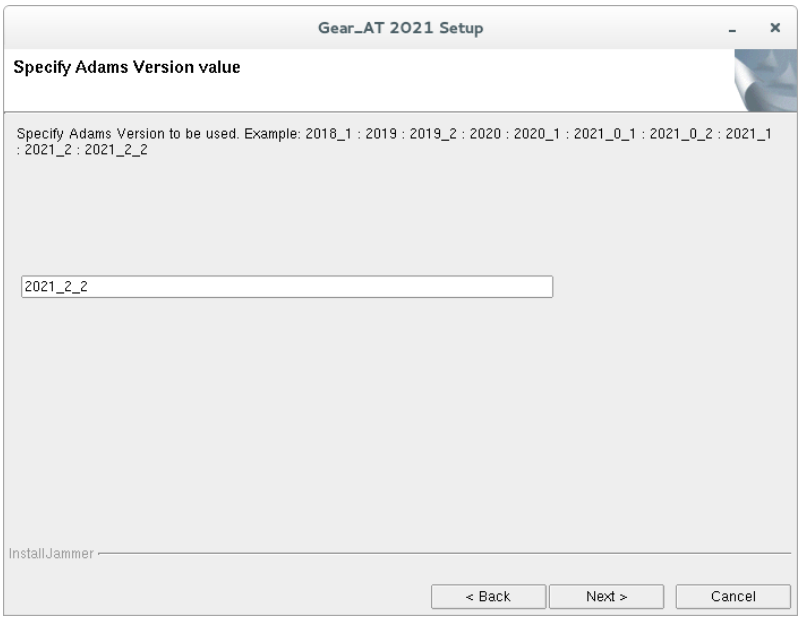
In case you have selected to install Gear AT directly under Adams, the Install Directory reported should point to Adams installation directory.



Adams Version

In this step specify Adams Version to be used with Gear AT. For example:

- **2018_1** for Adams 2018.1
- **2019** for Adams 2019.0
- **2019_2** for Adams 2019.2
- **2020** for Adams 2020
- **2020_1** for Adams 2020 FP1
- **2021_0_1** for Adams 2021.0.1
- **2021_0_2** for Adams 2021.0.2
- **2021_1** for Adams 2021.1
- **2021_2** for Adams 2021.2
- **2021_2_2** for Adams 2021.2.2

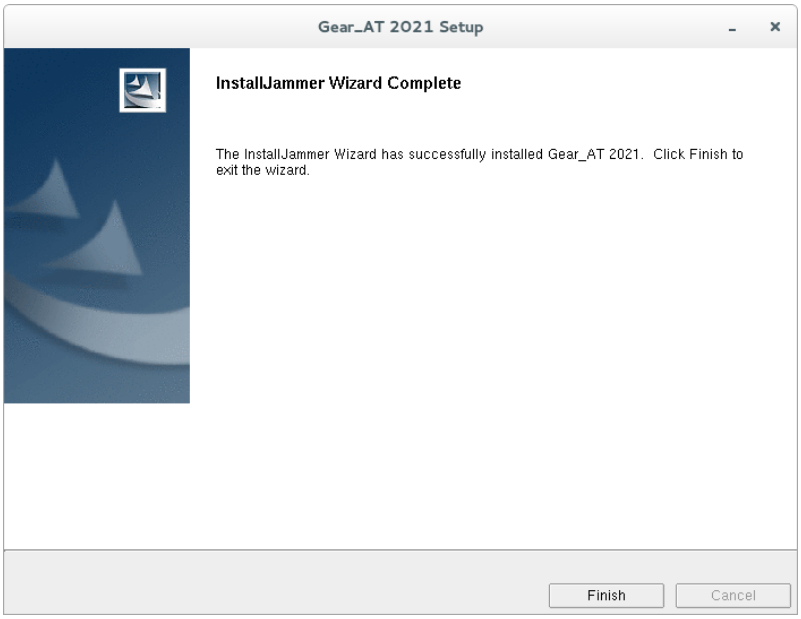


Adams Installation Path

Specify installation path to Adams version. If you opted to install directly under Adams, the Adams installation path you specify in this step should be identical to the *Destination folder* you entered in few steps before.

