Part 1: 2D – NACA 2412

1a) Thin airfoil theory

compute C_ℓ vs. α

For 4-digit NACA: (HW7) & p 59

$$\frac{z}{c} = \begin{cases} \cdots \end{cases}$$

$$\frac{dz/c}{dx/c} = \begin{cases} \frac{2m}{p^2}(p - x/c) & 0 \le x/c \le p \\ \frac{2m}{(1-p)^2}(p - x/c) & p \le x/c \le 1 \end{cases}$$

For elliptical: $a = \frac{a_0}{1 + a_0/(\pi \cdot AR)}$; $a_0 = 2\pi$

General distribution:

$$a = \frac{a_0}{1 + (a_0/\pi \cdot AR)(1+\tau)}$$

τ = induced factor for lift slope

$\tau = 0.05 \rightarrow 0.25$ common range

$$1 + (a_0/\pi AR)(1+\tau) = \frac{a_0}{a}$$

$$1 + \tau = \left(\frac{a_0}{a} - 1\right) \cdot \frac{\pi AR}{a_0}$$