Relevant Reading

- Flight Vehicle Design Book

  - Chapter 2: Fundamentals (13 pages)
  - Chapter 3: Drag (28 pages)

Problem 1   Vocabulary

Explain the following terms; making sure to use sufficient detail, including any math or helpful figures. In some cases, these terms are simple one sentence definitions, in others, you should include several paragraphs to explain them fully.

Wing Geometry Terms

- Wing Area

- Chord

  - Mean Geometric Chord
  - Mean Aerodynamic Chord

- Taper Ratio

- Span

- Aspect Ratio

- Sweep

- Dihedral

- Twist

- Washout

Forces and Moments

- Lift

- Drag

  - Induced Drag
  - Parasitic Drag
    * Skin Friction Drag
    * Pressure Drag
  - Compressibility Drag

- Pitching Moment

- Lift and Drag Polars

  - Angle of Attack
  - Zero Lift angle of attack
  - Lift Curve Slope
  - Stall

Problem 2   Exploration

Complete the following exploration.

2.a   Prerequisites

i. Install VortexLattice.jl and complete the Getting Started Guide as well as the Steady State Wing and Tail Example.

ii. Obtain, and become familiar with, the following tools auxiliary to VortexLattice.jl including:

   - The airfoil analysis code
   - The strip theory and far-field drag codes

2.b   Forces, Moments, and Polars

i. Create the following plots using the example wing from the previous problem:

   - Lift vs Angle of Attack
   - Induced Drag (near and far field) vs Angle of Attack
   - Moment vs Angle of Attack
   - Lift vs Drag
   - Lift/Drag vs Angle of Attack

ii. Explain why an external drag model is required to capture stall.

iii. Identify the lift curve slope in your lift vs angle of attack plot, and compare it to the lift curve slope from thin airfoil theory (2π).