



# SOLIDWORKS SIMULATION TRAINING

COURSE OUTLINE

# TABLE OF CONTENT

## COURSE OUTLINE / SOLIDWORKS SIMULATION

<u>SOLIDWORKS SIMULATION STATIC – 3 days (21h)</u> .....	<u>36</u>
<u>SOLIDWORKS MOTION – 2 days (14h)</u> .....	<u>38</u>
<u>SOLIDWORKS SIMULATION PROFESSIONAL – 2 days (14h)</u> .....	<u>39</u>
<u>SOLIDWORKS SIMULATION PREMIUM – 3 days (21h)</u> .....	<u>41</u>
<u>SOLIDWORKS SIMULATION PREMIUM COMPOSITE – 1 day (7h)</u> .....	<u>42</u>
<u>SOLIDWORKS FLOW SIMULATION - 2 days (14h)</u> .....	<u>43</u>
<u>SOLIDWORKS FLOW SIMULATION: HVAC MODULE - 1 day (7h)</u> .....	<u>44</u>
<u>SOLIDWORKS FLOW SIMULATION: ELECTRONIC COOLING MODULE – 1 day (7h)</u> .....	<u>45</u>
<u>SOLIDWORKS PLASTICS – 1.5 day (10h), 2 days (14h) or 3 days (21h)</u> .....	<u>46</u>

## SOLIDWORKS SIMULATION STATIC – 3 DAYS (21H)

### 1. The Analysis Process

- The analysis process
- SOLIDWORKS Simulation options
- Preprocessing
- Meshing
- Processing
- Postprocessing
- Multiple studies
- Reports
- Summary
- References

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

- Mesh Control
- Understanding the effect of Boundary Conditions

### 3. Assembly Analysis with Interactions

- Interaction Analysis
- Study Properties
- Contact or Bonded interaction
- Local Interaction

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

- Shrink Fit Parts
- Analysis with Soft Springs

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

- Problem Statement
- Remote Load/Mass
- Connectors
- Mesh Control in an Assembly
- Mesh Plots

### 6. Bonded Mesh Options

- Bonded Mesh Options
- Centrifugal Force
- Cyclical Symmetry
- Bonding Options
- Bonding Formulation

### 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

### 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

- Multiple load cases
- Geometry modification

## Part 2 →

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2540-ENG

## SOLIDWORKS SIMULATION STATIC (PART 2)

### 12. Thermal Stress Analysis

- Thermal stress analysis
- Saving model in a deformed shape

### 13. Adaptive Meshing

- Adaptive meshing
- h-Adaptivity study
- p-Adaptivity study
- h vs. p Elements – Summary

### 14. Large Displacement Analysis

- Small vs. Large displacement analysis
- Small displacement Linear analysis
- Large displacement Nonlinear analysis

### Annex

- Meshing Strategy
- Geometry Preparation
- Meshing Quality
- Mesh Controls
- Meshing Stages
- Failure Diagnosis
- Tips for the Shell Elements Usage
- Hardware Requirements for Meshing
- Solvers in SOLIDWORKS Simulation
- Solver Selection

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2540-ENG

## 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

- Latch forces
- STEP function
- Contact: Solid bodies
- Geometrical description of contacts
- Integrators
- Instability points

### 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 Optimization

- Motion Optimization
- Sensors
- Optimization 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 loads
- Direct solution in SOLIDWORKS Motion

### 11. Event Based Simulation

- Event based simulation
- Servo motors
- Sensors
- Task

### 12. Design Projects (Optional)

- Design Project
- Self-guided problems
- Problem solution
- Creating the force function
- Force expression

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2442-ENG

## SOLIDWORKS SIMULATION PROFESSIONAL – 2 DAYS (14H)

\*The "SOLIDWORKS Simulation Static" Training is required 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 Interaction Conditions
- Bonded and Free Interactions

### 3. Buckling Analysis

- Buckling Analysis
- Linear vs Nonlinear Buckling analysis

### 4. Load Cases

- Load Cases

### 5. Submodeling

- Submodeling

### 6. Topology Analysis

- Topology Analysis
- Goals and Constraints
- Manufacturing Controls
- Mesh Effects
- Load Cases in Topology

### 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 Analysis
- Thermal Stress Analysis
- 3D model

### 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

## Part 2 →

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2541-ENG

## SOLIDWORKS SIMULATION PROFESSIONAL (PART 2)

**12. Drop Test Analysis**

- Drop Test Analysis
- Rigid Floor Drop Test
- Elastic Floor/Elasto-Plastic Material
- Elasto-Plastic Material Model
- Drop Test with Contact Interaction

**13. Optimization Analysis**

- Optimization Analysis
- Static and Frequency Analysis

**14. Pressure Vessel Analysis**

- Pressure esVsel Analysis
- Manhole Nozzle Flange and Cover

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2541-ENG

## SOLIDWORKS SIMULATION PREMIUM – 3 DAYS (21H)

\*The "SOLIDWORKS Simulation Static" Training is required for this class.  
\*\*The "SOLIDWORKS Simulation Professional" is required 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. Nonlinear Static Buckling Analysis

