

SIMULATION CAPABILITIES IN CREO[®]

Enhance Your Product Design with Simulation & Analysis

Using digital prototypes to understand how your designs perform in real-world conditions is vital to your product development process. Not only can you reduce costly physical prototyping, but you can also increase your products durability, reliability, and safety. Nobody enjoys product recalls after all.

At PTC, we understand why most designers do not want to use simulation software. You are engineers not analysts! For too long, simulation software has been hard to use, time consuming, and difficult to integrate with CAD data. But, with PTC's simulation software you don't need a PhD to get accurate results fast.

PTC's simulation software is designed uniquely for the engineer, complete with the common Creo user interface, engineering terminology, and seamless integration between CAD and CAE data, allowing for a more streamlined process. Best of all, the results are accurate and reliable and can be easily calculated with very little input from non-simulation experts.

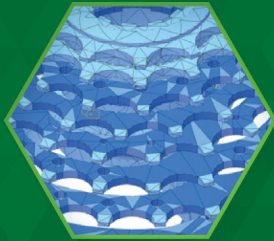
Our simulation software is a complete structural, thermal and vibration analysis solution with a comprehensive set of finite elements analysis (FEA) capabilities that allow you to analyze and validate the performance of your 3D virtual prototypes before you make the first part.



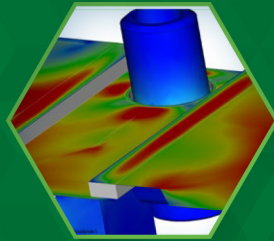
Finite Element Analysis for Parts & Assemblies



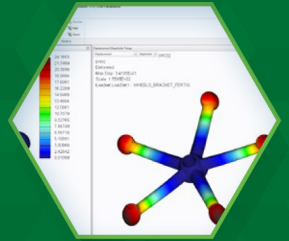
Static Structural Analysis



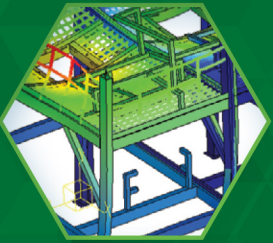
Automatic Meshing



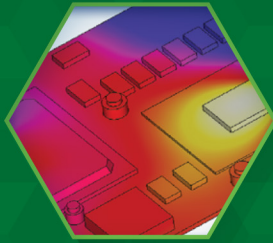
Finite Element Modeling Idealizations



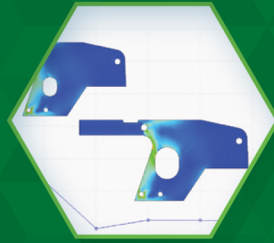
Results Display & Reporting



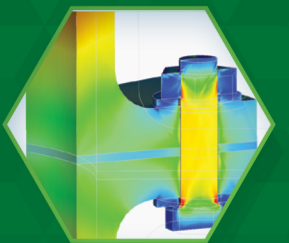
Modal and Buckling Analysis



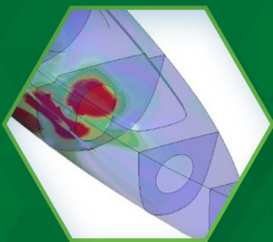
Steady State Thermal Analysis



Design Optimization



Contact Analysis

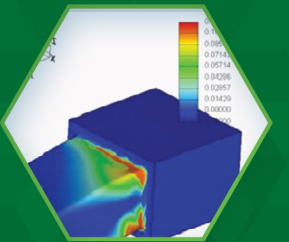


Advanced Finite Element Idealizations



creo®

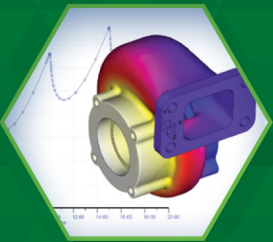
Simulation Capabilities



Nonlinear Materials & Large Deformation



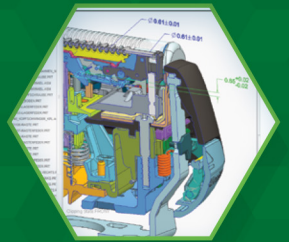
Dynamic and Pre-stress Analysis



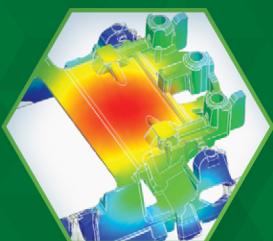
Transient and Nonlinear Thermal Analysis



