Chapter 5

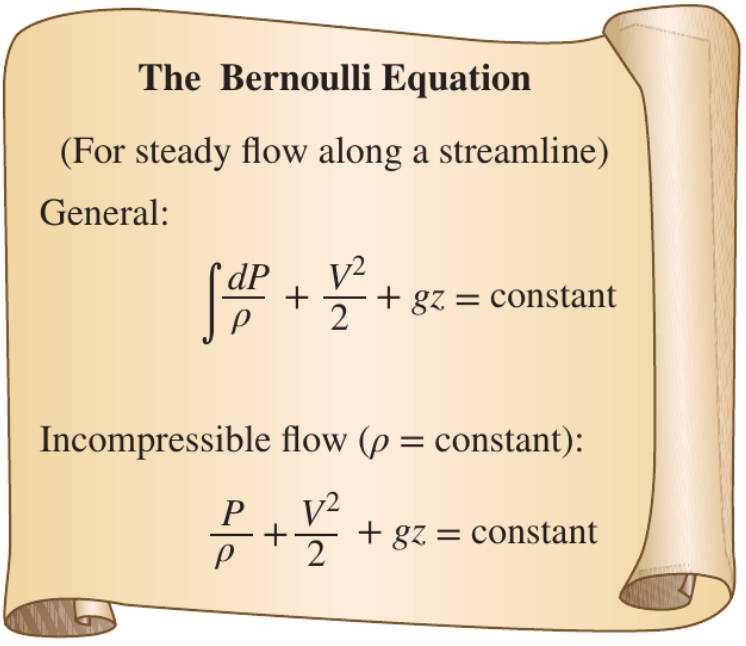
5-1 Conversion of Mass

- **Mass and Flow Rate**: $\dot{m} = \rho \dot{V}$
- **Mass Balance**: $\sum_{in} \dot{m} = \sum_{out} \dot{m}$
- **Incompressible Flow**: $\dot{V}_1 = \dot{V}_2 \Rightarrow v_1 A_1 = v_2 A_2$

5-2 The Bernoulli Equation

The **Bernoulli Equation** is an approximate relation between pressure, velocity, and elevation, and is valid in regions of steady, incompressible flow where net frictional forces are negligible

$$\frac{P_1}{\rho} + \frac{V_1^2}{2} + gz_1 = \frac{P_2}{\rho} + \frac{V_2^2}{2} + gz_2$$



5-3 Energy Analysis of Steady Flows

$$\frac{P_1}{\rho g} + \alpha_1 \frac{V_1^2}{2g} + z_1 + h_{\text{pump},u} = \frac{P_2}{\rho g} + \alpha_2 \frac{V_2^2}{2g} + z_2 + h_{\text{turbine},e} + h_L$$

- α: the kinetic energy correction factor
- $h_{\text{pump},u}$: the useful head delivered
- $h_{\text{turbine},e}$: the extracted head removed from the fluid by the turbine
- h_L: irreversible head loss