Completion

Setup completion window appears as shown below. Select **Finish**.



Set up environment variables

In case of the "**User installation directory**" installation type was chosen the **MDI_USER_PLUGIN_DIR** environment variable has to be set up or appended to the actual *Gear_AT_Install_Dir* path. This enables the Adams plugin manager to locate Gear AT plugin installation directory. This environment variable has to be set up manually for instance:

export MDI_USER_PLUGIN_DIR=/msc/Gear_AT/2021_0

or

setenv MDI_USER_PLUGIN_DIR /msc/Gear_AT/2021_0

You need Nastran or Adams ViewFlex to create the punch files for contact processing. To locate Nastran installation by Gear AT you have to set up **NASTRAN_TOP_DIR** environment variable manually, for instance:

export NASTRAN_TOP_DIR=/msc/MSC_Nastran/2021.2/bin/msc20212

or

setenv NASTRAN_TOP_DIR /msc/MSC_Nastran/2021.2/bin/msc20212

In case you do not have Nastran installation, make sure you have valid Adams ViewFlex license available.

Licensing

Please copy the license features of Gear AT in your overall MSC license file.

```
FEATURE PA_CATDirect_V5 MSC 2016.0115 15-jan-2016 3 4BD6A00EB4EC \
        ISSUED=19-dec-2013 ck=151 SN=1288214-7c91d2ae0686dfbdc66d-4d3e
FEATURE PA_Materials_Enterprise MSC 2016.0115 15-jan-2016 3 \
        A7D5CD0C5F2F ISSUED=19-dec-2013 ck=222 \
        SN=1174246-ccac818ab9689382023f-43f9
FEATURE PA_RandomAnalysis_Tool MSC 2016.0115 15-jan-2016 3 \
        59009B5C656D ISSUED=19-dec-2013 ck=81 \
        SN=1125067-8d822f1808ef461fbb1f-c91f
#
# MSC Toolkits
#
FEATURE TK_AdWiMo_BASE MSC 2016.0115 15-jan-2016 3 972C551C5C8E \
        ISSUED=27-jan-2015 ck=98 SN=1187362-cf8d73fdb76564f60947-5812
FEATURE TK_AdWiMo_BASE_PRE MSC 2016.0115 15-jan-2016 3 A0D4B3350987 \
        ISSUED=27-jan-2015 ck=130 SN=1293921-b74e92ecf3b4cc6660bc-743f
FEATURE TK_AdWiMo_BASE_SOLVER MSC 2016.0115 15-jan-2016 3 \
        1B95AB62AAC6 ISSUED=27-jan-2015 ck=115 \
        SN=1227345-b67a50db521132937f4c-465a
FEATURE TK_BearingAT_BASE MSC 2016.0115 15-jan-2016 3 27E818C22649 \
        ISSUED=27-jan-2015 ck=153 SN=1356269-57bf094d6ac6c4aa66de-543e
FEATURE TK_BearingAT_BASE_PRE MSC 2016.0115 15-jan-2016 3 \
        F730E0C5E6C8 ISSUED=27-jan-2015 ck=104 \
        SN=1146504-a173703ccd528dd1ff65-e4c0
FEATURE TK_BearingAT_BASE_SOLVER MSC 2016.0115 15-jan-2016 3 \
        0F2258ED9BF6 ISSUED=27-jan-2015 ck=129 \
        SN=1017687-bfe6768fe1c0a0fe78a3-85a1
FEATURE TK_GearAT_BASE MSC 2016.0115 15-jan-2016 3 9F567BDB7E46 \
        ISSUED=27-jan-2015 ck=127 SN=988907-f675b4697108836e703b-5734
FEATURE TK_GearAT_BASE_PRE MSC 2016.0115 15-jan-2016 3 BADBF4255F5E \
        ISSUED=27-jan-2015 ck=144 SN=1428005-4b9d8360414dea8b559f-fa55
FEATURE TK_GearAT_BASE_SOLVER MSC 2016.0115 15-jan-2016 3 \
        FE59E5107D2E ISSUED=27-jan-2015 ck=99 \
        SN=1223862-df7f55300ec7b7a1fb9e-880b
FEATURE TK_GearAT_Adanced MSC 2016.0115 15-jan-2016 3 ABC481F9266C \
        ISSUED=27-jan-2015 ck=145 SN=1235180-1e2908a948719b627c84-1e87
FEATURE TK_GearAT_Adanced_PRE MSC 2016.0115 15-jan-2016 3 \
        6A9825214AD8 ISSUED=27-jan-2015 ck=109 \
```

