



Femap Symposium 2016

Introduction to Modeling and Analysis with **FEMAP v11.3**

Presenters: Adrian Jensen, PE, Senior Staff Mechanical Engineer
Kyle Hamilton, Staff Mechanical Engineer

Location: Boeing's Future of Flight, Paine Field, May 19, 2016



**FEA, CFD & LS-DYNA Training, Support and
Consulting**



**Siemens NX CAD, CAM, CAE, Teamcenter and Femap
and NX Nastran Sales**

SEMINAR OUTLINE

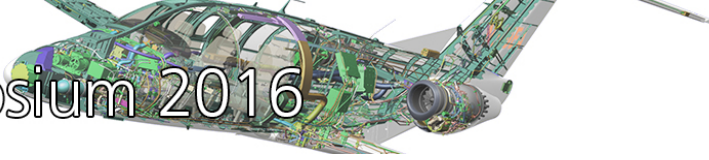
Introduction to Modeling and Analysis with FEMAP v11.3

Welcome! This seminar is intended for new and experienced FEMAP users alike. The goal is to provide clear and concise instructions for installing and configuring FEMAP v11.3. Once the software is installed and the license file is located, we will walk through some basic modeling and analysis techniques while sprinkling in new features and some classic tips and tricks. Next, we will tackle an assembly with advanced modeling, meshing and post processing techniques.

Who are Predictive Engineering and Applied CAx?

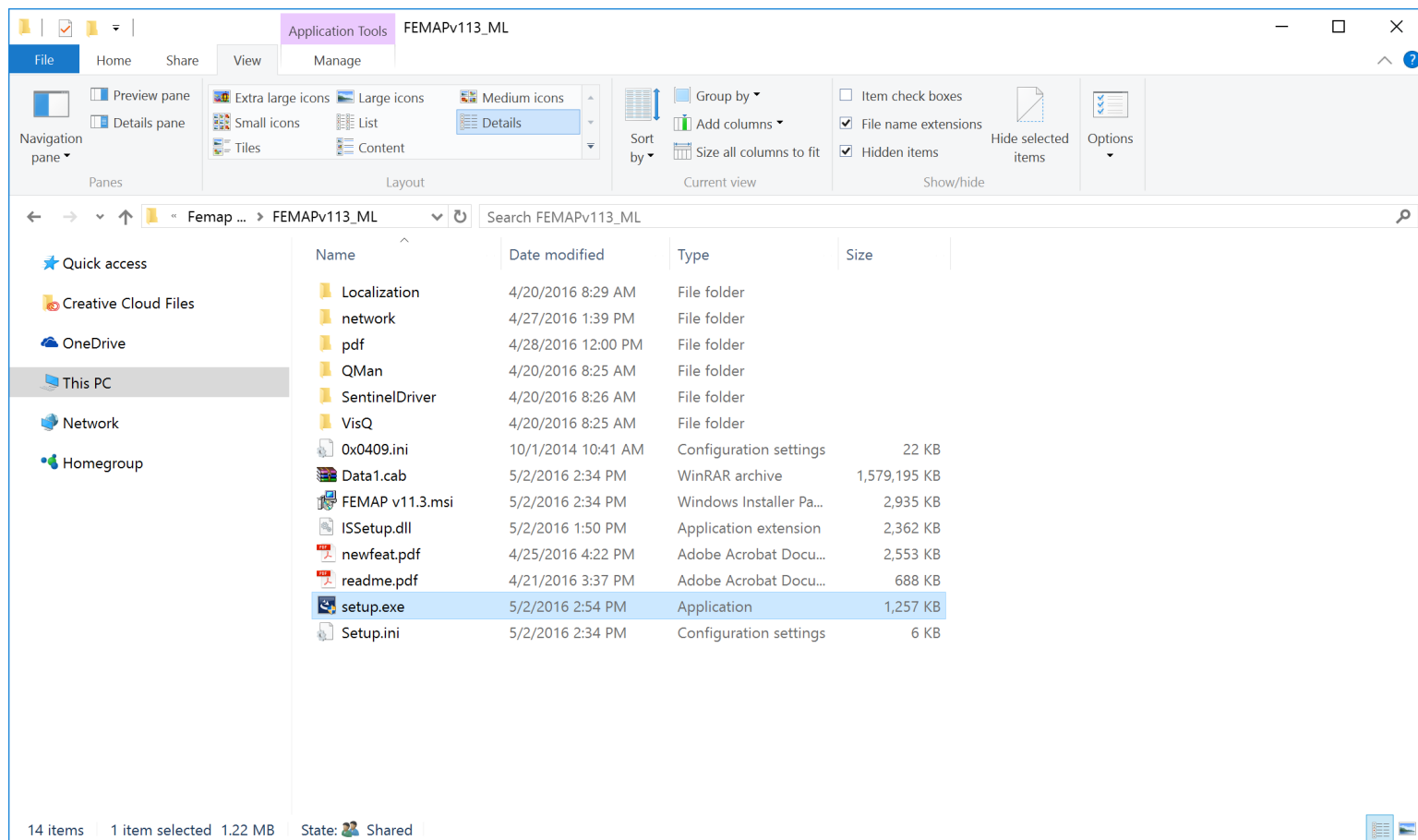
Predictive Engineering is a 20+ year engineering consultancy that specializes in finite element analysis using FEMAP, NX Nastran and LS-DYNA. We are simulation engineers that have built hundreds of FEA models that have been validated in test and in long term service. Our practice spans from satellites to mining equipment to submarines. We are generalists that can leverage expertise from diverse sectors to provide new insights to our clients.

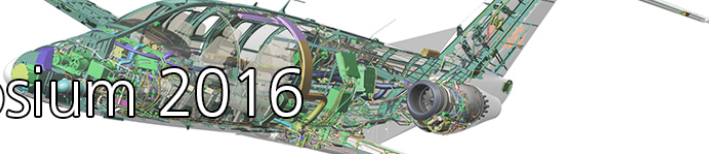
Applied CAx is a Siemens PLM Software value-added-reseller that is focused on delivering the industry's highest level of technical support for the software that they advocate. Predictive Engineering is a co-owner of Applied and provides first line technical support, training and startup services to Applied's CAE clients (e.g., FEMAP, NX Nastran, NX Adv CAE).



1. INSTALLATION

Copy the files from the USB drive to your computer. Unzip FEMAPv113_ML.zip and open the file folder. Run setup.exe.





FEMAP v11.3 - InstallShield Wizard

Preparing to Install...

FEMAP v11.3 Setup is preparing the InstallShield Wizard, which will guide you through the program setup process. Please wait.

Preparing to Install...

Cancel

FEMAP v11.3 - InstallShield Wizard

Welcome to the InstallShield Wizard for FEMAP v11.3

The InstallShield Wizard will install FEMAP v11.3 on your computer. To continue, click Next.

< Back Next > Cancel

FEMAP v11.3 - InstallShield Wizard

License Agreement

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I accept the terms of the license agreement

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Print

InstallShield

< Back Next > Cancel

FEMAP v11.3 - InstallShield Wizard

Choose Destination Location

Select folder where setup will install files.

