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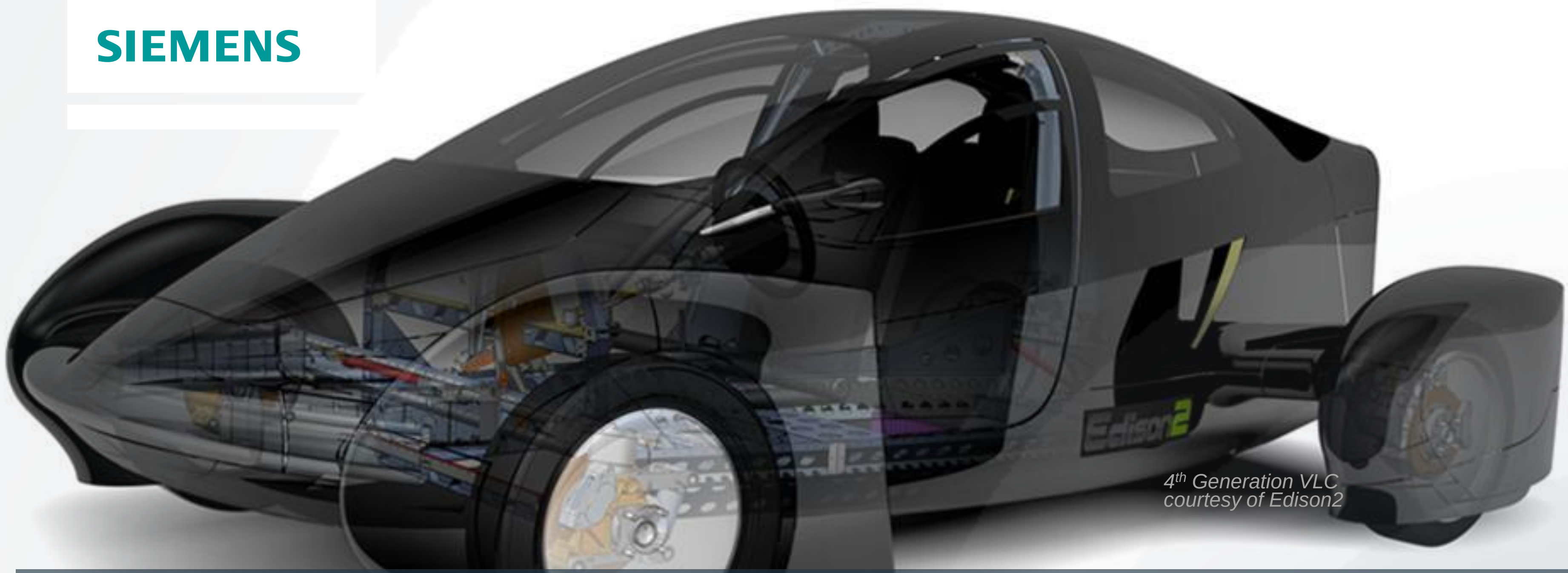


4th Generation VLC
courtesy of Edison2

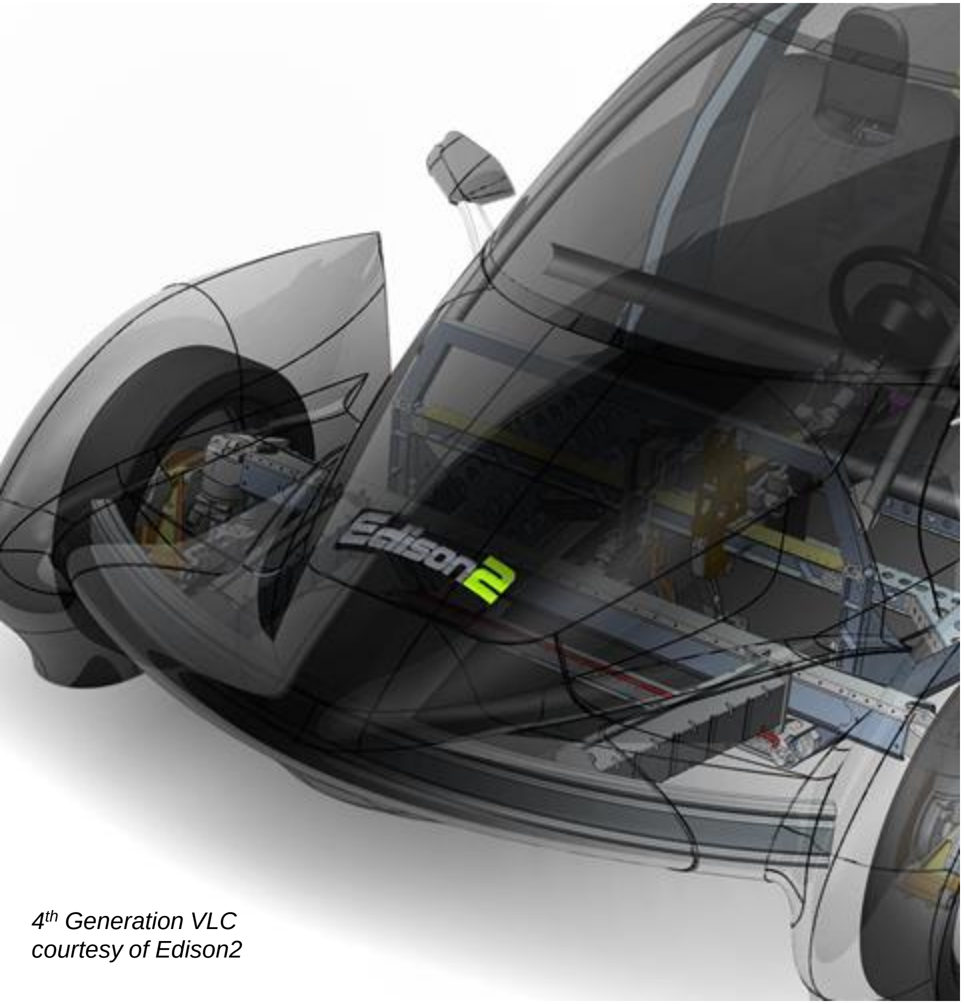
405 - Validate Designs with Simulation, Sensors, Goal Seek, and Engineering Reference

