



# **SOLIDWORKS** Simulation Course Outline

**SOLID**  **PERTS**  
by solidxperience

*ENSURE YOUR SUCCESS IN 3D DESIGN WITH SOLIDWORKS*

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## SOLIDWORKS Simulation Static – 3 Days (21h)

### 1. The Analysis Process

- The Analysis Process
- SOLIDWORKS simulation options
- Preprocessing
- Meshing
- Processing
- Post-processing
- Multiple studies
- Reports

### 2. Mesh Controls, Stress Concentrations and Boundary Conditions

- Mesh control
- Understanding the effect of boundary conditions

### 3. Assembly Analysis with Contacts

- Contact analysis
- No penetration or bonded contact
- Pliers with global contact
- No penetration local contact: Accuracy

### 4. Symmetrical and Free Self-Equilibrating Assemblies

- Shrink fit parts
- Analysis with soft springs

### 5. Assembly Analysis with Connectors and Mesh Refinement

- Connecting components
- Connectors
- Mesh Control in an Assembly
- Problem statement
- Draft quality coarse mesh analysis
- Mesh analysis

### 6. Compatible/ Incompatible Mesh

- Compatible /incompatible meshing
- Centrifugal force
- Cyclical symmetry

### 7. Analysis of Thin Components

- Thin components
- Mesh with solid elements
- Refined solid mesh
- Solid vs. shell
- Creating shell elements
- Shell elements – mid plane surface
- Results Comparison

### 8. Mixed Meshing Shells & Solids

- Mixed meshing solids and shells

### 9. Beam Elements – Analysis of a conveyor frame

- Beam and truss elements

### 10. Mixed Meshing Solids, Beams & Shells

- Mixed meshing
- Beam Imprint

### 11. Design Study

- Design study
- Multiple load cases
- Geometry modification

➔ Continued...

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## *SOLIDWORKS Simulation Static (continued...)*

### 12. Thermal Stress Analysis

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- Thermal stress analysis
- Saving models in its deformed shape

### 13. Adaptive Meshing

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- Adaptive meshing
- H-adaptivity study
- P-Adaptivity study
- H vs P elements – summary

### 14. Large Displacement Analysis

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- Small vs Large displacement analysis
- Small displacement linear analysis
- Large displacement non-linear analysis

### Appendix A. Meshing, Solvers, and Tips & Tricks

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- Meshing Strategies
- Geometry Preparation
- Mesh Quality
- Mesh Controls
- Meshing Stages
- Failure Diagnostics
- Tips for Using Shell Elements
- Hardware Considerations in Meshing.
- Solvers in SOLIDWORKS Simulation
- Choosing a Solver
- Email Notification Settings

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## SOLIDWORKS Motion – 2 Days (14h)

### 1. Introduction to Motion Simulation and Forces

- Basic motion analysis
- Forces
- Results

### 2. Building a Motion Model and Post Processing

- Creating local mates
- Mates
- Local mates
- Power
- Plotting kinematic results

### 3. Introduction to Contacts, Springs and Dampers

- Contact and friction
- Contact
- Contact groups
- Contact friction
- Translational spring
- Translational damper
- Post-processing
- Analysis with friction (optional)

### 4. Advanced Contact

- Contact forces
- STEP function
- Contact: Solid bodies
- Geometrical description of contacts
- Integrators
- Instability points
- Modifying result plots
- Path Mate Motor

### 5. Curve to Curve Contact

- Contact forces
- Curve to curve contact
- Solid bodies vs. Curve to curve contact
- Solid bodies contact solution

### 6. CAM synthesis

- Cams
- Trace path
- Exporting trace path curves

### 7. Motion Optimisation

- Motion Optimisation
- Sensors
- Optimisation analysis

### 8. Flexible Joints

- Flexible joints
- System with Flexible Joints

### 9. Redundancies

- Redundancies
- How to check for redundancies
- Typical redundant mechanisms

### 10. Export to FEA

- Exporting results
- Export of load
- Direct solution in SOLIDWORKS motion

### 11. Event Based Simulation

- Event based simulation
- Servo motors
- Sensors
- Task

### 12. Design Projects (Optional)

- Design Project
- Self-guided problem – **Part 1**
- Self-guided problem – **Part 2**
- Problem solution – Part 1
- Creating the force function
- Force expression

