The University of Melbourne
ENGR30002 Fluid Mechanics

Workshop 08 – *Pipe flow (Parallel)*

Part A: Creating symbolic variables and functions

Syms Symbolic variables do not contain values and allow the user to write algebraic expressions. In MATLAB, syms is used to represent variables.

fprintf You can print a string using the **fprintf** function with the %s format specifier.

Question 01

(1) Write simple code to solve a linear equation using **syms**.

$x + 3 = 2$

(2) Write simple code to solve two equations using **syms**.

$x + y = 2$
$2x + 4y = 10$

Question 02

(1) Enter the following into MATLAB

```
x=7;
fprintf('The value of x is %d\n',x)
fprintf(1,'The value of x is %d\n',x)
```

and observe the result. What does the `fprintf` function do?

(2) Now enter the following into MATLAB

```
fprintf('The value of x is %f\n',x)
```

and observe the result. How does the different specifier (%d,%f) change the output?

Part B

Question 01

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. The flow rate through pipe A is 0.4 m^s/s.

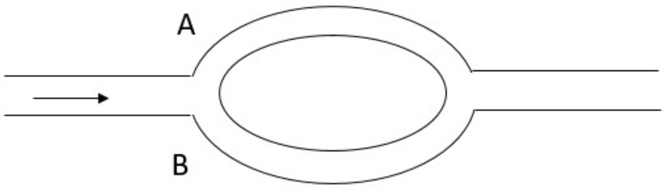

Figure 1: Parallel piping system

(1) Determine the flow rate through pipe B. Disregard minor losses and assume the water temperature to be 15°C

(2) Plot two graphs using subplots to show how L_A and L_B affect V_B. Is the flow rate in pipe B greater or less than the flow rate in pipe A? Explain why they have different velocities.

(3) You want to control the flow rates in each pipe by installing valves. A halfway-closed gate valve is placed at the beginning of pipe A while pipe B has a fully open globe valve at the end. Determine V_B assuming that the other minor losses are negligible.

(4) Compare the result of (1) and (3) and explain their differences.

Question 02

Water at 20°C is to be pumped from a reservoir to another reservoir at a higher elevation through two 25-m-long plastic pipes connected in parallel. The diameters of the two pipes are 3 cm and 5 cm. Water is to be pumped by a 68 percent efficient motor-pump unit that draws 7 kW of electric power during operation. The minor losses and the head loss in the pipes that connect the parallel pipes to the two reservoirs are considered to be negligible.

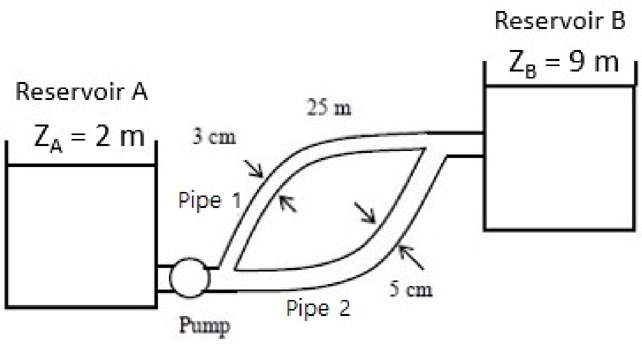

Figure 2: Parallel piping system

(1) Derive an expression for the pump head in terms of Z_A, Z_B, and h_L.

(2) You realise that this problem cannot be solved directly because velocities in the pipes are not known. Utilising codes you have developed in the previous workshops, apply an iterative method to determine velocities in each pipe. Set an acceptable tolerance as 10^{-4}.

(3) Display results of velocities, flow rates, head losses, and pump head.

END OF WORKSHOP