Setup will install FEMAP v11.3 in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

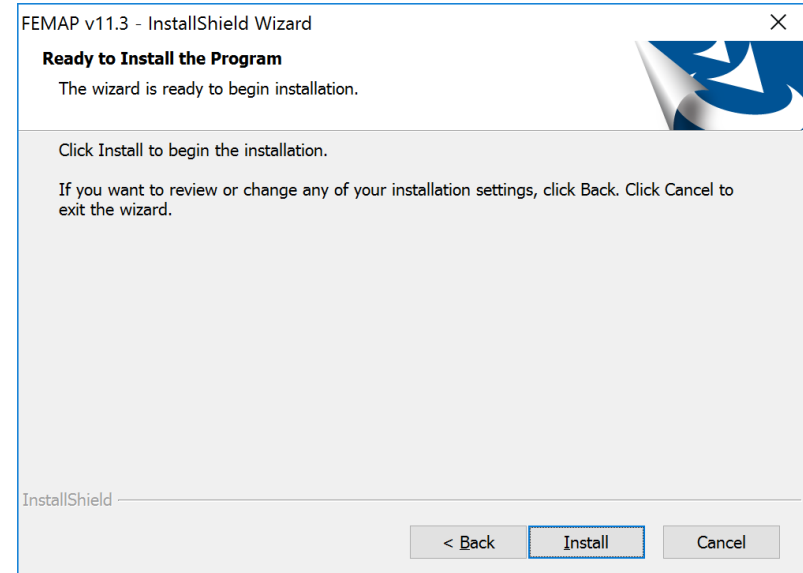
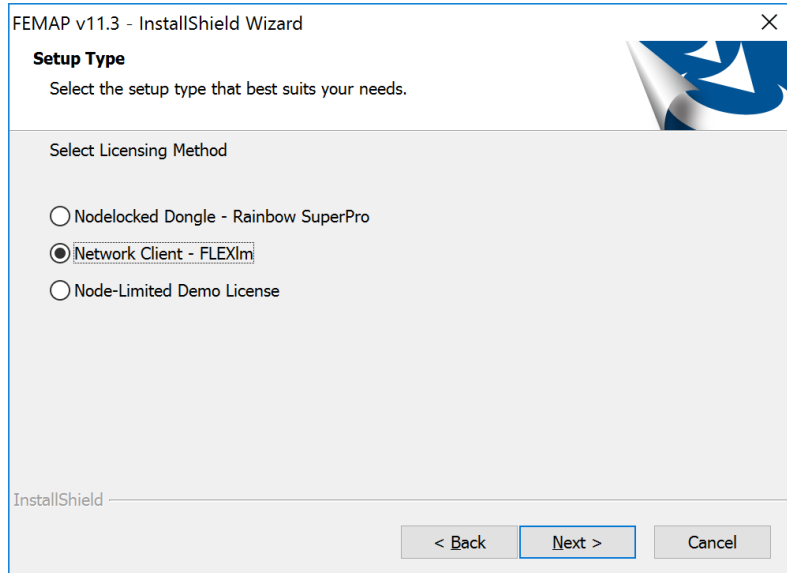
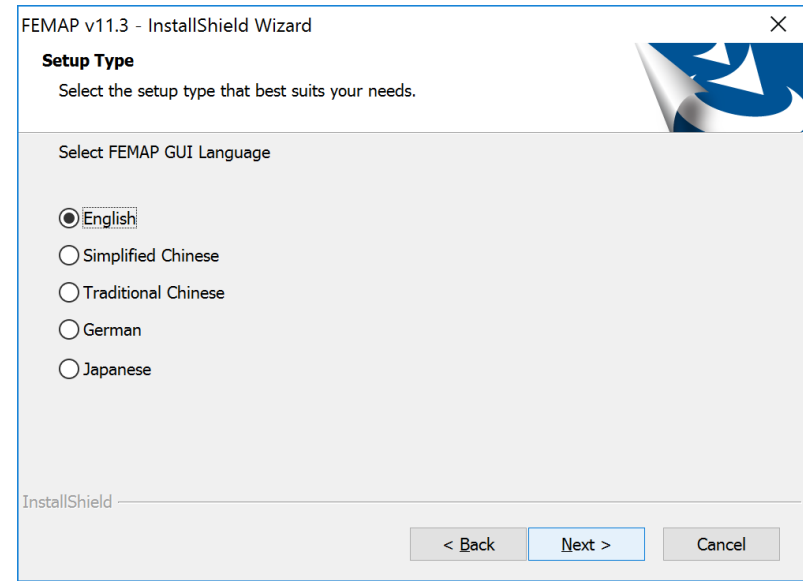
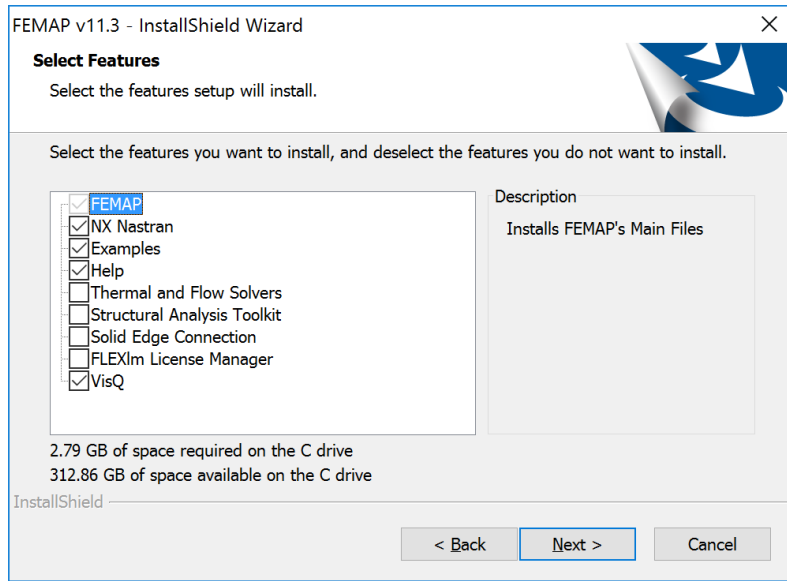
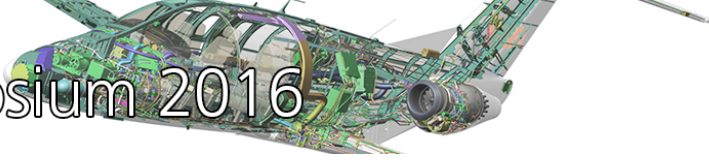
Destination Folder