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## SOLIDWORKS Simulation Professional – 2 Days (14h)

*\*SOLIDWORKS Simulation Static is a prerequisite for this class.*

### 1. Frequency Analysis of Parts

- Modal analysis basics
- Frequency analysis with supports
- Frequency analysis without supports
- Frequency analysis with load

### 2. Frequency Analysis of Assemblies

- All bonded contact conditions
- Bonded and allow penetration contacts

### 3. Buckling Analysis

- Buckling analysis

### 4. Load Cases

- Load Cases

### 5. Sub-modeling

- Sub-modeling

### 6. Topology Optimization

- Topology Analysis
- Manufacturing Controls
- Mesh Effects
- Load Cases in Topology Studies
- Export Smoothed Mesh

### 7. Thermal Analysis

- Thermal analysis basics
- Steady – state thermal analysis
- Transient thermal analysis
- Transient analysis with time varying load
- Transient thermal analysis using a Thermostat

### 8. Thermal Analysis with Radiation

- Steady state analysis

### 9. Advanced Thermal Stress 2D Simplification

- Thermal stress analysis
- Thermal analysis
- 3D model
- Microchip Testing Assembly

### 10. Fatigue Analysis

- Fatigue
- Stress-life (S-N) based fatigue
- Thermal study
- Thermal stress study
- Fatigue terminology
- Fatigue study
- Fatigue study with dead load

### 11. Variable Amplitude Fatigue

- Fatigue study

### 12. Drop Test Analysis

- Drop test analysis
- Rigid floor drop test
- Elastic floor, Elasto-Plastic Material
- Elasto-plastic material model
- Drop test with contact (optional)

### 13. Optimization Analysis

- Optimization analysis
- Static and frequency analyses

### 14. Pressure Vessel Analysis

- Pressure vessel analysis
- Manhole nozzle flange and cover

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## SOLIDWORKS Simulation Premium – 3 Days (21h)

*\*SOLIDWORKS Simulation Static and SOLIDWORKS Simulation Professional is a prerequisite for this class.*

### NON-LINEAR

#### 1. Large Displacement Analysis

- Linear static analysis
- Nonlinear static study
- Linear static study (Large displacement)

#### 2. Incremental Control Techniques

- Incremental control techniques
- Linear analysis
- Nonlinear analysis – Force control
- Nonlinear analysis – Displacement control

#### 3. Non-Linear Static Buckling Analysis

- Linear buckling
- Linear static study
- Nonlinear symmetrical buckling
- Nonlinear asymmetrical buckling

#### 4. Plastic Deformation

- Plastic deformation
- Problem statement
- Linear elastic
- Nonlinear – von Mises
- Nonlinear – Tresca's
- Stress accuracy
- Non-linear Elastic Material

#### 5. Hardening Rules

- Hardening rules
- Isotropic hardening
- Kinematic hardening

#### 6. Analysis of Elastomers

- Two constant Mooney-Rivlin (1 material curve)
- Two constant Mooney-Rivlin (2 material curves)
- Two constant Mooney-Rivlin (3 material curves)
- Six constant Mooney-Rivlin (3 material curves)

#### 7. Nonlinear Contact Analysis

- Problem statement

#### 8. Metal Forming

- Bending

### DYNAMIC

#### 1. Vibration of a Pipe

- Static analysis
- Frequency analysis
- Dynamic analysis (slow force)
- Dynamic analysis (Fast force)

