MAE: 4700 Wing Project

Description:

This page has helpful resources for the Fall MAE 4700 Wing Project which includes a demo video with no sound, a project outline of steps in ANSYS, and an FAQ that will be updated as questions come in.

Note:

Please note that this video is a demonstration of creating the wing geometry in SpaceClaim. There is no sound in the video. Creating the geometry/solution can be achieved in many different methods. This video is simply an example.

Here is the .txt file that was used in this tutorial:



Mesh: The video below has a mesh size that is much smaller than you need. Realistically, an element size of 0.1 meter is a good start and will give you a reasonable mesh to explore mesh convergence with.

Summary of Steps:

- 1. Static Structural
- 2. Eng. Data
- a. Create New Material: Aluminum 2024-T36
- b. Linear Elastic>Isotropic Elasticity
 - i. Add appropriate material properties
- c. Strength>Tensile Yield Strength
 - i. Add appropriate material properties
- 3. Geometry
- a. New SpaceClaim Geometry
- b. Change units
 - i. File>SpaceClaim Options>Units
 - ii. Change length to meters
 - iii. Change minor grid spacing to .1 m
- c. Import Wing
 - i. Sketch New Sketch Plane
 - ii. XY plane
 - iii. Assembly>File
 - Choose All Files
 - 2. Open NACA_0012_Airfoil_4Meters.txt
 - iv. Close trailing edge
 - v. Return to 3D Mode
- d. Pull Wing
 - i. Design>Edit>Pull

- ii. Select the upper curve from the tree, select the Design tab and then "Pull" the curve to 15m.
- iii. Go into the Repair tab and box select the surface you have just created. "Merge Surfaces."
- iv. Repeat for the lower curve.
- v. Pull the trailing edge profile to meet the length of the wings.
- e. Create Ribs and Spars
 - i. Create Plane Along Z Axis
 1. Design>Create>Plane

 - 2. Move plane to designated position (Design>Edit>Move)
 - ii. Design>Mode>Sketch Mode
 - 1. Click on new plane
 - 2. Design>Sketch>Project to Sketch
 - a. Click on the curves that represent the top/bottom of the airfoil
 - b. Click on the trailing edge
 - 3. Click on Fill
 - a. Select all three surfaces again
- f. Repeat process for each rib
- g. Repeat process for each spar but along the X axis
- h. Share Topology
 - i. Click on Design1

 - ii. Properties>Analysis iii. Share topology: Share
- 4. Model Setup
 - a. Add a thickness to your surfaces and change the material assignment
 - b. Create named sections (optional, just good practice)
 - i. Wing surface
 - ii. Spars
 - iii. Ribs
 - iv. Wing Tip
 - c. Mesh
- i. Face Sizing
 - 1. Geometry should be the entire body
 - 2. Confirm quadrilaterals Is selected
- ii. Sizing
 - Select body again
 - 2. Choose sizing
 - 3. Behavior: Hard
- d. Add fixed support
 - i. Extend to limits
- e. Add pressure loads
 - i. Make sure the load is Normal to Surface
 - ii. Add pressure loads to top and bottom surface
 - iii. Note gauge pressure
- 5. Solve Model
 - a. Click Solve
- 6. Solution
- a. Add Total Deformation
- b. Add Equivalent (von-Misses)
- 7. Reiteration

Reiterate with varying numbers of spars/ribs, varying locations, and different thicknesses. For varying thickness, look at setting up a parameter. This tutorial should help:

https://confluence.cornell.edu/display/SIMULATION/ANSYS+-+Plate+With+a+Hole+Optimization