SIEMENS

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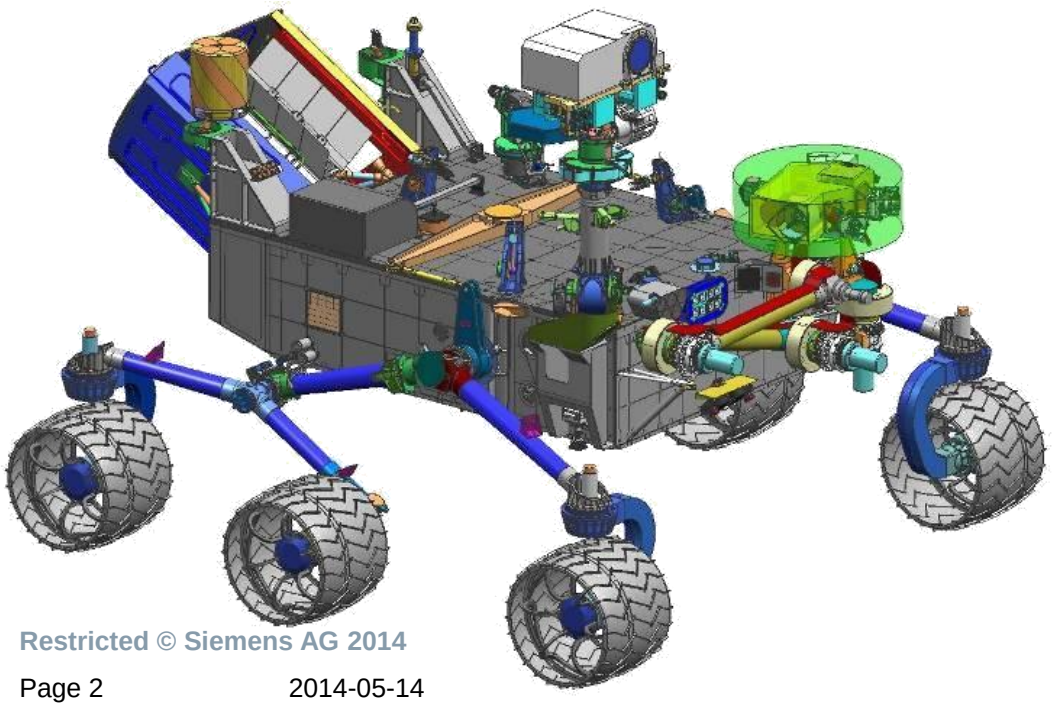
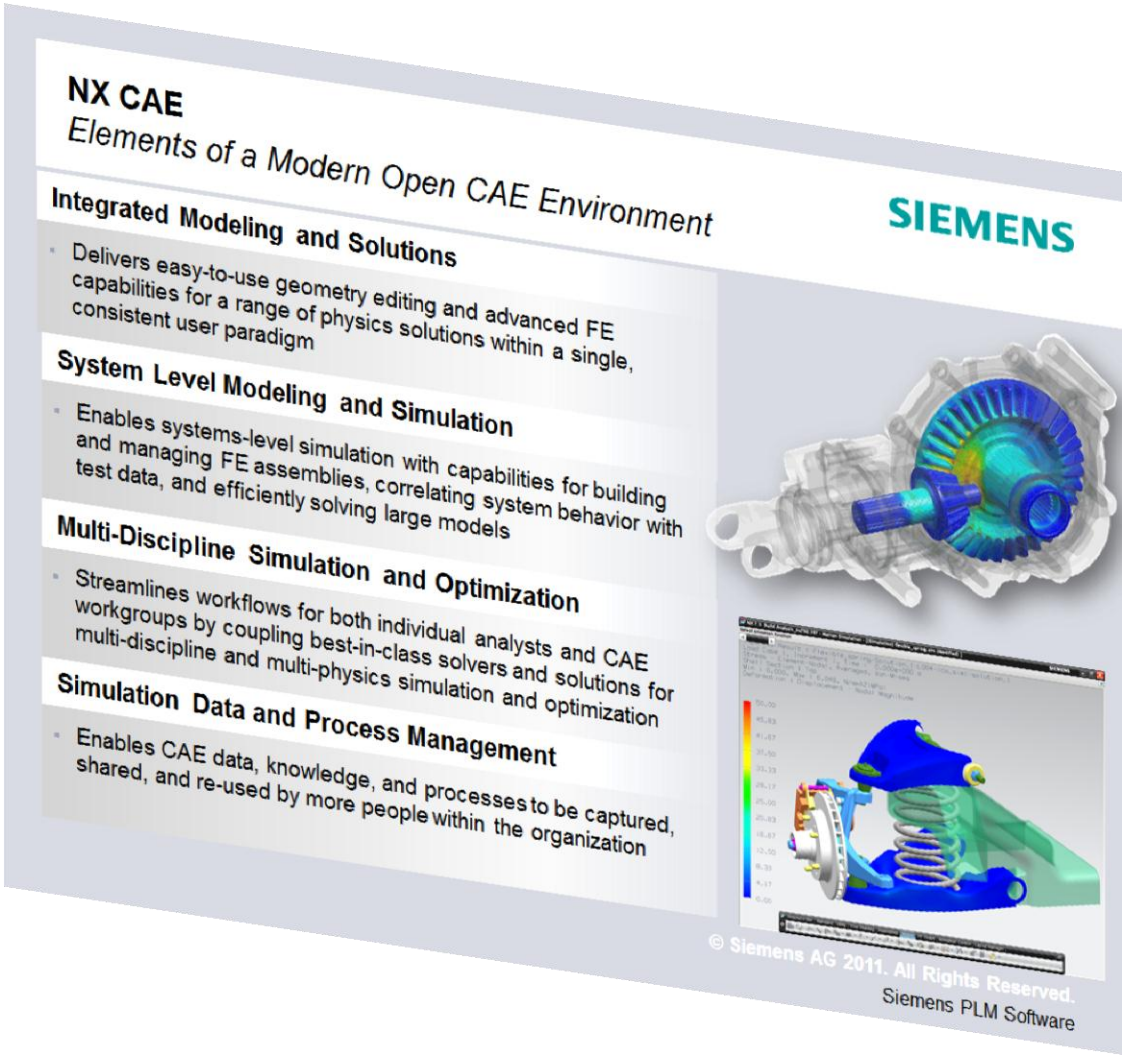
NX CAE - NX Nastran Tips & Tricks

Agenda

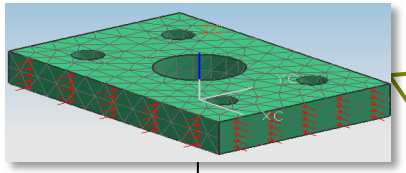
- Reuse
- Assembly Fem
- Connection examples
- Debugging some related issues



