

Elementary Fluid Mechanics CEE 357-02
 Fall 2019
 October 23, 2019

MATLAB ASSIGNMENT- PB SET 5, Due October 30, 2019

Chapter 6: Viscous Flow in Ducts

Water, with density (ρ) = 998 kg/m³ and kinematic viscosity (ν)= 1.01 E-6 m²/s flows through a 45-cm diameter pipe 150 m long with a head loss of 10 m. The roughness ratio is $\epsilon/d = 0.0001$.

Problem 1: Write a MATLAB script that calculates the friction factor (f) and the average velocity (V). To do so you should assign an initial guess for the friction factor, calculate the resulting Reynold's number, update the friction factor using

$$\text{Eq 6.48} \quad \frac{1}{f^{1/2}} = -2.0 \log \left(\frac{\epsilon/d}{3.7} + \frac{2.51}{Re_d f^{1/2}} \right)$$

and then update the Reynold's number and flow velocity.

Problem 2: Using your code from problem 1 create a script that calculates and plots the flow velocity and friction factors for a range of pipe diameters from 20 cm to 65 cm (one graph each variable: (1) V vs d , (2) f vs d). A sophisticated solution to this problem would use a 'for loop' to run through the solution for the range of pipe diameters, using the solution code from problem 1 inside the 'for loop'.

Submission information: Your submission should include the numerical results for problem 1, the two graphs requested in problem 2 and printouts of the MATLAB scripts from problems 1 and 2.

