Creo Simulate: Structural and Thermal Analysis

Target Audience

This course is designed for design engineers, analysts, and CAD professionals who want to perform structural and thermal finite element analysis (FEA) using Creo Simulate. It is ideal for Creo Parametric users who need to evaluate part and assembly performance under real-world loading, thermal, and boundary conditions before committing designs to manufacturing.

Course Objective

This course aims to provide learners with a comprehensive understanding of structural and thermal analysis using Creo Simulate. Participants will learn the fundamentals of finite element analysis (FEA) and P-element technology, how to apply materials, loads, and constraints, and how to use shell and beam idealizations. The course also covers sensitivity and optimization design studies, assembly interfaces and contact analysis, thermal analysis, modal analysis, welds, springs, masses, fasteners, rigid links, and buckling analysis. The course focuses on practical, hands-on application of Creo Simulate through real-world modeling and analysis scenarios.

Course Outcome

Upon completion of this course, learners will be able to confidently set up and run structural and thermal simulations in Creo Simulate, apply appropriate materials, loads, and constraints, and use shell and beam idealizations to simplify models where appropriate. Participants will also gain the skills required to perform sensitivity and optimization design studies, configure assembly interfaces and contact analysis, conduct modal and buckling analyses, model welds, springs, masses, fasteners, and rigid links, and verify and interpret FEA results with confidence.

Course Outline: The course duration is **40 hours** divided into **12 comprehensive chapters**. Each chapter is followed by **hands-on lab exercises** to reinforce learning and gauge understanding of the topics covered.

Chapter 1: Introduction to Creo Simulate

- Finite Element Analysis (FEA)
- FEA Solution Refinement
- P-Elements
- Convergence Methods
- Types of Analysis in Creo Simulate
- FEA Process
- CAD Model Preparation
- Creo Simulate Modes of Operation

Chapter 2: Basic Creo Simulate Modeling

- Launching Creo Simulate
- Structure Ribbon
- Modeling Steps
- Defining Model Type
- Creating Idealizations
- Applying Material
- Applying Constraints
- Applying Loads
- Meshing the Model
- Analysis Types
- Convergence Methods
- Design Studies
- Files and Directories
- Result Verification
- Result Visualization

Chapter 3: Loads and Constraints

- Rigid Body Motions
- Constraint Sets
- Displacement Constraint
- Planar, Pin, and Ball Constraints
- Symmetry Constraints
- Load Sets
- Force/Moment Load
- Pressure Load
- Bearing Load
- Gravity Load
- Centrifugal Load
- Temperature Load
- Preload
- Divide Surface
- Types of Singularities
- Excluded Elements
- Singularity Guidelines

Chapter 4: Shell Idealizations

- Shell Idealizations Overview
- Midsurface Shells
- Shell Pair Creation
- Manual Shell Pairs
- Automatic Shell Pairs
- Shell Pair Compression
- Standard Shells
- Standard Shell Creation
- Applying Loads and Constraints to Shell Models

Chapter 5: Beams and Frames

- Beam Idealization
- Beam Definitions
- Beam Sections
- Beam Coordinate Systems
- Beam Action Coordinate System
- Beam Shape Coordinate System
- Beam Releases
- Beam Analysis Results

Chapter 6: Sensitivity and Optimization Design Studies

- Design Considerations
- Objectives
- Measures
- Design Variables
- Types of Design Studies
- Standard Studies
- Sensitivity Studies
- Optimization Studies
- Setting Up Design Studies

Chapter 7: Assembly Interfaces

- Types of Interfaces
- Bonded Interface
- Free Interface
- Contact Interface
- Automatic Contact Detection
- Reviewing Interfaces
- Setting Up Contact Analysis

- Mesh Refinement

Chapter 8: Thermal Analysis

- Modes of Heat Transfer
- Conduction
- Convection
- Radiation
- Creo Simulate Thermal
- Thermal Ribbon
- Thermal Modeling Steps
- Interfaces
- Idealizations
- Applying Boundary Conditions
- Applying Heat Loads
- Thermal Analysis Types
- Result Visualization
- Thermal Load Transfer

Chapter 9: Modal Analysis

- Natural Frequency
- Natural Modes
- Defining a Modal Analysis

Chapter 10: Welds, Springs, and Masses

- Weld Connections
- Spot Welds
- End Welds
- Perimeter Welds

- Weld Features
- Springs
- Stiffness
- Orientation
- Masses

Chapter 11: Fasteners and Rigid Links

- Rigid Links
- Creating Rigid Links
- Rigid Links Best Practices
- Fasteners
- Creating Fasteners
- Modeling Fastener with a Beam
- Modeling Fastener with a Spring
- Part Separation
- Fastener Preload
- Fastening Three or More Components
- Fastener Measures

Chapter 12: Buckling Analysis

- Theory of Buckling
- Creo Simulate Buckling Analysis