Knowledge Base

Information

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Plug-in utility to automatically mesh parts and instances in Abaqus/CAE

Portfolio / Domain: SIMULIA Abaqus Unified FEA / n/a
Product: n/a

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QUESTION

I have a model with many parts and instances. Is there an option that will alllow me to automatically mesh all of them at once?

ANSWER

(The following applies to Versions 6.7 and higher)

An Abaqus/CAE plug-in application for this purpose is attached below. The plug-in automates the repetitive tasks of seeding, setting mesh controls, and meshing. An HTML report containing mesh statistics is created each time the plug-in is executed. The Auto Mesher plug-in can only create meshes with tetrahedral elements (first or second order) on 3D deformable solid parts (and independent instances).

If necessary, the application employs virtual topology to mesh parts and instances that are not initially meshable. Please note that this plug-in is best suited for initially meshable parts that are precise and valid. It is not meant to automate the repair of geometry. If required, please use the various geometry repair tools available in Abaqus/CAE prior to using this plug-in.

The basic algorithm used by the plug-in is as follows:

1. All parts and instances in all available models are considered for meshing. Of these, the following items are filtered out:
    a. Dependent instances
    b. Parts that have been instanced, where the instance(s) are independent (In this case the instance is meshed rather than the part)
    c. 2D, 1D or 0D parts/instances
    d. Parts/instances with shell/wire features
    e. Rigid parts/instances
    f. Parts/instances that are already meshed
    g. Orphan parts/instances
    h. Parts/instances that do not have a single solid region.
    i. Suppressed instances
2. The remaining parts and assemblies are unlocked.
3. The seeds and mesh controls of the parts/instances are set. If the part/instance was already seeded then the existing seeds are honored. However, mesh controls are reset to those specified in the plug-in.
4. A mesh is attempted on the first part/instance. If successful, then the next part is meshed. If unsuccessful, the seeds are refined and the mesh generation is re-attempted. Mesh quality is taken into account when deciding if the part has meshed successfully.
5. If the meshing is unsuccessful after 5 attempts, the plug-in attempts to create a virtual topology feature on up to 100 faces that it determines to be un-meshable. Specifically, a face that is not meshable is combined with its neighbors.
6. If after creating the virtual topology feature the mesh still cannot be created, then this part/instance is skipped and the next is considered.
7. The mesh summary report is generated once the plug-in loops through all parts and instances.

Installation

To install the plug-in, save the attached archive file to one of the following directories:

- *abaqus_dir*\`abaqus_plugins` where *abaqus_dir* is the Abaqus parent directory
- *home_dir*\`abaqus_plugins` where *home_dir* is your home directory
- *current_dir*\`abaqus_plugins` where *current_dir* is the current directory

Note that if the `abaqus_plugins` directory does not exist in the desired path, it must be created. The *plugin_dir* directory can also be used, where *plugin_dir* is a directory specified in the `abaqus_v6.env` file by the environment variable **plugin_central_dir**. You can store plug-ins in a central location that can be accessed by all users at your site if the directory to which **plugin_central_dir** refers is mounted on a file system that all users can access. For example,

```
plugin_central_dir = r'\\fileServer\sharedDirectory'
```

On Windows platforms, right click on the archive file and select **WinZip** → **Extract to here**. On Linux platforms, type **unzip autoMesher.zip** at the command prompt. A folder named autoMesher and a file named `autoMesher_plugin.py` are extracted. Note that the plug-in may not function properly if this procedure is not followed.

Usage

1. Open the Abaqus/CAE file containing the parts and instances that are to be meshed.
2. From the Part, Assembly, or Mesh module, select **Plug-ins** → **Tools** → **Auto Mesher...**. The following dialog is displayed:

4. In the **Report file:** text field type the name of the HTML file where the summary report will be created. You may use the folder icon next to the text field to interactively select the filename.
5. If you would like to **Use mapped meshing** or would like to **Increase the size of interior elements** in the mesh then select the appropriate check-boxes. If you do not want the plug-in to use virtual topology then uncheck the **Apply virtual topology** checkbox.

6. If you do not want to see the summary report at the end of plug-in execution then uncheck the **Display HTML report** checkbox. Please note that even if you uncheck this checkbox, the report is still created (though it will not be displayed). Any associated image files for the HTML report are created in same folder as the HTML file.
7. Press **OK**.

Notes

1. The HTML report lists the parts and instances that the plug-in was able to mesh, unable to mesh, and those that were already meshed. For those parts and instances that the plug-in was able to mesh, mesh statistics are given. If a virtual topology feature was added to a part, it is noted.
2. If virtual topology features are created, they can be checked by browsing the feature list of the part from the Abaqus/CAE model tree. The plug-in applies an upper limit of 9 virtual topology features for any part. It is recommended that you check all virtual topology features to make sure that the resulting mesh is adequate.
3. If virtual topology features are created and the meshing operation still fails, then all virtual topology features that the plug-in created are removed.
4. Default Deviation factor value of 0.1 for curvature control is used. This value is hard-coded.
5. If no instances of a part are created then the mesh is put directly on the part.
6. By default, a mesh is automatically created for all parts and instances using the default global seed size. Before running the plug-in, the global seed size can be changed, or the seed size for an individual part/instance can be changed.
7. A part may fail to mesh if it cannot be unlocked, or if a virtual topology feature cannot be created.

Disclaimer

The attachments to this article are subject to certain usage conditions. Please click here for details.

Revision History

12 Nov 07	Answer created. Version 1.1-1 of plug-in released.
28 May 08	Version 1.1-2 of plug-in released. Decreases number of times virtual topology is attempted to be applied.
20 Jun 08	Version 1.1-3 of plug-in released. Added curvature control.

MY FAVORITE CONTENT

KEYWORDS **automatic, tet, mesh, part, instance, plug, plug-in, plugin, script, customization, 3532, failure**

ATTACHMENT automesher.zip answer_3532_dialog.png

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