2.25

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4 Inviscid Flow I: Euler's Equation of Motion, Bernoulli's Integral, and the Effects of Streamline Curvature

4.1 Euler's equation for inviscid motion: a relationship between fluid acceleration (convective and temporal) and the pressure distribution.

4.2 Concepts for describing fluid flows: streamlines, particle paths, streaklines.

4.3 Euler's equation for steady flow expressed in streamline coordinates: the pressure-velocity relation along the streamline direction, and the pressure gradient normal to streamlines when streamlines have curvature. Comments on the "inviscid flow" approximation and the boundary conditions that are appropriate for velocity and pressure in such flows.

4.4 Incompressible flow examples involving both the Bernoulli effect and the streamline curvature effect. Lift on airfoils. Boundary conditions on pressure at exit planes.

4.5 Bernoulli's integral for two types of steady, isentropic, compressible flows: (a) perfect gases and (b) liquids with constant compressibility. Isentropic expansion of a gas into vacuum. A criterion for "incompressible flow."

4.6 The general form of Bernoulli's integral (for unsteady as well as steady flow). Examples: startup transients, Rayleigh bubble oscillation, etc., mainly in incompressible flows.

4.7 Introductory comments on potential (vorticity-free) flow and the velocity potential ϕ. Incompressible flows as solutions of $\nabla^2\phi = 0$ with $\partial\phi/\partial n = 0$ at solid boundaries. The equation for pressure in terms of the velocity potential ϕ.

<u>Read</u>:	Fay	Chapt. 4 Assignments
	Kundu & Cohen	Chapt. 4.16-4.17; Chapt. 5.3
<u>Problems</u>:	Shapiro & Sonin	4.1, 4.4, 4.7, 4.8, 4.9, 4.15, 4.18, 4.19, 4.21, 4.23, 4.24, 4.28