

Chapter 1

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Introduction

Stress

Stress is defined as the force per unit area

Normal Stress

$$\sigma = \frac{dF_n}{dA}$$

In a fluid at rest, the **normal stress** is called **pressure P**

Tangential Stress

$$\tau = \frac{dF_t}{dA}$$

Fluid

A substance in the **liquid** or **gas** phase is referred to as a **fluid**

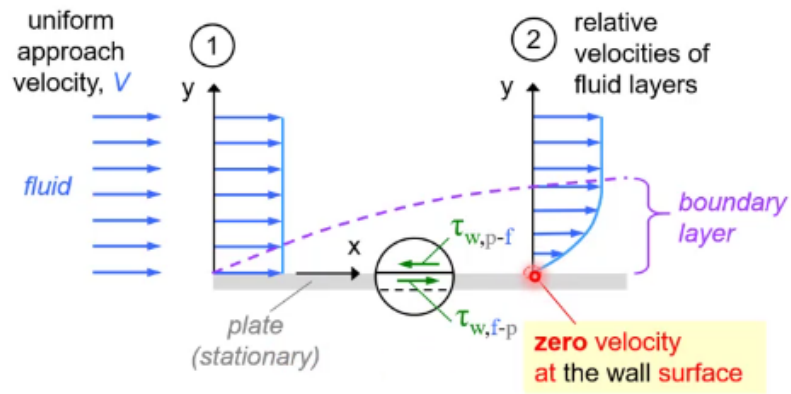
A fluid **deforms continuously** under the influence of a shear stress, no matter how small and approaches a certain rate of strain

1-1 The No-Slip Condition

Definition

A fluid in direct contact with a solid "sticks" to the surface due to viscous effects

The fluid property responsible for the no-slip condition and the development of the boundary layer is **viscosity**



1-2 System and Control Volume

Definition

A **system** is defined as a quantity of matter or a region in space chosen for study

The mass or region outside the system is called the **surroundings**

The real or imaginary surface that separates the system from its surroundings is called the **boundary**

Classifications

Closed System

a system consists of a fixed amount of mass and no mass can cross its boundary

Open System

a system where both mass and energy can cross the boundary of a control volume