

## 04 – The Typical Section: from 3D to 2D

Vibraciones y Aeroelasticidad

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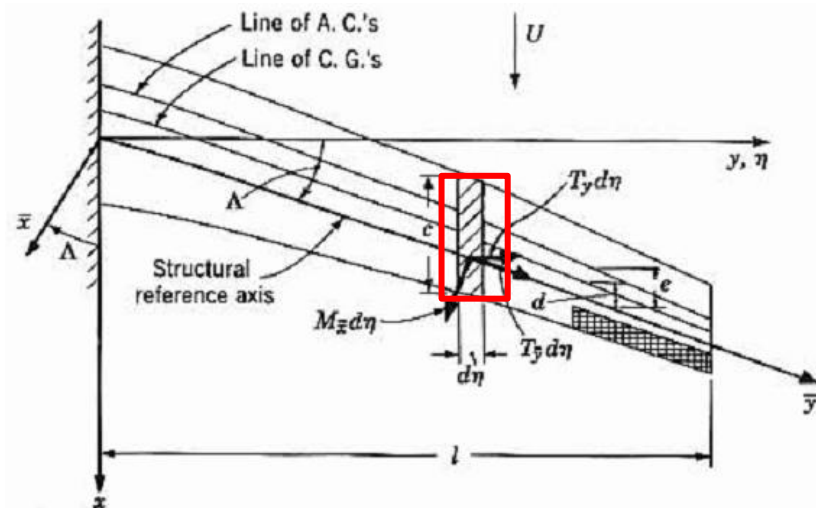
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## □ Typical Section from a finite wing:

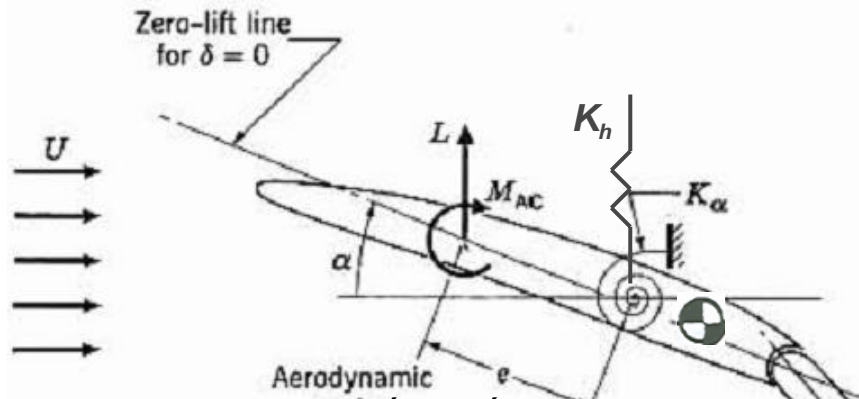
Ref: NACA Rep. 685: "Mechanism of Flutter. A Theoretical and Experimental Investigation of the Flutter Problem"; Theodorsen, T., and Garrick, I.E.

- ▶ 2D with geometry, structural, and mass properties of the 3/4 semispan location
- ▶ Span length = 1
- ▶ 2D Aerodynamics without aspect ratio corrections



## □ Concepts

- ▶ Aerodynamic Centre (AC)
- ▶ Elastic Axis (EA)
- ▶ Centre of Gravity (CoG)
- ▶ Bending Stiffness ( $K_h$ )
- ▶ Torsion Stiffness ( $K_\alpha$ )