Ronnie Conerly, Simulation Product Manager, Siemens PLM Software

SOLID EDGE UNIVERSITY 2013

#SEU13

Agenda: 405 - Validate Designs with Simulation, Sensors, Goal Seek, and Engineering Reference



4th Generation VLC courtesy of Edison2

Who am I?

What you will learn

Solid Edge capabilities

Demonstrations

Benefits of this topic

How to learn more

About: Ronnie Conerly

Ronnie Conerly
Simulation Product Manager
Siemens PLM Software

Ronnie holds a bachelor’s degree in Mechanical Engineering from Texas A&M University. He has more than 25 years of experience in the mechanical CAD/CAE industry with involvement in all aspects of the software development process. He worked at NASA’s Marshall Space Flight Center as a CAD/CAE consultant, later managing engineering support contracts at Marshall, Johnson, and Kennedy Space Centers. Prior to his return back with Siemens he managed manufacturing companies with emphasis in plastic injection and blow molding consumer products.

What you will learn

This session will cover concepts on validating your Solid Edge designs using:

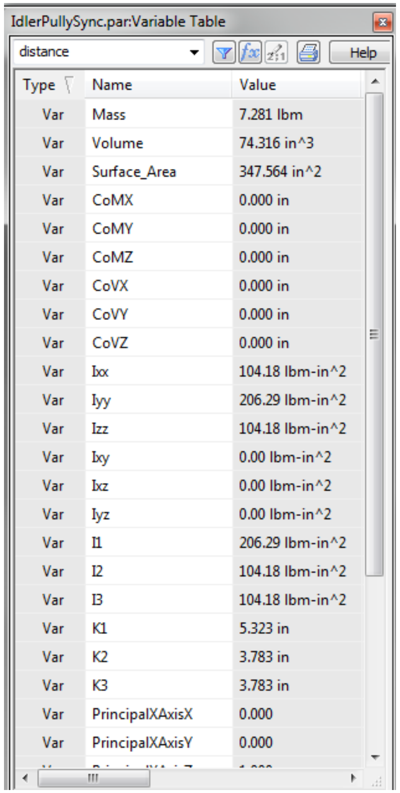
- Goal Seek
- Sensors
- Simulation
- Engineering Reference

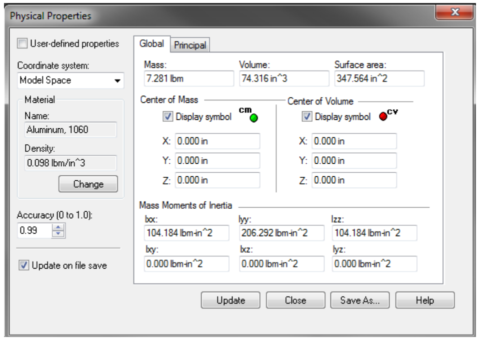
This presentation will cover basic topics in each of these areas of validation along with what's new in ST6 with certain key areas of the product. In particular, you can check out what is new with Goal Seek and Simulation enhancements.

This session is targeted towards designers and/or engineers who need an overview of design validation during the early concept phase. Anyone interested in learning about Solid Edge's engineering analysis capabilities should attend this session.