#### 2. Transient Shock Analysis According to MILS- STD-810G

- Model with remote mass

#### 3. Harmonic Analysis of a Bracket

- Harmonic analysis of a bracket

#### 4. Response Spectrum Analysis

- Response Spectrum Analysis
- Response Spectrum

#### 5. Random Vibration Analysis According to MIL-STD-810G

- Random vibration analysis according to MIL-STD-810G

#### 6. Random Vibration Fatigue

- Material properties, S-N curve
- Random vibration fatigue options

#### 7. Nonlinear Dynamic Analysis of an Electronic Enclosure

- Linear dynamic analysis
- Nonlinear dynamic analysis

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### SOLIDWORKS Simulation Premium Composite – 1 Day (7h)

*\*SOLIDWORKS Simulation Static and SOLIDWORKS Simulation Professional is a prerequisite for this class.*

- Introduction to Composites
  - Objectives
  - Composite Materials
  - Composite Lamina
  - Composite Laminate
  - SOLIDWORKS Simulation Premium:
    - Composites
  - Composite Post Processing
  - Case Study: Mountain Board
  - Project Description
  - Stages in the Process
  - Lamina Properties
  - Experimental Measurements
  - Micromechanics
- Required Parameters
  - Strength Parameters
  - Composite Options
  - Composite Orientation
  - Offset
  - Shell Alignment
  - Composite Post Processing
  - Stresses
  - Inter Laminar Shear
  - Failure Criterion
  - Shear Stresses
  - Summary
  - Reference

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## SOLIDWORKS Flow Simulation – 2 Days (14h)

### 1. Creating a SOLIDWORKS Flow Simulation Project

- Model preparation
- Post-Processing

### 2. Meshing

- Computational mesh
- Basic mesh
- Initial mesh
- Geometry resolution
- Result resolution / Level of initial mesh
- Control planes

### 3. Thermal Analysis

- Fans
- Perforated plates

### 4. External Transient Analysis

- Reynolds number
- External flow
- Transient analysis
- Turbulence intensity
- Solution adaptive mesh refinement
- Two-Dimensional Flow.
- Computational domain
- Calculation control options
- Time animation

### 5. Conjugate Heat Transfer

- Conjugate Heat Transfer
- Real Gases

### 6. EFD Zooming

- EFD zooming

### 7. Porous Media

- Porous media
- Design modification

### 8. Rotating Reference Frames

- Rotating reference frame
- Noise Prediction
- Tangential faces of rotors
- Time step

### 9. Parametric Study

- Parametric analysis
- Steady state analysis

### 10. Free Surface

- Free Surface

### 11. Cavitation

- Cavitation

### 12. Relative Humidity

- Relative humidity

### 13. Particle Trajectory

- Particle trajectories

### 14. Supersonic Flow

- Supersonic flow

### 15. FEA Load Transfer

- FEA Load Transfer

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### SOLIDWORKS Flow Simulation: Electronic Cooling Module – 1 Day (7h)

*\*SOLIDWORKS Flow Simulation is a prerequisite for this class.*

#### 1. Introduction to Electronics Module

- Objectives
- Electronic Module
- Case Study: Computer Box
- Project Description
- Conclusions

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## **SOLIDWORKS Flow Simulation: HVAC Module – 1 Day (7h)**

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### **1. Introduction to HVAC**

- Objectives
- HVAC Module
- Case Study: Office
- Project Description
- Radiation
- Radiation Transparency
- Radiation Source
- Radiative Surface
- Discussion
- Comfort Parameters
- Conclusions

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## SOLIDWORKS Plastics 1.5 Days (10h), 2 Days (14h) or 3 Days (21h)

*\*The SOLIDWORKS Plastics training manual covers all the features and functions of the SOLIDWORKS Plastics application.*

*Lessons 1 through 8 cover the features of SOLIDWORKS Plastics Standard (1.5 day).*

*Lessons 1 through 14 cover the features of SOLIDWORKS Plastics Professional (2 day)*

*Lessons 1 through 19 cover the features of SOLIDWORKS Plastics Premium (3 day).*