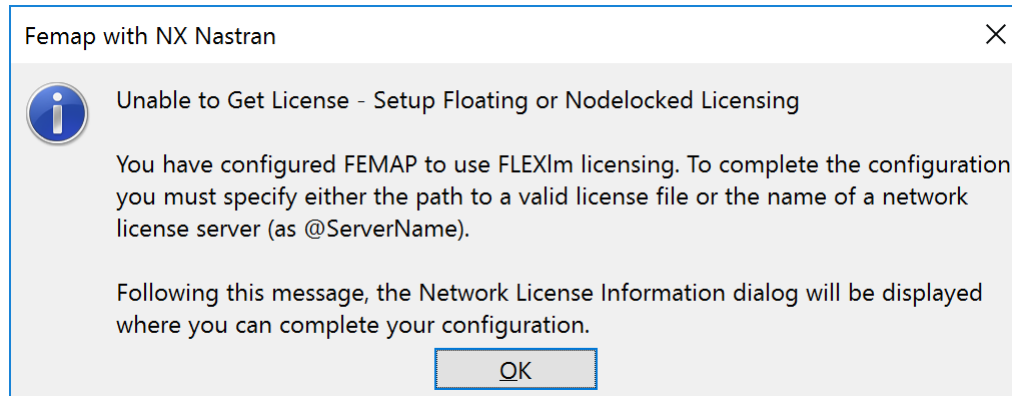
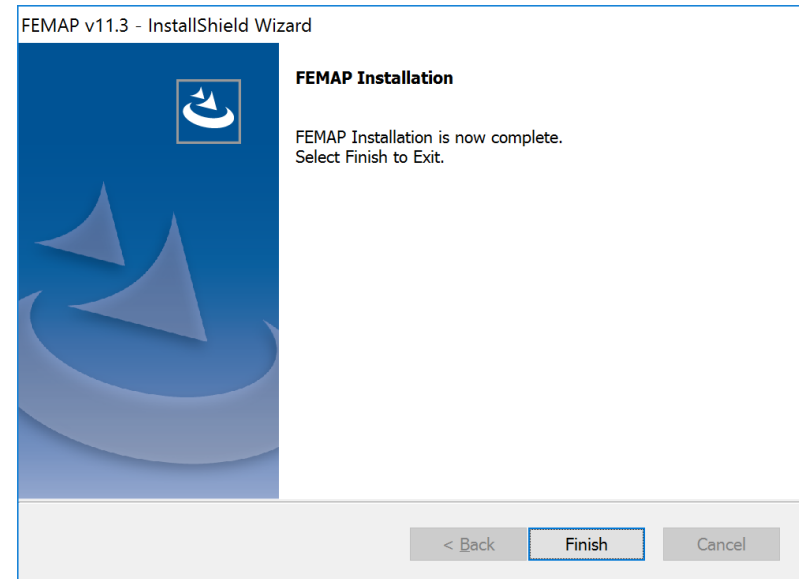
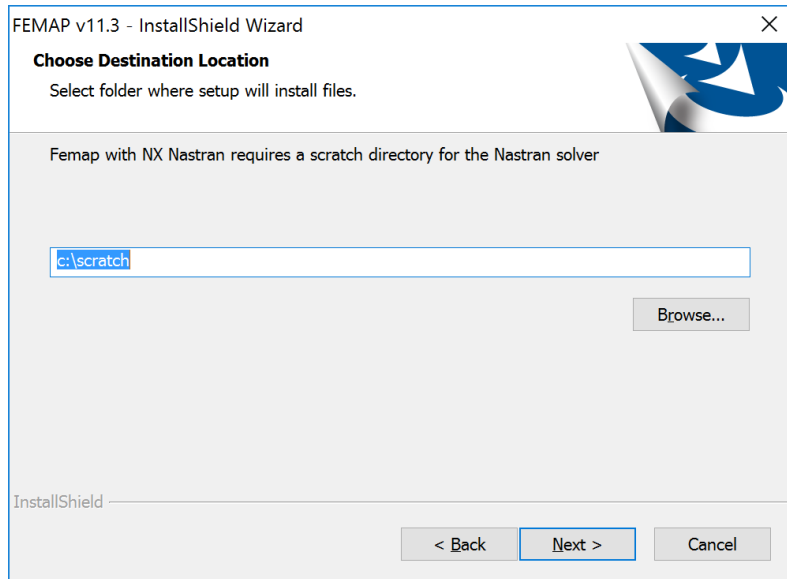
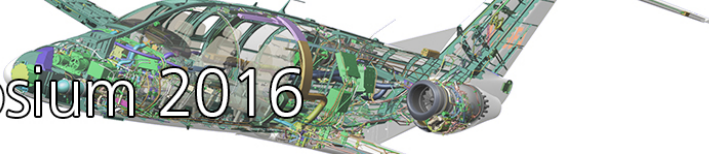
C:\FEMAPv113\

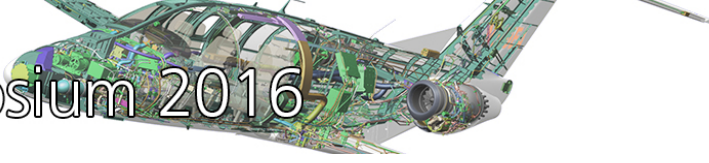
Browse...

InstallShield

< Back Next > Cancel

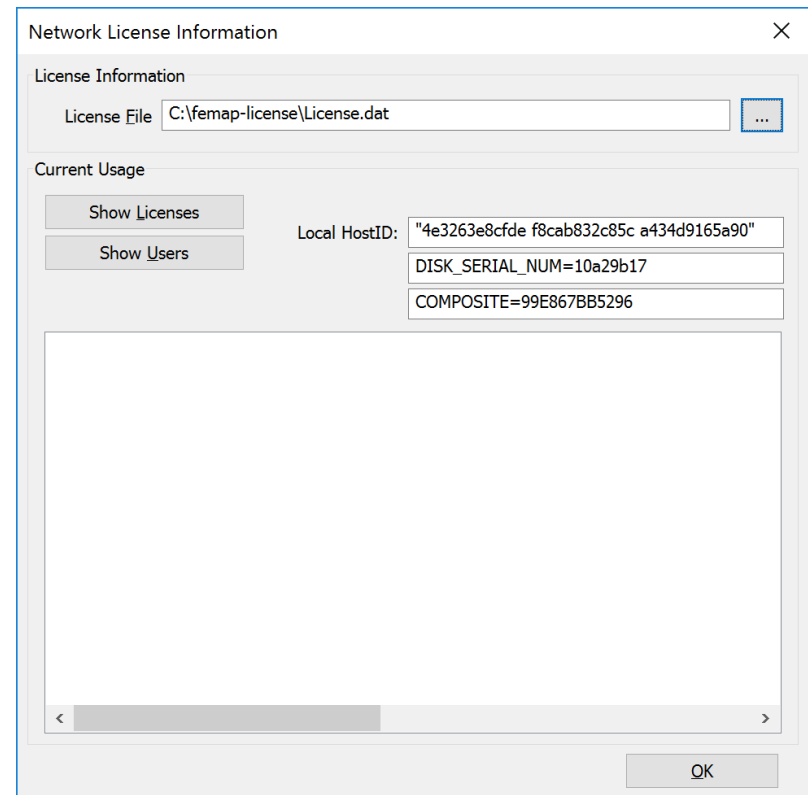
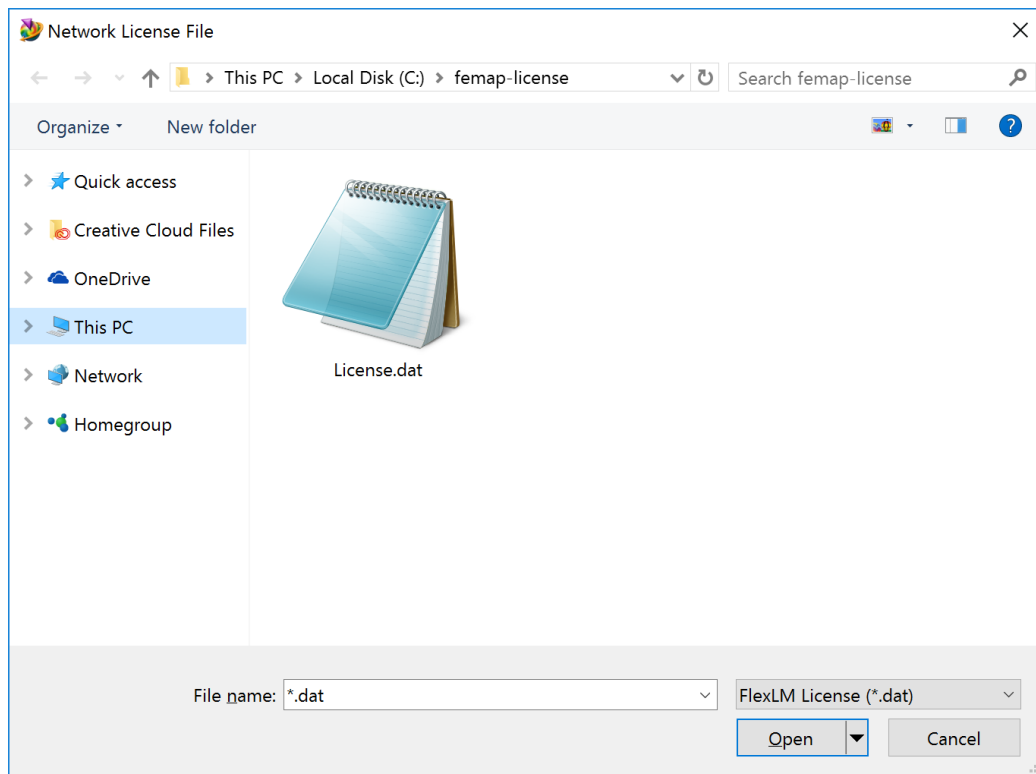