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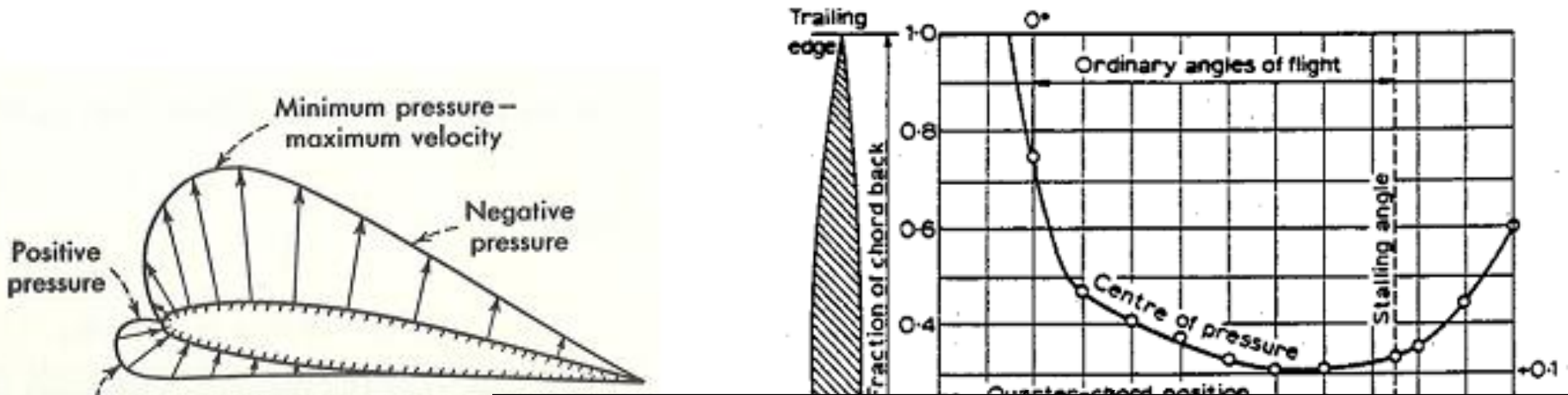
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# AERODYNAMIC CENTRE (AC)



- Centre of Pressure :  $C_{MCP}=0$ 
  - ▶ Centre of pressure moves with AoA
- Aerodynamic Centre:  $C_{MAC}$  does not change with AoA
  - ▶ Thin airfoil, incompressible flow, the aerodynamic theory places the AC at  $\frac{1}{4}$  chord
  - ▶ Symmetric airfoils, the constant pitching moment is ZERO

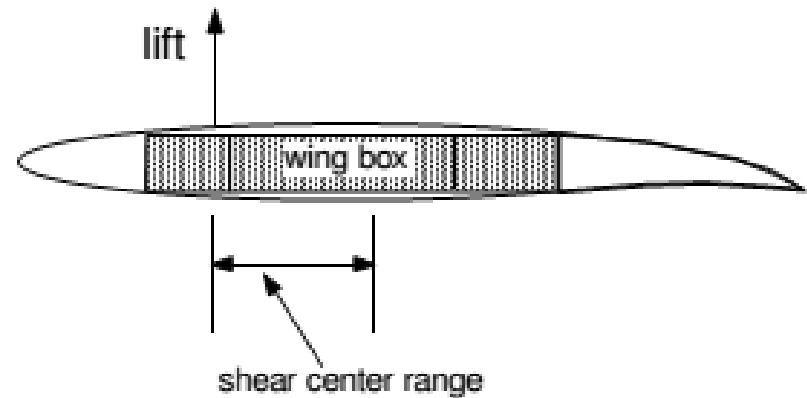
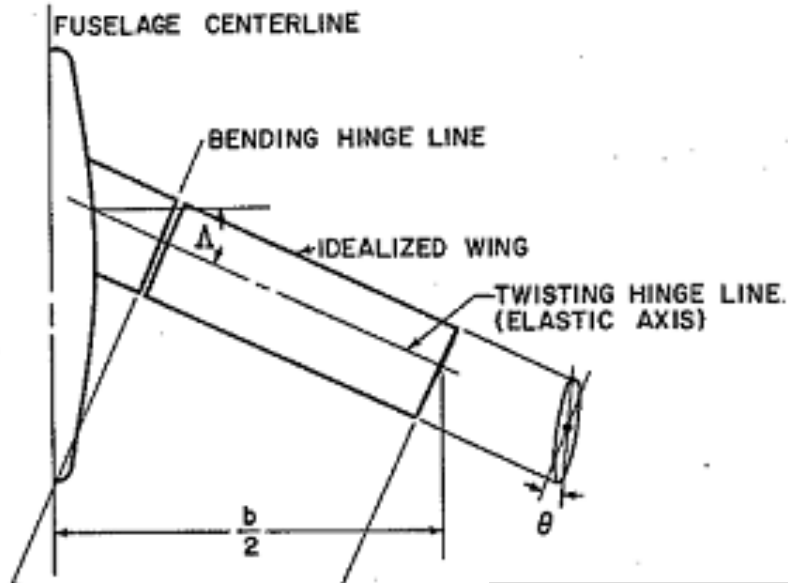


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- ❑ Shear Centre: a concentrated force causes only displacement
- ❑ Centre of Twist: a concentrated torsional moment causes only rotation
- ❑ Linear elastic structure: Shear Centre = Centre of Twist



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