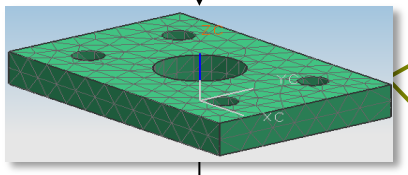


NX CAE: Basic File Structure – Single FEM

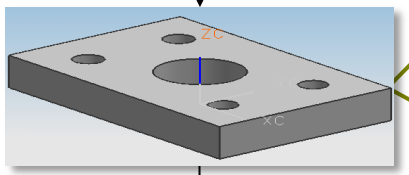
Simulation Part



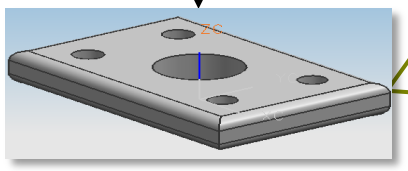
FEM Part

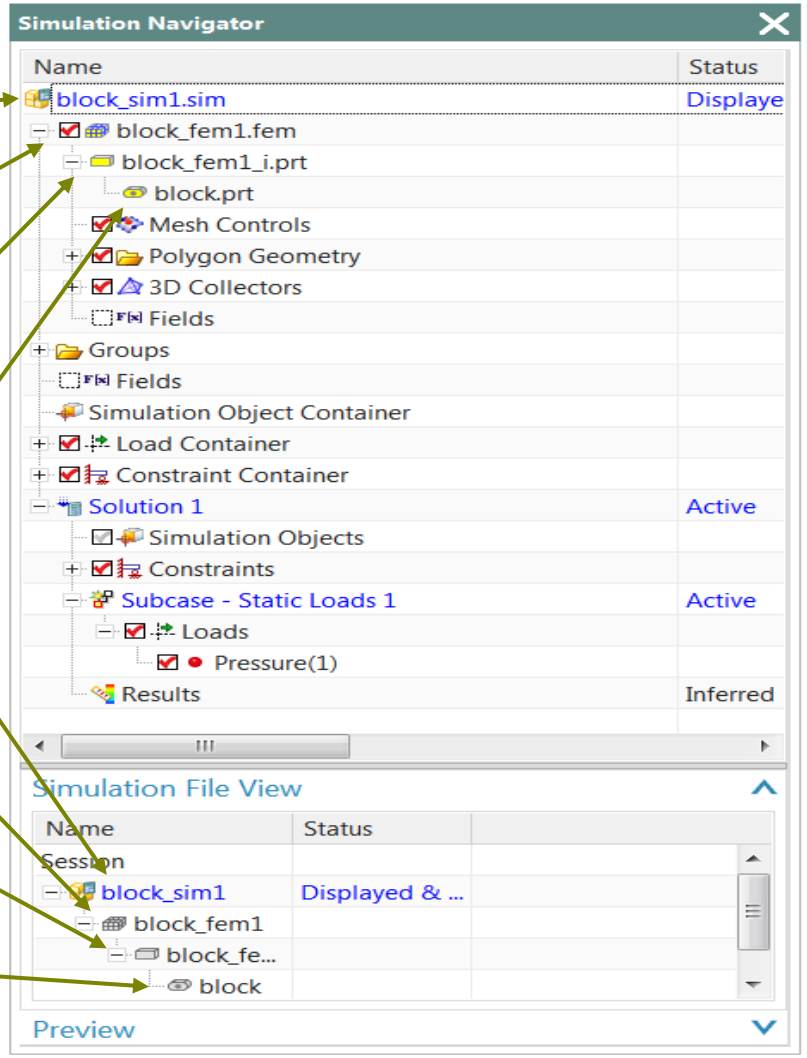


Idealize Part



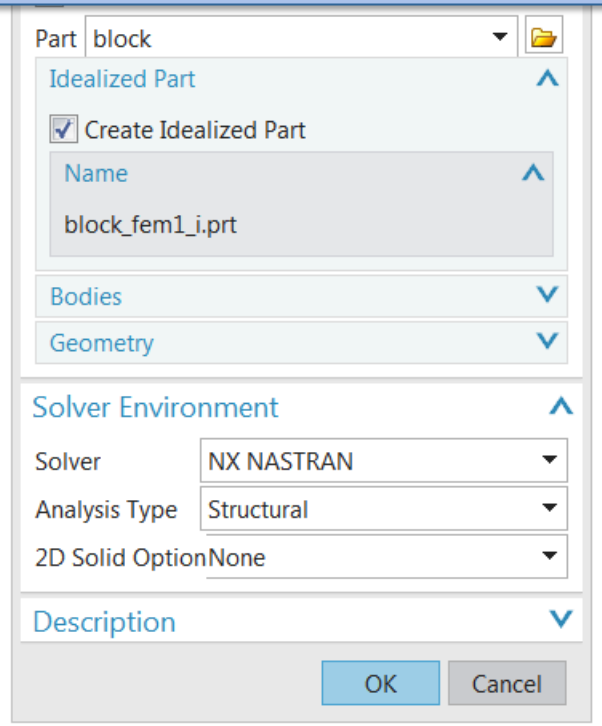
Master Part





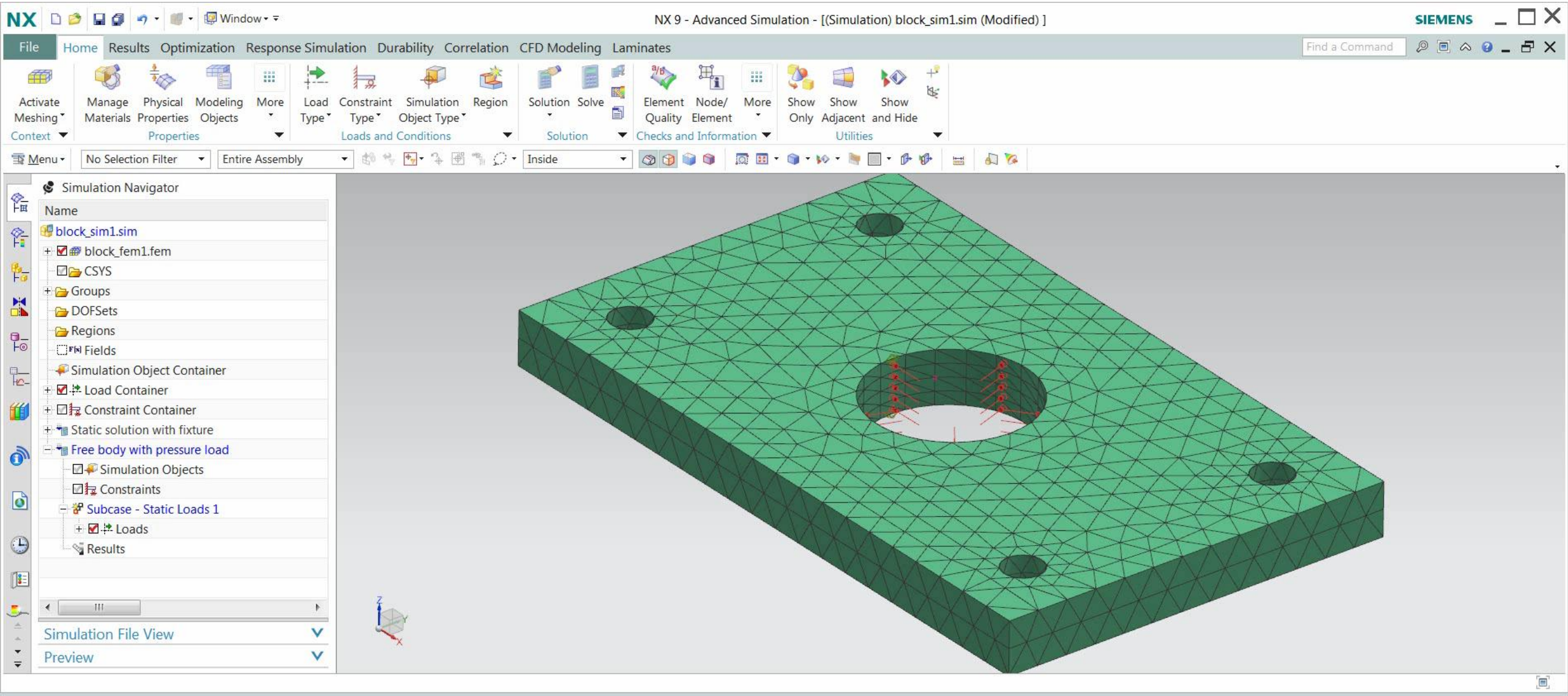
Benefits

- Working in a concurrent environment
- Efficient use of model and data re-use
- Efficient use of local memory – not all files need to be loaded

