Experiment n°4

Head losses: experiment vs theories

Objective

The main goal of this experiment is to confront the theories established with experiment performed on the bench in the Hydrodynamic Lab

Description

The bench used is the HD98B hydraulic bench, precisely the pipes n°1, 2, 4, 5, 7, 8.

The n°1 pipe is a 77cm long pipe with a diameter of 16mm, the n°2 pipe is a 47.4mm diameter and 29.5 cm long pipe. The pipe n°4 is 3 section pipe, each section is 30 cm long the diameter of each section is 27.4mm, 20mm, 16mm. The number 5 pipe is a 20mm diameter and 77 cm long rough pipe, the ε is about 0.0015. The pipe n°8 is a 20mm diameter pipe.

Theories

When a fluid flows in a pipe, friction due to the contact between the fluid and the pipe, appear.

Head losses follow the following laws:

Darcy-Weisbach formula: $\Delta Pt = \xi * \frac{L}{D} * \frac{1}{2} * \rho * Um^2$ ξ regular head lose coefficient

For laminar flow:

$$\xi = \frac{64}{Re}$$

For turbulent flow in a smooth pipe:

$\xi = \frac{0.316}{\sqrt[4]{Re}}$ (Blasius fromula)

For turbulent flow in a rough pipe, the Colebrook formula have to be used:

$$\frac{1}{\sqrt{\xi}} = -2log10\left[\frac{\varepsilon}{3.71D} + \frac{2.51}{Re\sqrt{\xi}}\right] \text{ (Colebrook formula)}$$

Material

U shaped manometer,

Pipes 1, 2, 4, 5, 7, 8

Experiment

a) Check the opening of the exit valve;
b) connect the U shaped manometer to the desired pipe;
c) pick up the value of the manometer

Pick up the value of manometer in the following table:

Qv m^3/s	U m/s	ξ measured	Re	(ξ Blasius/Poiseuille)	(ξ Colebrook)

Compare the value measured to the theoretical ones, conclude.