In addition to a Gear AT license, access to the Adams ViewFlex and Adams Flex license is required. This provides access to the finite element meshing and calculation technology used in the pre-processing setup. The ViewFlex license is consumed only while pre-processing in Adams View. During analysis only the Gear AT license and Adams Flex license is consumed in case of Full Flex Gear modeling option in addition to the usual Adams Solver license.

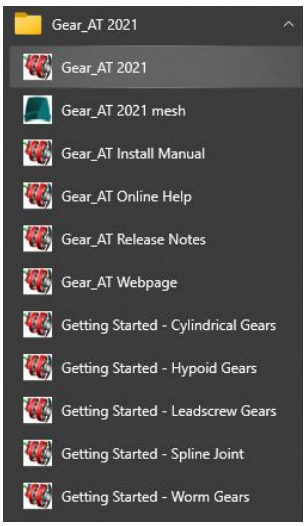
Running Gear AT

Following section explains how to load the **Gear AT plugin** on Windows and Linux.

1 Launch Gear AT on Windows

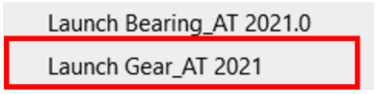
If you installed Gear AT in user installation directory (default) you have number of options how to run the product with Adams.

Go to the Windows **Start** menu and Select **All Programs**. Go to **Gear AT 2021** folder and select **Gear AT 2021** icon; this will launch Adam/View.



You can use the desktop icon

Or you can launch Gear AT via the context menu of the explorer in the working directory



In case you installed Gear AT under Adams installation directory you simply launch Adams View or Car version you opted and load the plugin. **There is none of options mentioned above available for you in this case.**

