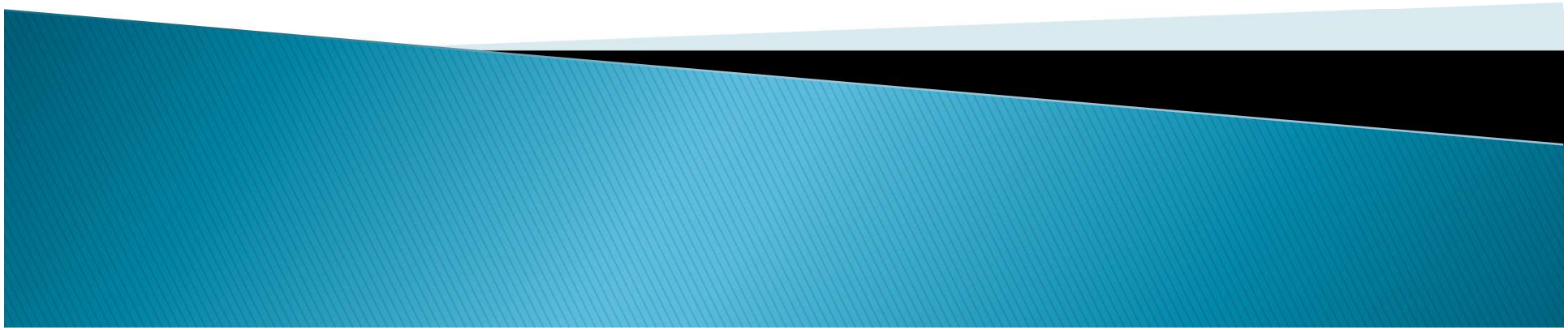
FDE 205 Fluid Mechanics



Measurement of Flowing Fluids

- It is very important to know and control the flow rate of the fluids in industrial processes.
- Many different devices have been developed to determine the rate at which a fluid is flowing. The level of sophistication, size, cost, accuracy, versatility, capacity, pressure drop, and operating principle of the flow meters varies widely.
- Some flow meters measure the flow rate directly while most of them measure the flow rate indirectly by measuring the average fluid velocity from which the volumetric flow rate can be calculated
  - Pitot Tubes
  - Venturi meter
  - Orifice meter

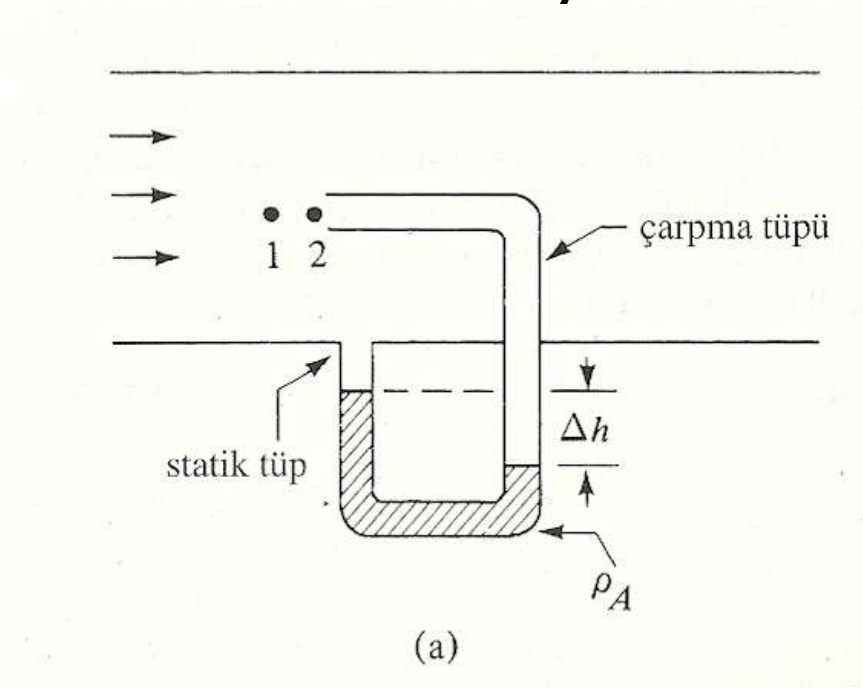
Pitot Tubes

- Pitot tubes are the devices which measures the local velocity along a streamline. (Pitot tüpü, bir boru içerisinde ortalama hızı değilde, belli bir noktadaki yerel hızı ölçmekte kullanılır.)