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

#### 4. Plastic Deformation

- Plastic deformation
- Problem statement
- Linear elastic
- Nonlinear Study with Linear Material
- Nonlinear – von Mises
- Nonlinear – Tresca's
- Stress accuracy
- Using Nonlinear 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 Interaction Analysis

- Connections
- Dynamic Solutions

#### 8. Metal Forming

- Bending

### DYNAMICS

#### 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-810H

- Run Frequency
- Damping

#### 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

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2544-ENG



## SOLIDWORKS SIMULATION PREMIUM COMPOSITE – 1 DAY (7H)

\*The "SOLIDWORKS Simulation Static" training is required for this class.  
\*\*The "SOLIDWORKS Simulation Professional" training is required 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

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

## 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
- Averaging
- Noise Prediction
- Sliding Mesh
- Tangential faces of rotors
- Time step
- Axial Periodicity

### 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 Trajectory

### 14. Supersonic Flow

- Supersonic Flow

### 15. FEA Load Transfer

- FEA Load Transfer

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2543-ENG

## SOLIDWORKS FLOW SIMULATION: HVAC MODULE – 1 DAY (7H)

\*The "SOLIDWORKS Flow Simulation" Training is required for this class.

### 1. Introduction to HVAC

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

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

## SOLIDWORKS FLOW SIMULATION: ELECTRONIC COOLING MODULE – 1 DAY (7H)

\*The "SOLIDWORKS Flow Simulation" training is required for this class.

### 1. Introduction to Electronics Module

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

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

## SOLIDWORKS PLASTICS – 1.5 DAY (10H), 2 DAY (14H) OR 3 DAY (21H)

### 1. Basic Fill Analysis

- Basic Fill Analysis
- Injection Process
- Element Types
- Units
- User Interface
- Injection Units
- Material
- Boundary Conditions
- Injection Location
- Create Mesh
- Simulation Type
- Running a Fill Analysis
- Fill Results

### 2. Detecting a Short Shot

- Detecting Short Shots
- Fill Properties
- Flow Front Central Temperature
- Configurations

### 3. Automation Tools

- Automation Tools
- Duplicate Study
- Plastics File Management
- Batch Manager

### 4. Injection Locations and Sink Marks

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

### 5. Materials

- Materials Properties
- User-Defined Database
- Resin Properties
- Temperature Properties
- Polymer types
- Thermal Properties
- Rheological Properties
- PVT Data
- Thermo-Mechanical Properties

### 6. Mesh Manipulation

- Mesh Manipulation
- Local Mesh Refinement
- Edit/Review
- Element Issues
- Leader Lines
- Edit Study
- Solid Mesh
- Solid Mesh Size

### 7. Detecting Air Traps

- Detecting Air Traps
- Air Traps
- Venting
- Solver settings

### 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
- Clipping Plane Mode
- Isosurface Mode
- Cooling Times

**Part 2 →**

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

**PMT2539-ENG**

## SOLIDWORKS PLASTICS (PART 2)

### 10. Multiple Cavity Molds

- Multiple Cavity Molds
- Mold Layouts
- Runner System
- Runner Channel Design
- Clamping Force
- Family Mold Layout
- Using Runner-Balancing

### 11. Symmetry Analysis

- Symmetry Analysis
- Symmetry
- Cyclic Symmetry

### 12. Valve Gates and Hot Runners

- Hot Runners
- Valve Gates

### 13. Reaction Injection Molding

- Reaction Injection Molding

### 14. Using Inserts

- Using Inserts
- Inserts
- Metal Material Database

### 16. Co-Injection Molding

- Co-Injection Molding
- Thick Parts

### 17. Bi-Injection Molding

- Bi-Injection Molding
- Copy and Paste
- Bi-Injection
- Injection Start Value

### 18. Cooling Analysis

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

### 19. Warpage Analysis

- Warpage Analysis
- Shrinkage
- Warpage
- Warp Parameters
- Warp Results
- Reducing and Fixing Warped Parts

**Course Objectives :** At the end of each course, students will know the capabilities of the software and will be able to use the learned features.

**Training Course :** Training is given in class at SolidXperts or online where each student has access to a workstation or online product version.

**Methodology :** Training is based on case studies demonstrated by the instructor. At the end of each lesson, time will be given for exercises.

**Competences Evaluation :** During the classwork, the instructor will correct the exercises on-demand and explain the solutions to the entire class if needed.

**Instructor :** SolidXperts trainers are Certified SolidWorks Instructors (CSWI) and authorized by Emploi-Québec.

**Course Materials :** One or more training manuals are included with the training course.

**Attestation :** A certificate will be given to each student at the end of the course to attest to the successful completion of the requirements for the course.

PMT2539-ENG