Physical Properties

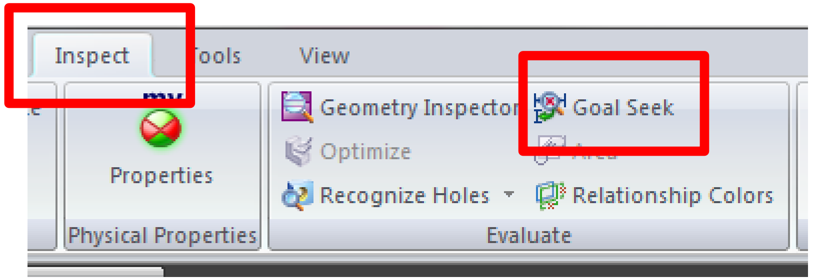
- Physical Properties are now written to the Variable Table
  - For both PAR/PSM and ASM documents
  - Can Expose them as Custom Properties (ie, for Draft Callouts)
  - Physical Property Filter for limiting the display in the Variable Table
  - New Variables
    - Mass, Volume, Surface Area (not in Assy)
    - Center of Mass/Volume (xyz locations)
    - Mass Moments of Inertia (Ixx, Iyy, Izz, Ixy, Ixz, Iyz)
    - Principal Moments of Inertia (I1, I2, I3)
    - Radii of Gyration (K1, K2, K3)
  - Side topic, can now Update Physical Properties on Save in Assembly

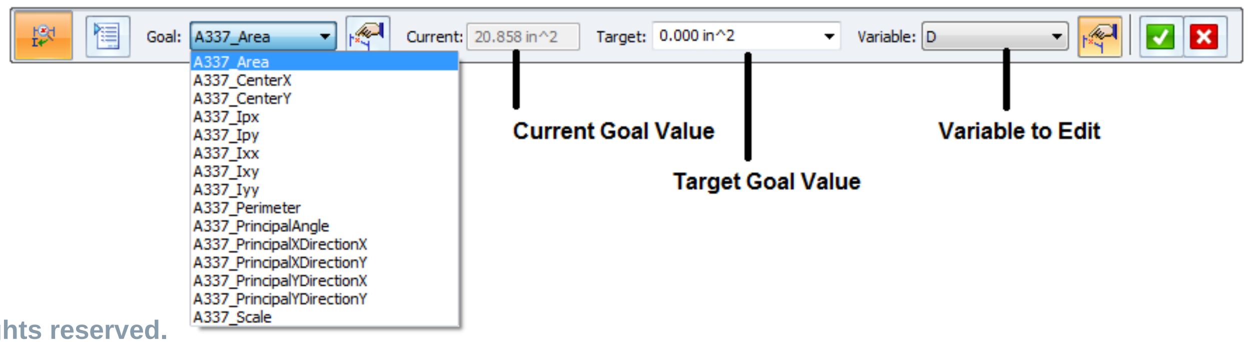




Goal Seek

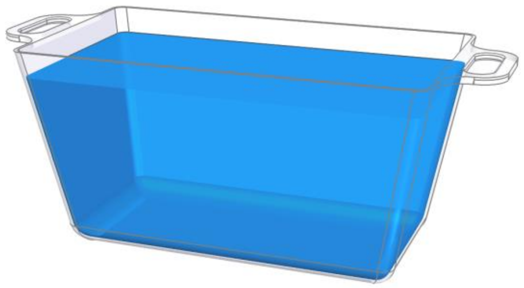
- Goal Seek now support both 2D and 3D Properties (Area and Physical Properties)
- Works in both Sync and Ordered Modes
- Inputs to the command
  - Options
  - Goal Variable (ie. Mass, volume, center of Mass, etc)
  - Current Goal Value
  - Target Goal Value
  - Variable to Drive the change



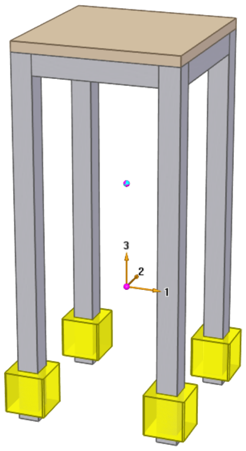


Goal Seek - Continued

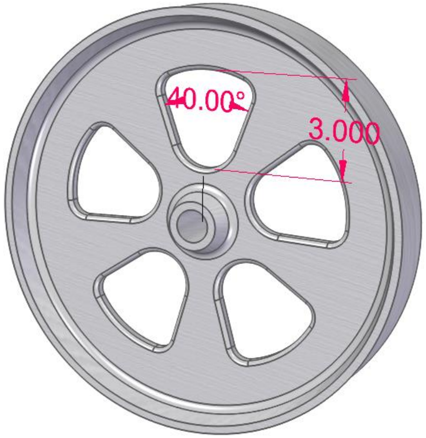
- Practical Applications
  - Targeting a certain Volume - **DEMO**
  - Positioning parts based on Center of Mass - **DEMO**
  - Targeting a certain Mass - **DEMO**
  - Targeting a certain Surface Area (ie. How much paint needed)



Volume



Center of Mass -Z



Mass

Sensors

- Sensors allow for monitoring of key parameters to make sure they maintain certain conditions
- Notification when sensor get outside a desired range
- Types of Sensors
  - Minimum Distance
  - Variable
  - Surface Area
  - Custom
  - Sheet Metal Sensor (PSM Only)

