Altair OptiStruct™

OS-E: 0170 Revolute Joint Using JOINTG and MOTNJG

Demonstrate a revolute joint using JOINTG and MOTNJG. The JOINTG entry can be used for defining a variety of joints, including revolute, ball, universal, cardan, and so on. Motion on these joints can be applied using the MOTNJG entry.

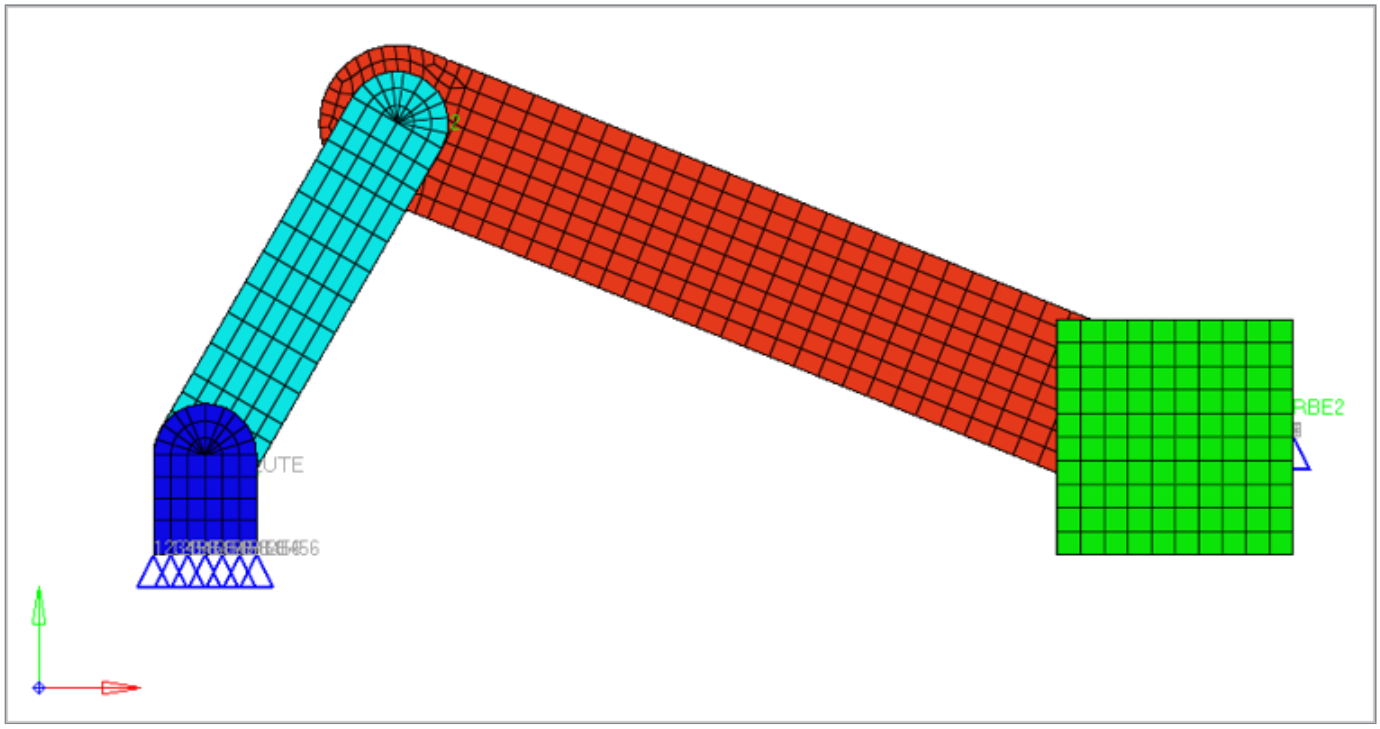

Figure 1. FE Model is a Slider-Crank System Meshed using 3D Elements.
A -X-direction enforced motion is applied at one end of the block

---

Model Description

Objective here is to do conduct a Large Displacement Nonlinear Analysis of a Slider-Crank model using JOINTG. A horizontal enforced displacement is applied using an SPC entry on one end of the block in the negative X direction. The model is shown in Figure 1.

Twelve JOINTG entries are used in the model, to represent the six joints.