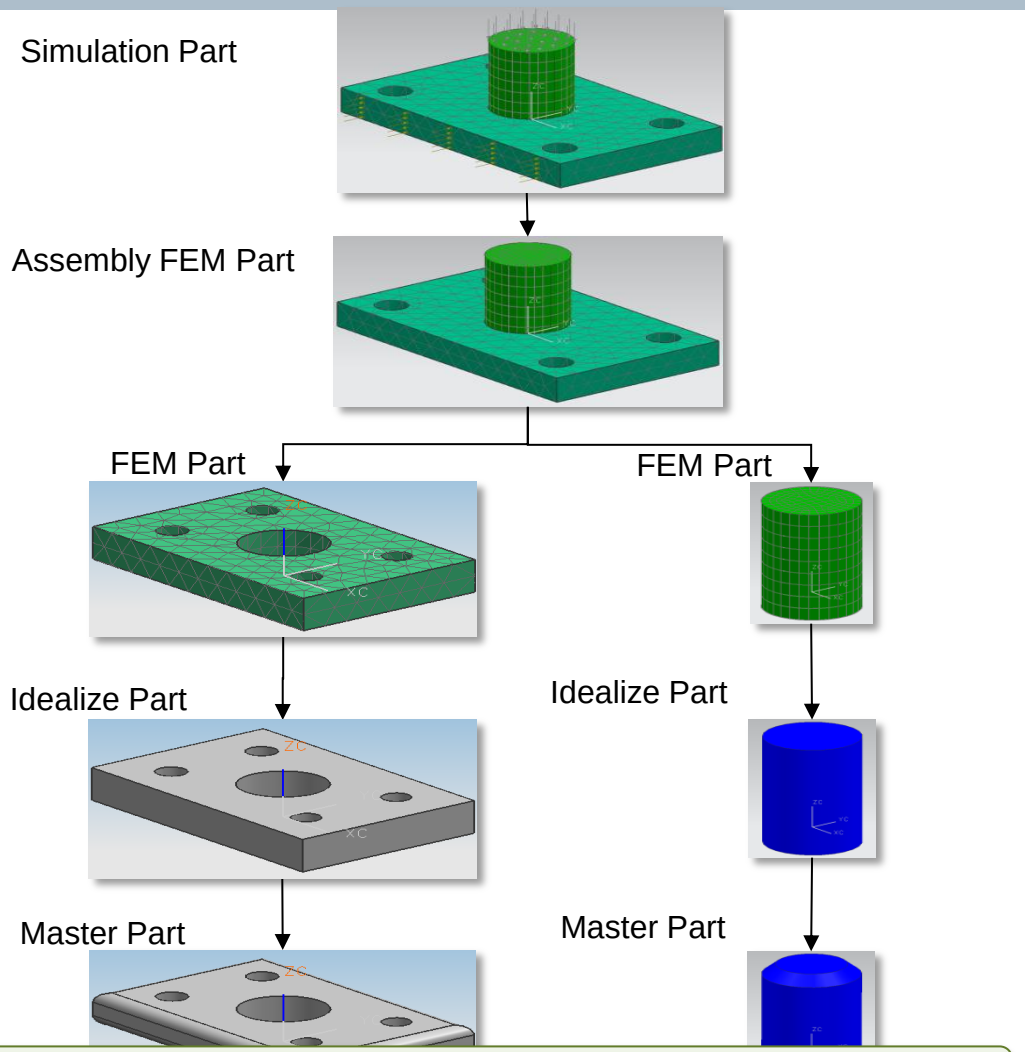


Note – Write Access to Master Part is not required

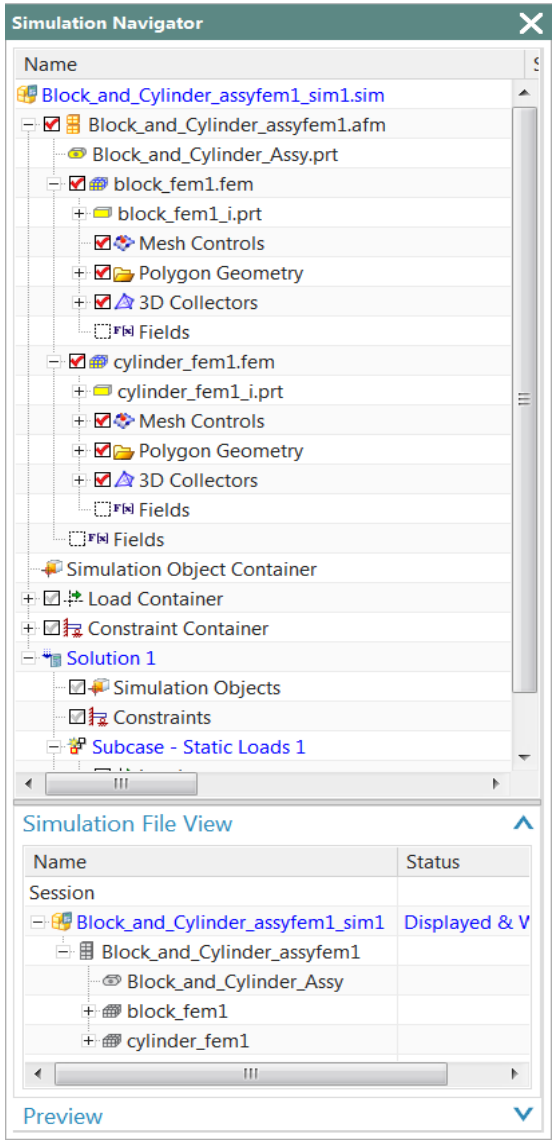
Reuse Fem/Sim + templates



NX Advanced Simulation: Basic File Structure – Assembly FEM



Note – Write Access to Master Part is not required



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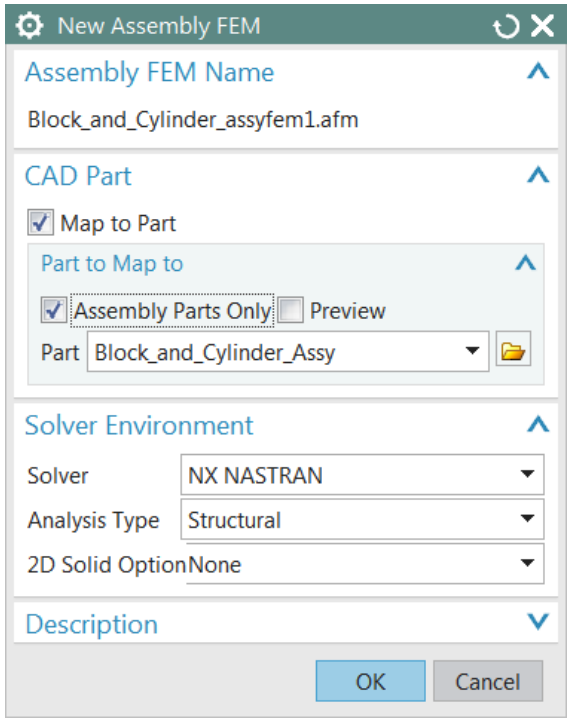


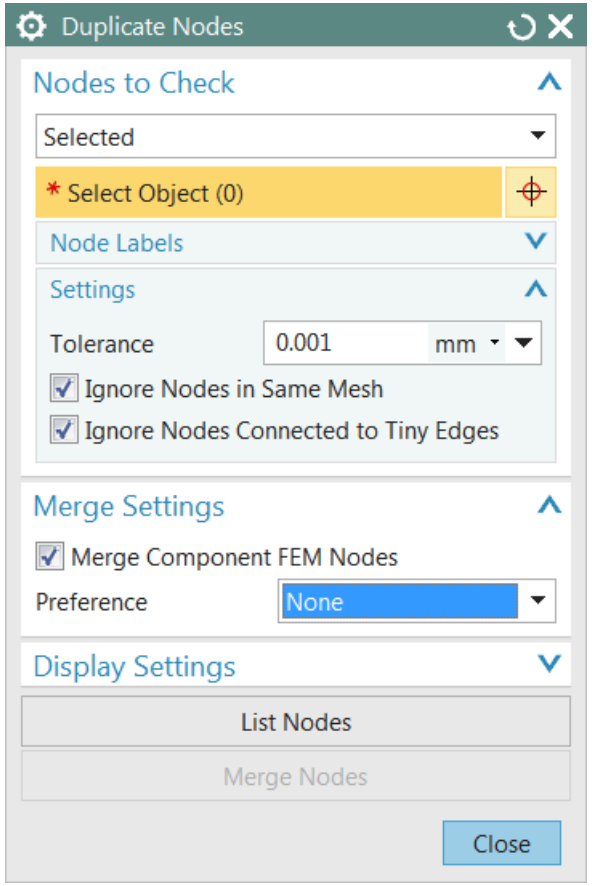
NX Advanced Simulation: Basic File Structure – Assembly FEM

- Assembly FEM can reuse the CAD assembly locations defined by the designer.
- Assembly FEM support single and multi level structures
- Distribute work among members of a team
- Improve the documentation and management of component meshes using assembly FEMs.
- Use and reuse existing component FEMs.
- Replace individual component FEMs with alternate mesh or geometry representations.
- Support workflow for external super elements.
- Less methods to make assyfem level connection between component compared to ‘single fem above assembly’ workflow
    - Operators that change component mesh like Mesh Mating, Stitch Edge,… not possible.

Connecting Component FEMs

If the FEMs brought into the AFEM have coincident nodes, the nodes can be merged at the assembly FEM level without modifying the individual FEMs.

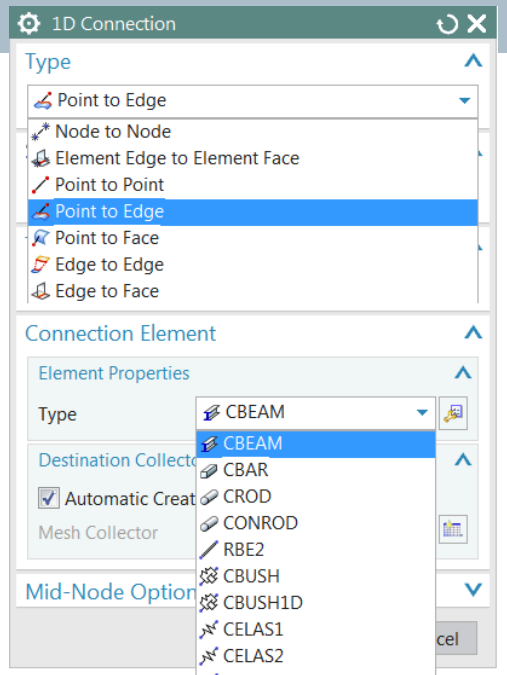
- The user may select the nodes or meshes to be checked or the software investigates the displayed model
- It is recommended that the user verify the duplicate nodes before merging them.

