ENGR 292 Fluids and Thermodynamics

Design a Pump and Pipe System Step 5

Supporting Docs

Feb.03, 2017

Step 5

- ***Determine the Reynolds Number***
  - ***The behavior of a fluid, particularly with regard to energy losses, is quite dependent on whether the flow is laminar or turbulent***
  - ***For this reason, we need a means of predicting the type of flow without actually observing it.***

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Step 5

- ***Determine the Reynolds Number***
  - ***Laminar flow: the flow has fairly uniform diameter and there is little or no evidence of mixing of the various parts of the flow. Smooth, Steady.***
  - ***Turbulent flow: The elements of flow appear to be mixing chaotically within the flow.***

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Step 5

- ***Determine the Reynolds Number***

Reference: http://www-history.mcs.st-and.ac.uk/Biographies/Reynolds.html

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Step 5

- ***Reynolds Number – Circular Sections:***
  - ***Dimensionless:***

$$N_R = \frac{\mathbf{v}D\rho}{\eta} = \frac{\mathbf{v}D}{v}$$

- ***Dimensional analysis***

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Step 5

- ***Reynolds Number – Circular Sections:***

$$N_R = \frac{\mathbf{v}D\rho}{\eta} = \frac{\mathbf{v}D}{v}$$

- ***Flows having large Reynolds number, typically because of high velocity and/or low viscosity, tend to be turbulent.***
- ***Those fluids having high viscosity and/or moving at low velocities will have low Reynolds number, and will tend to be laminar.***

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Step 5

- ***Quantitative data to predict whether a given flow is laminar or turbulent***

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Step 5

- ***Critical Reynolds Numbers (for circular cross section only)***

N_R	
$N_R < 2000$	*Laminar*
$2000 < N_R < 4000$	*Critical region*
$N_R > 4000$	*Turbulent*

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