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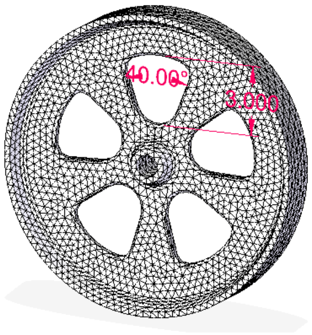
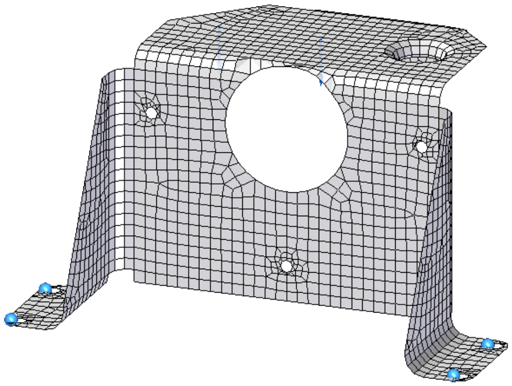
Simulation

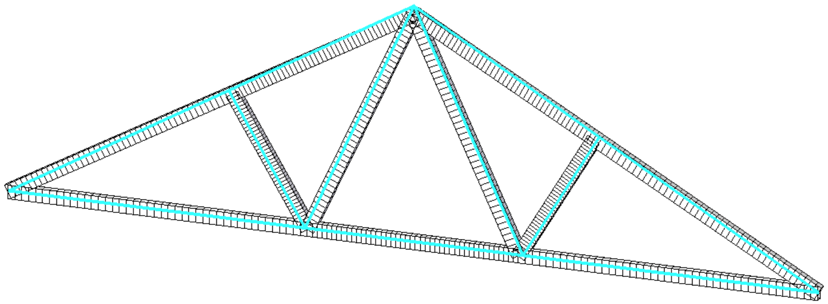
- Simulation continues to expand in ease of use for designers and engineers
- New in ST6
  - Meshing Enhancements
  - Design Optimization
  - Quick Enhancements
    - Reduction in Beam Results Data
    - New units of N/mm2 for Stress/Pressure
    - Factor of Safety of Assemblies with disimilar materials
    - Large Displacement Linear Static Analysis

Simulation – Birds Eye View

- Supports parts with Isotropic Material Properties
- Study Types:
  - Linear Static
  - Normal Modes (Modal)
  - Linear Buckling
  - Steady State Heat Transfer
  - Steady State Heat Transfer coupled with Static
  - Steady State Heat Transfer coupled with Buckling
- Mesh Types:
  - Tetrahedral (Solid Mesh)
  - Surface Mesh
  - Beam Mesh
  - General Body Mesh (Combination of solids and surfaces
- Model Types
  - Parts
  - Sheetmetal – Midsurfaces
  - Assemblies

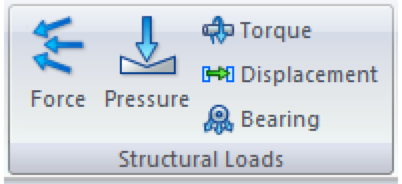




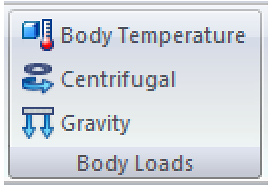


Simulation – Birds Eye View - Continued

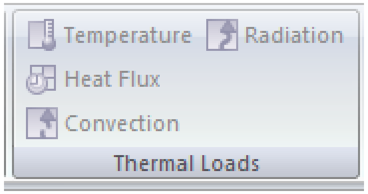
- Structural Load Types
  - Force, Pressure, Torque, Displacement, Bearing



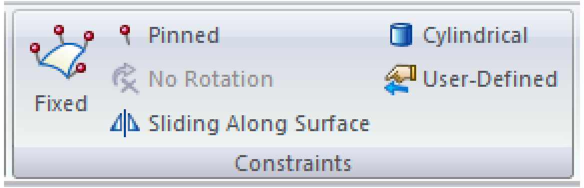
- Body Loads
  - Body Temperature
  - Centrifugal
  - Gravity



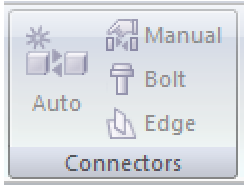
- Thermal Loads
  - Temperature, Heat Flux, Convection, Radiation



- Constraint Types
  - Fixed, Pinned, No Rotation, Slide Along Surface
  - Cylindrical , User Defined

