

Assignment #3: Wing Design

due 9/29/2021 before midnight via Learning Suite

ME 415
50 possible points

3.1 Design an appropriate wing for your project. Keep in mind that while we are focused on lift and lift coefficient distributions you should still consider the impact on other disciplines. For example, an untapered wing can produce reasonable lift/lift coefficient distributions but is rarely a good design because it carries unnecessary wetted area and weight. The following XFLR5 videos may be helpful:

- The first 4:30 of design a plane: <https://youtu.be/vhykE-mVB04>
- The video plane analysis: <https://youtu.be/bJdd1SRSZGY> is partially relevant. We will do something similar later, but for this specific analysis I'd use type 1 (fixed speed), viscous is not needed, and inertial properties are irrelevant. The view we are interested in is the furthest left button (called OpPoint View). If you right click on a graph and click Current Graph then Define Graph Settings you make alternate between plotting lift ($c_l \cdot c/mac$) and the lift coefficient.

Provide the following:

- (a) A description and justification of how design choices were made. The description should contain enough detail that someone could build it (a common omission is forgetting to mention the airfoil(s)).
 - (b) A to-scale planform view of the wing along with the rest of the aircraft even if fuselage/tail sizing is still notional.
 - (c) The inviscid span efficiency and a plot of the lift distribution at your design C_L . Make sure the lift distribution provides a high inviscid span efficiency, the c_l distribution provides favorable stall characteristics.
 - (d) The wing C_{Lmax} (not the airfoil section c_{lmax}), and a plot of the lift coefficient distribution at C_{Lmax} . Calculate also the corresponding stall speed. Make sure there is adequate margin between your design C_L and the wing C_{Lmax} (or equivalently between your design speed and stall speed).
- 3.2** Cut your wing using the foam cutter (group effort: one wing per project group). Your wing may have multiple segments. You don't have to cut them all, just any one section is sufficient for the purposes of this assignment. Take a picture of it and include it in the assignment. Describe any lessons learned or important details needed to reproduce.