

Knowledge Base

Information



Abaqus/CAE plug-in to wrap a flat 3D mesh into a cylindrical shape

Portfolio / Domain: SIMULIA Abaqus Unified FEA / SIMULIA Abaqus Unified FEA
Product: SIMULIA Abaqus/CAE

QA Article: QA0000008170e
Applicable Level: 6.10
Last Update Date: 10/09/2020
Rating:
Views: 106

QUESTION

How can I wrap a flat 3D mesh into a tubular or cylindrical shape?

ANSWER

(The following applies to Abaqus 6.10 and later.)

An Abaqus/CAE plug-in application for this purpose is attached below. It will wrap the mesh of an independent part instance into a cylindrical shape and create a new orphan mesh part that contains the wrapped mesh.

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,

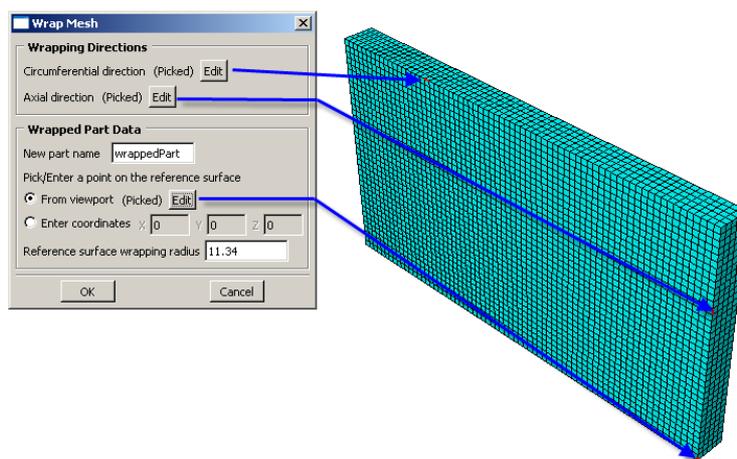
```
plugin_central_dir = r'\\fileServer\sharedDirectory'
```

On Windows platforms, right click on the archive file and select **WinZip** → **Extract to here**. On Linux platforms, type **unzip wrapMesh.zip** at the command prompt. A folder named abq_WrapMesh and a file named wrapMesh_plugin.py will be extracted.

Note that the plug-in will not function properly if this procedure is not followed.

Usage

1. The plug-in is launched from the Assembly module of Abaqus/CAE and operates on a flat, 3D, independent part instance that has been meshed. Select **Plug-ins** → **Tools** → **Wrap Mesh...**
2. As shown in the plug-in dialog below, from a current viewport you need to pick two directions that will be the circumferential and axial orientations of the wrapped part. This tool aligns the axial orientation with the global Z axis. For the directions you can pick element edges, geometry edges, or datum axes (defined at the part level). The picked entities are highlighted in the viewport.
3. You also need to specify a point to be placed on the reference surface of the wrapped part; the radius you specify will be measured to this surface. Either pick the point from the viewport or enter the coordinates. When picking from the viewport, the point can be either a vertex or a node. The picked point is highlighted in the viewport.



Enter the name of the wrapped part and the radius at which the instance will be wrapped. The plug-in then creates a new orphan mesh part when you click **OK**.

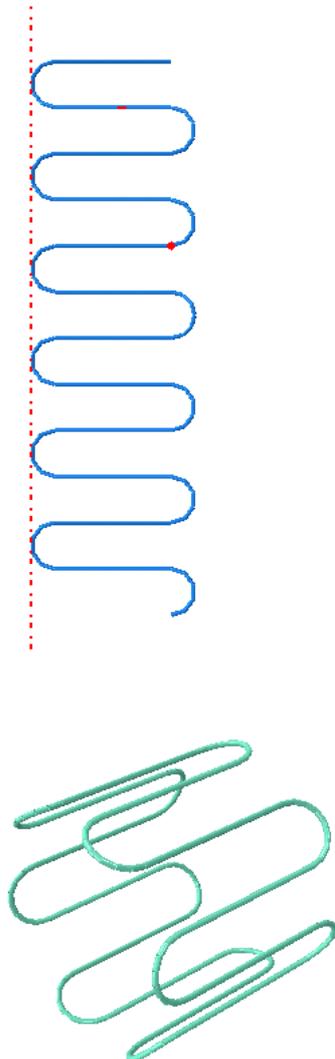


4. Position the instance as desired. As noted above, the instance will be aligned with the global Z axis in the axial direction. This utility will not re-position the instance after wrapping.