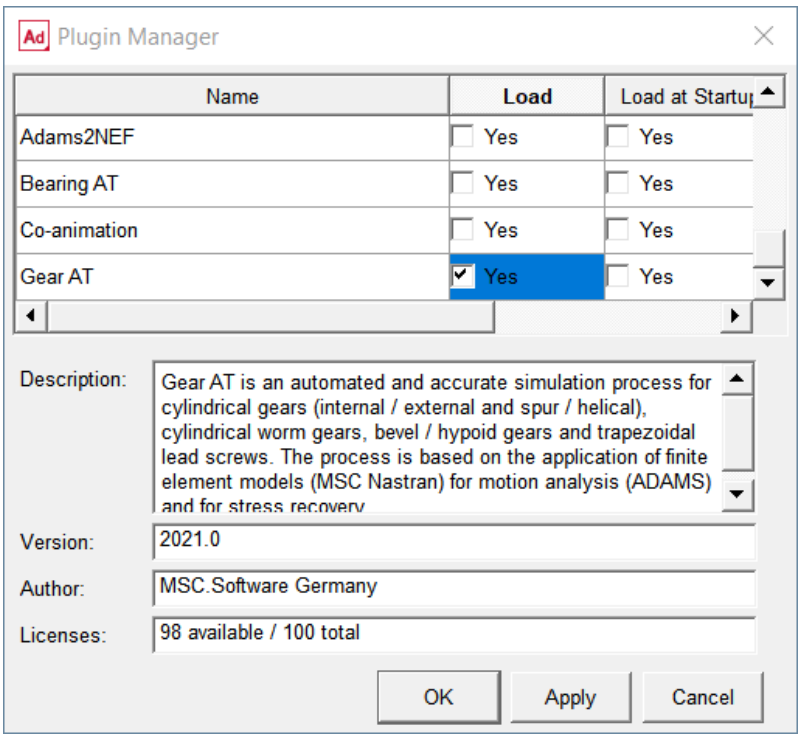
2 Launch Gear AT on Linux

The Adams Toolbar is a starting point to using Adams products on Linux. Make sure to start Adams version which the Gear AT 2021 was installed to, thus assure that Gear AT plugin is compatible with Adams version. To learn how to start Adams on Linux read the **adams_20xx_doc_install.pdf** document provided with the Adams installation. The toolbar of Adams is shown below.

3 Loading Plugin

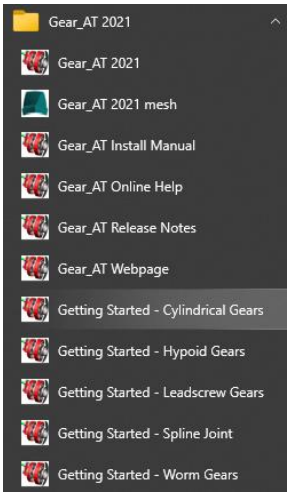
After Start Up from Adams/View open the plugin ribbon or go to **Tools** -> **Plugin Manager**.
In the ribbon click on the Gear AT Button in the Gear AT tab.

This opens the Plugin Manager if the plugin is not loaded so far. Check the plugin checkbox **Gear AT**. Specify if you want it to start every time you start ADAMS/View or just for a single session by clicking on **Load at Startup.** The **Gear AT** menu will be available in the Adams toolbar and in the ribbon plugin tab.

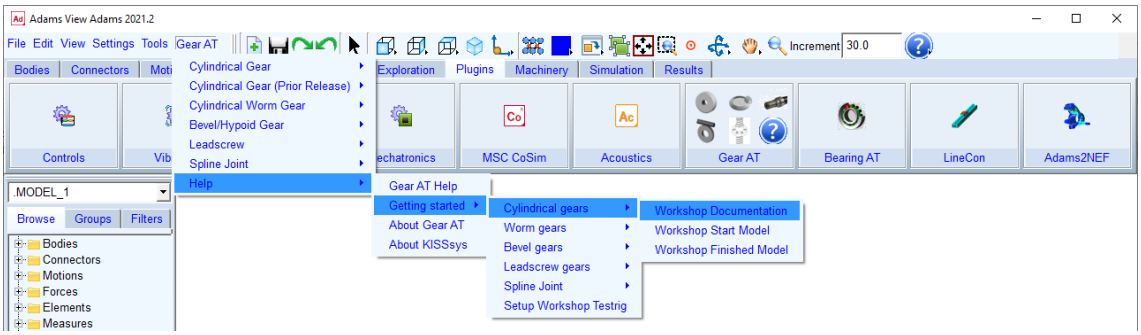


4 Getting Started with Gear AT

To help you get familiar with Gear AT plugin we provide the Getting Started document along with example model and files in the installation folder. You can access Getting started document either from windows Start menu



or from Gear AT menu in Adams.



5 Gear AT initialization

If you load the plugin the *Gear_AT_ini.cmd* file is automatically imported from the *Gear_AT_Install_Dir/gear_at* directory. You can use this file to set your personal preferences such as:

