

Problem 40

**Analysis of a cracked body
with ADINA-M — gluemesh**

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Problem description

It is desired to reanalyze the cracked body analyzed in primer problem 17 using the gluemesh feature.

In primer problem 17, there are two meshed regions, a mapped mesh region and a free-form mesh region. We used face-links in order to compatibly connect the two meshed regions.

In this primer problem, we use the gluemesh feature to connect the two meshed regions. We do not use face-links.

In this problem solution, we will demonstrate the following topics that have not been presented in previous problems:

- Running an unstable model in static analysis.
- Using the gluemesh feature.

Before you begin

Please refer to the Icon Locator Tables chapter of the Primer for the locations of all of the AUI icons. Please refer to the Hints chapter of the Primer for useful hints.

Note that you must have an ADINA-M license to do this problem. In addition you need to allocate at least 80 MB of memory to the AUI and 750 MB of memory to ADINA.

This problem cannot be solved with the 900 nodes version of the ADINA System because the 900 nodes version of the ADINA System does not include ADINA-M.

You should work through primer problem 17 if you have not already done so.


Much of the input for this problem is stored in file prob40_1.in and prob40_1.plo. You need to copy files prob40_1.in and prob40_1.plo from the folder samples\primer into a working directory or folder before beginning this analysis.

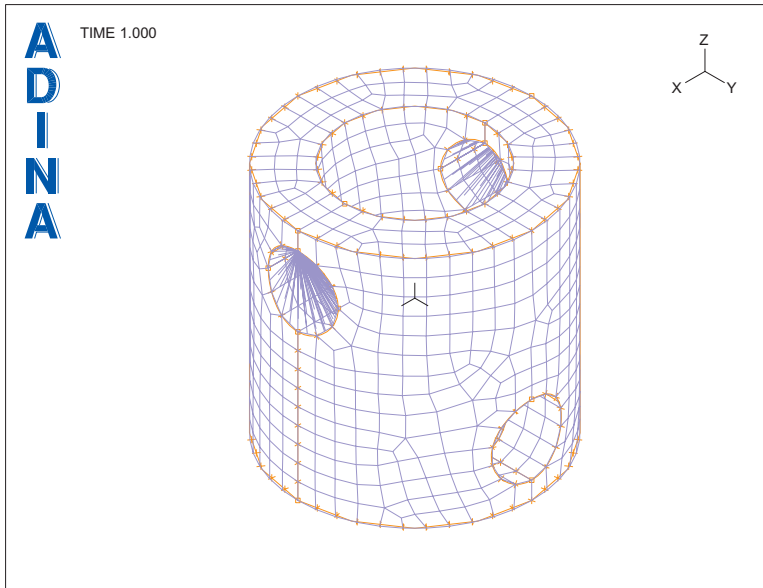
Invoking the AUI and choosing the finite element program






Invoke the AUI and choose ADINA Structures from the Program Module drop-down list. Choose Edit→Memory Usage and make sure that the ADINA/AUI memory is at least 80 M Bytes.

Defining the model

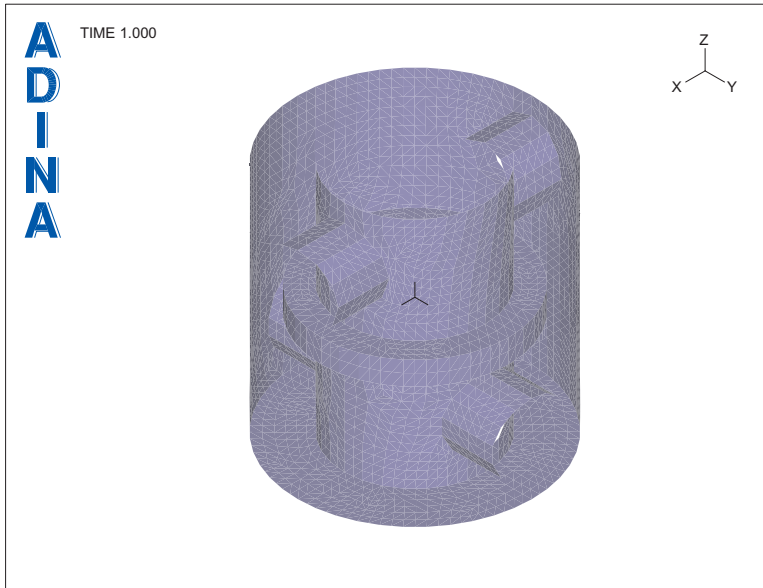
We have prepared a batch file (prob40_1.in) which contains the entire model definition, with the exception of the gluemesh definitions.

