Measuring Rotation in Ansys Mechanical Workbench Mechanical Application

Although Mechanical Workbench Application does not have a results Probe that will measure averaged rotation of a geometric entity, such a measurement can be done easily with the use of one Remote Point, and two APDL Commands Objects. The Remote Point is associated with the geometry of interest, and rotation of the pilot node at the Remote Point can be measured by Ansys APDL commands.

Workbench Setup

The first step to measure rotation of geometry of interest is to associate a Remote Point with the geometry of interest. The behavior of the associated geometry is set to Deformable, so that the FEA model behavior is not affected by the Remote Point.

The geometry of interest could be a set of Vertices, or one or more Edges, or one or more Faces.

The remote point will have an Ansys Pilot Node associated with it, and a TARGE170 element placed there. A Commands Object inserted at the Remote Point object can record the node number.
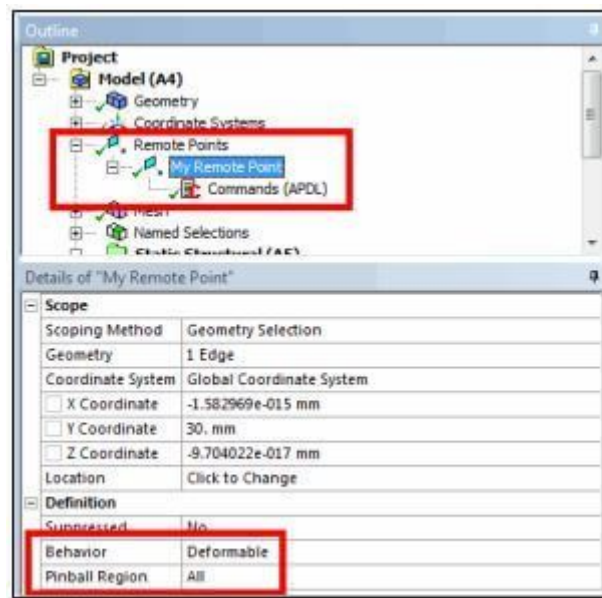
Workbench 14.0 supplies a parameter "_npilot" at each Remote Point that identifies the node placed at the Pilot Node TARGE170 element. This node number can be recorded with a user defined parameter, as illustrated for the Commands (APDL) object for the Remote Point of the figure above, in the figure below. The parameter "Measure_Pilot" is used to record the node number with the APDL code:

Measure_Pilot=_npilot
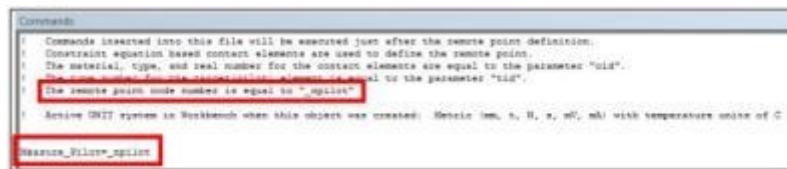
A second Commands Object is inserted at the results Solution area, and employs the pilot node number at the remote point to measure the rotation that is found during SOLVE of the model. Three commands find rotations about the X, Y, and Z directions. The user can control the coordinate system for this measurement with a suitable coordinate system and **RSYS** command, if desired. The user should restore **RSYS,0** once the commands are complete. The following three commands measure the node rotation in degrees, noting that Ansys reports node rotation in radians, and converting to degrees:

my_rotx=ROTX(Measure_Pilot)*57.29577951
my_roty=ROTY(Measure_Pilot)*57.29577951
my_rotz=ROTZ(Measure_Pilot)*57.29577951
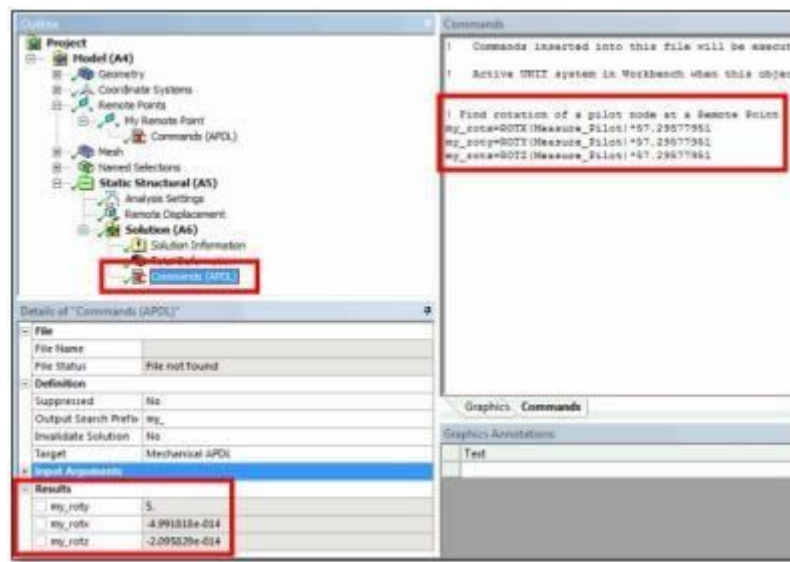
Use of the prefix "my_" in the above parameters enables report of these parameters in the Results in Workbench, as seen in the figure above.