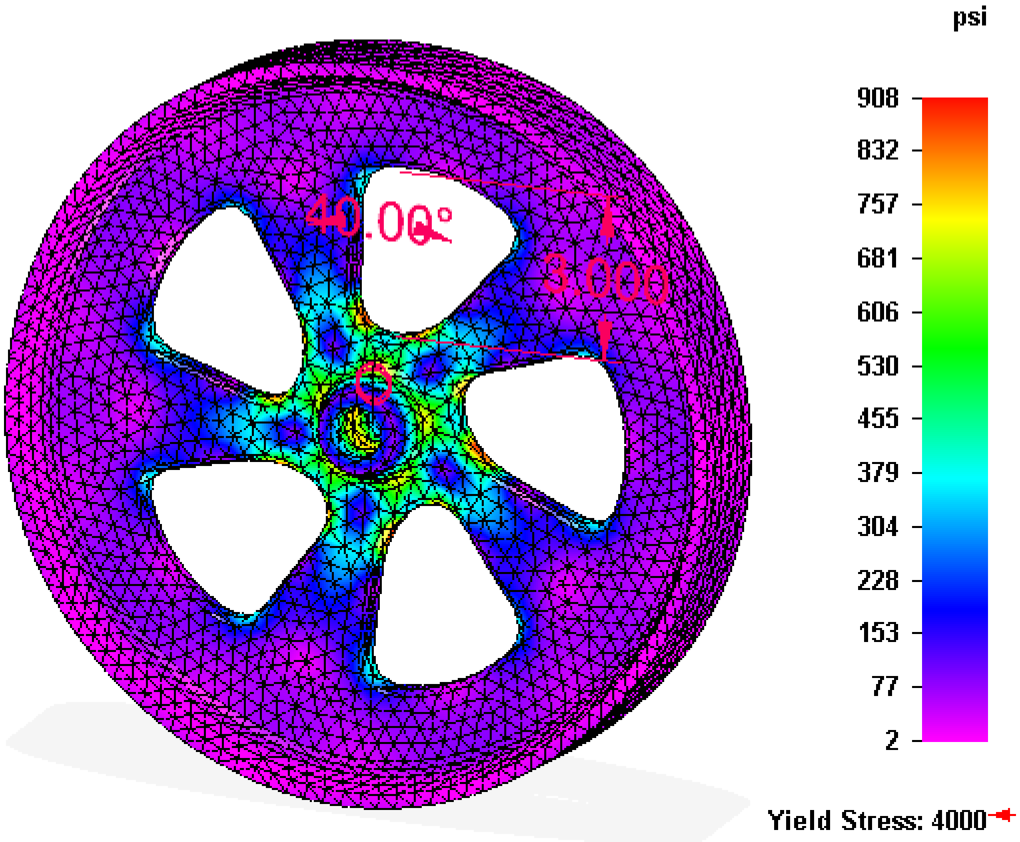


- Assembly Connector Types
  - Automatic (surface to surface)
  - Manual (surface to surface)
  - Bolted
  - Edge (edge to edge/surface)



Simulation – Birds Eye View - Continued

- Output Results
  - Nodal Results
    - Displacements
    - Applied Loads
    - Constraint Forces
    - Temperature
    - Applied Temperatures
    - Beam End Reactions
  - Elemental Results
    - Stress
    - Strain
    - Force
    - Strain energy
    - Beam Stresses
    - Heat Flux

