Introduction to SolidWorks SimulationXpress
For use in Pressure Housing Analysis

Marine Advanced Technology Education
Design Tools
What is SolidWorks SimulationXpress?

- SolidWorks SimulationXpress is a design analysis software that is fully integrated in SolidWorks.
- SolidWorks SimulationXpress simulates the testing of your part’s prototype in its working environment. It can help you answer questions like: how safe, efficient, and economical is your design?
- SolidWorks SimulationXpress is used by students, designers, analysts, engineers, and other professionals to produce safe, efficient, and economical designs.
- SimulationXpress cannot be used with assemblies.
Traditional Design Cycle vs. FEM

- Use SolidWorks to build the model.
- Manufacture a prototype.
- Test the prototype under various loading conditions. Instrumentation is needed in most cases.
- Based on results, modify the model in SolidWorks, build a new prototype, and test it again until you are satisfied.

Images and models created with SolidWorks® software. SolidWorks is a registered trademark of Dassault Systèmes.
Benefits of Analysis

- Design cycles are expensive and time-consuming.
- Analysis reduces the number of design cycles.
- Analysis reduces cost by testing your model using the computer instead of expensive field tests.
- Analysis reduces time to market.
- Analysis can help you optimize your designs by quickly simulating many concepts and scenarios before making a final decision.

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The Finite Element Method

- Analytical solutions are only available for simple problems. They make many assumptions and fail to solve most practical problems.

- SolidWorks SimulationXpress uses the Finite Element Method (FEM). Analysis using the FEM is called Finite Element Analysis (FEA) or Design Analysis.

- FEA is very general. It can be used to solve simple and complex problems.

- FEA is well-suited for computer implementation. It is universally recognized as the preferred method of analysis.
The FEM replaces a complex problem by many simple problems. It subdivides the model into many small pieces of simple shapes called elements.
Static or Stress Analysis

- This is the most common type of analysis.
- SimulationXpress uses von Mises stress analysis.
- It calculates displacements, strains, stresses, and reaction forces.
- A material fails when the stress reaches the material’s Yield Strength.
Analysis Steps

1. **Assign materials. What is the part made of?**
   - If there material is not listed you will have to create that material
   - The most important property is Yield Strength

2. **Specify restraints. Which faces are fixed and do not move?**
   - You must have at least one restraint

3. **Apply loads. Where are the forces or pressures acting on the part?**

4. **Run the analysis.**

5. **View the results. What is the factor of safety? What are the resultant displacements or stresses?**
Understanding the Analysis

- The Analysis is just a reference to what to expect and does not yield a absolute trust worthy value.
- The analysis should be used as a guide to your design and give a starting point for testing.
- Use “factor of safety” to take into account uncertainties and give your design a safe load rating.
- Confirm this rating by actual testing of the real part.
Factor of Safety (FOS) is simple how over or under design a part is expressed as a number.

- A number Larger than 1: Over-designed and safe
- A number equal to 1: designed right at the breaking point
- A number smaller than 1: Under-designed and will break

\[
FOS = \frac{\text{The maximum load the design can handle}}{\text{The load applied to the design in the analysis}}
\]

The maximum load for a design can be calculated by:

\[(FOS) \times \text{(Applied Load)}\]
Learn to use SimulationXpress

- Go through the built in tutorial to learn more about this tool:
  - All SolidWorks Tutorials (Set 2), SolidWorks SimulationXpress

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Additional Included Analysis Types

**SolidWorks FlowXpress includes:**
- Flow simulation of liquids and gases over and inside 3D objects
- Go through the built-in tutorial to learn more about this tool:
  - All SolidWorks Tutorials (Set 2), SolidWorks FlowXpress