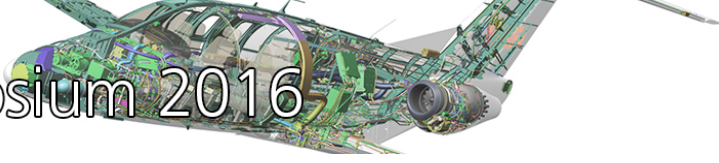


2. LICENSING

Copy the license.dat file to a new folder in the FEMAP directory.



Femap Symposium 2016

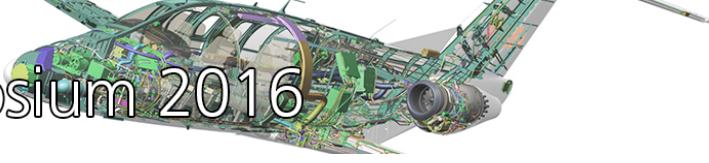


The screenshot shows the Femap with NX Nastran software interface. The main window is titled "Untitled" and displays a dark blue background with a 3D coordinate system (X, Y, Z) at the bottom center. A dialog box is open in the center of the screen, titled "Femap with NX Nastran", with the message "A license has been obtained. Press OK to continue." and an "OK" button.

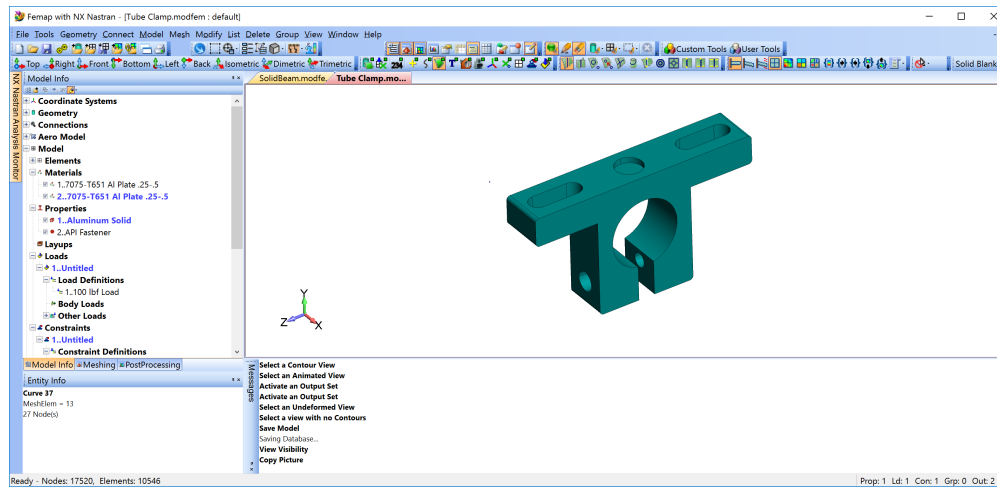
The interface includes a menu bar (File, Tools, Geometry, Connect, Model, Mesh, Modify, List, Delete, Group, View, Window, Help) and a toolbar. The left sidebar contains a tree view with categories like Coordinate Systems, Geometry, Connections, Aero Model, Model, Analyses, Results, Views, Groups, and Layers. Below the tree view is a "Selection List" section. At the bottom of the interface, there is a status bar with the text "Ready" and "Prop: 0 Ld: 0 Con: 0 Grp: 0 Out: 0".

At the bottom of the window, a message pane displays the following text:

```
Opening File C:\femap-license\License.dat...
Loading Parasolid Geometry Engine...
Femap with NX Nastran Version 11.3.0
Copyright © 2016 Siemens Product Lifecycle Management Software Inc. All Rights Reserved.
Full OpenGL Hardware Acceleration (Double Buffered)
Your card supports OpenGL 4.5
Waiting for a license ...
```

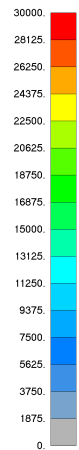
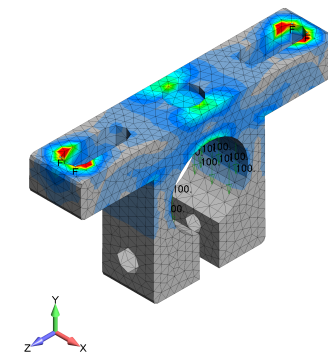
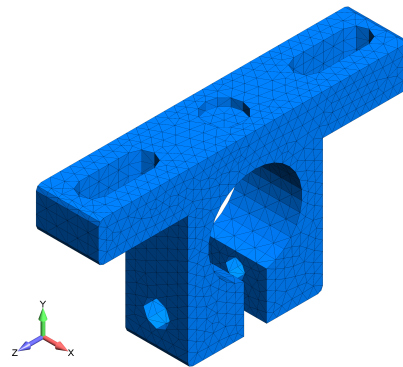
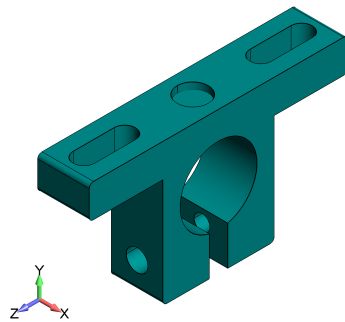



3. YOUR FIRST FEMAP MODEL

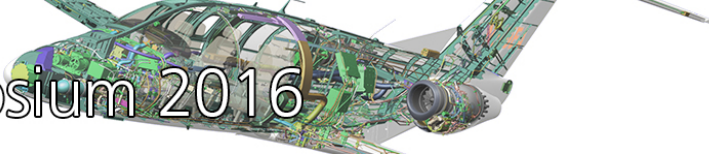


Analysis Workflow:

- Geometry
- Material
- Property
- Mesh Sizing
- Meshing
- Loads
- Constraints
- Analyze



Output Set: NX NASTRAN Case 1
Deformed(0.00398): Total Translation
Elemental Contour- Solid Von Mises Stress



3.1 GEOMETRY

File > Import > Geometry

Solid Model Read Options

Title:

Entity Options

Geometry Scale Factor:

Layer:

Update Existing Geometry

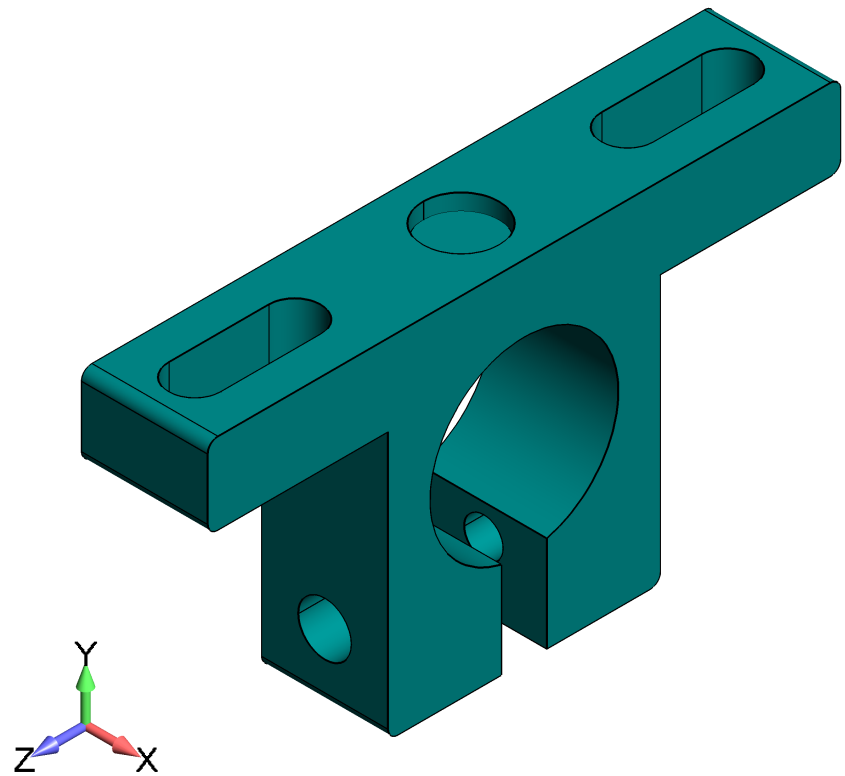
Colors From File

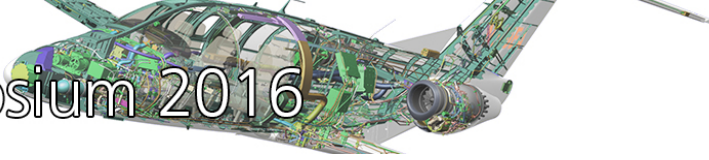
Active Colors

Single Color

Assembly Options

Increment Layer Increment Color





3.2 MATERIALS

Model > Material > ISOTROPIC (7075-T651)

Define Material - ISOTROPIC

ID 1 Title 7075-T651 Al Plate .25-. Color 104 Palette... Layer 1 Type...

General Function References Nonlinear Ply/Bond Failure Creep Electrical/Optical Phase

Stiffness

Youngs Modulus, E 10300000.

Shear Modulus, G 0.

Poisson's Ratio, ν 0.33

Limit Stress

Tension 66000.

Compression 67000.

Shear 43000.

Thermal

Expansion Coeff, α 1.23E-5

Conductivity, k 0.00201389

Specific Heat, Cp 77.28

Heat Generation Factor 0.

Mass Density 2.59062E-4

Damping, 2C/Co 0.

Reference Temp 70.

Load... Save... Copy... OK Cancel

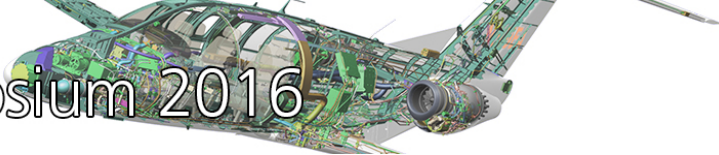
Select From Library

Library Entry Choose Library...

AISI 4340 Steel
 15-5PH Stainless H1025
 2024-T351 Al Plate .25-.5
 6061-T651 Al Plate .25-2.
 7050-T651 Al Plate .25-.5
 7075-T651 Al Plate .25-.5
 Ti-6Al-4V Sol Tr & Aged .
 AISI 1025 Carbon Steel
 AISI 4130 Steel
 Stainless Steel Annealed
 Magnesium AZ31B
 Magnesium ZK60A
 Titanium, Pure
 A286 HRES Iron Alloy
 Hastelloy X
 Inconel 600
 Rene 41
 Beryllium
 Beryllium Copper
 Nonlinear
 FuncDep

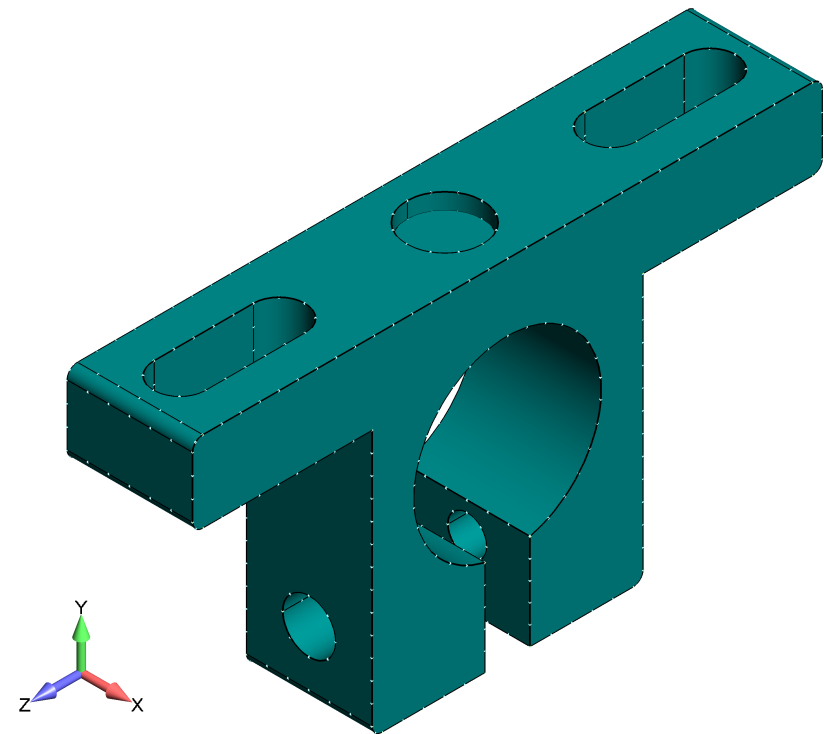
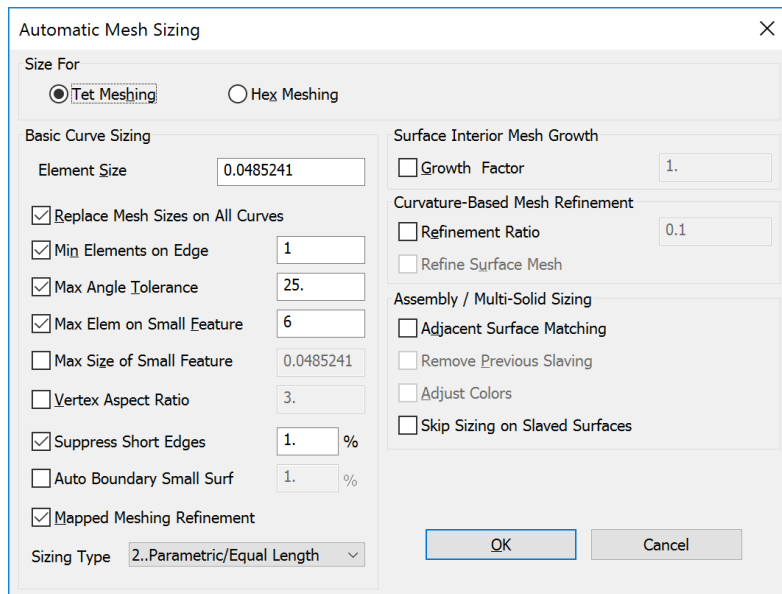
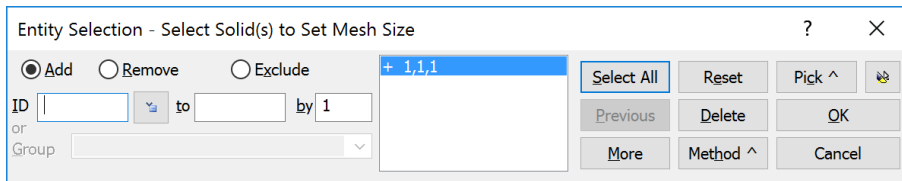
Values in Library files distributed with FEMAP are believed to be correct but have not been verified. You must verify these values are correct and appropriate before using them for any purpose.

