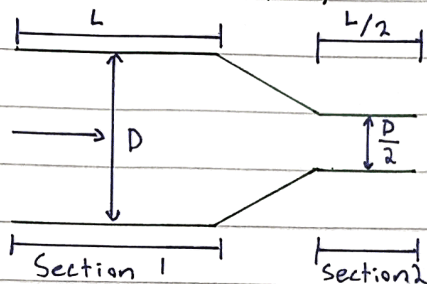


Quiz 07

For a given mass flow rate (\dot{m}), in the flow through a pipe system as shown below, determine:



1. Volumetric flow rate ratio, \dot{Q}_1/\dot{Q}_2

$$\dot{m}_1 = \dot{m}_2 \text{ (Steady state)}$$

$$\rho \dot{Q}_1 = \rho \dot{Q}_2$$

$$\text{Ratio} = \dot{Q}_1/\dot{Q}_2 = 1$$

2. Reynold's Number Ratio, Re_1/Re_2

$$Re = \rho \cdot V \cdot D_h / \mu$$

$$Re = (\rho \cdot V \cdot D / A_c \cdot A_c) / \mu$$

$$Re = (\dot{m} \cdot D / A_c) / \mu$$

$$\rightarrow Re = \frac{\dot{m}}{\mu} \cdot \frac{D}{\frac{1}{4} \pi D^2}$$

$$\text{Ratio: } \left(\frac{\dot{m}}{\mu} \cdot \frac{1}{\frac{1}{4} \pi D} \right) / \left(\frac{\dot{m}}{\mu} \cdot \frac{1}{\frac{1}{4} \pi D} \right)$$

$$\text{Ratio: } 0.5$$

3. Velocity Ratio, V_1/V_2

$$V_1 A_{c1} = V_2 A_{c2}$$

$$V_1/V_2 = A_{c2}/A_{c1}$$

$$\rightarrow \text{Ratio: } (D_2^2/D_1^2) = 0.25$$

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$$q_f = \sqrt{h P K A_c} \tanh(m L) (T_b - T_\infty)$$

Find R_f

$$R = \frac{\Delta T}{q} \rightarrow q_f / (T_b - T_\infty) = \sqrt{h P K A_c} \tanh(m L) \quad \text{Inverse both sides for } R_f$$

$$R_f = 1 / (\sqrt{h P K A_c} \tanh(m L))$$