

AE603 Aerodynamics

Assignment

(Sept-Dec, 2020)

Released on : Oct 27 2020

Weightage: 20 marks

Instructions:

- Open this file in a viewer than renders the hyperlinks visible
- Use good coding practices to make your code accessible to readers. Some guidelines here MIT,Harvard. (This will carry weightage in grading)
- Code should be validated against a reliable source
- Along with the code, a documentation file (.pdf) also must be prepared, by each batch, outlining the techniques implemented and results obtained(10% weightage)
- Late submission will not be entertained
- Evaluation will be based on viva voce

Questions:

1. Devise a linear vortex based panel method [*Low speed Aerodynamics*, Katz] and apply to NACA 4-digit airfoil[Katz] and calculate C_L and C_M [2 Students]
• **Code structuring**
INPUT: NACA 4 digit series
OUTPUT: $C_L - \alpha$, $C_M - \alpha$ plots compared with XFOIL results
2. Using stream function based linear vortex panel method [Drela] estimate the streamline pattern over NACA airfoils. Relax the Kutta condition and study the effect of circulation on the flow field. [2 Students]
• **Code structuring**
INPUT: NACA 4 digit series
OUTPUT: Streamline plots, $C_L - \alpha$ plots compared with XFOIL results
3. The NACA 7-series airfoil is designed to generate a prescribed surface pressure distribution and thereby ensure favourable operational characteristics [*Theory of wing sections*, Abbott]. Devise a linear vortex panel method and estimate the surface pressure distribution, comparing it with the design specifications. Use XFOIL

to compute the viscous solutions and comment on the effects [2 Students]

Code structuring

INPUT: NACA 7 series airfoil

OUTPUT: C_p distribution at different α and comparison with viscous XFOIL results

4. Use VLM [*Low speed Aerodynamics*, Katz] to study the effect of aspect ratio on performance of a flat finite wing . Thickness effects may be neglected [3 Students]

Code structuring

INPUT: Aspect ratio

OUTPUT: Drag polar and comparison with XFLR5 results