

TRAINING: SOLIDWORKS Simulation Essentials (3 Days)

Prerequisites: SOLIDWORKS Essentials, 100 plus hours hands-on

Description: Topics covered in this course are: introduction to FEA; FEA principles and theory; element quality; linear static analysis of parts; gap/contact and advanced assembly analysis; analysis setup and post-processing; evaluating FE convergence; limitations of linear analysis; load and boundary condition application; stress analysis with thermal loading; model and result validation; automatic report generation.

Introduction

- What is SOLIDWORKS Simulation?
- What Is Finite Element Analysis?
- Build Mathematical Model
- Build Finite Element Model
- Solve Finite Element Model
- Analyze Results
- Errors in FEA
- Finite Elements: First Order Solid Tetrahedral Elements, Second Order Solid Tetrahedral Elements, First Order Triangular Shell Elements, Second Order Triangular Shell Elements, Beam Elements
- Choosing Between Solid and Shell Elements
- Draft vs. High Solid and Shell Elements
- Degrees of Freedom
- Calculations in FEA
- Interpretation of FEA Results, Principal Stresses: P1, P2, and P3
- Units of Measurement
- Limitations of SOLIDWORKS Simulation

Lesson 1: The Analysis Process

- The Analysis Process
- SOLIDWORKS Simulation Interface
- SOLIDWORKS Simulation Options
- Plot Settings
- Preprocessing
- Assigning Material Properties
- Fixtures
- External Loads
- Meshing, Standard, Curvature, Density, Element Sizes, Number of Elements in a Circle, Ratio and Mesh Quality
- Processing

- Postprocessing, Result Plots, Nodal vs. Element Stresses, Show as Tensor Plot, Modifying Result Plots, Plot Controls
- Multiple Studies, Creating New Studies, Copy Parameters, Check Convergence and Accuracy, Comparison with Analytical Results
- Reports

Lesson 2: Mesh Controls, Stress Concentrations and Boundary Conditions

- Mesh Control
- Analysis with Local Mesh Refinement
- Mesh Controls
- Results and Results Comparison
- Stress Singularities
- Analysis of a Welded Bracket
- Understanding the Effect of Boundary Conditions

Lesson 3: Assembly Analysis with Contacts

- Contact Analysis
- Global Contact
- Component Contact: Options
- Component Contact: Default Setting
- Component Contact: Hierarchy and Conflicts
- Viewing Assembly Results
- No Penetration or Bonded Contact
- Local Contact
- Self-Contact
- Required Force
- No Penetration Local Contact Properties and Accuracy
- Contact Stresses

Lesson 4: Symmetrical and Free Self-Equilibrating Assemblies

- Shrink Fit Parts
- Symmetry
- Defeathering
- Rigid Body Mode
- Shrink Fit Contact Condition
- Plot Results in Local Coordinate System
- Cylindrical Coordinate Systems
- Saving All Plots
- What's Wrong Feature
- Analysis with Soft Springs, Inertial Relief

Lesson 5: Assembly Analysis with Connectors and Mesh Refinement

- Connecting Components, Connectors, Connector Types
- Mesh Control in an Assembly
- Draft Quality Coarse Mesh Analysis
- Remote Load/Mass, Load Location
- Reference Coordinate System
- Types of Loads
- Connection Type
- Automatic Conversion of Toolbox Fasteners to Bolts
- Bolt Tight fit and Diameter
- Bolt Strength Data, Bolt Pre-load
- Contact Visualization Plot
- Automatically Find Contact Sets
- Pin Connectors
- Rotational and Axial Stiffness
- Virtual Wall, Axial
- Tangential Stiffness
- Pin/Bolt Force
- High Quality Mesh Analysis, Required Number of Solid Elements in Thin Features, Aspect Ratio Plot, Jacobian

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Lesson 6: Compatible / Incompatible Meshes

- Compatible / Incompatible Meshing
- Centrifugal Force
- Cyclical Symmetry
- Compatible Mesh
- Incompatible Mesh
- Automatic Switch to Incompatible Mesh
- Incompatible Bonding Options

Lesson 7: Analysis of Thin Components

- Thin Components
- Mesh with Solid Elements
- Symmetry Fixtures
- Refined Solid Mesh
- Solid vs. Shell
- Creating Shell Elements
- Shell Elements - Mid-plane Surface
- Thin vs. Thick Shells
- Changing Mesh Orientation
- Shell Element Alignment
- Render shell thickness in 3D
- Applying Symmetry Restraints
- Deformed Results
- Results Comparison and Computational Effort

Lesson 8: Mixed Meshing Shells & Solids

- Mixed Meshing Solids and Shells
- Bonding Shells and Solids
- Mixed Mesh: Supported Analysis Types
- Pressure Vessel
- Material
- Steel Identification Systems
- Bulk and Shear Moduli
- Bonding Entities with Clearance
- Shell Face to Shell Face Bonding
- Shell Edge to Shell Face Bonding
- Shell to Solid Bonded Contact
- Failure Diagnostics
- Meshing Small Features
- Incremental Meshing

Lesson 9: Beam Elements- Analysis of a Conveyor Frame

- Beam Elements
- Truss Elements
- Slenderness Ratio
- Section Properties
- Connected and Disconnected Joints
- Sphere Diameter Defining Beam Joint
- Beam Joints: Locations, Type
- Beam Joint Types
- Render Beam Profile
- Beam Stress components
- Cross-section 1st and 2nd Directions
- Bending Moment and Shear Force Diagrams

Lesson 10: Mixed Meshing Solids, Beams & Shells

- Mixed Meshing
- Beam Mesh
- Beam Imprint

Lesson 11: Design Study

- Design Study
- Suspension Design
- Multiple Load Cases
- Parameters
- Design Study Results
- Design Study Options
- Geometry Modification
- Design Study Graph

Lesson 12: Thermal Stress Analysis

- Thermal Stress Analysis
- Bimetallic Strip
- Material Properties
- Importing Temperatures
- Averaging Stress
- Saving Model in its Deformed Shape

Lesson 13: Adaptive Meshing

- Adaptive Meshing
- Geometry Preparation
- h-Adaptivity Study
- h-Adaptivity Options
- h-Adaptive Plots
- Strain Energy Error is NOT Stress Error
- p-Adaptivity Study
- p-Adaptive Solution Method
- h vs. p Elements
- Method Comparison
- Which Solution Method is Better?

Lesson 14: Large Displacement Analysis

- Small vs. Large Displacement Analysis
- Small Displacement Linear Analysis
- Contact Solution in Small and Large Displacement Analyses
- Large Displacement Nonlinear Analysis
- Permanent Deformation
- SOLIDWORKS Simulation Premium

Appendix A:

- Meshing, Solvers, and Tips & Tricks
- Meshing Strategies
- Geometry Preparation
- Defeaturing
- Idealization/ Clean-up
- Mesh Quality/ Aspect Ratio Check
- Jacobian Check
- Mesh Controls
- Failure Diagnostics
- Tips for Meshing Parts and Assemblies
- Tips for Using Shell Elements
- Hardware Considerations in Meshing
- Solvers in SOLIDWORKS Simulation
- Choosing a Solver
- Email Notification Settings

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