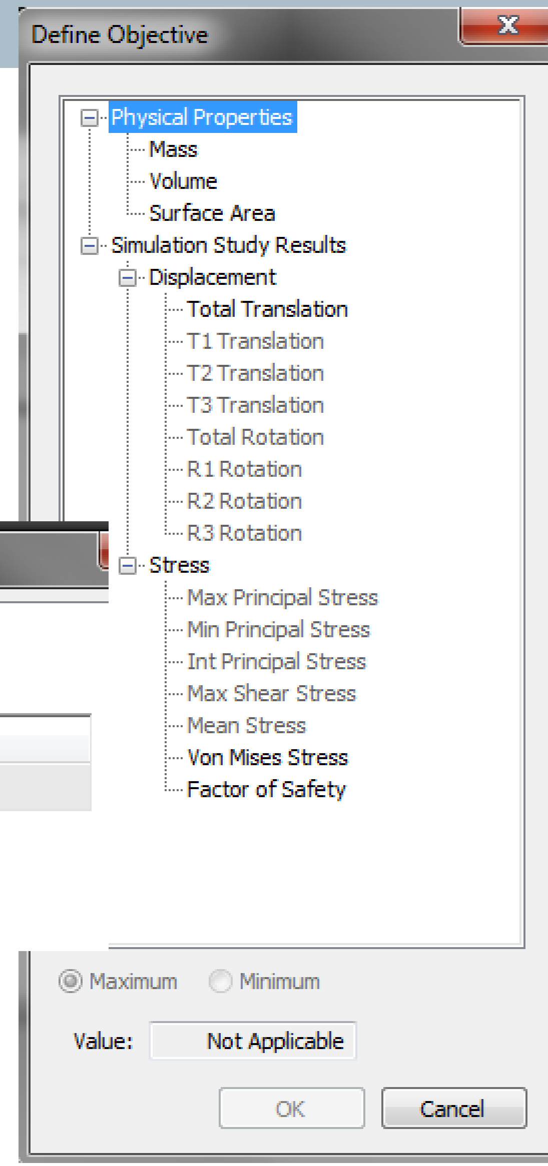


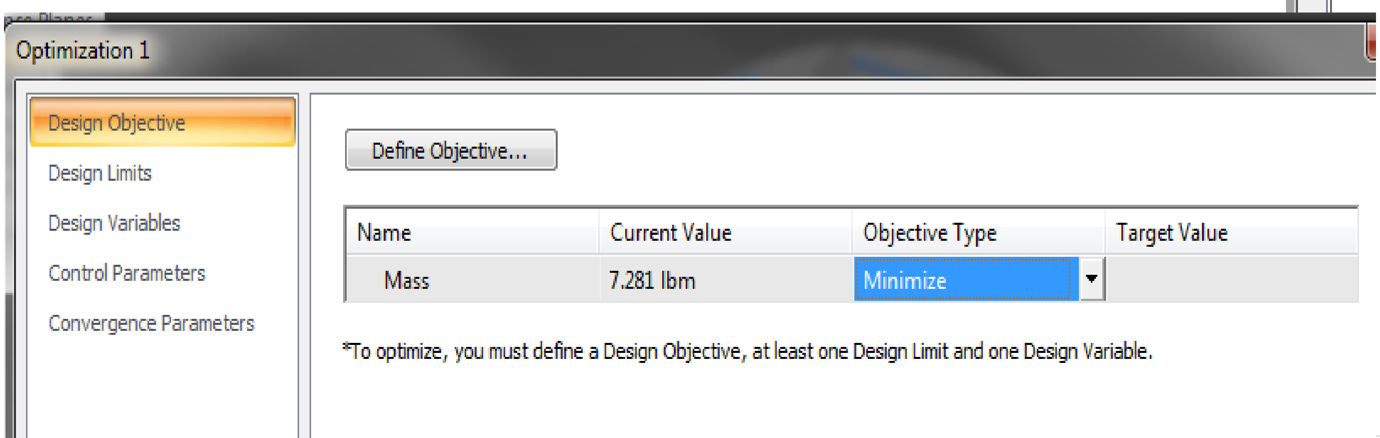
Design Optimization

- New easy to use Optimization embedded in the product
- Inputs to Optimization
  - Design Objective
  - Design Limits
  - Design Variables
  - Control Parameters
  - Convergence Parameters
- Practical Applications
  - Minimize Mass while maintaining Max Stress below Yield Stress
  - Find Stiffest design of a frame structure using a static load
  - Find load value that takes the design to Yield Stress

Design Optimization - Continued

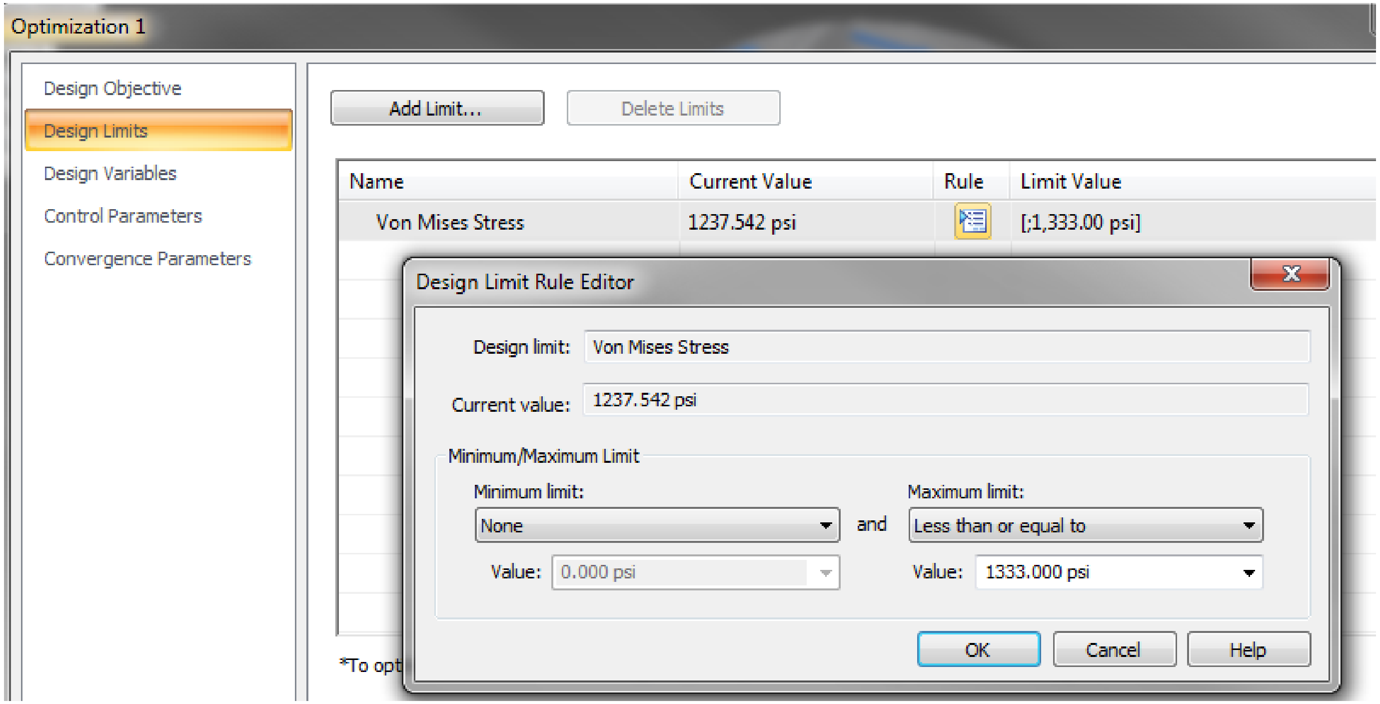
- The Design Objective can be selected from:
  - Physical Property calculations
  - Study Results
- Objective type can be Minimize, Maximize or Target





