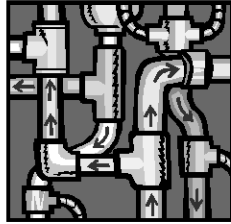


Chapter 12

Pipes in Parallel



Miami University

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What are Pipes In Parallel

- Def:
 - We have 2 or more paths (pipes) that go from a source to a destination
 - No branches off the these pipes

2

Continuity Eq. For Pipes in Parallel

- Sum of Volumetric flows in each pipe = the total volumetric flow
- Very unlikely that volumetric flow in each of the parallel pipes is the same.
- Velocity in individual pipe = its volumetric flow rate / cross sectional area

3

Bernoulli Equation for Pipes Parallel

Eq (2) - If we write Bernoulli upstream u (just before the branching) and downstream d (just after their junction), and then rearrange to solve for the total losses:

$$h_L = \left(\frac{P_u - P_d}{\lambda} \right) + (z_u - z_d) + \frac{V_{aveu}^2 - V_{aved}^2}{2g}$$

4

Bernoulli Concluded

- Each branch has same change in elevation head, same change in pressure head, and no change in velocity head.
- Therefore, each branch must have the same loss h_L

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Frictional Losses Through Two Round Pipes in Parallel

$$h_1 = \left(f_1 \frac{L}{D} + \sum K_1 \right) \left(\frac{8\dot{V}_1}{g\pi^2 D_1^4} \right) = h_2 \text{ of same form}$$

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Frictional Losses Concluded

- If we solve for the ratio of volumetric flow rates in the 2 branches:

$$\frac{\dot{V}_1}{\dot{V} - \dot{V}_1} = \left(\frac{D_1}{D_2}\right)^2 \sqrt{\frac{f_2 \frac{L_2}{D_2} + \sum_z K_i}{f_1 \frac{L_1}{D_1} + \sum_1 K_i}}$$

7

Friction factors for Pipes in Parallel

- $f_{i,s}$ are not identical, but similar, with a ratio we might approximate as one
- For example, max $D_1/D_2 = 4$, so velocity ratios is 4^2 and f might change from 0.021 to 0.013
 - While Re goes from 40,000 to 640,000

8

Sample Class Problem

9

Chap 12 Homework

- Problem 12.4E. Use formula in lecture on 2 parallel pipes, assuming ratios of friction factors is 1
- Use $K = 10$ for globe valve, $K = 2$ for swing type check valve, $K = 0.3$ for each elbow, and $K = 2$ for each of the two tees.

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