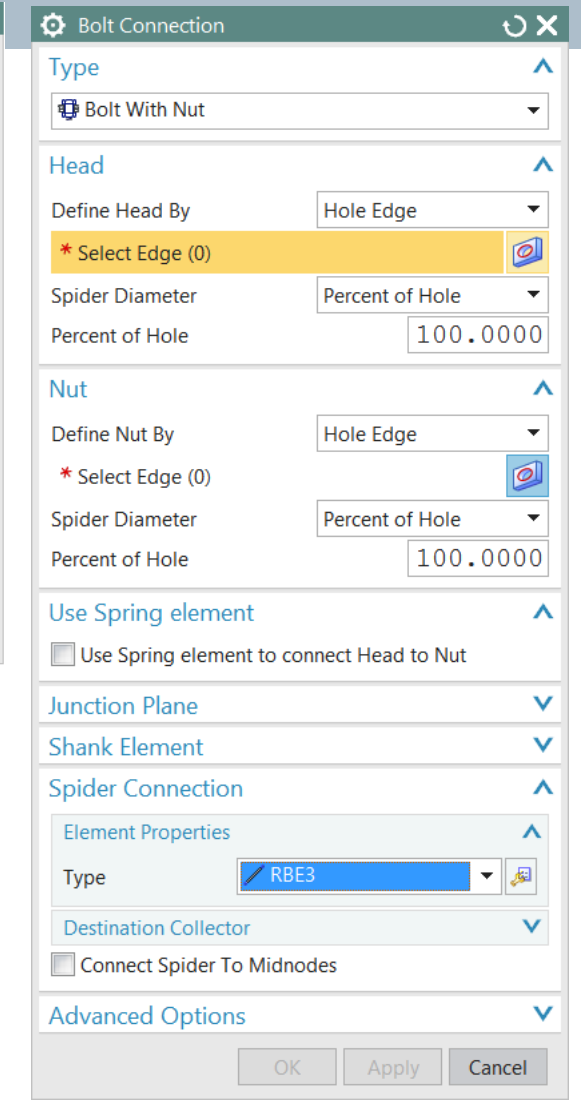


Connecting Component FEMs

In the assembly FEM file, you can define connection elements to join component FEMs into a system using the following tools:

- Use the **1 D Connection** command to define 1 D connection meshes, spider elements, or connecting structures such as pins, bolts, or struts.
- Use **Bolt connection** method
- **CFAST – CWELD** connections
- Use **manual** node and element operations to create individual elements, including lumped mass, shells, or solid elements.
- Automation using **NX.Open** to support manual methods connection methods