Mechanism Dynamics



Tolerance Analysis



Mold Filling Analysis



Fatigue Analysis



Human Factor Analysis

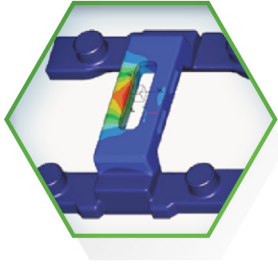


Engineering Notebook

Simulation Capabilities in Creo

Capability	Creo Parametric Essentials Premium	Creo Simulation Extension*	Creo Advanced Simulation Extension
Finite Element Analysis for Parts & Assemblies	✓	✓	✓
Static Structural Analysis	✓	✓	✓
Finite Element Modeling Idealizations	✓	✓	✓
Automatic Meshing	✓	✓	✓
Results Display & Reporting	✓	✓	✓
Modal & Buckling Analysis		✓	✓
Steady State Thermal Analysis		✓	✓
Design Optimization		✓	✓
Contact Analysis			✓
Advanced Finite Element Idealizations			✓
Nonlinear Materials & Large Deformation			✓
Dynamic and Pre-stress Analysis			✓
Transient and Nonlinear Thermal Analysis			✓

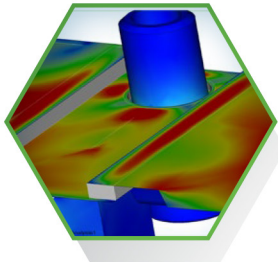
* Creo Simulation Extension is also available as a standalone application (Creo Simulate)

Creo Parametric Essentials Premium Capabilities:**Finite Element Analysis for Parts & Assemblies**

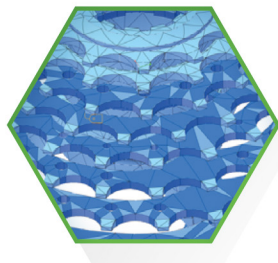
- Understand the response of your design when subjected to various loading conditions
- Integrated seamlessly with the Creo 3D CAD environment
- Automatic checks to ensure robust and reliable analysis results
- Comprehensive materials library provided
- Fully automatic mesh generation directly on 3D CAD geometry
- Units of measurement are managed consistently throughout the application

**Static Structural Analysis**

- Determine accurate stresses, strains and displacements in your product
- Conduct linear static analyses
- Loads and boundary conditions are easily applied and use engineering terminology

**Finite Element Modeling Idealizations**

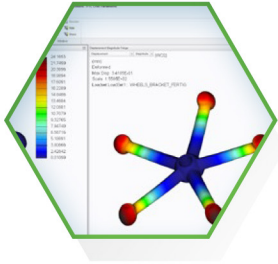
- Solids, Shells and Beams
- Springs and Masses
- Welds and Fasteners
- Rigid Links

**Automatic Meshing**

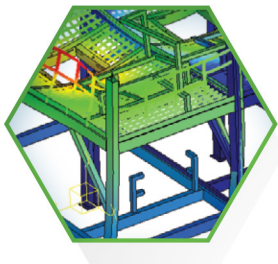
- Create accurate meshes directly on 3D CAD geometry
- Meshes follow highly detailed and curved geometry precisely
- Automatically update and refine meshes to ensure accurate simulations
- Supports solid (tetrahedron, wedge, hex), shell (triangle, quad), beam, spring, mass elements
- Flexibility to define element sizes, distribution and shapes (mapped meshing, thin solids)

Simulation Capabilities in Creo

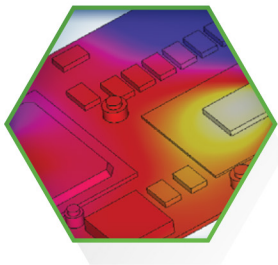
Creo Simulation Extension Capabilities*:

**Results Display & Reporting**

- Full results post-processing including contour, isosurface, cross section plots, and 2D graphs
- Create and save animated plots (deformed shape)
- Linearized stress report
- Multiple result window display
- Create templates for results window definitions
- Export reports as common formats: VRML, MPG, AVI, Graph Tables, Microsoft Excel

**Modal and Buckling Analysis**

- Determine natural frequency modes of vibration
- Automatically handle rigid mode (unconstrained) cases
- Determine buckling loads or solve unstable snap-through problems

**Steady State Thermal Analysis**

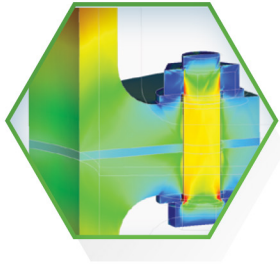
- Simulate the effects of temperature on a product
- Analyze conduction and convection heat transfer
- Use highly configurable distributions to apply loads to geometry
- Transfer Thermal Analysis results to Structural Analysis to understand impact of thermal load

