

# TRAINING: SOLIDWORKS Simulation Premium: Nonlinear (2 Days)

**Prerequisites:** Must have attended the basic SOLIDWORKS Simulation class, or must have an experience with SOLIDWORKS + working basic knowledge of finite elements and of basic mechanical principles

**Description:** This class will raise your SOLIDWORKS Simulation FEA skills to the next level! It offers hands-on experience on the use of SOLIDWORKS Simulation Premium nonlinear module. The 2-day course provides an overview on a wide range of nonlinear structural/mechanical analysis topics. You will learn how to deal with models that exhibit large displacements and/or yielding, discuss and practice the use of many material models available in SOLIDWORKS Simulation and, most importantly, how to drive a non-linear analysis to successful completion.

## Introduction

About This Course

## Introduction to Nonlinear Structural Analysis

Types of Nonlinearities  
Solving Nonlinear Problems<sup>12</sup>

## Geometric Nonlinear Analysis

Small Displacement Analysis  
Large Displacement Analysis  
Finite Strain Analysis  
Large Deflection Analysis

## Material Models and Constitutive Relations

Elastic Models  
Elasto-Plastic Models  
Super Elastic Nitinol Model  
Linear Visco-Elastic Model  
Creep Model

## Numerical Procedures for Nonlinear FEA

Incremental Control Techniques  
Iterative Methods  
Termination Criteria

## Interaction Analysis

Component Interaction/ Gap Conditions  
Local Interaction/ Gap Conditions  
Troubleshooting for Gap / Interaction Problems

## Lesson 1: Large Displacement Analysis

Case Study: Hose Clamp  
Linear Static Analysis  
Nonlinear Static Study  
Linear Static Study (Large Displacement)

## Lesson 2: Incremental Control Techniques

Incremental Control Techniques  
Case Study: Trampoline  
Linear Analysis  
Nonlinear Analysis - Force Control  
Nonlinear Analysis - Displacement Control

## Lesson 3: Nonlinear Static Buckling Analysis

Case Study: Cylindrical Shell  
Linear Buckling  
Nonlinear Symmetrical Buckling  
Nonlinear Asymmetrical Buckling

## Lesson 4: Plastic Deformation

Case Study: Paper Clip  
Linear Elastic  
Nonlinear - von Mises  
Nonlinear - Tresca's  
Stress Accuracy (Optional)

## Lesson 5: Hardening Rules

Case Study: Crank Arm  
Isotropic Hardening  
Kinematic Hardening

## Lesson 6: Analysis of Elastomers

Case Study: Rubber Pipe  
Two Constant Mooney-Rivlin (1 Material Curve)  
2 Constant Mooney-Rivlin (2 Material Curves)  
2 Constant Mooney-Rivlin (3 Material Curves)  
6 Constant Mooney-Rivlin (3 Material Curves)

## Lesson 7: Nonlinear Interaction Analysis

Case Study: Rubber Tube  
Instability in Assemblies  
Releasing Prescribed Displacement  
Validity and Limitations of Static Analysis

## Lesson 8: Metal Forming

Case Study: Sheet Bending  
Plane Strain  
Large Strain Formulation Option  
Convergence Problems  
Automatic Stepping Problems  
Small Strain Vs Large Strain Formulations

## Appendix A: True and Engineering Stress and Strain

Engineering Stress and Strain  
True Stress and Strain



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+1 251-305-3636