Background

The Vortex Lattice Method (VLM) is an invscid method for the low-fidelity analysis of lifting bodies (wings). For this assignment, you will be utilizing a Julia package called VortexLattice.jl to explore aspects of wing aerodynamic performance.

Assignment

Start a new branch on your repository. Name it something relevant to the project. Create github issues for at least steps 3-5. You should use these issues to write down questions you have about those steps of the assignment for reference in your weekly meeting with your graduate student mentor. Close each issue you create with a comment as you finish each step.

1. Read through the chapter 4 in the ME EN 515 Text (linked below). 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.

   - You may consider, rather than including an appendix in your papers, producing a dictionary of terms for yourself using the wiki feature on github.

2. Complete the Getting Started and 3 Steady State Examples in the VortexLattice.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 and discuss the effects of wing aspect ratio vs wing efficiency.

4. Explore the effects of tail volume ratio on the stability derivatives of an airframe. Be sure to discuss desirable signs for stability derivatives.

5. Explore the effects on angle of attack on the lift coefficient. Discuss the limitations of the VLM and explain which of your results are wrong due to those limitations.

6. Write a report (paper) on your methods, results, and takeaways. You should include introduction and discussion material on what you learned in steps 1-5, giving special attention to the methods and results from steps 3-5. Your report should:

   – Contain all the elements required for Paper 1.

   – Use the provided Paper 2 LaTeX Template.

   – Include high quality figures (based on feedback from your first paper).

7. Submit your code and paper (.tex and .pdf files) via a pull request for your assignment branch on github. In this assignment we expect a higher level of coding. We will specifically be look for the following:

- Most of your code should be written in functions, with a small script to call your functions. Functions are faster and more modular that writing everything in scripts. Every function should have a docstring explaining the purpose, inputs, and outputs.
- All of your code should be well commented. This doesn't mean that every line must have a comment, but sufficient comments throughout are required. Comments should make the intent of the code explicit, as well as provide a road map. Any complicated line of code should be commented.

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 (3D), C_D
- Coefficient of Lift (3D), C_L
- Coefficient of Moment (3D), C_M
- Wing Mean Aerodynamic Chord, $\overline{c}$
- Wing Span, b
- Wing Dihedral, ϕ
- Wing Twist, θ
- Wing Sweep, Λ
- Wing Aspect Ratio
- Tail Volume Ratios (horizontal and vertical)
- Inviscid Span Efficiency, e
- Airframe Stability Derivatives

Useful Resources

- ME EN 515 Book (chapter 4 specifically)
- VortexLattice.jl Documentation
- Google
- Adding wiki pages to your repository.