**Design Optimization**

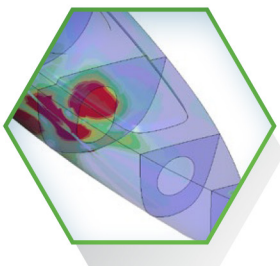
- Clearly understand the impact of design changes
- Reduce product costs by optimizing your design to meet multiple objectives, such as maintaining a product's strength while reducing its weight
- Save time by automatically iterating your design to meet your design requirements
- Reduce errors by using the results from external tools to drive your design directly, without manually transferring data

* Creo Simulation Extension is also available as a standalone application (Creo Simulate)

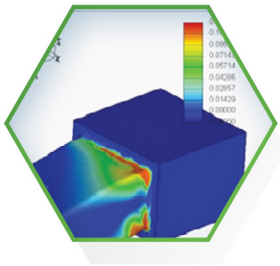
Simulation Capabilities in Creo

Creo Advanced Simulation Extension Capabilities:**Contact Analysis**

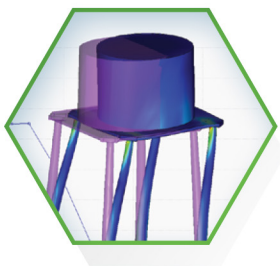
- Simulate the forces transferred between components when they come into contact
- Automatic contact interface detection
- Include the effect of friction in contact interfaces
- Simulate shrink-fit or snap-fit situations

**Advanced Finite Element Idealizations**

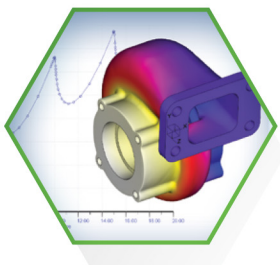
- Composite shells (laminated layup)
- Non-linear springs (force-deflection curve)
- Cracks, fracture mechanics
- Weighted links

**Nonlinear Analysis & Large Deformation**

- Easily define elasto-plastic materials and hyper-elastic materials
- Perform nonlinear static structural analysis
- Time varying loads
- Understand residual stresses in the model
- Large deformation of thin/slender products

**Dynamic and Pre-stress Analysis**

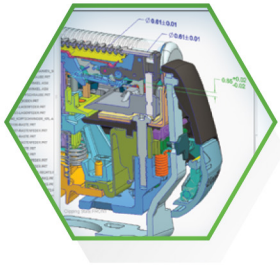
- Dynamic structural analysis of time response, frequency response, random response, and response spectrum
- Utilize previous static analysis results to determine effects of pre-stress on modal or structural analysis
- Display full results at any frequency or time intervals

**Transient and Nonlinear Thermal Analysis**

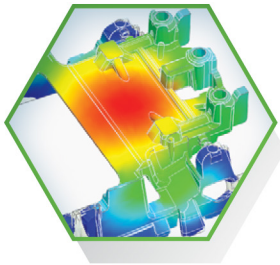
- Temperature dependent convections
- Radiation heat transfer
- Temperature dependent material properties
- Time dependent boundary conditions

Expand Your Simulation Capabilities As Your Requirements Grow**Mechanism Dynamics**

- Determine reaction forces in mechanism design
- Ability to include gravity, springs, dampers and force-based drivers
- Define cam/follower connections between parts in the mechanism
- Automated transfer of MDO results to Structural Analysis to evaluate stresses in the mechanism

**Tolerance Analysis**

- Evaluate the impact of tolerances on the manufacturability of designs
- Tolerance stack-ups
- Automatic validation of dimensions and dimension loops
- Graphical display of statistical distributions
- Contribution and sensitivity output plots

**Mold Filling Analysis**

- Identify potential mold filling problems
- Improve design quality, reduce manufacturing cycle times and rework of molds
- Easily usable by a non-specialist without extensive knowledge of plastic analysis

**Fatigue Analysis**

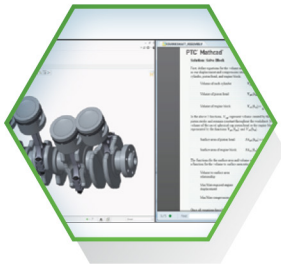
- Predict the life of metal structures that are prone to fatigue failure
- Estimate the number of load cycles your model can sustain before failure
- Investigate the impact design changes have on endurance

Simulation Capabilities in Creo



Human Factor Analysis

- Reduce time, budget, and obsolescence associated with physical prototypes
- Ensure conformance with safety, health, ergonomics and workplace standards and guidelines
- Communicate and share complex human-product interaction issues



Engineering Notebook

- Embed a PTC Mathcad worksheet directly within the Creo model
- Embedded worksheet can be opened, edited and saved within the Creo model
- All design details in the worksheet automatically travel with the Creo model



PTC's simulation & analysis software are available in both perpetual and subscription licensing. Many other simulation tools are available. Please visit ptc.com to learn more.

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