

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:



NACA_0012_Airfoil_4Meters.txt

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
 1. 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
 - 1. 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>