

# Fluid Mechanics Homework #2

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共五題，題號為：2-22,33,47,75,96

題號的對照書本是 Yunus A. Cengel and John M. Cimbala "Fluid Mechanics: Fundamentals and Applications 3/e (SI Units) "

2 – 22

A pump is used to transport water to a higher reservoir. If the water temperature is  $20^{\circ}\text{C}$ , determine the lowest pressure that can exist in the pump without cavitation.

2 – 33

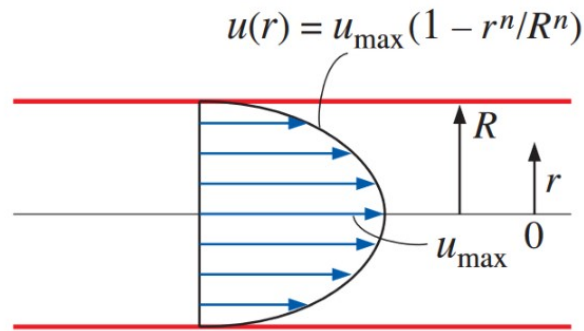
Saturated water vapor at  $150^{\circ}\text{C}$  (enthalpy  $h = 2745.9 \text{ kJ/kg}$ ) flows in a pipe at  $50 \text{ m/s}$  at an elevation of  $z = 10 \text{ m}$ . Determine the total energy of vapor in  $\text{J/kg}$  relative to the ground level.

2 – 47

Prove that the coefficient of volume expansion for an ideal gas is  $\beta_{\text{ideal gas}} = 1/T$ .

2 – 75

Consider the flow of a fluid with viscosity  $\mu$  through a circular pipe. The velocity profile in the pipe is given as  $u(r) = u_{\text{max}}(1 - r^n/R^n)$ , where  $u_{\text{max}}$  is the maximum flow velocity, which occurs at the centerline;  $r$  is the radial distance from the centerline; and  $u(r)$  is the flow velocity at any position  $r$ . Develop a relation for the drag force exerted on the pipe wall by the fluid in the flow direction per unit length of the pipe.



2 – 96

Consider a 0.15-mm diameter air bubble in a liquid. Determine the pressure difference between the inside and outside of the air bubble if the surface tension at the air-liquid interface is (a) 0.080 N/m and (b) 0.12 N/m.