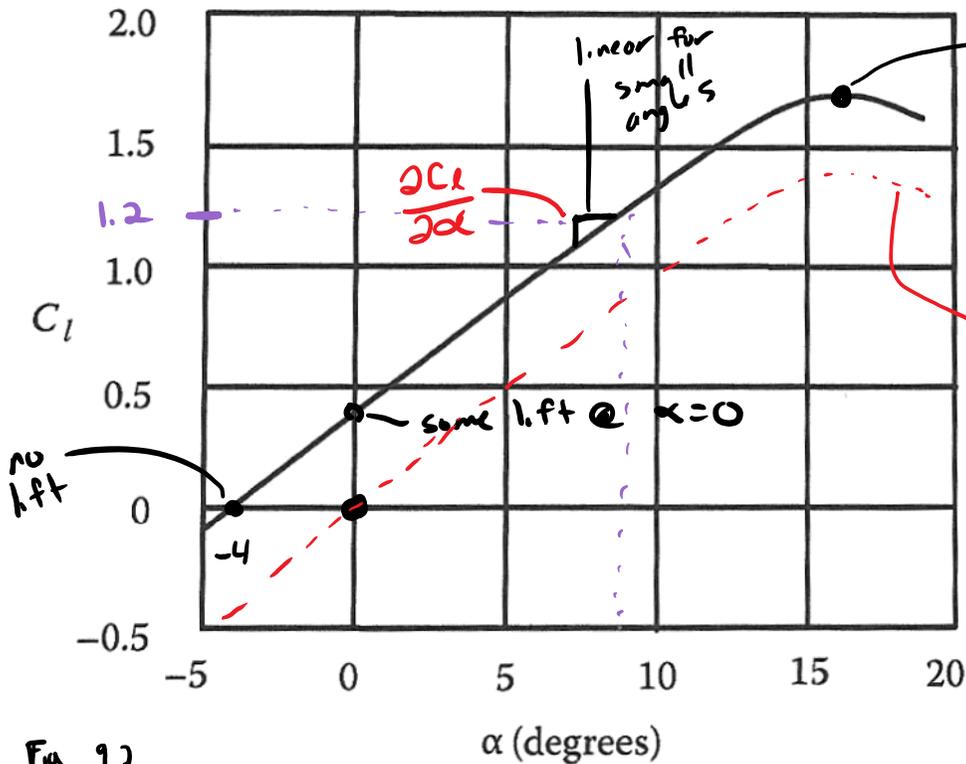


Lift coefficient vs Angle of Attack



Camber airfoil

stall α (max lift generation)

