

Lift and Drag

Lecture 7



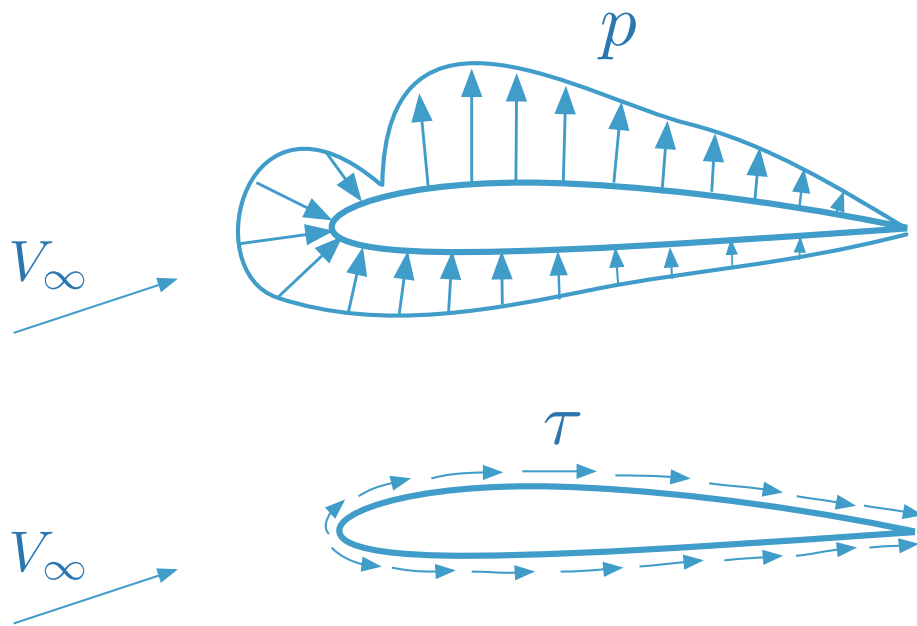
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Outline

Definitions

Lift and Drag in Potential Flow

Definitions



Flat Plate Example

Munson 9.5. Assume the following average pressure and shear stress on the surface of the 1-m-square flat plate. Determine the lift and drag generated. How much does the shear stress contribute to each?

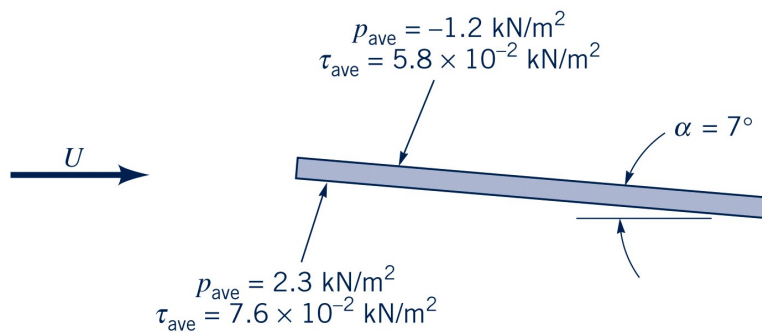


Figure P9.5
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Dynamic Pressure:

Pressure coefficient:

Lift and Drag coefficient:

Moment coefficient:

Center of pressure:

Aerodynamic center:

Lift and Drag in Potential Flow

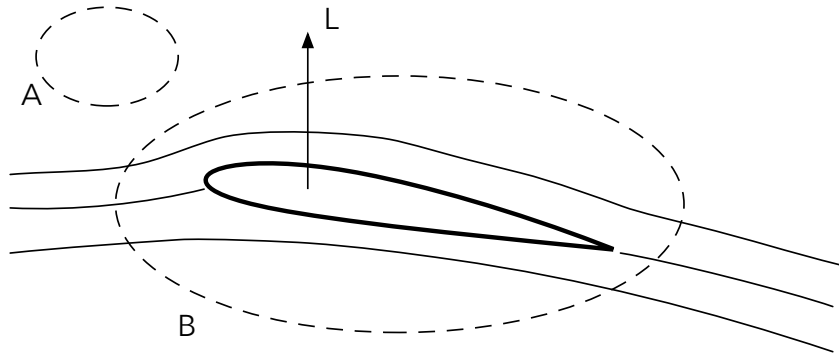
D'Alembert's Paradox

For potential flow, what is the drag around the cylinder?

What about around an arbitrary airfoil?

Circulation

$$\Gamma = \oint_C \vec{V} \cdot d\vec{s}$$



Kutta-Joukowski Theorem

$$\vec{L}' = \rho_{\infty} \vec{V} \times \vec{\Gamma}$$

Drag in Viscous Fluids

Skin Friction Drag and Pressure Drag