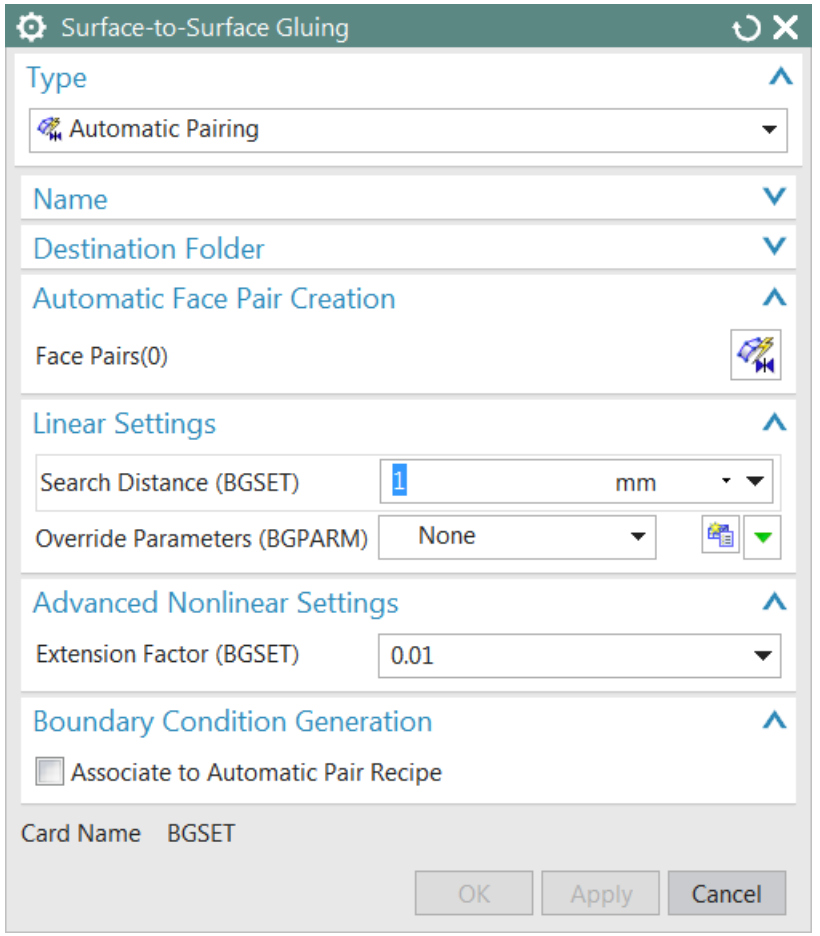




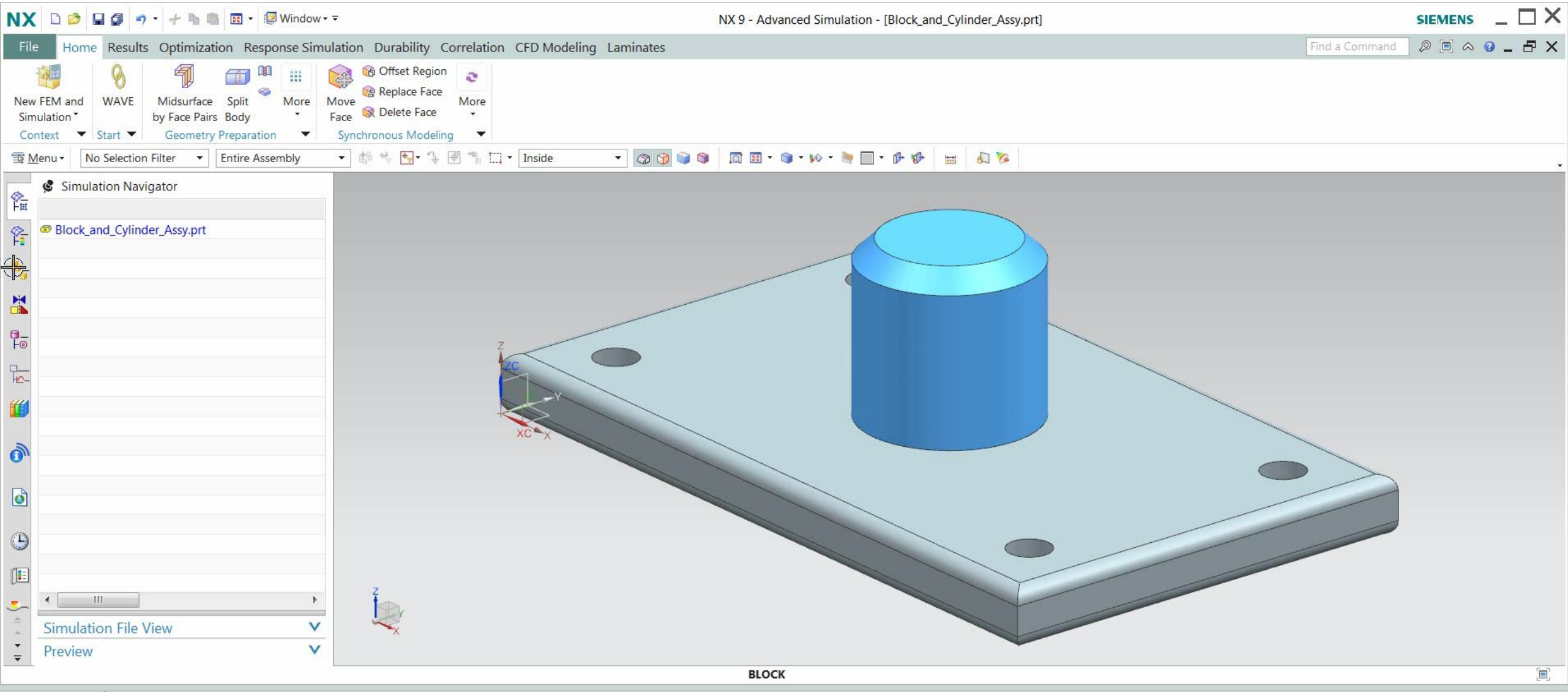
Connecting Component FEMs

In the Simulation file, you can use the Boundary conditions like:

- Surface-to-Surface Contact
- Surface-to-Surface Gluing
- Edge to Surface Gluing
- Edge to Edge Gluing
- Edge to Edge Contact (axisymmetric, plane stress and plane strain elements)
- MPC



Creating Assembly FEMs – Reuse LBC



NX CAE: An extensive set of connection tools

The decision on which tool to use depends on the model requirements and the project needs.

Connection techniques for NX Nastran

- 1D Connections
  - Node-to-Node
  - Element Edge to Element Edge
  - Point-to-Point
  - Point-to-Edge
  - Point-to-Face
  - Edge-to-Edge
  - Edge-to-Face
- Mesh – 3D Sweep Between
- Node Merge
- Mesh Mating
  - Glue Non-coincident (MPC's)
  - Glue Coincident
  - Free Coincident
- Edge Contact
- Surface Contact
- Simulation Regions
- Contact
  - Surface-to-Surface Contact
  - Linear Contact
  - Non-Linear Contact
- Glue
  - Surface-to-Surface Glue
  - Edge-to-Surface Glue
  - Edge-to-Edge Glue
- Bolt
  - Bolt with Nut
  - Bolt in Tapped Hole
  - Bolt with Spider at Junction
