

# 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>