A revolute joint is a joint which allows single axis rotation functions (for example, in a door hinge). The joint works by allowing free rotation (or enforced displacement via MOTNJG) about one degree of freedom of the two grid points associated with the joint (the two selected degrees of freedom should be the same). The remaining rotational degrees of freedom are automatically constrained. The translational degrees of freedom can be fixed by defining an additional ball joint.

Therefore, on the JOINTG entry, the following rules should be followed to define a revolute joint:

1. JTYPE should be set to REVOLUTE.

2. The X-axis of the coordinate system (CID1) of grid point 1 should be parallel (and in the same direction) to the X-axis of coordinate system (CID2) of grid point 2. The `MOTNJG` Subcase and Bulk Data Entries can be used to define the value of rotation (DOF=4) about the X-axis.
3. The other axes of the coordinate system may point in any direction.
4. The translational degrees of freedom can be fixed by defining an additional ball joint.

For more information, refer to `JOINTG` and `MOTNJG` Bulk Data Entries in the *Reference Guide*.

FE Model

Elements Types	`CHEXA`
	`CPENTA`
	`JOINTG`
	`RBE2`

The linear material properties are:

`MAT1`

Young's Modulus	2.1E7 Pa
Poisson's Ratio	0.3

Results

The revolute joints constrain rotation in all directions except the X-direction rotation of the assigned local coordinate system (*`CID`*=1). The translations in the local system are also constrained by the ball joint. Therefore, only rotations in local X direction is allowed between the grids which are connected by the `JOINTG` entry.