Potential applications of the plug-in:

1. Stents and other tubular shaped structure

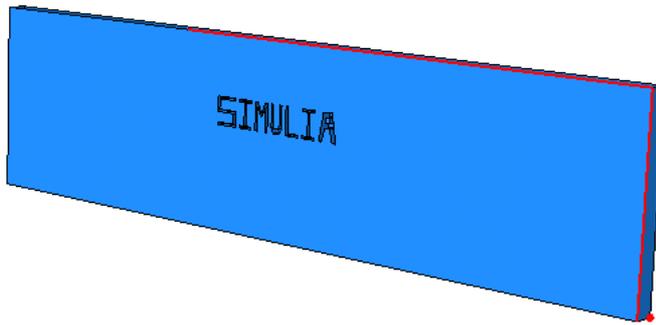
Stents are tiny, tubular-shaped structures used to expand and support blocked blood vessels. Abaqus has been used widely by stent manufacturers to analyze critical stresses/strains and to predict stent fatigue life. Stent models are usually created from a flat (unrolled) geometry due to special fabrication techniques used. It is very convenient to create and mesh these flat geometries in Abaqus/CAE. Once the flat part has been meshed, the plug-in provides a user-friendly interface to wrap the mesh into the final tubular shape. The images below show an example of a wire stent before and after wrapping.



Similarly, the plug-in can be used to create other tubular shaped meshes. One example is the expandable sand screen used by the oil and gas industry.

2. Emboss/Engraving on a cylindrical part

The images below show how a cylindrical engraving can be achieved using this plug-in.



Notes:

- The plug-in uses **Parallel Edge** constraints. Regardless of the orientation of the meshed instance to be wrapped the plug-in will wrap the instance with respect to Z direction. Once the wrapped mesh is created however, it may be translated/rotated as desired. This limitation is due to bug SIR-100122.
- If the mesh is wrapped into a closed cylinder, the coinciding nodes at the adjoining faces have to be manually merged in the **Mesh** module using **Mesh** → **Edit...** → **Category Node** → **Method Merge** in order to have a closed cylinder before running the analysis.
- The performance of this utility may degrade if the part has a very refined mesh. Please see the table below for some performance testing results of the plug-in on a Linux 64 bit machine using Abaqus/CAE 6.10:

Number of Nodes	Number of Elements	Run Time (seconds)
202,005	160,000	15
1,255,005	1,000,000	90
5,271,021	5,000,000	436

Revision History

03 May 10	Release version 1.1-1
02 Jul 10	Fix error messages. Release 1.1-2

Disclaimer

The attachments to this article are subject to certain usage conditions. Please [click here](#) for details.

KEYWORDS **plug-in, plugin, 4454**

ATTACHMENT

- [answer_4454_fig4.png](#)
- [answer_4454_fig6.png](#)
- [wrapMesh.zip](#)
- [answer_4454_fig3.png](#)
- [answer_4454_fig1.png](#)
- [answer_4454_fig5.png](#)
- [answer_4454_fig2.png](#)

SUBSCRIBE TO CHANGES

RATING **On a scale of 1-5, how would you rate the technical content of the article?**

Please rate this article...

LET US KNOW IF THIS ARTICLE NEEDS TO BE ENHANCED

UNCLEAR

MISSING INFO

DUPLICATE

OUT OF DATE

ERROR DETECTED

[See Comments \(2\)](#)