Introduction to Creo Simulate 4.0

Overview

Course Code	TRN-5104-T
Course Length	40 Hours

In this course, you will learn how to test, validate, and optimize product designs with the Creo Simulate module. Creo Simulate enables you to simulate structural and thermal loads on product designs. You will complete comprehensive, hands-on lab exercises that simulate realistic analysis and design optimization activities. You will also be introduced to advanced topics such as dynamic analyses, combined mechanical and thermal analyses, and Optimization Studies. After completing the course, you will be able to run engineering analyses and optimizations on your product design models.

At the end of each module, you will complete a set of review questions to reinforce critical topics from that module. At the end of the course, you will complete a course assessment in Pro/FICIENCY intended to evaluate your understanding of the course as a whole.

This course has been developed using Creo Simulate 4.0
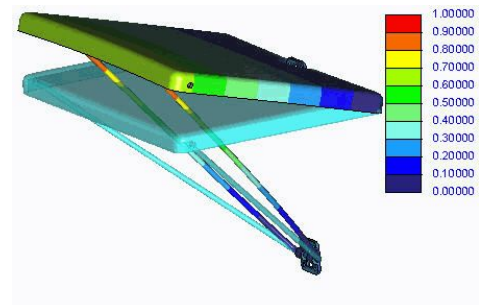
Course Objectives

- Understand the basic Simulate analysis process
- Understand theory and simulate model topics
- Explore results
- Explore materials and material properties
- Understand and use Simulate idealizations
- Understand and use structural loads
- Understand and use structural constraints
- Run structural analyses
- Understand convergence

- Analyze assemblies with Simulate
- Complete design and sensitivity studies

- Run optimization studies
- Understand the basics of Thermal analysis
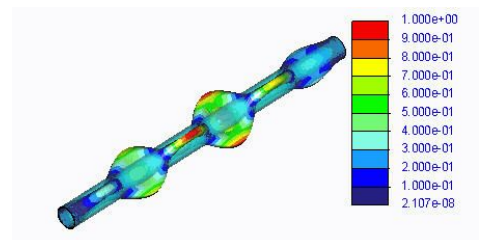
Prerequisites

- Three months of Pro/ENGINEER Wildfire 5.0 or Creo Parametric experience

Audience

- This course is intended for design engineers and mechanical designers. People in related roles will also benefit from taking this course.

Agenda

Day 1

Module	1	Introduction to Creo Simulate
Module	2	Theoretical Foundations
Module	3	Simulation Models
Module	4	Materials and Material Properties
Module	5	Structural Constraints
Module	6	Structural Loads

Day 2

Module	7	Meshing
Module	8	Convergence
Module	9	Structural Analysis
Module	10	Introduction to Results Evaluation

Day 3

Module	11	Refining the Design
Module	12	Basic Model Debugging
Module	13	Singularities

Day 4

Module	14	Analyzing Assemblies
Module	15	Shells
Module	16	Idealizations

Day 5

Module	17	Thermal Analysis
Module	18	Advanced Analysis
Module	19	Project

Course Content

Module 1. Introduction to Creo Simulate
- i. Simulate Analysis Functionality
- ii. Simulate Model Functionality
- iii. The Simulate Application
- iv. The Simulate User Interface Functionality
- v. The Typical Simulation Process

Knowledge Check Questions

Module 2. Theoretical Foundations
- i. The Finite Element Method
- ii. The h- and p-Versions of Finite Elements
- iii. The p-Method
- iv. Structural Mechanics – Stress Definitions and Hooke's Law
- v. Structural Mechanics – Strain Energy and Failure Theories

Knowledge Check Questions

Module 3. Simulation Models
- i. Preparing a CAD Model
- ii. Using Inheritance and Remove Features
- iii. Managing Units
- iv. Understanding Model Types
- v. Element Types Overview
- vi. Defining Simulate Model Geometry
- vii. Using Simulate Coordinate Systems
- viii. Using Surface Regions
- ix. Using Volume Regions
- x. Controlling the Display of Simulation Entities
- xi. Using Measures

Knowledge Check Questions

Module 4. Materials and Material Properties
- i. Understanding Material Properties
- ii. Defining Linear Elastic Materials
- iii. Understanding Failure Criteria
- iv. Creating Materials
- v. Using 3-D Material Orientation
- vi. Using 2-D Material Orientation
- vii. Understanding Material Libraries