- FE preprocessor
- FE Mesh viewer
- request activity
- default damping ratio of a gear flex body (Full Flex Gear approach)
- maximum number of gear elements
- background color
- solver settings
- relative paths for property files

or any other of your choice.

```
!variable set variable=.gear_at.variables.Gear_AT_max_pairs integer=15
!variable set variable=.gear_at.variables.Gear_AT_max_elem integer=30

variable set variable=.gear_at.variables.relative_path integer=1 &
comment="0-> do not use relative paths",&
        "1-> use relative paths"

variable set variable=.gear_at.variables.backup_update integer=1 &
comment="0 -> do not back files up",  &
        "1 -> ask for backing files up",  &
        "10-> back files up without asking"

variable set variable_name = .gear_at.variables.mesh_viewer &
string_value = "Apex" &
comment="Apex or Patran"

variable set variable_name = .gear_at.variables.preprocessor &
string_value = "Internal ViewFlex" &
comment="Internal ViewFlex, External ViewFlex, Internal Nastran, External Nastran, Mesher only"

variable set variable_name = .gear_at.variables.keep_fe_mesh &
string_value = "no" &
comment="yes or no"

! defaults for request activity of old Cylindrical Gears
variable set variable_name =.gear_at.udes.gear_at_gforce.request_activity &
 string_value = "on","off","on","off","on","off","off","off","off","off" &
gear_at_ini.cmd [+]

! defaults for request activity of Lead Screw Gears
variable set variable_name = .gear_at.udes.gear_at_leadscrew_t_gear_force.request_activity  &
 string_value = "on","off","on","off","off","off","off","off","off","off" &
 comments = "" ,&
            "1-> Flex: Standard", &
            "2-> Unused", &
            "3-> Flex: Enhanced", &
            "4-> Unused ", &
            "5-> Flex: Contact Pattern", &
            "6-> Fast: Standard Force", &
            "7-> Unused", &
            "8-> Fast: Enhanced", &
            "9-> Full Flex Gear: Gear Tooth 0 deformation", &
            "10->Unused",&
            "Flex and fast are exclusive"
!
! default for damping ratio of flex body of old cylindrical gear element
variable set variable_name = .gear_at.udes.gear_at_element.wb_cratio  &
 string_value = "STEP5(TIME, 0.0, 1.0, 0.02, 0.2)"
!
! default for damping ratio of flex body of new cylindrical gear element
variable set variable_name = .gear_at.udes.gear_at_cylindrical_element.wb_cratio  &
 string_value = "STEP5(TIME, 0.0, 1.0, 0.02, 0.2)"
!
! default for damping ratio of flex body of hypoid gear element
variable set variable_name = .gear_at.udes.gear_at_hypoid_element.wb_cratio  &
 string_value = "STEP5(TIME, 0.0, 1.0, 0.02, 0.2)"
```

The file could be located in the:

- Plugin installation directory - *Gear_AT_Install_Dir/gear_at*,
- Home directory,
- Working directory,

and is read in that order.

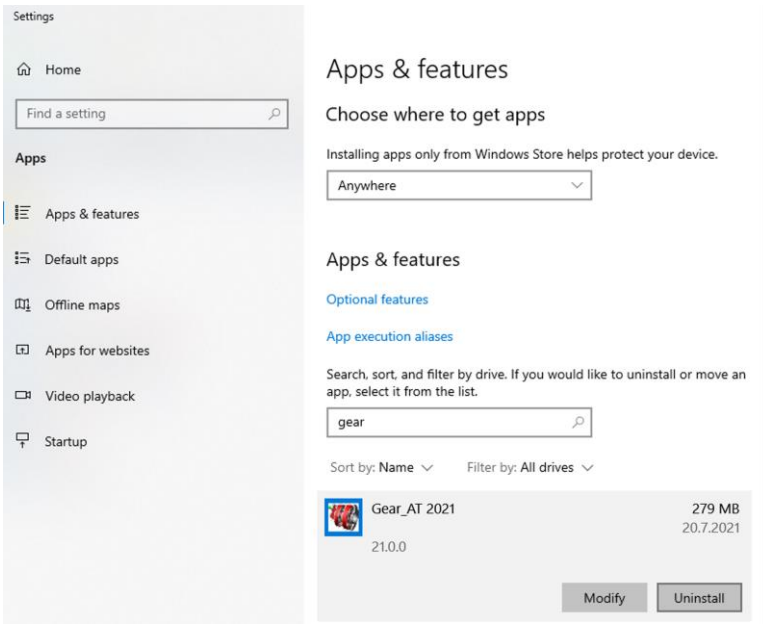
Uninstalling Gear AT

IMPORTANT NOTE:

