

## Background

Airfoils are the cross sections of wings and rotors, so airfoil performance directly affects the performance of any lifting object. A simple way to analyze airfoils is by using a *panel method*. For this assignment, you will be utilizing a code produced by Mark Drela, a professor at MIT, called XFOIL. Rather than the original Fortran, you will use a Julia version written by students in the FLOWLab called [Xfoil.jl](#).

## Assignment

Start a new branch on your repository. Name it something relevant to the project. Create issues for each of the following 9 steps of this assignment. Close them with a comment as you finish each step.

1. Read through the chapter 2 in the ME EN 515 Text (linked below), specifically sections 5 and 6. As you read and come across unfamiliar terms see hint below), look them up and include them in an appendix in your report. As part of the definitions, include images and equations to add clarity where applicable.
2. Complete the examples given in the [Xfoil.jl documentation](#). Take notes on which functions you'll need for the rest of the assignment and how to use them (i.e. write some pseudo code).
3. Explore the effect of airfoil angle of attack on airfoil lift, drag, and moment.
4. Compare data collected from Xfoil to published data (experimental or other).
5. Explore the effect of Reynolds number on airfoil lift, drag, and moment.
6. Explore the effect of airfoil thickness and camber on airfoil lift to drag ratio and lift curve slope behavior.
7. Write a report (paper) on your methods, results, and takeaways. You should include introduction and discussion material on what you learned in steps 1-6, giving special attention to the methods and results from steps 3-6. Your report should:
  - Use the IMRaD format.
  - Use the provided [AIAA journal paper template](#).
  - Include comments for all of the packages already in the L<sup>A</sup>T<sub>E</sub>X document preamble, and any that you add, so you know what they are doing.
8. Submit your code and paper (.tex and .pdf files) via a pull request for your assignment branch on github.

**Hint:** Here are some common terms that you may want to include in your appendix dictionary. You should also include other terms you come across that are unfamiliar.

- Coefficient of Drag,  $C_D$
- Coefficient of Lift,  $C_L$
- Coefficient of Moment,  $C_M$
- Angle of Attack,  $\alpha$
- Airfoil Polar
- Lift Curve Slope
- Stall
- Airfoil Chord,  $c$
- Airfoil Camber
- Airfoil Thickness
- Freestream Velocity,  $V_\infty$
- Reynolds Number,  $Re$
- Mach Number,  $M$

## Useful Resources

- [ME 515 Textbook : Chapter 2 Sections 5 & 6](#)
- [Original Xfoil Documentation](#)
- [Xfoil.jl Documentation](#)
- [Google](#)