- Constraints
  - Coupling
- Weld Techniques
  - CFAST/CWELD
  - LOHR technique

Connection techniques in NX Thermal, Flow, ESC & Space Thermal

- 1D Connections
  - Node-to-Node
  - Point-to-Point
  - Point-to-Edge
  - Point-to-Face
  - Edge-to-Edge
  - Duct for thermal/flow transfer
- Surface-to-Surface Contact
- Surface-to-Surface Glue
- Thermal Coupling
- Articulation Joints for transient radiative heat exchange
- Recirculation Loop
- Interference Resistance
- Peltier Cooler
- Radiation Enclosure & Heating
- Convection and Radiation to Environment

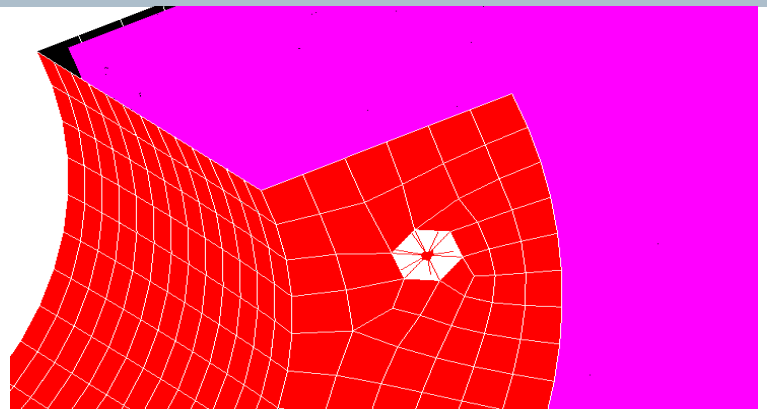
RBE2 - Rigid Elements

Considerations:

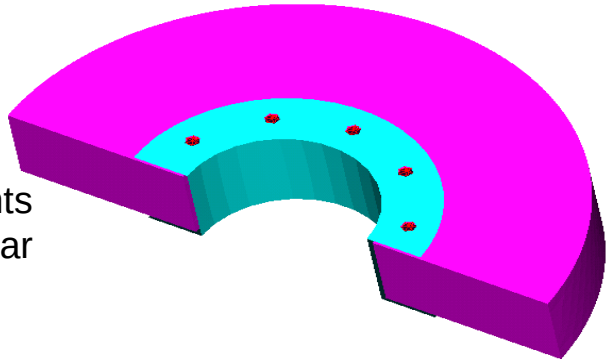
- All forces will be transferred
- No localized behavior considered
- Maintains shape of hole

Concerns:

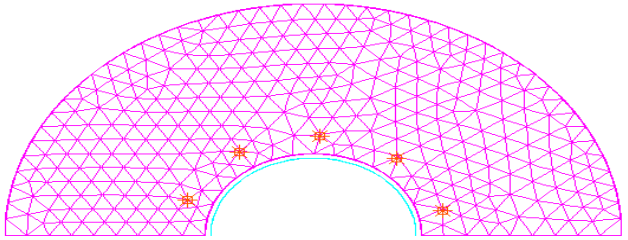
- Consider DOF of connected elements
- May add numeric stiffness
- If the nodes are not coincident, the resulting moment will be included
- Depended nodes: No constraints or other depended nodes connected



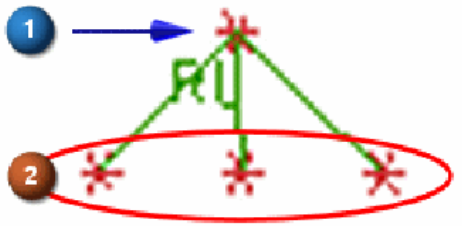
One rigid element connecting all the nodes to one central node