To make sense of complicated rotation results, note that the rotation sequence in Ansys is in the order:

THXY – First rotation about local Z (positive X toward Y).
THYZ – Second rotation about local X (positive Y toward Z).
THZX – Third rotation about local Y (positive Z toward X).

Recall also that nodal coordinate systems are not re-oriented in a large displacement analysis, if RSYS,SOLU is employed in rotation measurement.

Note that if the geometry chosen to be associated with the Remote Point contains a large number of nodes, this can affect the Wavefront of the FEA model, increasing solution time. Use of Edges, or a set of Vertices, or restricting the Pinball size, might be employed to reduce the impact on Wavefront, if this becomes problematic.

Conclusion

The use of one Remote Point associated with geometry set to Deformable, plus two APDL Commands Objects, makes it possible to measure the averaged rotation of that associated geometry.

Since rotations of nodes in Ansys are reported in radians, a conversion to degrees can be included in the APDL coding. Coordinate systems in the model could be used with an **RSYS** command if
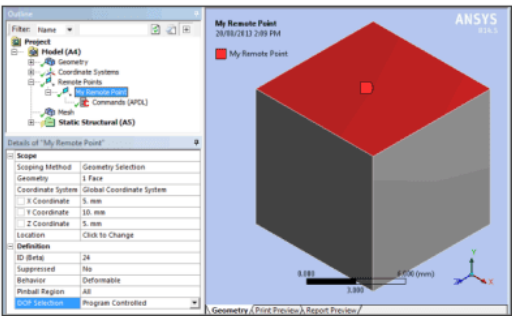
particular directions for rotation measurement were desired.

The use of APDL parameter names with the prefix "my_" can be used to report these rotations and to make it possible to use them for Workbench Parameters.
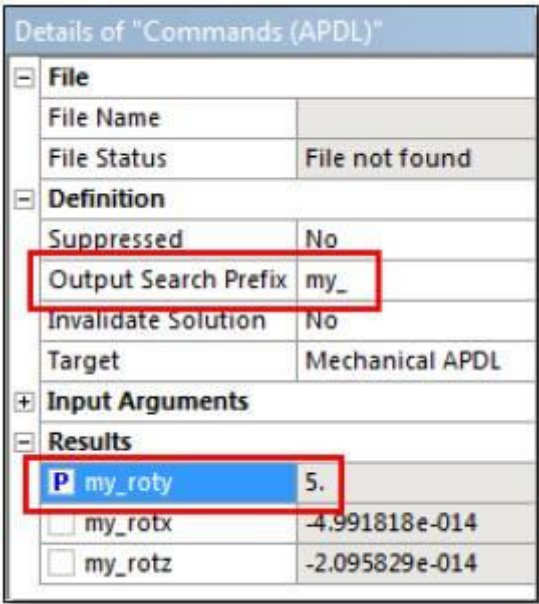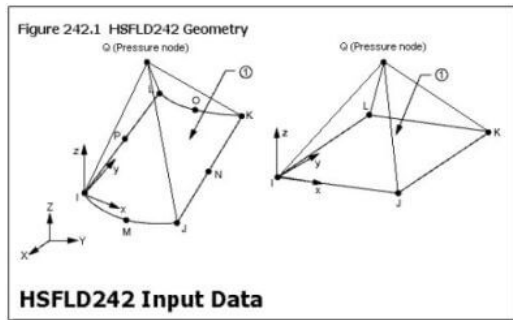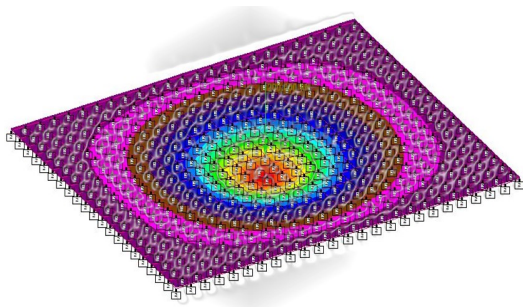

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