r2.25

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 pressure distribution.

4.2 Concepts for describing fluid flows: streamlines, particle paths, and 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 Bernoulli's integral and the effects of streamline curvature. Classroom demonstrations of the Bernoulli effect and the streamline curvature effect (the latter being the origin of lift on airfoils).

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 a vacuum. A criterion for "incompressible flow."

4.6 The general form of Bernoulli's integral for unsteady flow. Examples: startup problems, Rayleigh bubble oscillations, etc., mainly for 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.

Read:	Fay	Chapt. 4
Problems:	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