Fluid Mechanics Homework #11

繳交期限：2019/12/18(三) 09:10

共五題，題號為：8-29,31,47,51,88

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

8-29 The velocity profile for the fully developed laminar flow of a Newtonian fluid between two large parallel plates is given by

$$u(y) = \frac{3u_0}{2}\left[1 - \left(\frac{y}{h}\right)^2\right]$$

where $2h$ is the distance between the two plates, u_0 is the velocity at the center plane, and y is the vertical coordinate from the center plane. For a plate width of b, obtain a relation for the flow rate through the plates.

Assumption:

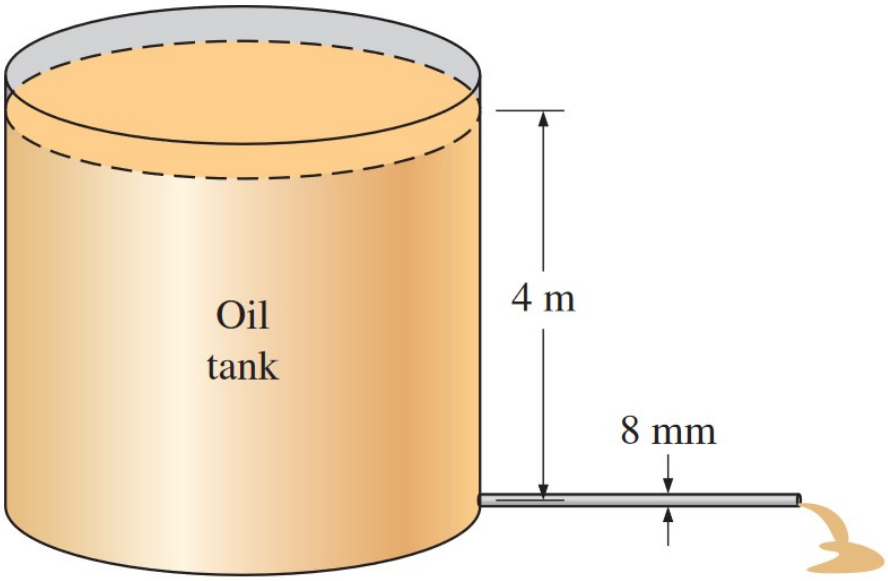
The flow is steady and incompressible.

8-31 Water at 10°C ($\rho = 999.7$ kg/m^3 and $\mu = 1.307 \times 10^{-3}$ kg/m·s) is flowing steadily in a 0.12-cm-diameter, 15-m-long pipe at an average velocity of 0.9 m/s. Determine (a) the pressure drop, (b) the head loss, and (c) the pumping power requirement to overcome this pressure drop.

Assumption:

1. The flow is steady and incompressible.
2. The entrance effects are negligible, and thus the flow is fully developed.
3. The pipe involves no components such as bends, valves, and connectors.
4. The piping section involves no work devices such as pumps and turbines.

8-47 Oil with a density of 850 kg/m^3 and kinematic viscosity of 0.00062 m^2/s is being discharged by a 8-mm-diameter, 40-m-long horizontal pipe from a storage tank open to the atmosphere. The height of the liquid level above the center of the pipe is 4 m. Disregarding the minor losses, determine the flow rate of oil through the pipe.



Assumption:

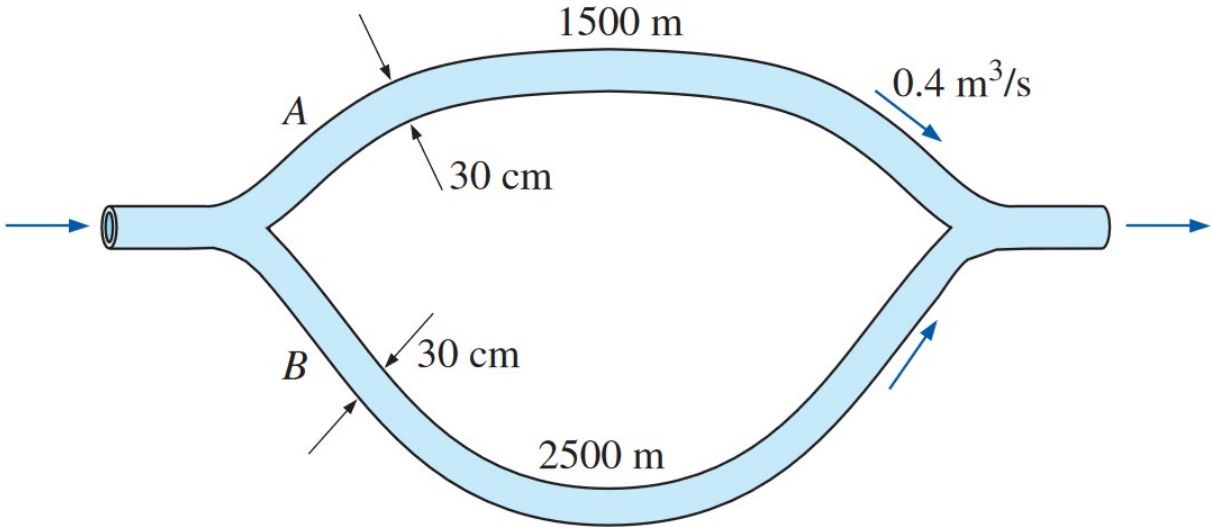
1. The flow is steady and incompressible.
2. The entrance effects are negligible, and thus the flow is fully developed.
3. The entrance and exit loses are negligible.
4. The pipe involves no components such as bends, valves, and connectors.
5. The piping section involves no work devices such as pumps and turbines.

8-51 Liquid ammonia at −20°C is flowing through a 20-m-long section of a 5-mm-diameter copper tube at a rate of 0.09 kg/s. Determine the pressure drop, the head loss, and the pumping power required to overcome the frictional losses in the tube.

Assumption:

1. The flow is steady and incompressible.
2. The entrance effects are negligible, and thus the flow is fully developed.
3. The pipe involves no components such as bends, valves, and connectors.
4. The piping section involves no work devices such as pumps and turbines.

8-88 A certain part of cast iron piping of a water distribution system involves a parallel section. Both parallel pipes have a diameter of 30 cm, and the flow is fully turbulent. One of the branches (pipe *A*) is 1500 m long while the other branch (pipe *B*) is 2500 m long. If the flow rate through pipe *A* is 0.4 m^3/s, determine the flow rate through pipe *B*. Disregard minor losses and assume the water temperature to be 15°C.



Assumption:

1. The flow is steady and incompressible.
2. The entrance effects are negligible, and thus the flow is fully developed.
3. The minor losses are negligible.
4. The flow is fully turbulent and thus the friction factor is independent of the Reynolds number