Two rigid elements connected with one bar



One rigid element connecting a node at the center of the hole



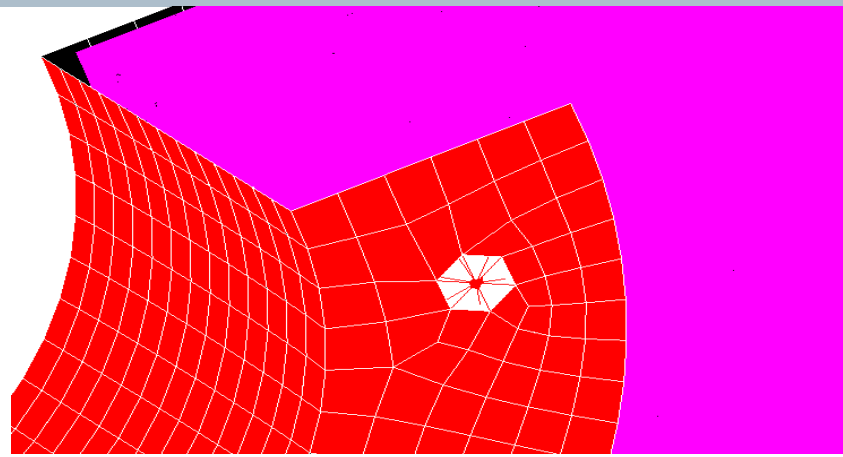
(1) independent node (2) dependent nodes

RBE3 – Constraint Relation Elements

Considerations:

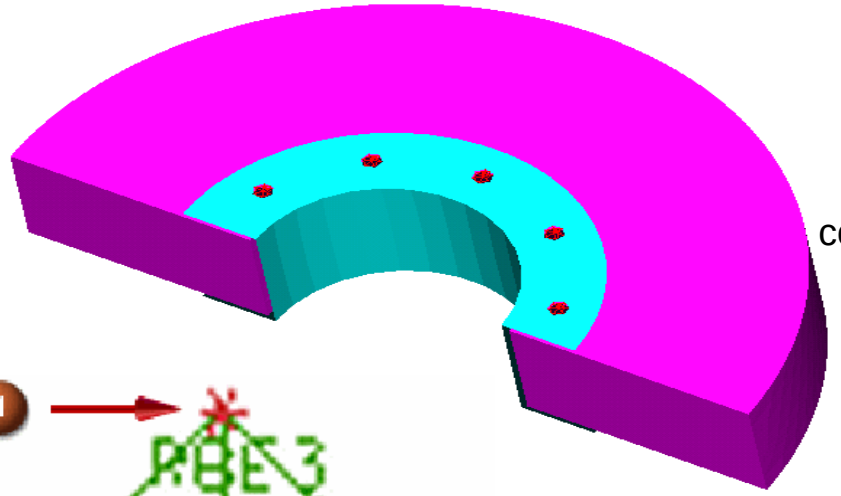
- All forces will be transferred
- No localized behavior considered
- Allows ovalization of hole

One constraint element connecting all the nodes to one central node



Concerns:

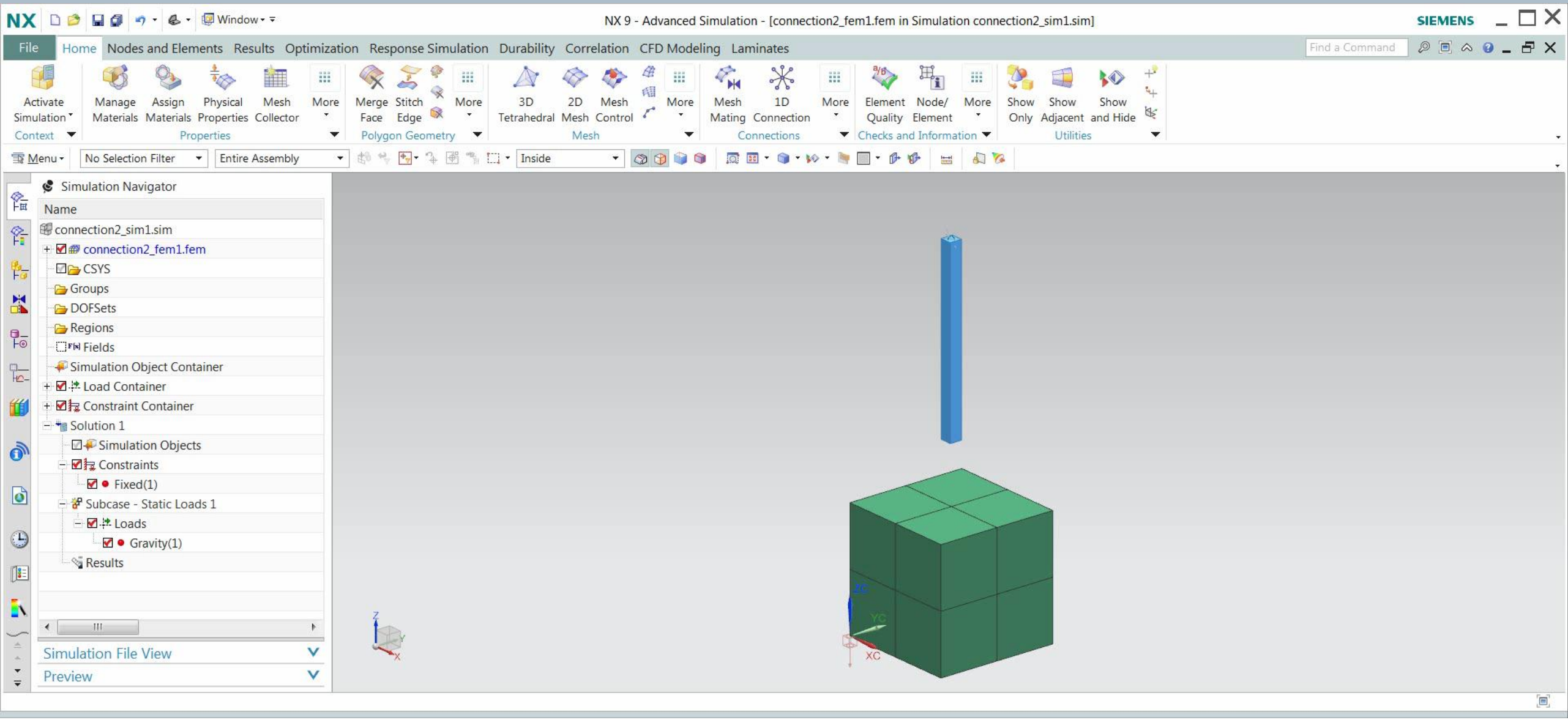
- Consider DOF of connected elements
- If the nodes are not coincident, the resulting moment will be included
- Depended node: No constraints or other depended nodes connected