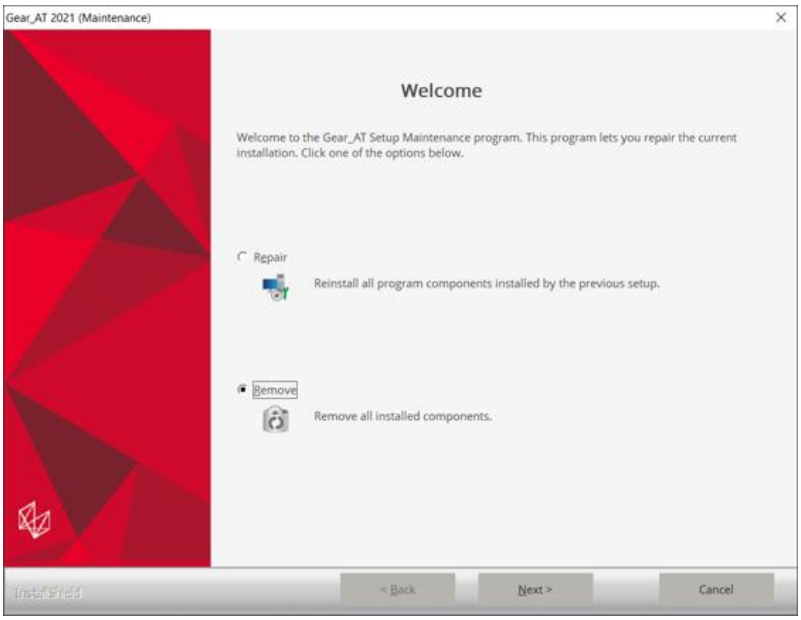
In case you have installed Gear AT directly under Adams installation directory, there is no uninstaller program available. The product will be removed along with Adams uninstallation.

1 Uninstall Gear AT on Windows

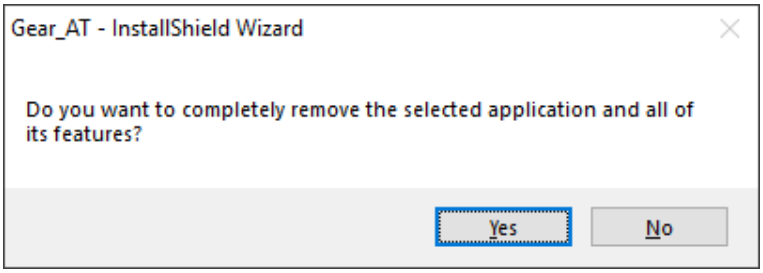
To uninstall the toolkit, go to **Apps & features** > select **Gear_AT 2021** and **Uninstall.**



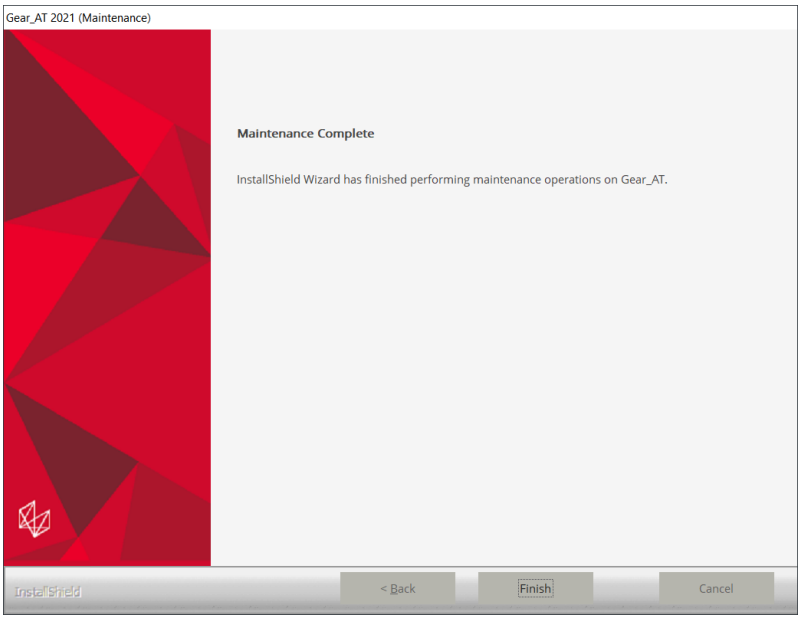
Select **Remove** and click **Next**.