### 1. Basic Flow Analysis

- Basic Flow Analysis
- Element Types
- Meshing
- The PlasticsManager Tree
- Material
- Injection Location
- Running a Flow Analysis
- Flow Results

### 2. Detecting Short Shots

- Detecting Short Shots
- Fill Settings
- Flow Front Central Temperature

### 3. Automation Tools

- Automation Tools
- Duplicate Study
- Copying Settings
- Batch Manager

### 4. Injection Locations and Sink Marks

- Injection Locations and Sink Marks
- Injection Location Rules
- Sink Marks

### 5. Materials

- Materials Properties
- User-Defined Database
- Resin Properties
- Heat Transfer Properties
- Viscosity
- PCT Data
- Mechanical Properties

### 6. Mesh Manipulation

- Local Refinement of Mesh
- Element Issues
- Mesh Editing
- Leader Lines
- Solid Mesh
- Solid Mesh types

### 7. Detecting Air Traps

- Detecting Air Traps
- Air Traps
- Venting

### 8. Gate Blush

- Gate Blush
- Runner Elements

### 9. Packing and Cooling Times

- Pack and Cooling
- Flow/Pack Switch
- Pack Stage
- Pack Analysis
- Pack Results
- X-Y Plot
- CoolingTimes

### 10. Multiple Cavity Molds

- Multiple Cavity Molds
- Mold Layouts
- Channel Design
- Runner Channel Design
- Runner Wizard Channel Design
- Family Mold Layout
- Using Runner-Balancing

### 11. Symmetry Analysis

- Symmetry Analysis
- Symmetry Face

➔ Continued...

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***SOLIDWORKS Plastics (continued...)***

**12. Valve Gates and Hot Runners**

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- Valve Gates and Hot Runners
- Hot Runners
- Valve Gates

**13. Reaction Injection Molding**

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- Reaction Injection Molding

**14. Using Inserts**

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- Using inserts
- Cavities and Inserts
- Materials for Inserts

**15. Multi Shot Mold**

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- Multi Shot Mold

**16. Gas Assistance Molding**

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- Using Inserts
- Gas Assist

**17. Cooling Analysis**

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- Cooling Analysis
- Cooling
- Cooling Channels and Mold Bodies
- Coolant
- Mold
- Cool Settings
- Cooling Simulations
- Cool Analysis
- Cool Results
- Baffle
- Bubbler

**18. Warpage Analysis**

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- Warpage Analysis
- Shrinkage
- Warpage
- Warp Settings
- Flow, Pack and Warp Analysis

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## SOLIDWORKS Sustainability– 1 Day

### 1. SustainabilityXpress

- Evaluating the Environmental Impact of a Part
- Selecting a Material
- Using the Find Similar Material Tool
- Setting the Manufacturing Options
- Setting Use Options
- Using the Environmental Impact Dashboard
- Impact Assessment Methodologies
- Creating a Report
- Exporting Settings for a SOLIDWORKS Sustainability Study
- Adding Materials
- Updating the Materials Database

### 2. SOLIDWORKS Sustainability

- SOLIDWORKS Sustainability Overview
- Sustainability Task Pane Views
- Evaluating the Environmental Impact of a Part
- Selecting a Material
- Using the Find Similar Material Tool
- Setting the Manufacturing Options
- Setting Use Options

- Using the Environmental Impact Dashboard
- Impact Assessment Methodologies
- Creating a Report
- Exporting Settings for a SOLIDWORKS Sustainability Study
- Evaluating the Environmental Impact of an Assembly
- Preparing the Assembly to Be Evaluated
- Defining the Assembly Process
- Specifying Assembly Use Parameters
- Modifying Transportation Defaults
- Modifying End of Life Disposal Defaults
- Specifying Duration of Use
- Modifying Components
- Adding Materials
- Adding Sustainability Data to a Custom Material
- Assigning Financial Impact to a Custom Material
- Updating the Materials Database
- Requesting Materials
- Visualizing Sustainability Properties

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