Knowledge Base

Abaqus/CAE plug-in application to visualize contact pressure and frictional stress total force vectors

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

QUESTION

I would like to visualize the vector of total force due to contact pressure and frictional stress. Is there an option to do this?

ANSWER

(*The following applies to Abaqus 6.8 and higher.*)

An Abaqus/CAE plug-in for this purpose is attached below. The utility allows you to visualize the vectors of total force due to contact pressure, total force due to frictional stress, and total force due to contact pressure and frictional stress. You may plot the complete vector or the respective components. Before running the analysis, you must request the following contact related history output:

- **CFN**: Total force due to contact pressure
- **CFS**: Total force due to frictional stress
- **CFT**: Total force due to contact pressure and frictional stress
- **XN**: Center of the total force due to contact pressure
- **XS**: Center of the total force due to frictional stress
- **XT**: Center of the total force due to contact pressure and frictional stress

It is most convenient to request this output for the entire model. If you are using a general contact definition (in Abaqus/Standard or Abaqus/Explicit) and the model also includes contact pairs, the force quantities due to contact pairs are not included in the associated general contact quantities. The force vectors for the general contact domain and the contact pairs will be separate.

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

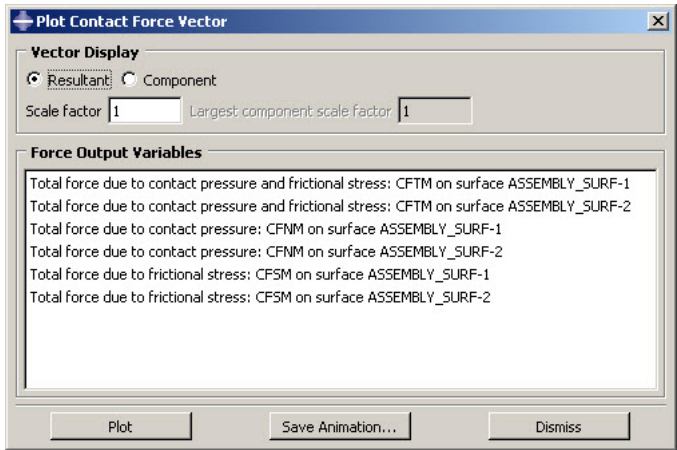*current_dir*\abaqus_plugins where *current_dir* is the current directory

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 plotContactForce.zip** at the command prompt. A folder named abq_contactForce and a file named plotContactForce_plugin.py will be extracted. Note that the plug-in will not function properly if this procedure is not followed

Usage

1. In Abaqus/Viewer or the **Visualization** module of Abaqus/CAE, open the desired output database (.odb) file.

2. Select **Plug-ins → Visualization → Plot Contact Force Vector...** to receive the following dialog:
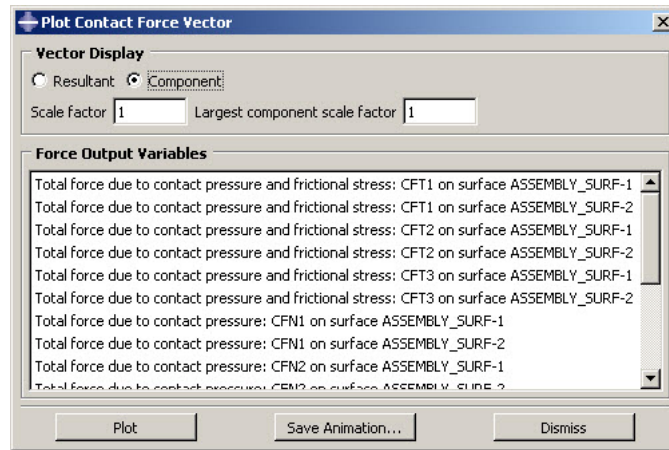

All applicable output will be listed. These are outputs that contain any of the following strings:'CFNM', 'CFSM','CFTM', 'CFT1', 'CFT2', 'CFT3', 'CFN1', 'CFN2', 'CFN3', 'CFS1', 'CFS2' or 'CFS3'. Note that for the output associated with contact pairs, the force variables are listed with the slave/master pairings.

3. From the **Vector Display** panel choose **Component** if you want plot the components of total force or **Resultant** if you want to plot the magnitude of total force.

