1.050 Engineering Mechanics

Lecture 10:

Strength models

1D examples – truss structures

1.050 – Content overview

I. Dimensional analysis
1. On monsters, mice and mushrooms
2. Similarity relations: Important engineering tools

II. Stresses and strength
2. Stresses and equilibrium
3. Strength models (how to design structures, foundations.. against mechanical failure)

III. Deformation and strain
4. How strain gages work?
5. How to measure deformation in a 3D structure/material?

IV. Elasticity
5. Elasticity model – link stresses and deformation
6. Variational methods in elasticity

V. How things fail – and how to avoid it
7. Elastic instabilities
8. Plasticity (permanent deformation)
9. Fracture mechanics

1.050 – Content overview

I. Dimensional analysis

II. Stresses and strength

III. Deformation and strain

IV. Elasticity

V. How things fail – and how to avoid it

Quiz I

Covers first 15 lectures

QUIZ I:
Dimensional analysis, stresses and strength

Monday October 15 in class

Start to prepare early!

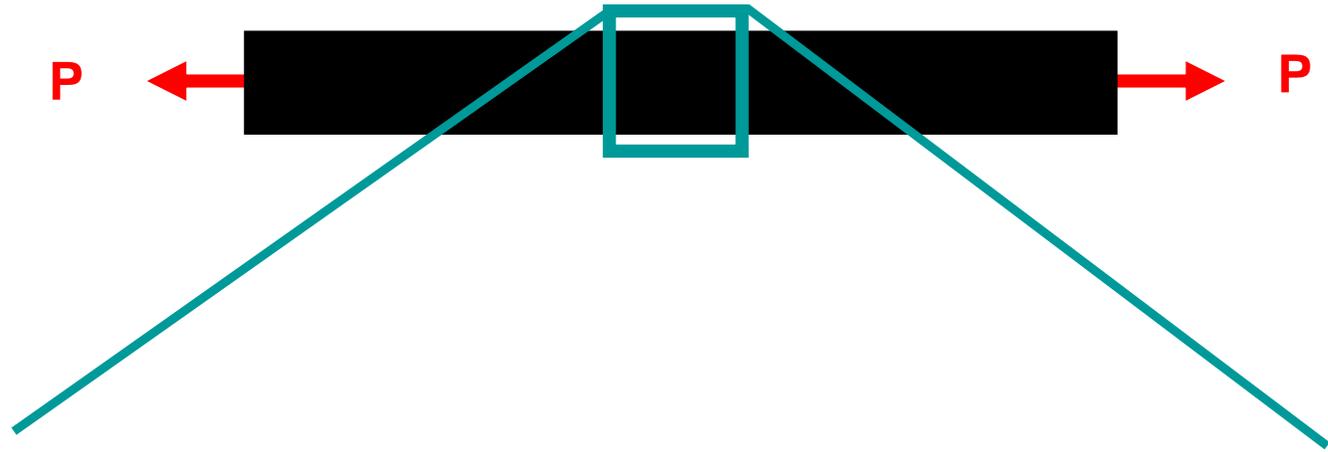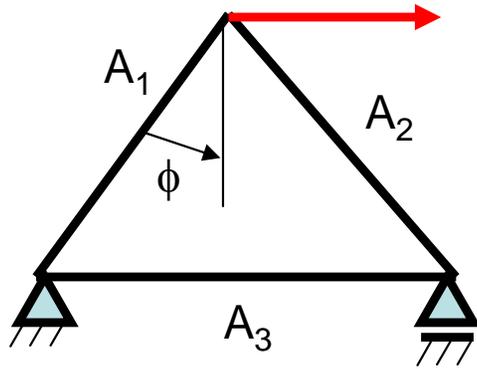P $\longleftarrow$ P $\longrightarrow$

Image of crack propagation removed due to copyright restrictions.
See Figure 3 in: Buehler, Markus, et al. "Threshold Crack Speed Controls
Dynamical Fracture of Silicon Single Crystals." *Physical Review Letters* 99
(2007): 165502.

Surface
roughness

A_1

A_2

ϕ

A_3

$A_1/A_3=2$ same strength σ_0

Robustness ratio gamma_1/gamma_3

Angle phi