Chapter 2

Introduction

Any characteristic of a system is called a **property**

- intensive properties: independent of the mass of the system
- extensive properties: depend on the the size of the system

2-1 Density and Specific Gravity

$$\rho = \frac{m}{V}$$

$$\mathrm{SG} = \frac{\rho}{\rho_{H_2O}}$$

and we could find the density of the ideal gas by the following equation

$$PV = mRT$$

2-2 Vapor Pressure and Cavitation

the **collapse of cavities** of vapor in a liquid

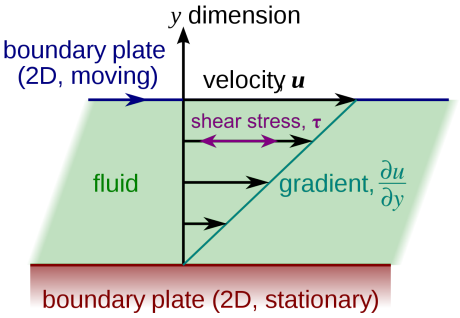
- $P_{\text{local}} > P_v$: safe
- $P_{\text{local}} \leq P_v$: risk of cavitation

> is a violent process which can damage machinery and can cause structural vibrations

2-3 Viscosity

Definition

A property that represents the internal resistance of a fluid to motion



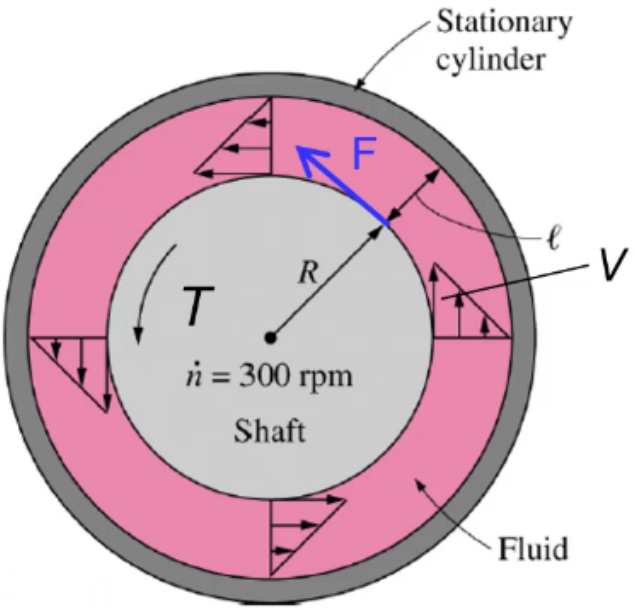
$$\tau = \mu \frac{\mathrm{d}u}{\mathrm{d}y}$$

and the shear force acting on the fluid layer is

$$F = \tau A = \mu A \frac{\mathrm{d}u}{\mathrm{d}y} = \mu A \frac{V}{l}$$

where the upper plate is at a constant speed while the lower plate remains **stationary**

Example - Cylindrical



Find the torque

$$\begin{aligned} T &= F \cdot R \\ &= \mu A \frac{V}{l} \cdot R \\ &= \mu \cdot 2\pi RL \cdot \frac{2\pi \dot{n} \cdot R}{l} \cdot R \\ &= \mu \frac{4\pi^2 R^3 \dot{n} L}{l} \end{aligned}$$