

# Knowledge Base

Information



## Abaqus/CAE plug-in to plot contour integrals for conventional and XFEM crack analyses

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

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QUESTION

I have contour integral history output data. How do I plot the data against node labels and/or distance along the crack front?

ANSWER

(The following applies to Abaqus 6.10 and higher)

An Abaqus/CAE plug-in for this purpose is attached below. It allows you to plot contour integral history output data against:

1. Node labels of conventional crack fronts
2. Node labels of XFEM crack fronts, or
3. Distance along the crack front.
4. Crack front position

For the third option the plug-in computes the straight line distance from the start node as a fixed location to the current node. Whereas for the fourth option, the plug-in approximates the actual length from the start node of the crack front to the current node on the crack front by taking the incremental straight line distance from the current point to the previous point in the crack front node sequence and adding to the accumulated distance from all the prior incremental distances starting at 0.0 at the first node in the sequence.

The plug-in also creates a comma-separated (.csv) file with coordinates of the crack front nodes.

**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

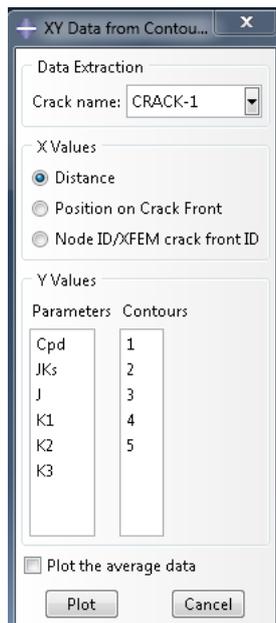
Note that if the abaqus\_plugins directory does not exist in the desired path, it must be created. The *plugin\_dir* directory can also be used, where *plugin\_dir* is a directory specified in the abaqus\_v6.env file by the environment variable **plugin\_central\_dir**. You can store plug-ins in a central 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 files and select **WinZip** → **Extract to here**. On Linux platforms, type **unzip ContourIntegral.zip** at the command prompt. A folder named `abq_ContourIntegral` and a file named `contourIntegral_plugin.py` will be extracted.

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

**Usage**

In Abaqus/Viewer or the Visualization module of Abaqus/CAE select **Plug-ins** → **Tools** → **Plot Contour Integrals...** to receive the following dialog:



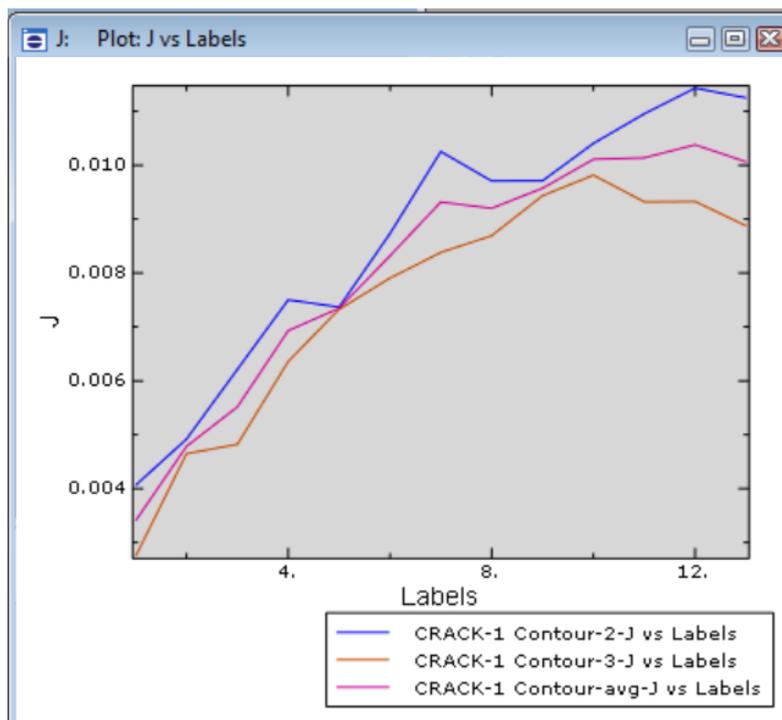
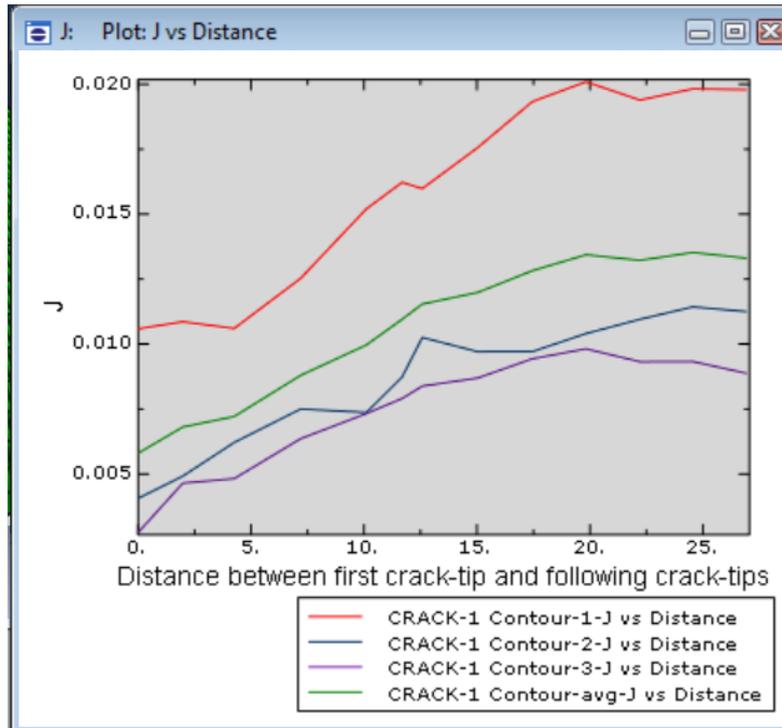
The contour integral history outputs containing crack information will be listed under **Data Extraction**.