Confirm the removal operation to finish the process.



Select **Finish** to complete uninstall process.



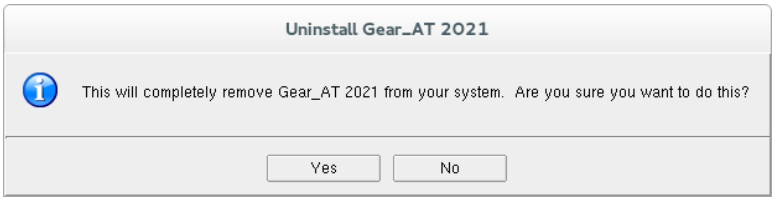
Please note you have to remove NASTRAN_TOP_DIR environment variable manually after uninstalling Gear AT. Be aware that this variable is shared with the Bearing AT installation.

After uninstalling the installation folder is cleaned up but left for previously installed versions of Gear AT. For instance, if the *Gear_AT_Install_Dir* was *c:\MSC.Software\GEAR_AT\2021_0* there will remain following empty folder *c:\MSC.Software\GEAR_AT* after uninstallation.

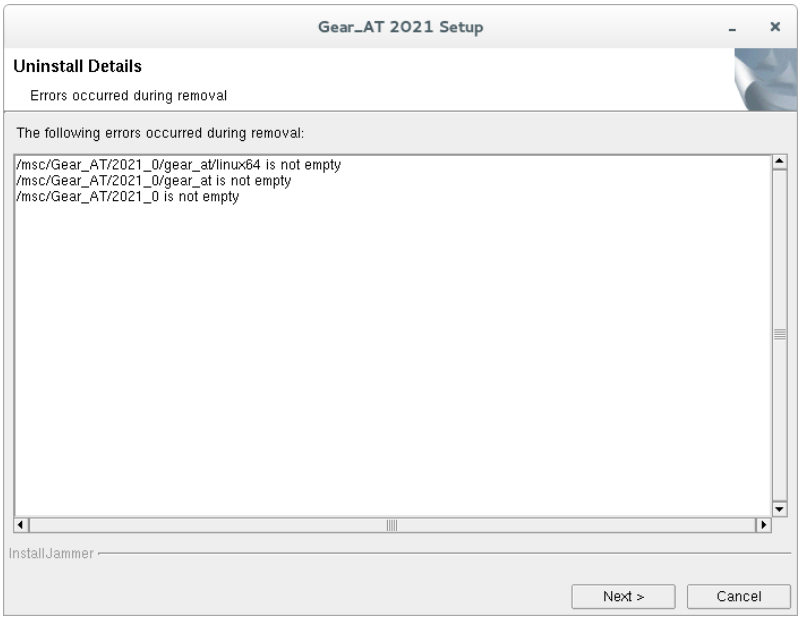
2 Uninstall Gear AT on Linux

To uninstall Gear AT plugin, go to *Applications – MSC.Software – Uninstall Gear AT 2021* or go to the *Gear_AT_Install_Dir* and execute *uninstall* program.

