Assignment #2: Drag and Airfoils — ME 415

due 9/22/2021 before midnight via Learning Suite — **50 possible points**

Reminder (repeated again): Project homework is just like any other homework. You are welcome to work together, but each person must do their own write-up. Each person will need to know how to complete the assigned tasks. Often it is beneficial to do the problems separately, even if on the same team. This will allow you to explore more design options (you don't all have to analyze the same design), or to compare results (if evaluating the same design comparing can provide a sanity check). Your final report contains an updated version of these analyses so clear reporting will save you time later.

2.1 Create a function to compute the total drag of your aircraft during steady, level flight. Use the function to create a plot of the lift-to-drag ratio (L/D) as a function of flight speed. Find the speed that maximizes L/D (note this might not be the best long-term metric, but it uses what you know at this stage to provide a rough estimate of the optimal flight speed). Provide some detail on your aircraft parameters and your computational approach. Report the following:

- the design flight speed (speed that maximizes L/D)
- the corresponding Reynolds number
- the corresponding lift coefficient
- the max L/D.

Provide some sort of sanity check to show that your numbers are reasonable.

Aside: It may be instructive to visualize the two main components of drag (parasitic and induced) as a function of flight speed.

2.2 Download the latest version of XFLR5 and watch the first tutorial video.

Using XFLR5, compare the performance of at least three different appropriate airfoils. Plot their performance on drag polars and lift curves. Select (or design) an airfoil with good performance for your aircraft's Reynolds number and lift coefficient range. Plot the geometry. Describe the rationale for your design decisions.