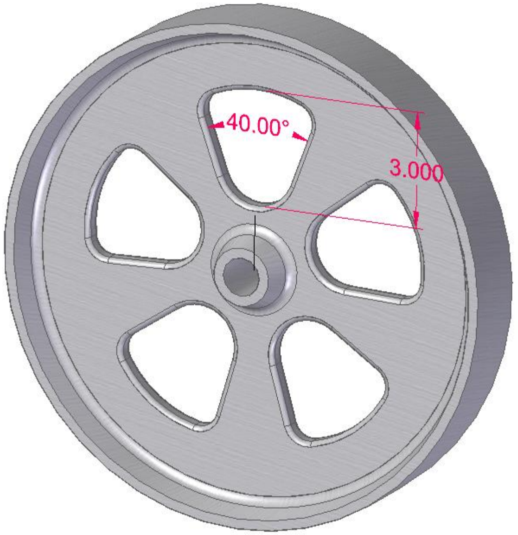
Design Optimization - Continued

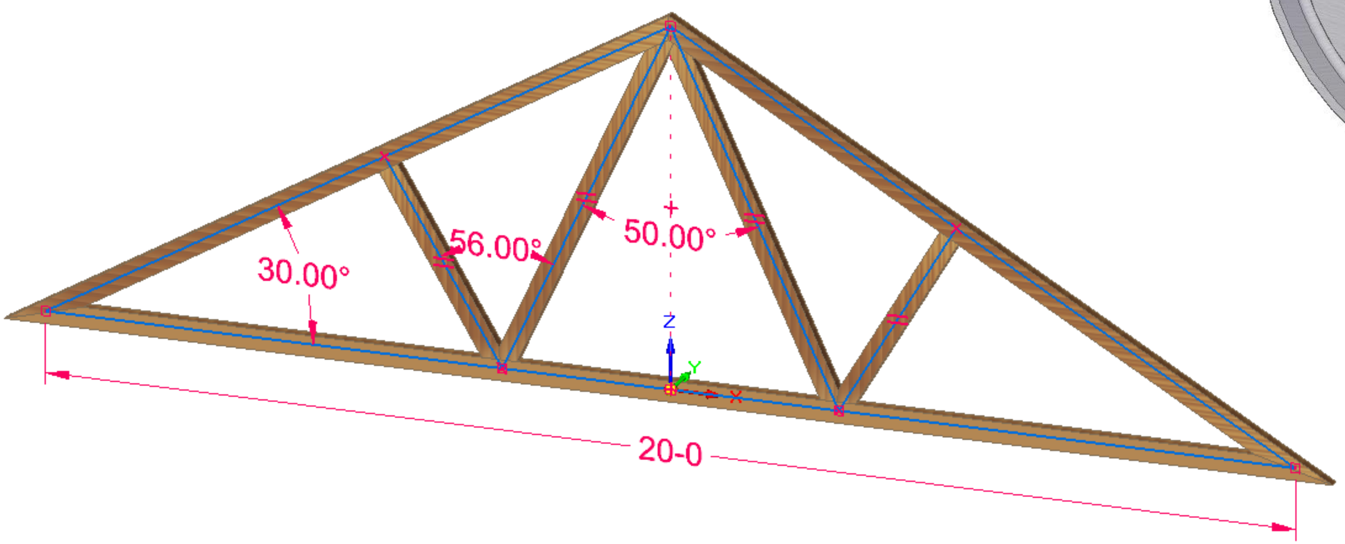
- The Design Limit can be selected from:
  - Physical Property calculations
  - Study Results
- Can have min and/or max limits
- Example, Ensure Maximum Stress is below Yield Stress



Design Optimization - Continued

- Design Variables can be any variables from the Variable Table that can be driven
  - Angle Variables
  - Linear Dimensions
  - Assembly Relationship offset values
  - Load Magnitudes (now written to table)