Click the Open icon , navigate to the working directory or folder, set the 'File type' field to 'ADINA-IN Command Files (*.in)', select the file prob40_1.in and click Open. The graphics window should look something like this:





Click the Show Geometry icon  (to hide the geometry), the Show Rigid Links and Constraints icon  (to hide the constraints), the Shading icon , the Cull Front Faces icon  and the No Mesh Lines icon . The graphics window should look something like the figure on the next page.

The boundary between the mapped mesh and free mesh region is visible. Hence the meshing is incompatible at the boundary.



Generating the data file, running ADINA

We now demonstrate the effect of not connecting the mapped mesh and free mesh.

Click the Save icon  and save the database to file prob40. Click the Data File/Solution icon , set the file name to prob40, make sure that the Run Solution button is checked and click Save.

Since the mapped mesh is not connected to the free mesh, the mapped mesh has rigid body modes, so the model is unstable in static analysis. Depending upon round-off, ADINA either stops with the message

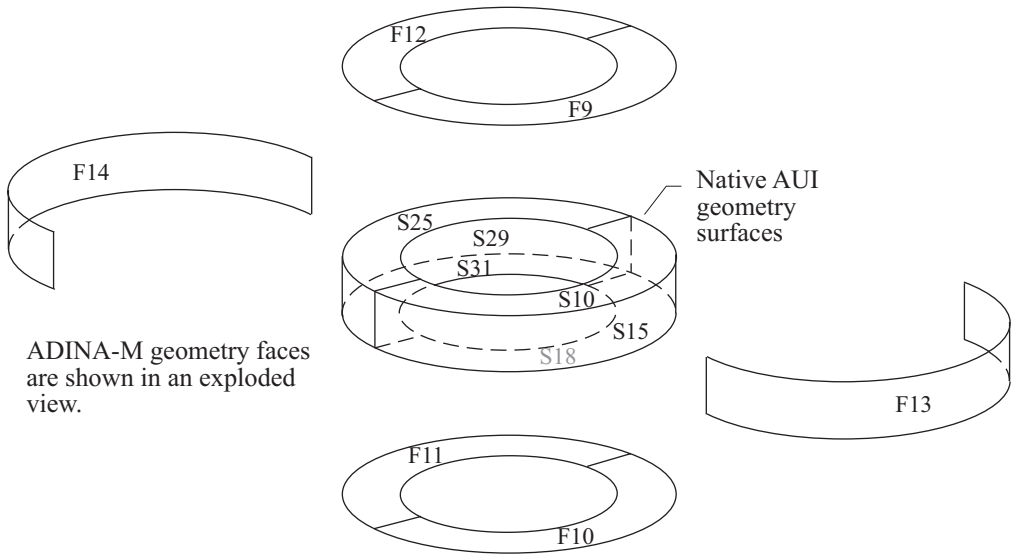
*** Stiffness matrix not positive definite ***

(which indicates that the model is unstable), or ADINA runs to completion. In the latter case, if you plot element group 1, you will find that the element group remains undeformed.

Using the gluemesh feature

We need to glue the mapped mesh to the free mesh.

The figure on the next page (reprinted from problem 17) shows how the surfaces and faces of the model line up.






Association of ADINA-M geometry faces with native AUI geometry surfaces

Choose Meshing→Glue Mesh, add Glue Mesh Set 1, enter the following information into the table and click OK.






Type	Label #	Body #	Side
Surface	10	(blank)	Slave
Surface	15	(blank)	Slave
Surface	18	(blank)	Slave
Surface	25	(blank)	Slave
Surface	29	(blank)	Slave
Surface	31	(blank)	Slave
Face	9	1	Master
Face	10	1	Master
Face	11	1	Master
Face	12	1	Master
Face	13	1	Master
Face	14	1	Master

