AEM 250 Mechanics of Materials

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I. Introduction

A. Course Introduction

Mechanics of Materials

- engineering materials: steel, glass, concrete
- study of how objects respond to load

In this class we will study useful engineering relationships between loads on structures & its deformation.

In general we will have

Basic Math → Concepts → Restrictions → Design Formula → Design Structures — Machine Design, aircraft structures, steel structures

AEM 250

To get the most out of class:

- read the book before class
- think about concepts on your own
- understand the homework

B. Concept of Stress

Stress is the <u>intensity of force</u>.

$$\frac{\text{FORCE}}{\text{AREA}} = \text{stress}$$

1. units of stress

Force	AREA	STRESS	
lb	in^2	lb/in^2	psi
N	m^2	N/m^2	Pa (Pascal)

Powers of 10^3

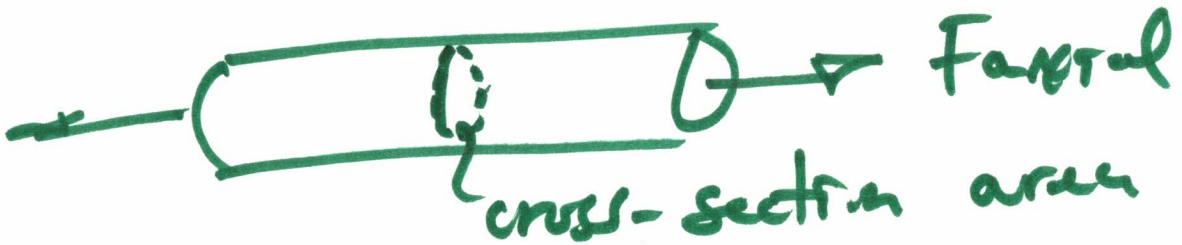
Pa		
KPa	10^3	Pa
MPa	10^6	Pa
GPa	10^9	Pa

mm	10^{-3}	milli meters
μm	10^{-6}	micro meters

ENG: 54.0×10^3

SCI: 5.4×10^4

2. Axial Normal Stress



$$\sigma_{axial} = \frac{F_{axial}}{A_{cross\text{-}section}}$$

(Free body diagram of 2-force member)

Sign convention


+σ (tension)


−σ (compression)

Steel bar $\sigma_{break} = 80\ ksi = 80\ kpsi$

diameter = 0.25 in

How much force can it hold?

$$\sigma = \frac{F}{A} = 80 \times 10^3 \frac{lb}{in^2} = \frac{F_{break}}{\pi/4\,(0.25)^2\,in^2}$$

$$F_{break} = 3930\ lbs$$