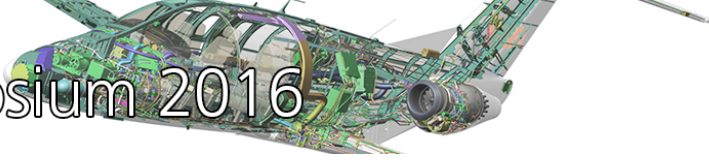
Delete OK Cancel



3.3 MESH SIZING

Mesh > Mesh Control > Size on Solid





3.4 MESH SIZING

Mesh > Geometry > Solid

Automesh Solids

Node and Element Options

Node ID: 1 CSys: 0..Basic Rectangular Node Param... Elem Param...

Elem ID: 1 Property: 1..Aluminum Solid Options...

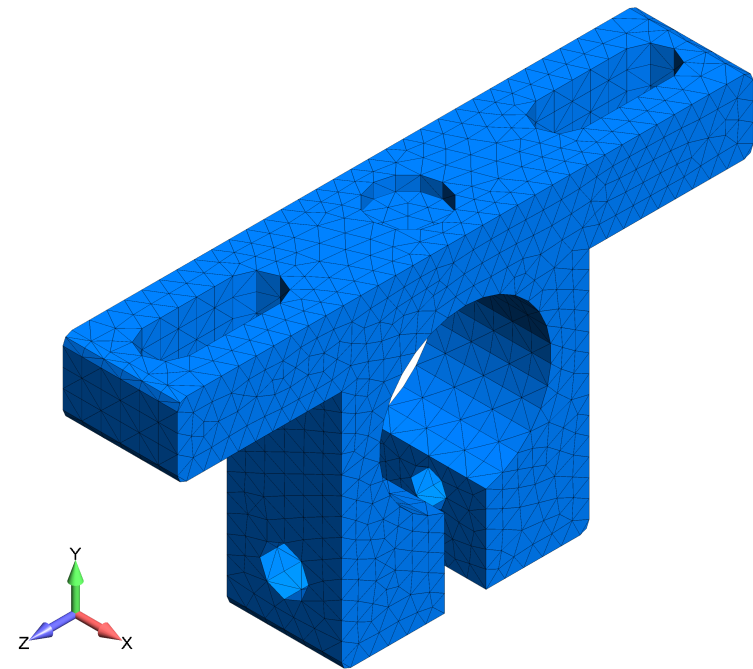
Mesh Generation

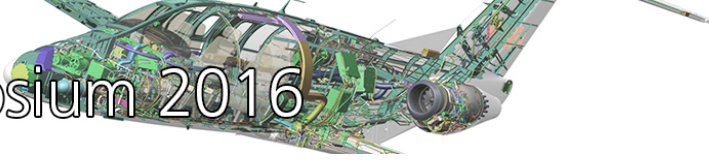
Surface Mesh Only Multiple Tet thru Thickness: 2 Merge Nodes: 0..Off

Allow Mapped Meshing Tet Sliver Removal Tet Optimization: 3..Default

Midside Nodes Tet Growth Ratio: 1.1 to 1

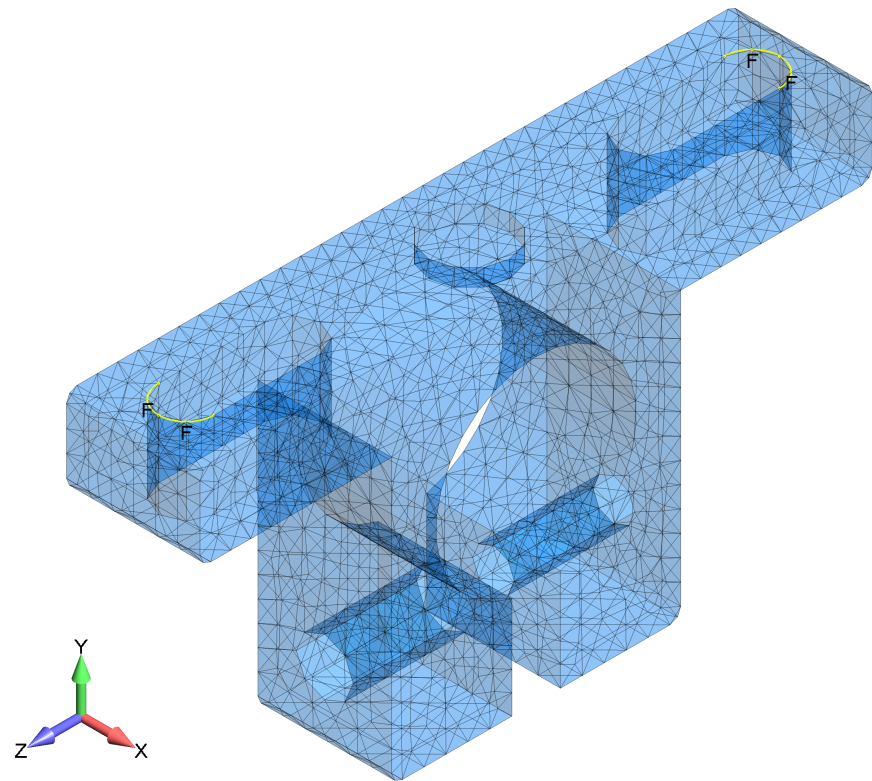
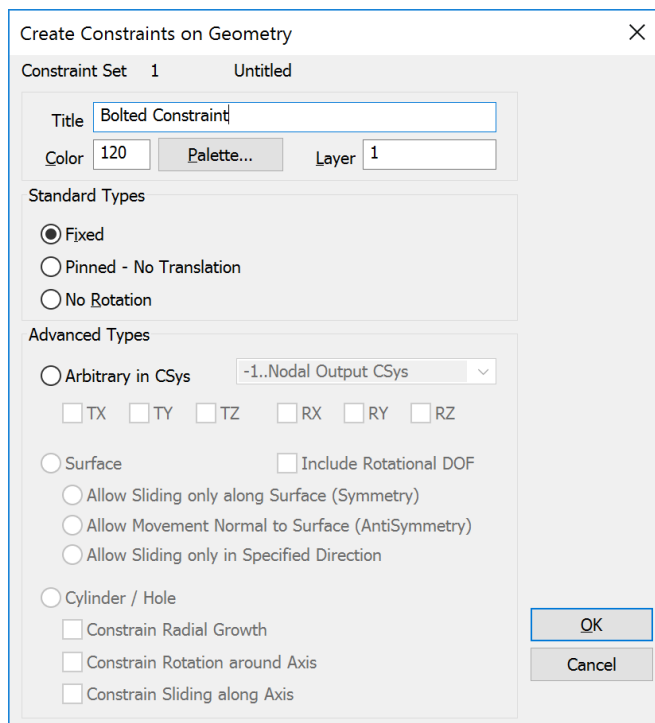
Update Mesh Sizing... OK Cancel

