Problem 1

Consider a thin, symmetric airfoil at 1.5° angle of attack. From the results of thin airfoil theory, calculate the lift coefficient and the moment coefficient about the leading edge.

Problem 2

The NACA 4412 airfoil has a mean camber line given by

\[ \frac{\xi}{c} = \begin{cases} 0.25 \left[ 0.8 \frac{x}{c} - \left( \frac{x}{c} \right)^2 \right] & \text{for } 0 \leq \frac{x}{c} \leq 0.4 \\ 0.111 \left[ 0.2 + 0.8 \frac{x}{c} - \left( \frac{x}{c} \right)^2 \right] & \text{for } 0.4 \leq \frac{x}{c} \leq 1 \end{cases} \]

Using thin airfoil theory, calculate
(a) \( \alpha_L = 0 \)  (b) \( c_I \) when \( \alpha = 3° \)

Problem 3

For the NACA 2412 airfoil, the lift coefficient and moment coefficient about the quarter-chord at \(-6°\) angle of attack are \(-0.39\) and \(-0.045\), respectively. At \(4°\) angle of attack, these coefficients are \(0.65\) and \(-0.037\), respectively. Calculate the location of the aerodynamic center.

Problem 4

Consider an NACA 2412 airfoil with a 2-m chord in an airstream with a velocity of 50 m/s at standard sea level conditions. If the lift per unit span is 1353 N, what is the angle of attack?