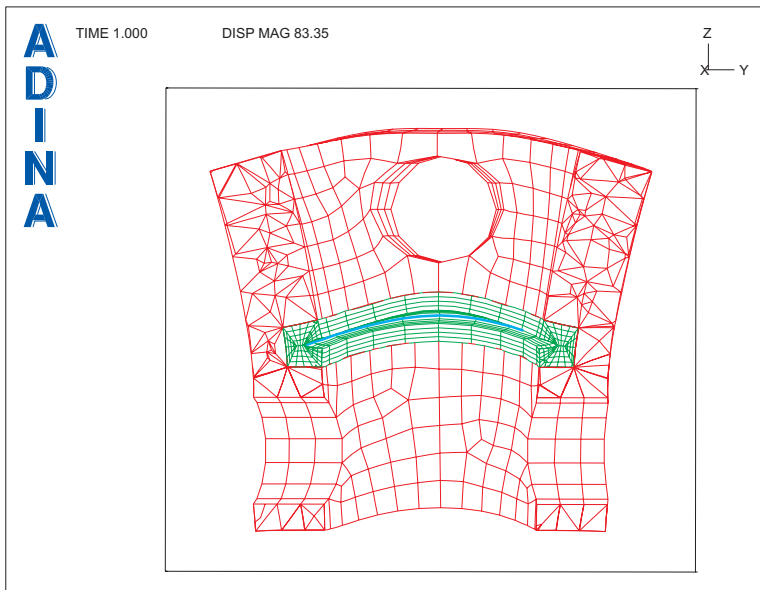
Generating the data file, running ADINA, loading the porthole file

Click the Save icon  to save the database file. Click the Data File/Solution icon , set the file name to prob40, make sure that the Run Solution button is checked and click Save. The ADINA analysis requires about 750 MB of memory.

When ADINA is finished, close all open dialog boxes, choose Post-Processing from the Program Module drop-down list (you can discard all changes), click the Open icon  and open porthole file prob40.


Plotting the deformed mesh

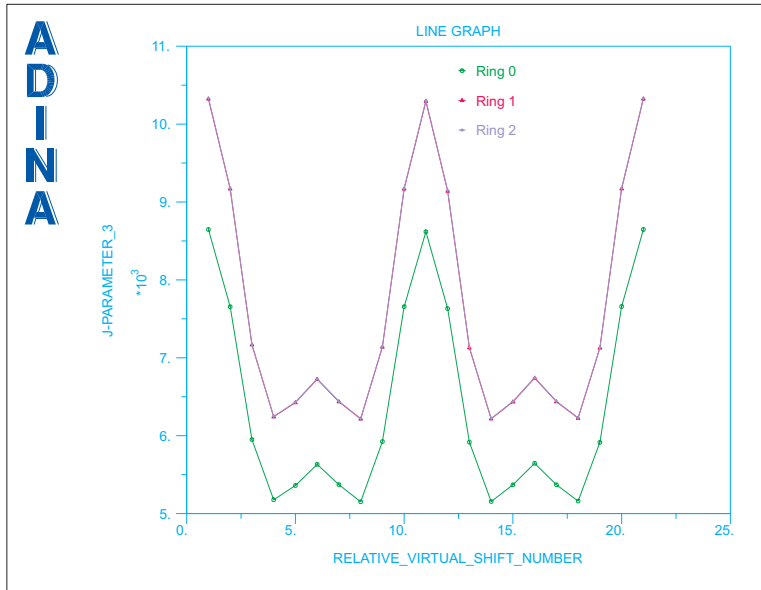
Click the Color Element Groups icon , the Show Rigid Links and Constraints icon  and the Scale Displacements icon  10%. Now click the Cut Surface icon , set the Type to Cutting Plane, the “Below the Cutplane” field to “Display as Usual”, the “Above the Cutplane” field to “Do not Display” and click OK. Use the Pick icon  and the mouse to rotate the plot until the graphics window look something like this:



The mapped mesh (in green) and the free mesh (in red) appear to deform compatibly.

Fracture mechanics

We have prepared the commands for plotting the J-integrals for the virtual shifts in file prob40_1.plo. Click the Open icon , navigate to the working directory or folder, set the ‘File type’ field to ‘ADINA-PLOT Command Files (*.plo)’, select the file prob40_1.plo and click Open. The graphics window should look something like this:



As compared with the graph in problem 17, in this graph we have three lines, one for the virtual shifts with ring 0, one for the virtual shifts with ring 1 and one for the virtual shifts with ring 2. (Of course, the results in problem 17 can also be plotted in this way.)

Exiting the AUI: Choose File→Exit (you can discard all changes).