no lift @ $\alpha = -4$



Symmetric air foil

$$C_l(\alpha) = \frac{L}{\frac{\rho v^2}{2} c}$$

Fig 9.2

Drag & Moment Coefficients vs Lift Coefficient

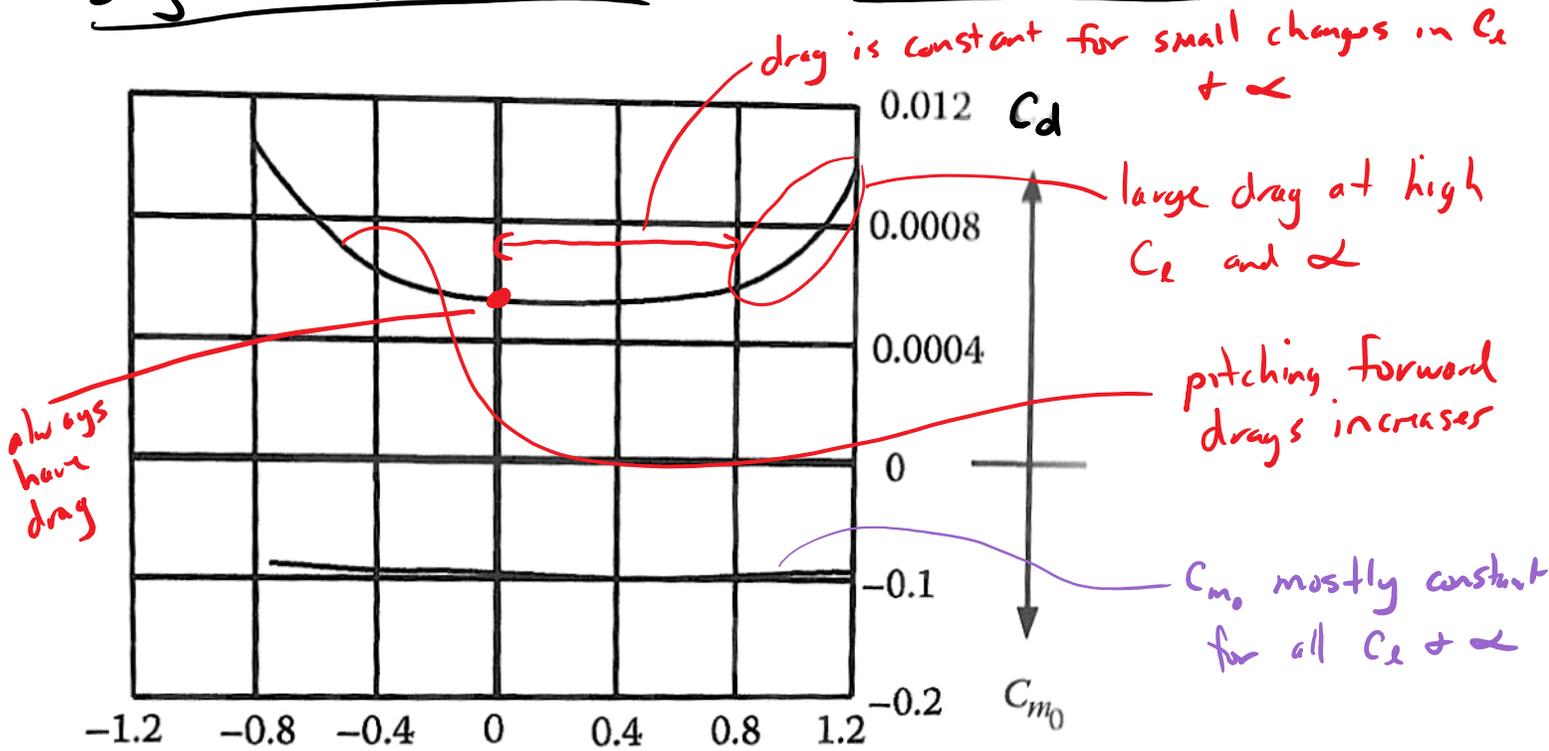
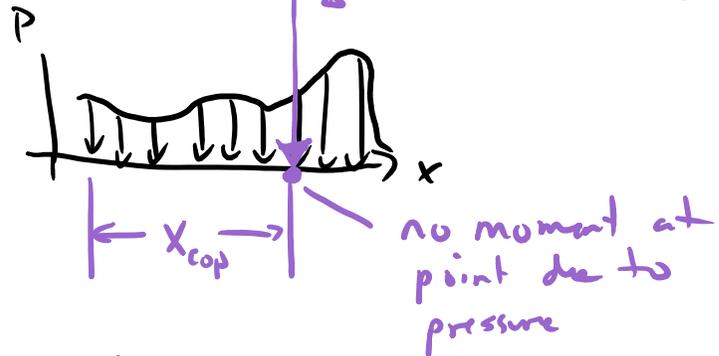
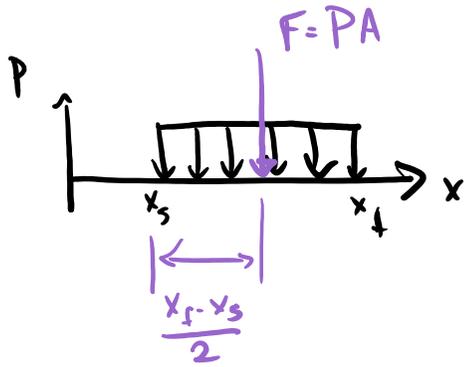


Fig 9.3 $\alpha = -9^\circ$ C_l lift coefficient $\alpha = 9^\circ$

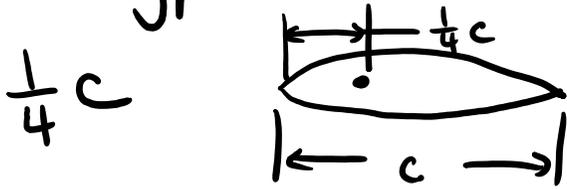
- The definition of aerodynamic center is the point on the cross section in which the moment stays constant wrt angle of attack.

- Center of pressure (CoP): point at which the resultant force due to air pressure acts: $F = \int_{x_s}^{x_f} P(x) w dx$
 w → width of surface

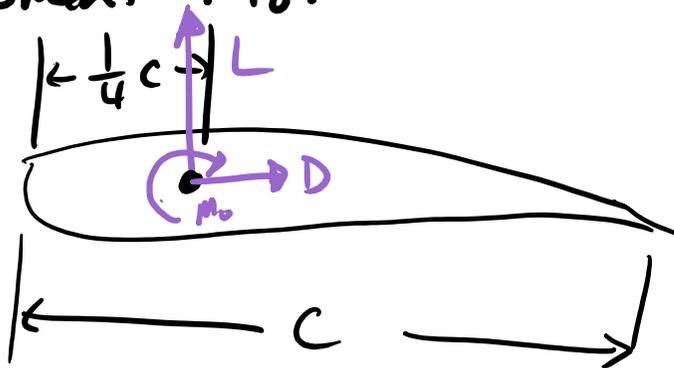


- For a symmetric air foil aero center = center of pressure
thin symmetric

- For a symmetric airfoil the center of pressure is at the center of pressure
- For typical ^{thin symmetric} airfoils the CoP is at about



- For cambered airfoils the CoP changes with α , but aerodynamic center doesn't. The aerodynamic center stays put @ $\frac{1}{4}c$ when α changes. But we have to account for the nonzero moment M_0 .



- Due to finite length of wing C_L of a specific wing will be less than predicted by C_{l} .

Static Longitudinal Stability of Aircraft

Assumptions:

- straight and level flight
- trim conditions required: sum of all forces and moments must zero
 - lift cancels weight &
 - thrust cancels drag
- Constant forward velocity

Static stability: Does small displacement in pitch cause a moment that tends to push back to equilibrium?



For the aircraft the horizontal tail is the key piece to provide static stability, (why it is also called the "stabilizer".)

Downwash : effects of the air flowing over the wing reduces lift generated at the tail.