Exercise 4a: Small and Large Displacement of a Block

This exercise demonstrates the differences between small and large-displacement for the same analysis setup performed on a rectangular block. The structural model is comprised of hexagonal first-order elements and a rigid element which covers the loading face. The material models, including plasticity effects, the property, the applied moment, and the load steps will be created by the user.



Problem Setup

You should copy this file: block.fem

Chapter 4: Large Displacement Exercises Step 1: Import the file block.fem into HyperMesh Desktop

Step 2: Create a plastic material with the following values:

- 1. Name: Material
- 2. *Type*: MAT1
- **3**. *E***: 3e6**
- 4. *nu*: 0.25
- 5. MATS1: <checked>
- 6. **TYPE**: Plastic
- 7. **H**: 30303
- 8. **YF**: 1
- 9. LIMIT1:1e8

Step 3: Create a new PSOLID named PSOLID that uses the material card created above. Assign that material to the PSHELL_1 property as well.

Step 4: Assign the PSOLID property to the PSOLID_2 component

Step 5: In a new load collector named SPC, constrain every node on the Y⁻ block face (opposite the RBE2) in DOFs 1-6



Step 6: In a new load collector named Load, create a Y-axis moment of

magnitude 5e7 on Node 6671

Step 7: Create an NLPARM load collector named NLPARM with an NINC of 20

Step 8: Create the load collectors incremental step requests for 20 increments using NLOUT and NLADAPT

Step 9: Create the control cards for small displacement analysis

- 1. Set PARAM, HASHASSM to YES.
- 2. Set PARAM, LGDISP to 0.

Step 10: Create a new Non-linear quasi-static analysis loadstep with SPC set to SPC, LOAD set to Load, and NLPARM set to NLPARM. Set the requests for incremental output in the subcase as well using the NLOUT and NLADAPT entries.

Step 11: Run the analysis as block_sm.fem with the options -optskip -out -cpu 4



Step 12: Review the results in HyperView

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Step 13: Return to the model and change the control cards to allow large displacement analysis: set PARAM, LGDISP to 1.

Step 14: Re-run the analysis as block_lg.fem



Step 15: Review the results in HyperView

Small displacement (left) vs. large displacement (right) results for a block with a moment load