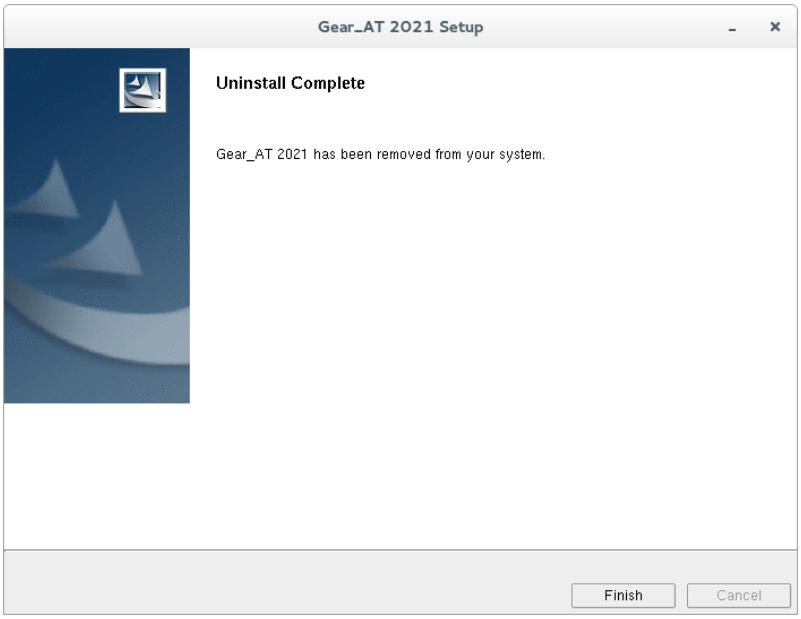
Confirm the removal operation to finish the process.



In case there is error message as shown below, please make sure the locations indicted are empty. Otherwise clean up the files manually.



A summary dialog box announces the completion of the uninstallation process. Selecting **Finish** will complete it.



After uninstalling the installation folder is cleaned up but left for previously installed versions of Gear AT. For instance, if the *Gear_AT_Install_Dir* was **/msc/gear_at*/2021_0*** this empty folder will remain after uninstallation.

3 Removal of Gear AT from Adams installation directory

If you need to remove Gear AT plugin from the system which was installed directly under Adams installation directory, you have to delete following files and folder on windows system:

- *Adams_Install_Dir*/gear_at
- *Adams_Install_Dir*/win64/gear_at_solver_cyl.dll
- *Adams_Install_Dir*/win64/gear_at_solver_hypoid.dll
- *Adams_Install_Dir*/win64/gear_at_solver_leadscrew.dll
- *Adams_Install_Dir*/win64/gear_at_solver_spl.dll
- *Adams_Install_Dir*/win64/gear_at_solver_worm.dll
- *Adams_Install_Dir*/win64/gear_at_view.dll
- *Adams_Install_Dir*/win64/gear_fast_solver.dll
- *Adams_Install_Dir*/win64/gear_at_plg.xml

and following files and folder on linux system:

- *Adams_Install_Dir*/gear_at
- *Adams_Install_Dir*/.configure_gat
- *Adams_Install_Dir*/linux64/gear_at_solver_cyl.so
- *Adams_Install_Dir*/linux64/gear_at_solver_hypoid.so

- *Adams_Install_Dir*/linux64/gear_at_solver_leadscrew.so
- *Adams_Install_Dir*/linux64/gear_at_solver_spl.so
- *Adams_Install_Dir*/linux64/gear_at_solver_worm.so
- *Adams_Install_Dir*/linux64/gear_at_view.so
- *Adams_Install_Dir*/linux64/gear_fast_solver.so
- *Adams_Install_Dir*/linux64/gear_at_plg.xml

There are no environment variables and/or registry set up during installation of Gear AT under Adams installation directory.

Special hints:

1 Previous installed versions of Gear AT

It is recommended to uninstall previous versions of Gear AT but not mandatory. You can handle multiple versions of Gear AT with the environment variable MSC_USER_PLUGIN_DIR.

Just set the path to the Gear AT installation of your choice. Be aware that you can set this environment as USER or as SYSTEM variable. Make sure that a path to a Gear AT Plugin is only set once.

In case you installed Gear AT under Adams installation directory, there is no MSC_USER_PLUGIN_DIR set by installer since Adams will automatically locate the plugin by itself. In that case there is no uninstaller available neither on Windows nor on Linux.