Chapter 5

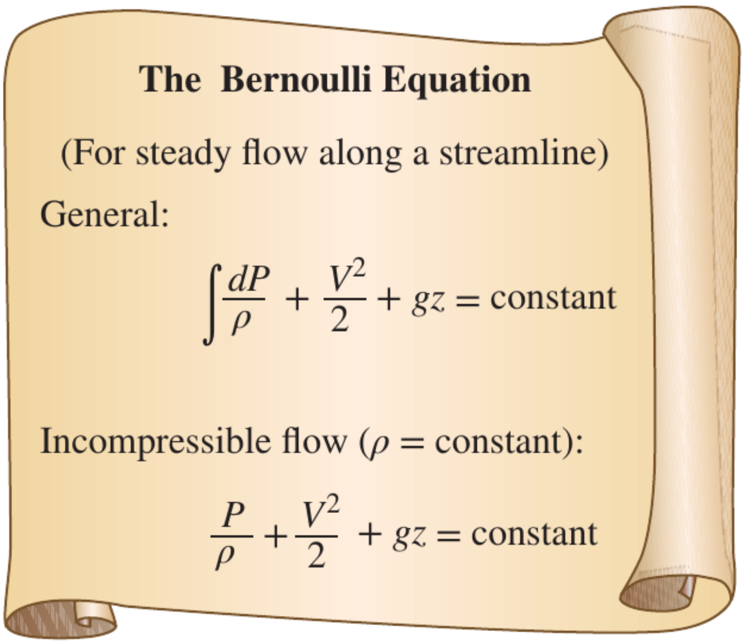
5-1 Conversion of Mass

- **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

$$\dot{m}\left(\frac{P_1}{\rho} + \alpha_1 \frac{V_1^2}{2} + gz_1\right) + \dot{W}_{\text{pump,u}} = \dot{m}\left(\frac{P_2}{\rho} + \alpha_2 \frac{V_2^2}{2} + gz_2\right) + \dot{W}_{\text{turbine,e}} + E_{\text{mech,loss}}$$

- α: the kinetic energy correction factor
- $\dot{W}_{\text{pump},u}$: the useful energy that the pump delivered
- $\dot{W}_{\text{turbine},e}$: the energy used by turbine

- $E_{\text{mech,loss}}$: the mechanical energy that lost