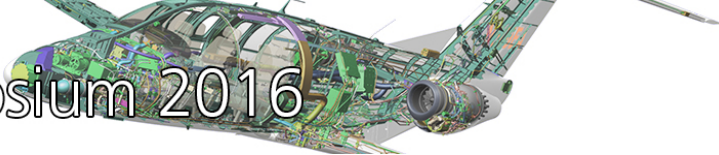




3.5 CONSTRAINTS

Model > Constraint > On Curve





3.6 LOADS

Model > Load > On Surface

Create Loads on Surfaces

Load Set 1 Untitled

Title: 100 lbf Load Coord Sys: 0..Basic Rectangular

Color: 10 Palette... Layer: 1

Force

- Force Per Area
- Force Per Node
- Bearing Force
- Moment
- Moment Per Area
- Moment Per Node
- Torque
- Displacement
- Enforced Rotation
- Velocity
- Rotational Velocity
- Acceleration
- Rotational Acceleration
- Pressure
- Temperature
- Element Temperature
- Heat Flux
- Heat Flux Per Area
- Heat Flux Per Node
- Heat Generation
- Element Heat Flux

Direction

Components

Vector

Along Curve

Normal to Plane

Normal to Surface

Specify...

Method

Constant

Variable

Data Surface

Advanced...

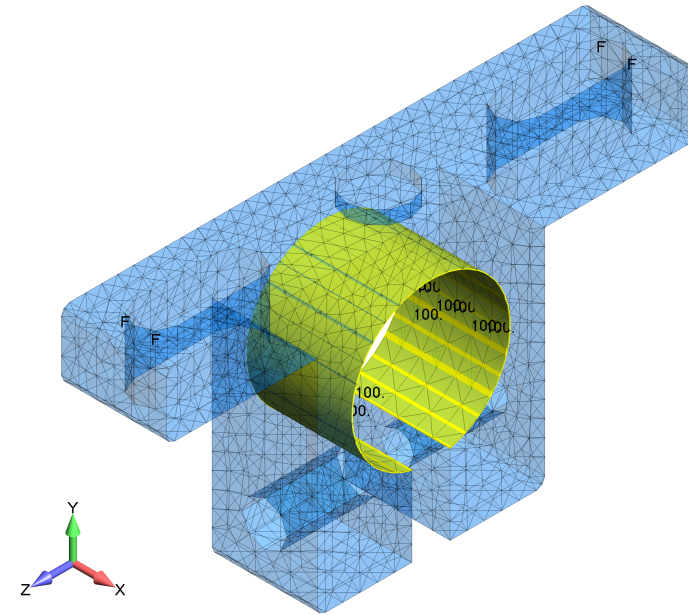
Load	Value	Time/Freq Dependence	Data Surface
FX	<input checked="" type="checkbox"/> 0.	0..None f_{sy}	0..None
FY	<input checked="" type="checkbox"/> -100		0..None
FZ	<input checked="" type="checkbox"/> 0.		0..None

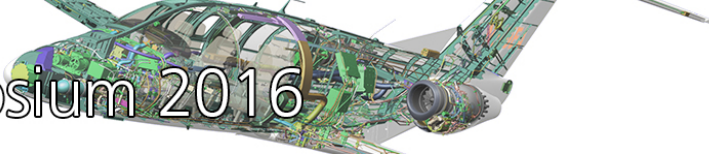
Phase: 0. 0..None f_{sy}

Midside Node Adjustment

Total Load

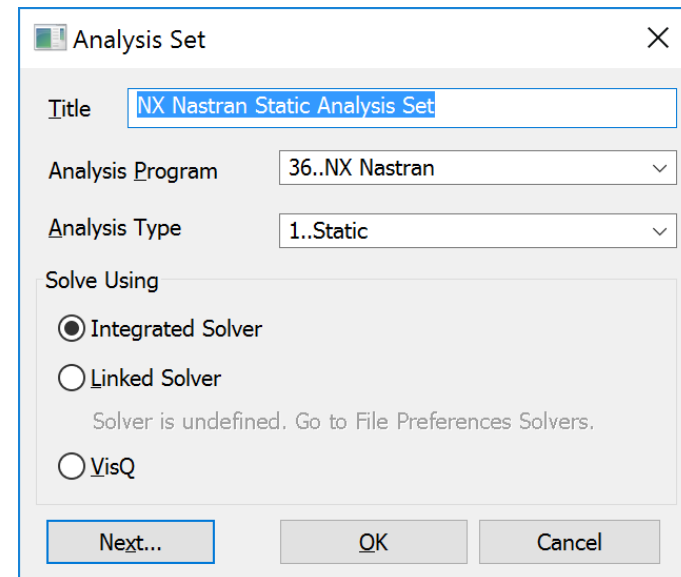
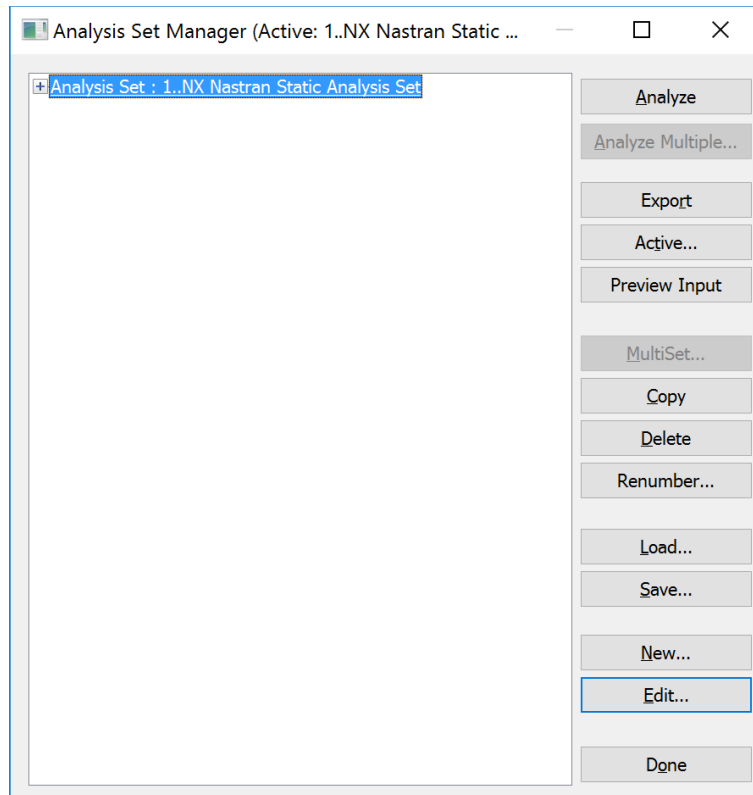
OK Cancel

