

APS106 - LAB #4

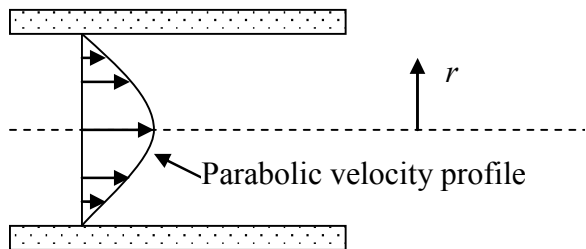
MONDAY, FEBRUARY 3, 2:00 - 4:00

This lab will test your ability to use various selection constructs (if, else if, switch) and a loop (while, do while, for). The extension of the source file must be .c, not .cpp (e.g. lab4.c).

Fluid mechanics is the discipline concerned with the behaviour of liquids and gases at rest or in motion. This field encompasses a variety of applications: from flow in micro-channels to the motion of airplanes.

An important area of fluid mechanics is flow through pipes. In a circular pipe, the fluid, e.g. water, is at rest adjacent to the wall of the pipe and reaches a maximum velocity at the centre of the pipe. Fully developed laminar flow has a parabolic velocity profile of the form:

$$v = \frac{\Delta p}{4\mu L} R^2 \left[1 - \left(\frac{r}{R} \right)^2 \right]$$



where v is the axial velocity at position r , Δp is the pressure loss over pipe length L , μ is the dynamic viscosity and R is the radius of the pipe.

Water ($\mu = 1.002 \times 10^{-3} \text{ Ns/m}^2$) is flowing through a 0.10 m diameter pipe. There is a 10 Pa loss per 100 m of pipe. Determine the velocity distribution in the radial direction by writing a program that:

- reads the diameter, dynamic viscosity, pressure loss and length of pipe from the keyboard, and exits the program if any of these values are not positive;
- outputs to the screen the velocity starting from the center of the pipe to the wall, every $R/10$ of the pipe.