

ARCH 314 STRUCTURE I

RECITATION SESSION 7
FACULTY: Prof. Peter Von Buelow
GSI: Faezeh Choobkar
FALL 2025

Welcome to recitation session

Introduction:

Faezeh Choobkar (PhD student)

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Office hours: by appointment

Outline:

Quick Recap

Provide the solution for the assignment

Answering student's questions

Recitation lab

Problem Set

10. Elastic Deformation

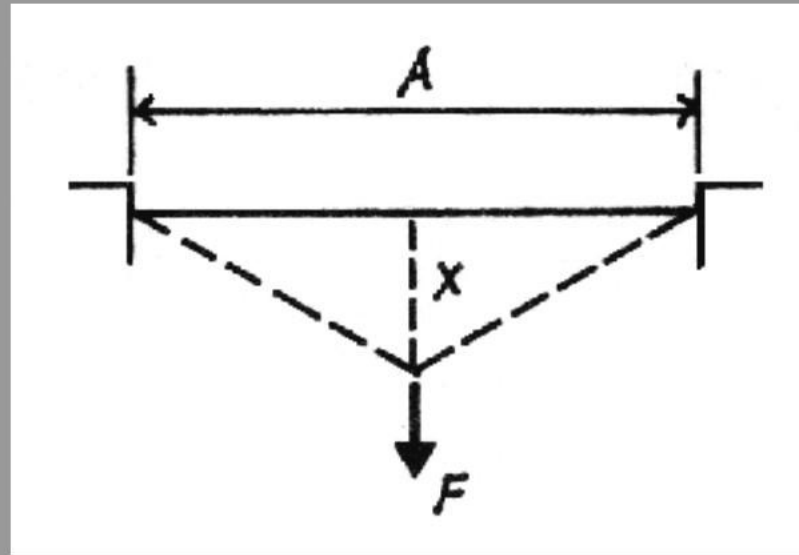
Find the final stretched length of the cable deflected distance x , and the load F needed to cause the deflection. Determine the resulting tensile force in the cable along with the stress and strain.

DATASET: 1

-2-

-3-

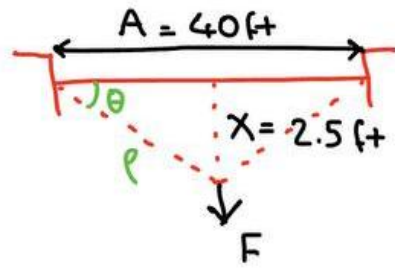
Original Unstretched Length: A	40 FT
Stretched Deflection: x	2.5 FT
Cable Area	0.869565217 IN ²
Young's Modulus: E	23341 KSI



Problem Set

#	Question	Your Response	Correct Answer
1	Full length of cable stretched x feet	<input type="text"/> FT	<input type="button" value="SUBMIT"/>
2	The amount the cable is stretched (deformation)	<input type="text"/> FT	<input type="button" value="SUBMIT"/>
3	Force in the stretched cable	<input type="text"/> KIPS	<input type="button" value="SUBMIT"/>
4	Horizontal component of the force in the cable	<input type="text"/> KIPS	<input type="button" value="SUBMIT"/>
5	Vertical component of the force in the cable	<input type="text"/> KIPS	<input type="button" value="SUBMIT"/>
6	Force F needed to cause the stretch, x, in the cable	<input type="text"/> KIPS	<input type="button" value="SUBMIT"/>
7	Stress in the cable	<input type="text"/> KSI	<input type="button" value="SUBMIT"/>
8	Strain of the cable	<input type="text"/> IN/IN	<input type="button" value="SUBMIT"/>

Problem Set



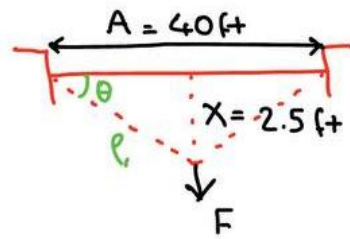
$$l^2 = \left(\frac{A}{2}\right)^2 + x^2$$

$$l^2 = (20)^2 + (2.5)^2 \rightarrow l = 20.15$$

Final length of full cable:

$$2l = 20.15(2) = 40.3$$

Problem Set



Deformation of full cable:

$$D = l' - l = 40.3 - 40 = 0.3$$

Stress and strain:

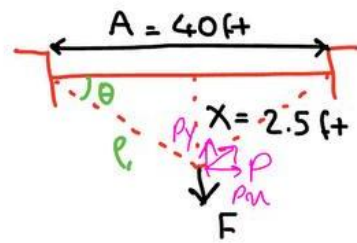
$$\sigma = E \epsilon$$

$$\epsilon = \frac{D}{l} = \frac{0.3}{40} = 0.0075$$

$$E = 23341$$

$$\sigma = (23341)(0.0075) = 179.72 \text{ ksi}$$

$$\sigma = \frac{P}{A} \rightarrow P = \sigma A = 179.72 \times (0.86956527) \\ = 156.28 \text{ kIPS}$$



$$\theta = \text{tg}^{-1} \left(\frac{2.5}{20} \right) \rightarrow \theta = 7.13^\circ$$

$$P_n = P \cos \theta = 156.28 (\cos (7.13)) = 155.07$$

$$P_y = P \sin \theta = 156.28 (\sin (7.13)) = 19.39$$

$$\Sigma F_y = 0$$

$$F = 2P_y = 2(19.39) = 38.79$$

Elasticity

Description

This project uses Hooke's Law to find the elastic modulus of a material.

Goals

- To observe elastic behavior of a material.
- To calculate stress and strain from a physical test.
- To produce a stress vs. strain graph and calculate the E modulus.

Procedure

1. Pin the large graph paper to the wall.
2. Put a clip on each end of the rubber cord hanging it so that the top clip is at the top of the graph paper. Adjust the bottom clip to the edge of a large, dark square. The larger squares are each $\frac{1}{2}$ inch.
3. Measure the length of the cord between the ends by counting the squares.
4. Hang one weight from the cord.
5. Measure the deformation of the cord (the amount it stretches). Each small square is 0.1 inch.
6. Next hang two weights on the chord and measure the total deformation.
7. Finally hang three weights on the chord and measure the total deformation again.
8. Calculate the stress ($f=P/A$) and strain ($\epsilon=D/L$). The area of the $\frac{1}{8}$ "x $\frac{1}{16}$ " cord is 0.007813 in^2 and each washer weighs $\frac{1}{2}$ oz. = 0.03125 lbs.
9. Plot the stress vs. strain.
10. Find the slope of the line to determine the modulus of elasticity, $E = f/\epsilon$.

