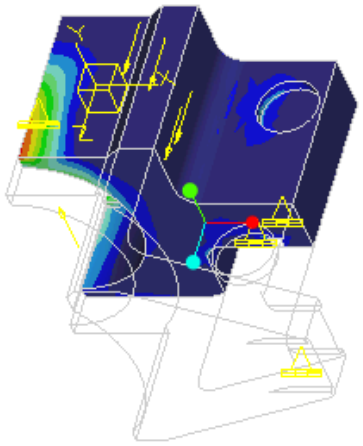
Pro/ENGINEER Mechanica Simulation using Pro/ENGINEER Wildfire 5.0

Overview

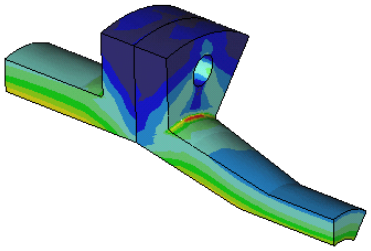
Course Code	TRN-2235-S
Course Length	40 Hours



This course is designed for new users who want to test, validate, and optimize product designs with the Pro/ENGINEER Wildfire 5.0 Mechanica module. Mechanica enables you to simulate structural and thermal loads on product designs. In this course, you will complete comprehensive, hands-on lab exercises that simulate realistic analysis and design optimization activities. You will also learn about advanced topics such as dynamic analyses, combined mechanical and thermal analyses, and Fatigue Studies. A module on Mechanica Best Practices is also included to help users avoid some of the more common problems that new users encounter. 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 find a set of review questions to reinforce critical topics from that module. Your instructor will discuss these with the class. At the end of the course, you will find a course assessment in Pro/FICIENCY intended to evaluate your understanding of the course as a whole. After completing the course you will be well prepared to complete Pro/MECHANICA analyses on product design projects in Pro/ENGINEER Wildfire 5.0.

Course Objectives

- Learning the basic Pro/MECHANICA Analysis Process
- Theory and Mechanica Model Topics
- Exploring Results
- Materials and Material Properties
- Understanding and Using Pro/MECHANICA idealizations
- Understanding and Using Structural Loads
- Understanding and Using Structural Constraints
- Running Structural Analyses
- Running Thermal Analyses
- Convergence
- Analyzing Assemblies with Pro/MECHANICA
- Completing Design and Sensitivity Studies
- Running Optimization Studies
- Advanced Topics
- Analysis Best Practices
- Analysis Projects



Prerequisites

- Three months of Pro/ENGINEER Wildfire 5.0 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	The Pro/ENGINEER Mechanica Process
Module	2	Theory and Mechanica Model Topics
Module	3	Results
Module	4	Materials and Material Properties

Day 2

Module	5	Idealizations
Module	6	Structural Loads
Module	7	Structural Constraints
Module	8	Structural Analysis I

Day 3

Module	9	Structural Analysis II
Module	10	Thermal Analysis
Module	11	Convergence
Module	12	Analyzing Assemblies I

Day 4

Module	13	Analyzing Assemblies II
Module	14	Design and Sensitivity Studies
Module	15	Optimization Studies
Module	16	Dynamic Analyses

Day 5

Module	17	Advanced Topics
Module	18	Analysis Best Practices
Module	19	Projects

Course Content

Module 1. The Pro/ENGINEER Mechanica Process

i. Mechanica Process Overview
ii. Building the Analysis Model
iii. Running the Analysis
iv. Reviewing Analysis Results
v. Improving the Design

Knowledge Check Questions

Module 2. Theory and Mechanica Model Topics

i. Finite Element Analysis Overview
ii. FEA Convergence
iii. Using Units in Mechanica
iv. Understanding Model Types
v. Element Types Overview
vi. Understanding Measures
vii. Controlling the Display of Simulation Entities
viii. Understanding Meshes
ix. Understanding AutoGEM Controls
x. Understanding AutoGEM Limits and Settings
xi. Understanding Mechanica Coordinate Systems
xii. Understanding Surface Regions
xiii. Understanding Volume Regions

Knowledge Check Questions

Module 3. Results

i. Understanding Results Files
ii. Results Interface
iii. Results File Operations
iv. Inserting Results
v. Formatting Results
vi. Performing Basic View Operations
vii. Hiding and Unhiding Results
viii. Editing, Copying, Deleting, Swapping, and Reordering Results Windows
ix. Using Results Templates
x. Using Annotations
xi. Creating Fringe Results
xii. Creating Vector Results
xiii. Creating Graph Results
xiv. Creating A Graph Preference File
xv. Creating Model Results
xvi. Using Cutting and Capping Surfaces

xvii. Using Results Mode Info/Query
xviii. Tying And Untying Results
xix. Controlling Animations
xx. Exporting Animations