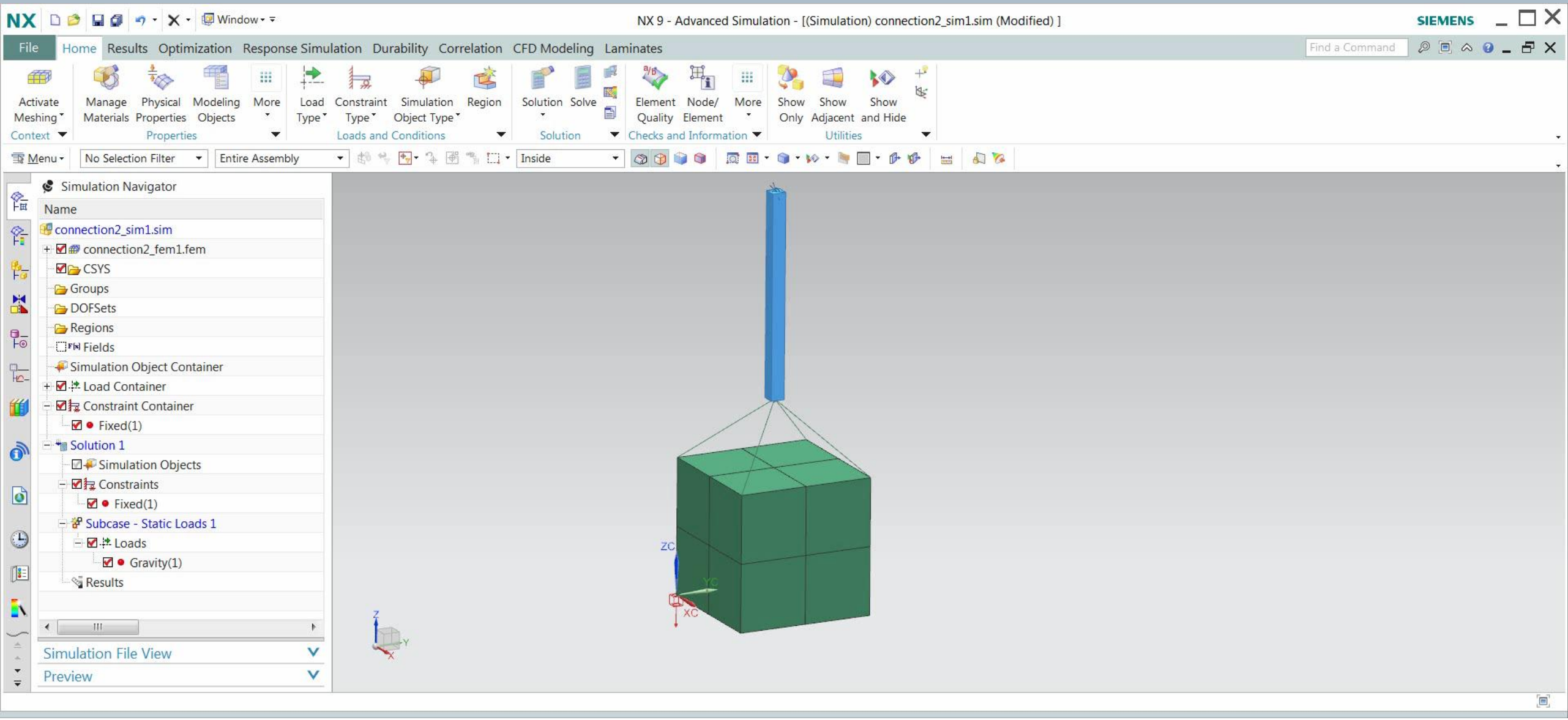
Two constraint elements connected with one rigid bar or beam element

(1) dependent node (2) independent nodes

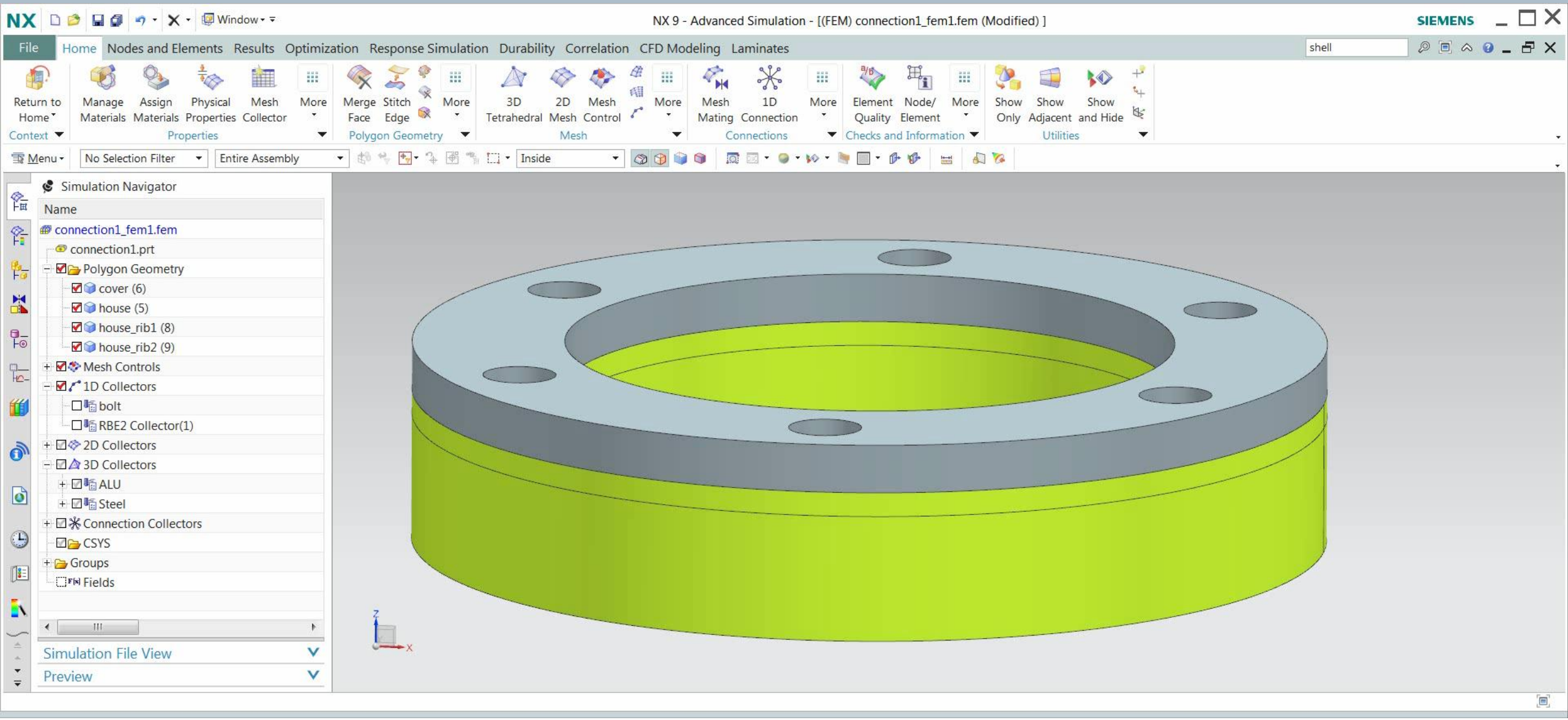
RBE2 example: DOF 3D Elements



RBE2 example: Depended Node



RBE2 example: Bolt connection



Questions

SIEMENS

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