Knowledge Check Questions

Module 5. Structural Constraints
- i. Defining Constraints

ii. Understanding Displacement Constraints

iii. Understanding Planar, Pin, and Ball Constraints

iv. Understanding Mirror Symmetry Constraints

v. Understanding Cyclic Symmetry Constraints

Knowledge Check Questions

Module 6. Structural Loads

i. Understanding Structural Loads

ii. Defining Global Loads

iii. Defining Forces, Moments, and Pressure

iv. Defining Loads as Functions

Knowledge Check Questions

Module 7. Meshing

i. Understanding Meshes

ii. Understanding Mesh Options

iii. Using AutoGEM Settings

Knowledge Check Questions

Module 8. Convergence

i. Convergence Methods

ii. Error Norms

iii. Comparing Convergence Methods

iv. Selecting a Convergence Method

v. Understanding P-Level Plots

vi. Recommendations for Memory Allocation

Knowledge Check Questions

Module 9. Structural Analysis

i. Fundamentals of a Linear Static Analysis

ii. Defining a Linear Static Analysis

iii. Understanding Modal Analysis

iv. Defining Fatigue Studies and Properties

v. Setting Up the Simulate Solver

vi. Starting, Stopping, and Monitoring the Simulate Solver

vii. Understanding the Batch Process

Knowledge Check Questions

Module 10. Introduction to Results Evaluation

i. Ensuring Result Quality

ii. The Simulate Result Directory Structure

iii. Using the Postprocessor

iv. Reviewing the Results Window

v. Inserting Results

vi.   Formatting Results

vii.   Performing Basic View Operations

viii.   Hiding and Unhiding Results

ix.   Editing, Copying, Deleting, Swapping, and Reordering Results Windows

x.   Using Results Templates

xi.   Using Annotations

xii.   Creating Fringe Results

xiii.   Creating Vector Results

xiv.   Creating Graph Results

xv.   Creating a Graph Preference File

xvi.   Creating Model Results

xvii.   Using Cutting and Capping Surfaces

xviii.   Using Results Mode Info and Query

xix.   Tying and Untying Results

xx.   Controlling Animations

xxi.   Exporting Results

Knowledge Check Questions

Module 11. Refining the Design

i.   Understanding Design Variables

ii.   Defining Design Studies

iii.   Understanding Standard Design Studies

iv.   Understanding Local Sensitivity Design Studies

v.   Understanding Global Sensitivity Design Studies

vi.   Understanding Optimization Design Studies

vii.   Understanding Design Study Options

Knowledge Check Questions

Module 12. Basic Model Debugging

i.   The Diagnostic Tool

ii.   Debugging a Model

Knowledge Check Questions

Module 13. Singularities

i.   Understanding Singularities

ii.   Treating Singularities

Knowledge Check Questions

Module 14. Analyzing Assemblies

i.   Using Interfaces

ii.   Reviewing Interfaces

iii.   Understanding Connections

iv.   Using End Welds

v.   Using Perimeter Welds

vi. Using Spot Welds

vii. Using Fasteners

Knowledge Check Questions

Module 15. Shells

i. Understanding Shells

ii. Using Shells on Quilts or Volume Surfaces

iii. Using Shell Pairs for Midsurface Models

iv. Using Connection Tools to Join Shell Midsurface Assemblies

Knowledge Check Questions

Module 16. Idealizations

i. Creating Discrete Masses

ii. Creating Rigid Links

iii. Creating Weighted Links

iv. Creating Springs

v. Defining a Beam

vi. Understanding Beam Results

Knowledge Check Questions

Module 17. Thermal Analysis

i. Understanding Thermal Analysis

ii. Creating Heat Loads

iii. Creating Prescribed Temperature Boundary Conditions

iv. Applying Traveling Heat Loads

v. Applying Temperature Loads to a Simulate Structure Model

Knowledge Check Questions

Module 18. Advanced Analysis

i. Understanding Static Analysis with Prestress

ii. Understanding Modal Analysis with Prestress

iii. Understanding Dynamic Analysis

iv. Understanding Linear Buckling Analysis

v. Understanding Nonlinear Stability Analysis: Snap-through

vi. Understanding Contact Analysis

vii. Understanding 2-D Plane Stress and Strain

viii. Understanding Symmetry

Knowledge Check Questions

Module 19. Project

i. The Journeyman's Piece