FEM Simulation

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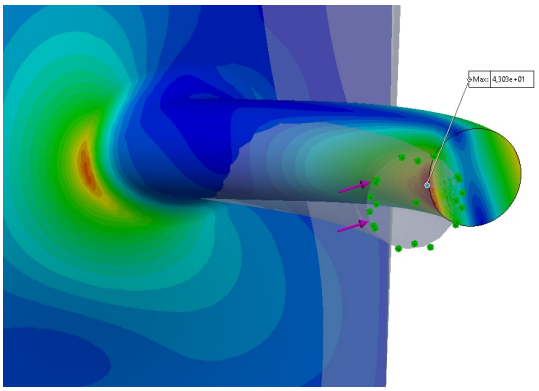
Why use FEM simulation?

- **Time & Cost save**
  - **Less material waste because there is no need for multiple physical prototypes.**
  - **Quicker than waiting for prototype orders.**
  - **Reduces need for real world testing.**
- **Safety**
  - **Detect high stress areas & failure points.**
  - **Prevent structural failures.**
  - **Reduce risk of product recalls or legal liabilities.**
- **Optimized designs**
  - **Helps with creating lightweight designs and reduce over-engineering.**
  - **Design efficient & strong parts with less material.**
  - **Quick exploration of alternative designs.**
  - **Dimension for Factor of Safety.**
- **Reliable results**
  - **More precise results than manual calculations.**



Quick FEM guide for beginners

1. Enable the Simulation Add-In

   Go to Tools → Add-Ins.

   Check SolidWorks Simulation and click OK.

2. Prepare Your Model

   Ensure the geometry is clean (no unnecessary gaps or interferences).

   Use simplifications if needed (e.g., suppress small features that don’t affect the analysis and use symmetry as much as possible).

3. Create a New Study

   Go to the Simulation tab and click New Study.

   The only type of analysis available in our SolidWorks Premium license is the Static type (for linear stress and deformation under load)

4. Define Material Properties

   Click on Parts in the Feature Tree → Apply Material.

   Select from the SolidWorks Material Library or define a custom material.

   (We have a set of common materials within FlexLink already defined here (TBA)).

5. Apply Fixtures (Constraints)

   Click Fixtures → Add Fixture.

   Fix the necessary parts to prevent rigid body motion.

6. Apply Loads

   Click External Loads → Select the type of load:

   Force, Pressure, Torque, Gravity, Thermal Loads, etc.

   Define the magnitude and direction.

7. Mesh the Model

   Click Mesh → Create Mesh.

   Adjust mesh density (finer for accuracy, coarser for speed).

   Use Mesh Control to refine critical areas.

   Make sure to run the simulation with a coarse mesh at first to find any eventual mistakes or unexpected results.

8. Run the Simulation

   Click Run and wait for the solver to complete the analysis.

9. Analyze Results

   Use Stress, Displacement, and Strain plots to interpret performance.

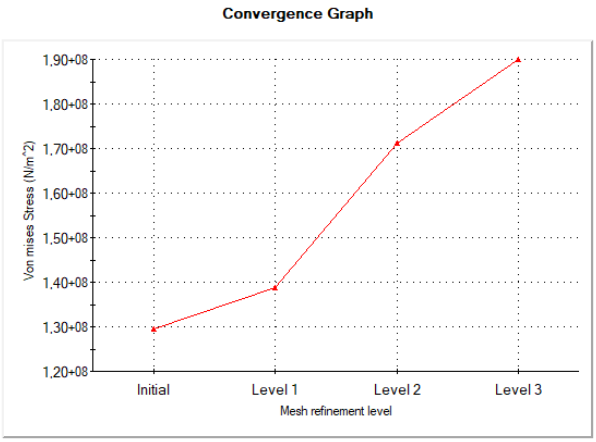
   Check for high-stress areas (red zones) to identify weaknesses.

   Use Factor of Safety (FOS) to evaluate design reliability.

10. Optimize and Refine

    Modify design if needed and re-run the analysis.

    Adjust mesh settings or boundary conditions to refine accuracy and make sure that the mesh doesn't converge to a singularity.


Convergence Graph
1,90+08
1,80+08
1,70+08
1,60+08
1,50+08
1,40+08
1,30+08
1,20+08
Von mises Stress (N/m^2)
Initial
Level 1
Level 2
Level 3
Mesh refinement level