Knowledge Check Questions

Module 4. Materials and Material Properties

i. Understanding Material Properties
ii. Using Materials
iii. Understanding Failure Criteria
iv. Creating Materials
v. Using Material Libraries
vi. Assigning Materials
vii. Using 3D Material Orientations
viii. Using 2D Material Orientations

Knowledge Check Questions

Module 5. Idealizations

i. Model Type Overview
ii. Using 3D Models
iii. Using 2D Plane Stress Models
iv. Using 2D Plane Strain Models
v. Using 2D Axisymmetric Models
vi. Understanding Beam Idealizations
vii. Creating and Using Beam Sections
viii. Using Beam Orientations
ix. Using Beam Releases
x. Understanding Shell Idealizations
xi. Creating Midsurface Shell Idealizations
xii. Creating Standard Shell Idealizations
xiii. Understanding Mass Idealizations
xiv. Understanding Spring Idealizations
xv. Other Techniques for Simplifying Models

Knowledge Check Questions

Module 6. Structural Loads

i. Understanding Structural Loads
ii. Creating Force/Moment Loads
iii. Creating Bearing Loads
iv. Creating Centrifugal Loads
v. Creating Gravity Loads
vi. Creating Pressure Loads
vii. Creating Temperature Loads

viii. Creating Mechanism Loads

Knowledge Check Questions

Module 7. Structural Constraints

i. Understanding Displacement Constraints
ii. Planar, Pin, and Ball Constraints
iii. Understanding Mirror Symmetry Constraints
iv. Understanding Cyclic Symmetry Constraints

Knowledge Check Questions

Module 8. Structural Analysis I

i. Understanding Static Analyses
ii. Understanding Modal Analyses
iii. Understanding Large Deformation Analyses

Knowledge Check Questions

Module 9. Structural Analysis II

i. Understanding Contact Analyses
ii. Setting Up the Mechanica Solver
iii. Starting, Stopping, and Monitoring the Mechanica Solver
iv. Running Analyses in Batch Mode

Knowledge Check Questions

Module 10. Thermal Analysis

i. Understanding Thermal Analysis
ii. Creating Heat Loads
iii. Creating Thermal Convective Boundary Conditions
iv. Creating Prescribed Temperature Boundary Conditions
v. Creating Thermal Cyclic Symmetry Boundary Conditions
vi. Steady State Thermal Analysis
vii. Transient Thermal Analysis

Knowledge Check Questions

Module 11. Convergence

i. Understanding Adaptivity Methods
ii. Understanding Convergence
iii. Understanding P-level Plots

Knowledge Check Questions

Module 12. Analyzing Assemblies I

i. Understanding Connections
ii. Using End Welds
iii. Using Perimeter Welds
iv. Using Spot Welds
v. Using Pro/Weld Feature Welds

vi. Using Fasteners
vii. Using Rigid Links
viii. Using Weighted Links

Knowledge Check Questions

Module 13. Analyzing Assemblies II

i. Understanding Interfaces
ii. Using Free Interfaces
iii. Using Contacts
iv. Using Simplified Representations in Mechanica

Knowledge Check Questions

Module 14. Design and Sensitivity Studies

i. Understanding Design Variables
ii. Understanding Design Studies
iii. Understanding Standard Design Studies
iv. Understanding Local Sensitivity Design Studies
v. Understanding Global Sensitivity Design Studies

Knowledge Check Questions

Module 15. Optimization Studies

i. Understanding Optimization Design Studies
ii. Understanding Shape Animate

Knowledge Check Questions

Module 16. Dynamic Analyses

i. Understanding Dynamic Time Analyses
ii. Understanding Dynamic Frequency Analyses
iii. Understanding Dynamic Random Analyses
iv. Understanding Dynamic Shock Analyses

Knowledge Check Questions

Module 17. Advanced Topics

i. Fatigue Studies and Properties
ii. Hyperelastic and Elastoplastic Materials
iii. Mechanica Thermal Loads
iv. Understanding Prestress Static Analyses
v. Understanding Prestress Modal Analyses
vi. Understanding Buckling Analyses
vii. Post Processing
viii. Process Advisor Overview

Knowledge Check Questions

Module 18. Analysis Best Practices

i. Designating Excluded Elements

ii. Understanding Boundary Conditions
iii. Understanding Stress Singularities
iv. Mesh Refinement
v. Suppressing Cosmetic Features
vi. Batch Files

Knowledge Check Questions

Module 19. Projects

i. Mechanica Projects 1–4
ii. Mechanica Project 5
iii. Mechanica Project 6
iv. Mechanica Project 7