- Akışkan 2 noktasına doğru akar, bu noktada basınç artar ve daha sonra akışkanın hızı sıfır olur. Bu nokta durgunluk noktası diye adlandırılır.
- Hızdaki azalma,

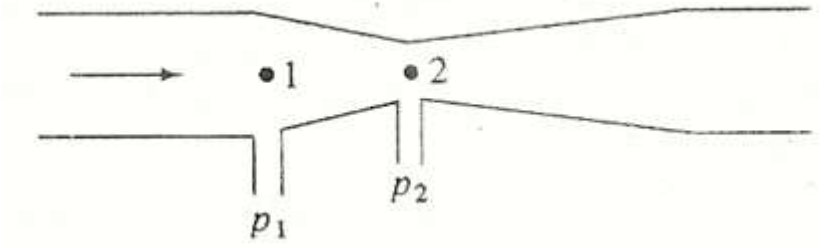
basınçtaki yükselme-

ye eşit olur.



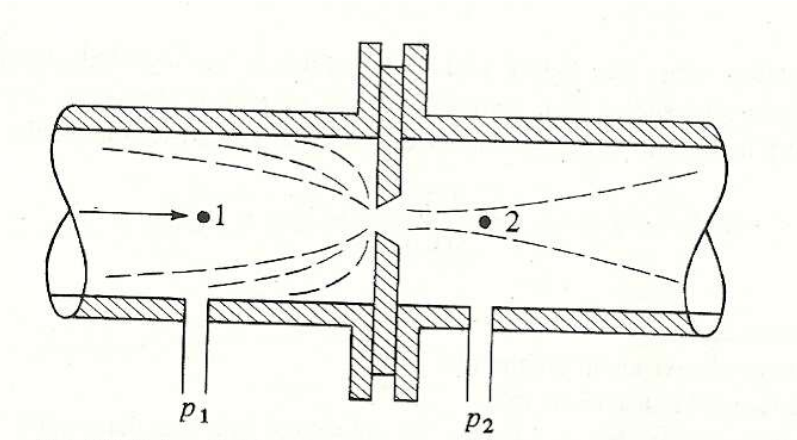
Venturi meter

- Venturi meter is a tube with constricted throat that increases velocity and decreases pressure. It is usually inserted directly into the pipeline. As the liquid flows through the pipeline, the device measures the pressure of the liquid before it enters the venturi tube and as it exits the constricted area.



Orifice meter

- In general, orifice meter has the same working principle as venture meter. Venturi meter occupies large spaces and expensive, therefore in some cases orifice meter may be preferred.
- A machined and drilled plate having a hole of diameter D_0 is mounted between two flanges in a pipe of diameter D_1 .



Şekil 3.2-4. *Orifis akış ölçer.*

Example 3.2.1

- A pitot tube is used to measure the air flow in a pipe with a diameter of 600 mm. The temperature of the air is 65.6 °C. The pitot tube is placed at the center of the pipe and the reading Δh on the manometer is 10.7 mm of water. If the pitot tube coefficient is 0.98, calculate the velocity at the center.

Example 3.2.2

- An orifice having a diameter of 0.0566m is installed in a 0.1541 m pipe, through which oil having a density of 878 kg/m^3 and a viscosity of 4.1 cp is flowing. The measured pressure difference across the orifice is 93.2 kN/m^2, calculate the volumetric flow rate (m^3/s). Assume that $C_0 = 0.61$.