Select **Distance** or **Node ID/XFEM crack front ID** for the plot's x-axis values. Depending upon the selected crack name, the respective contour integral parameters and the number of contours will be displayed in the **Y Values** lists. You can select multiple parameters and contours. After the selections, click **Plot** to plot the parameter history data for the current frame of the current step. A check button at the bottom the plug-in dialog provides an option to plot an

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average contour integral parameter value for the selected contours. The average plot will be displayed only when the check button is checked and more than one contour is selected in the plug-in dialog. A .csv file will be written to the working directory, which will have the coordinates of the crack front nodes. The name of the file will be Coordinates\_.csv.

Each parameter will be plotted on a separate viewport along with the specified contours. For better visualization you may tile the viewports horizontally or vertically. The sample plots for J are shown in the images below.



**Limitations**

1. For conventional cracks the plug-in is supported **only** when the NORMAL parameter is included with \*CONTOUR INTEGRAL keyword in the input file.
2. The use of '\_' (underscore) in the crack name string is not supported.
3. For ODBs with a large number of history variables, cracks, contour integrals and contours, the plug-in performance may be affected while populating the plug-in dialog box and plotting the data.
4. The plug-in does not support models involving independent instances in Abaqus/CAE.

**Related Links**

The **XY to Excel** plug-in, available in AnswerExporting X-Y data objects output to MS Excel, can be used to export the XY Data to MS Excel.

*Revision History*

19 Sept 2011	Release of Version 1.1-1
26 Sept 2011	Release of Version 1.1-2 (A bug fixed.)

03 March 2012	Release of Version 1.1-3 (A bug related history output string parsing is fixed.)
22 Nov 2013	Release of Version 1.1-4(A bug related to the number of contours > 9)
19 Aug 2015	Release of Version 1.2. Added a new option to use crack front position as X axis for plotting.
11 Nov 2016	Release of Version 1.3. Fixed a bug in determining the ODB version in Abaqus 2016 release.
09 Dec 2019	Fixed a bug when requesting more than 9 contours

**Disclaimer**

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

**KEYWORDS**     **plug-in, plugin, contour, integral, history, output, data, node, labels, id, crack, tip, xfem**

**ATTACHMENT**

- [answer\\_4239\\_fig2\\_distance.png](#)
- [answer\\_4239\\_fig3\\_labels.png](#)
- [answer\\_4239\\_fig1\\_dialog.png](#)
- [ContourIntegral.zip](#)

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