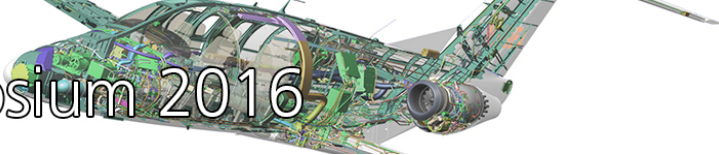




3.7 ANALYZE

Model > Analysis (36..NX Nastran, 1..Static)





3.8 POST PROCESSING

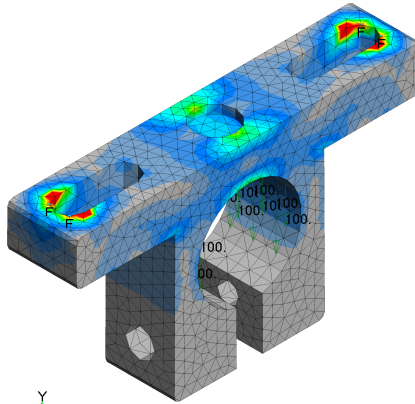
Post Processing Toolbox (Contour, Deform)

PostProcessing Toolbox

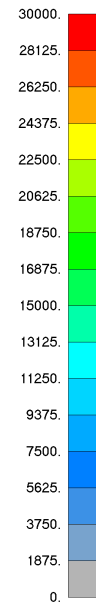
- Deform**
 - Style: Deformed
 - Results**
 - Output Set: 1..NX NASTRAN Case 1
 - Output Vector: 1..Total Translation
 - Options**
 - Transform: None
- Scale** (Selected)
 - Scale Actual By: 1.
 - Scale Based on Group:
 - Deform Relative To: Origin
 - Deformed Model:
 - Undeformed Model:
- Contour**
- Freebody**

Scale
Sets the Scale for the Deformation Output Vector. Default is % of Model, which

Model Info | Meshing | PostProcessing



Output Set: NX NASTRAN Case 1
Deformed(0.00398): Total Translation
Elemental Contour: Solid Von Mises Stress



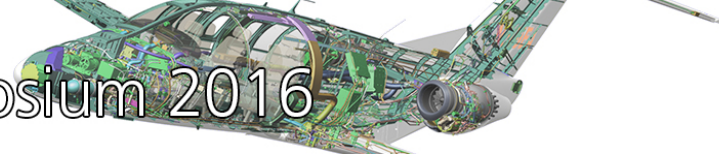
PostProcessing Toolbox

- Deform**
 - Contour** (Selected)
 - Style: Contour
 - Results**
 - Output Set: 1..NX NASTRAN Case 1
 - Output Vector: 7033..Plate Top VonMises St
 - Additional Vector(s):
 - Options**
 - Transform:
 - Data Conversion: Average
 - Data Selection: Contour Group
 - Type: Elemental
 - Double-Sided Planar:
 - Show On Groups: Full Model / Visible Groups
 - Show As: Filled
 - Levels
 - Level Mode: Max Min
 - Maximum Level: 30000.
 - Minimum Level: 0.
 - Contour Palette: Standard Palette
 - # of Levels: 12
 - Continuous Colors:
 - Animate:
 - Label Max/Min: No Labels
 - Legend:

- Freebody**

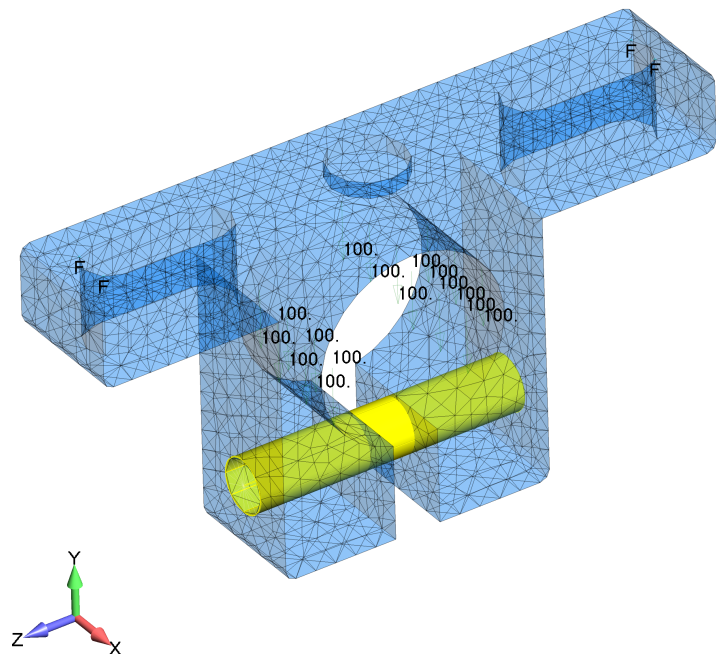
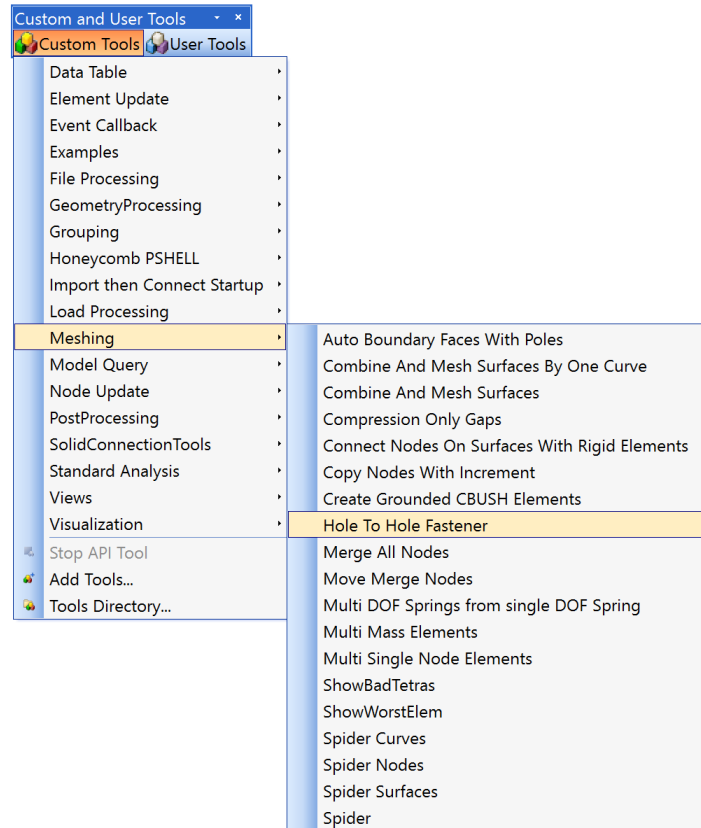
Contour
Tool for controlling Contour, Criteria, Beam Diagram, IsoSurface, Section Cut and

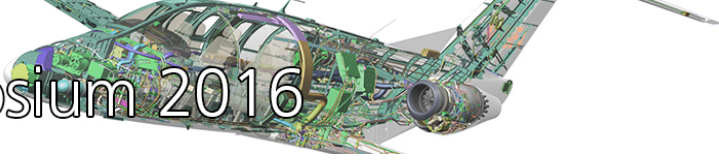
Model Info | Meshing | PostProcessing



3.9 BONUS MESHING

Custom Tools > Meshing > Hole to Hole Fastener





Thank You

Predictive Engineering is located in Portland, OR



PredictiveEngineering.com