4. Select an appropriate **Scale factor** to scale the size of the arrow displayed. For resultants, there is only one scale factor option. For components, there are two scales. The **Largest component scale factor** is used for the component
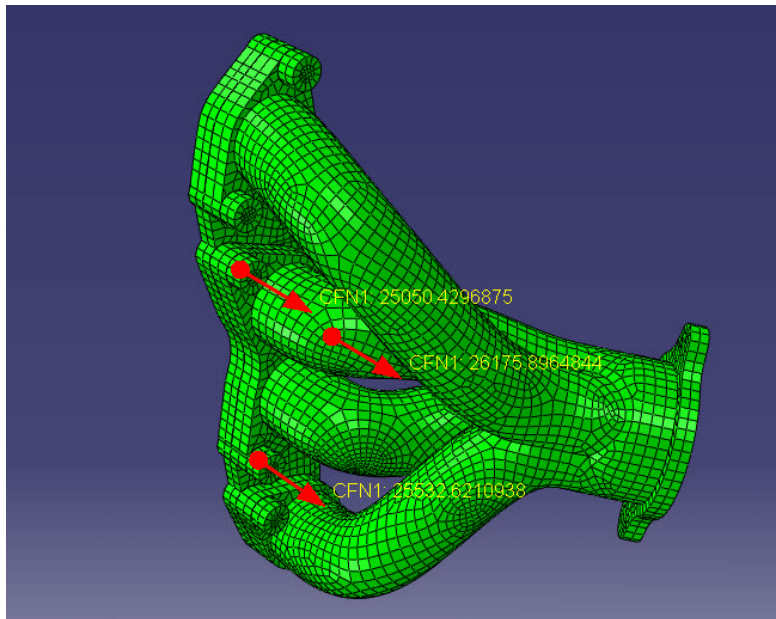
with the largest magnitude while **Scale factor** value is applied to the remaining components.
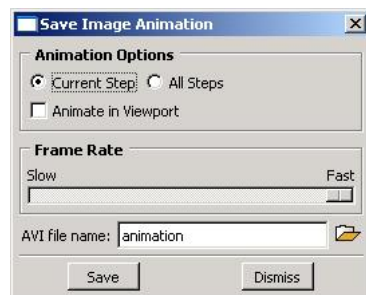
5. From the list of **Force Output Variables** choose single or multiple forces or force components that you wish to plot.

6. Select **Plot** to visualize the selected forces. Each component will be shown in the viewport as below, with the value of the component or magnitude printed near the arrow:

7. Select **Save Animation** to receive the following dialog:

8. From the **Animation Options** panel select **Current Step** or **All Steps** to specify the portion of the analysis history to plot and animate the chosen vector.

9. Select **Animate in Viewport** to view the animation in the viewport.

10. From the **Frame Rate** panel choose the speed at which you wish to animate the plot. Choosing **Slow** will pause the animation for 5 seconds before going to the next frame, while choosing **Fast** will eliminate the pause between frames.

11. In the **AVI file name** field enter the name of the file where the animation will be exported. If the file does not exist, it will be created in the directory from which you launched Abaqus/CAE.

Notes

- The start points for the arrows drawn in the viewport are the coordinates of the corresponding force center. For example, the base of the arrow for **CFT** is located by the coordinates given by **XT**. With the components of the given force vector, the unit vector is computed, and the components of the unit vector are used for visualization.

- When a vector is visualized it plots results for the current step and frame when the plot is created. If the step and/or frame are changed, the plot will not be automatically updated - you must return to the GUI and select **Plot** to update the result.

- As mentioned above, this utility will not work as expected if the contact related history outputs CFN/CFT/CFS and XN/XT/XS are not requested.

- Time values are taken from step and frame values. Force values are taken from interpolated X-Y data. It is recommended to first remove any noise from the X-Y data.

Disclaimer

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

Revision History

15 Oct 09	Release 1.1-1 of Plot Vector plugin
04 Nov 09	Release 1.1-2. Fix search string for Explicit history output.
19 May 11	Release 1.2-1. Fix animimation bug. Add ability to scale largest component vector.

KEYWORDS

plot, plug, vector, total, force, stress, utility, application, tool, contact, history, output, 4182

ATTACHMENT

| answer_4182_pic4a.jpg | answer_4182_pic3.jpg | answer_4182_pic1.jpg | answer_4182_pic2.jpg |

| plotContactForce.zip |

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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 |

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