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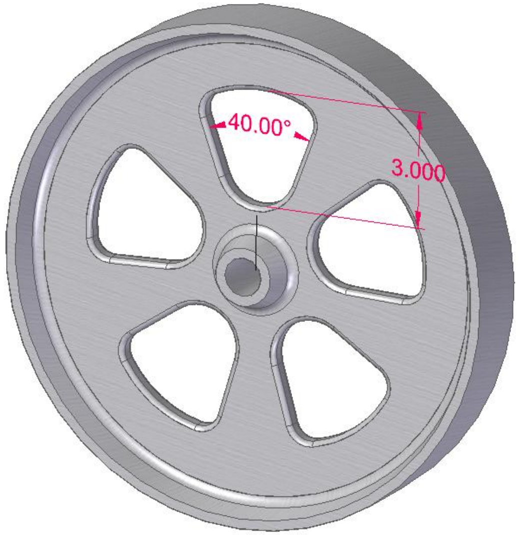
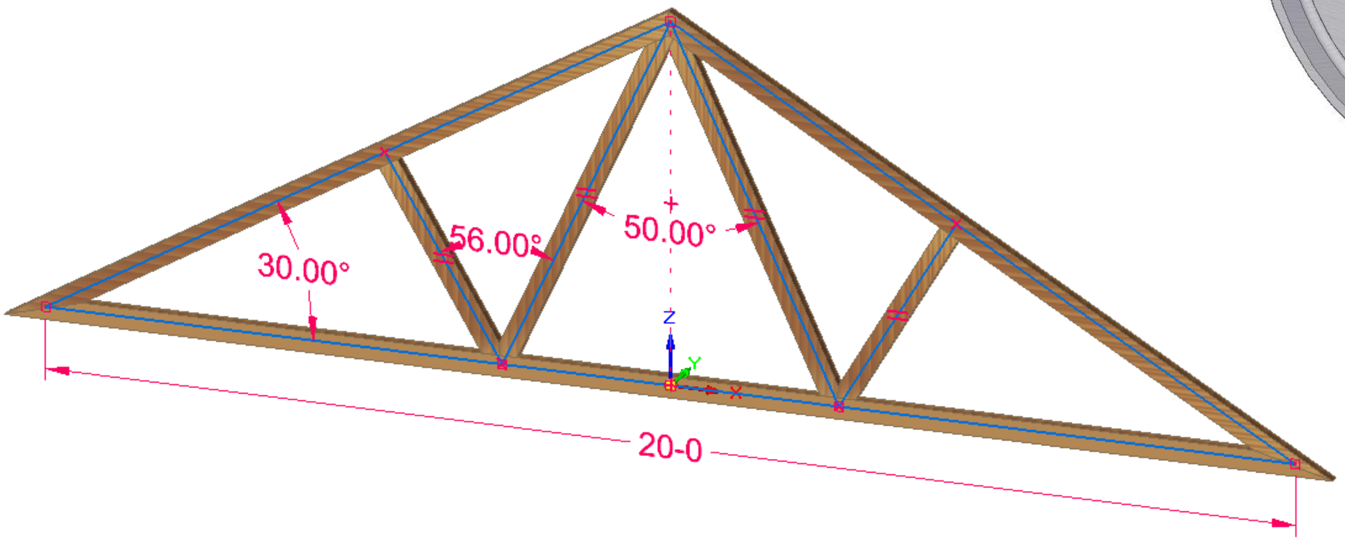
Design Optimization - Continued

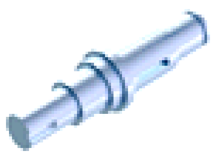
- Examples of Optimization
  - Roof Structure – DEMO
  - Idler Pulley – DEMO
  - Sheet Metal - DEMO





Engineering Reference

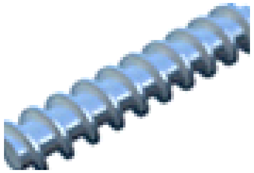
- Allows for creation of standard components based on engineering standards
- Allows for apply loads and supports for engineering calculations

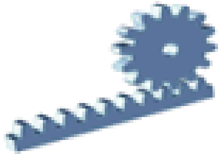

Shafts


Cams

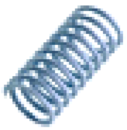

Spur Gear

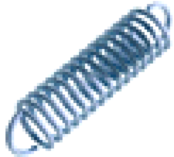

Bevel Gear


Worm Gear

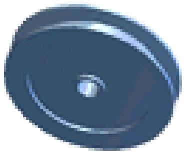

Rack and Pinion Gears

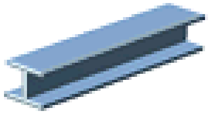

Sprockets

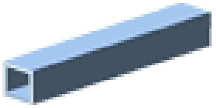

Compression Spring


Extension Spring


Synchronous Pulleys


Pulleys


Beams


Columns

Engineering Reference - Example

- Let's look at creation a shaft as an example
- Shaft Parameters
  - # of Sections
  - Geometric Information per section
    - Section Type (Simple, Ring Groove, Keyway, Locknut, Cone)
    - Dimensions (ie, Diameter, Length, etc)
  - Supports
  - Loads