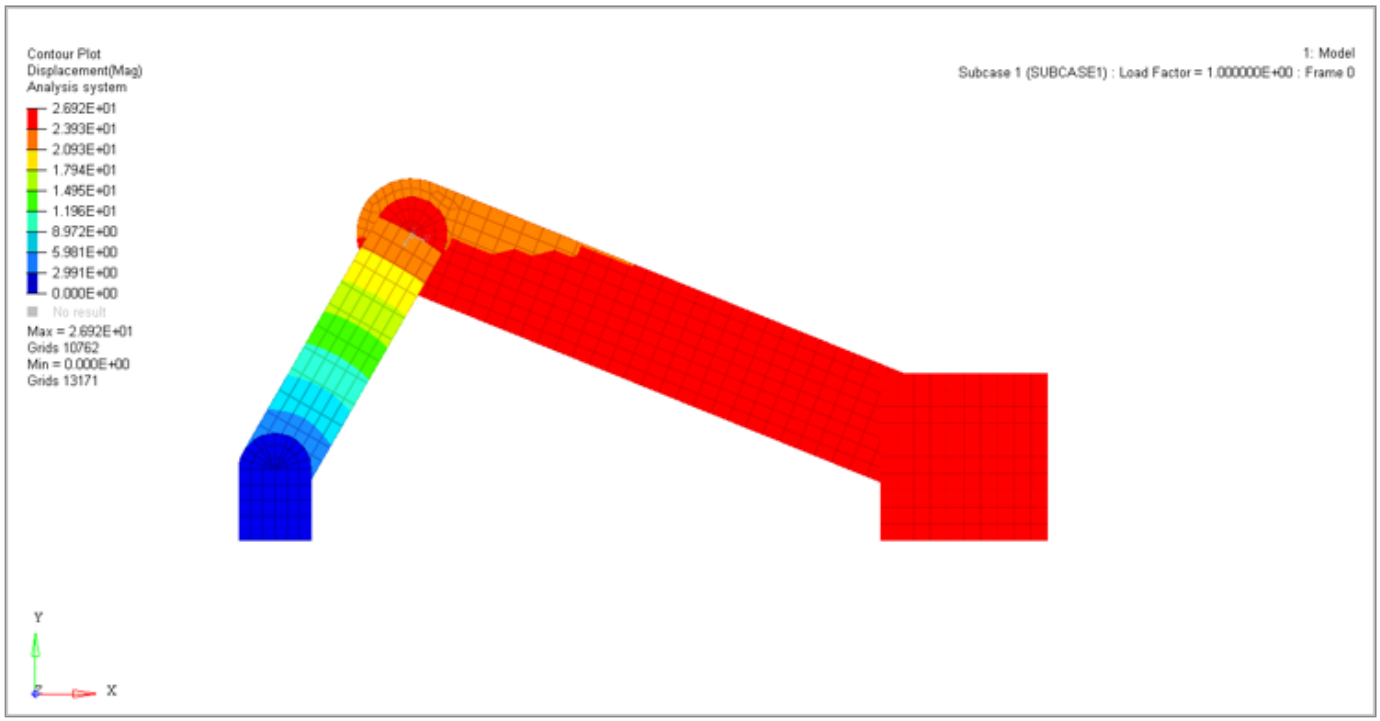

Figure 2. Initial Position

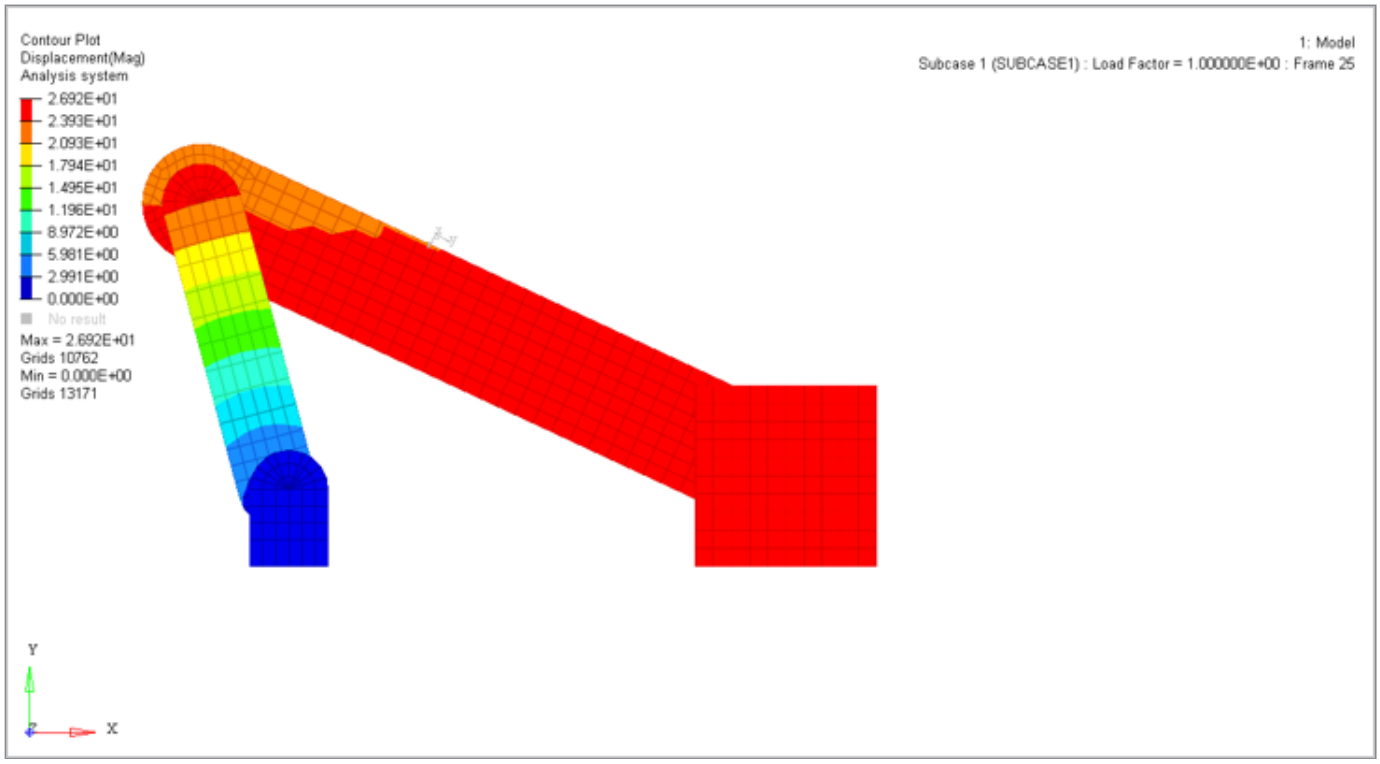

Figure 3. Final Position After Applied Enforced Displacement via SPC

Model Files

The model files used in this example include:

`<install_directory>/hwsolvers/demos/optistruct/examples/slider_crank.fem`