The Hashemite University
Faculty Of Engineering
Mechanical Engineering Department

Strain Measurement with Strain Gauges

Student Name: Mohammed Nedal ID # : 1832971

Result and calculations:

Rod material	Steel	**Cross section dimension**	(20 x 4) mm
Length	800 mm	**Distance of W from center**	200 mm
Cross section type	Rectangle	**Ends condition**	Simply supported

Experiment parameters

#	**W1 (N)**	**W2 (N)**	**Channel 1 Reading µ**	**Channel 2 reading µ**	**ϵ lateral**	**ϵ axial**	**Bending moment (M)**	**Stress (σ) Mpa**
1	**0**	**2.5**	**10**	**32**	**5**	**16**	**250**	**4.68**
2	**2.5**	**2.5**	**26**	**86**	**13**	**43**	**500**	**9.37**
3	**2.5**	**5**	**46**	**158**	**23**	**78**	**750**	**14**
4	**5**	**5**	**62**	**188**	**31**	**94**	**1000**	**18.74**
5	**5**	**7.5**	**80**	**260**	**40**	**130**	**1250**	**23.43**
6	**7.5**	**7.5**	**100**	**332**	**50**	**166**	**1500**	**28.12**

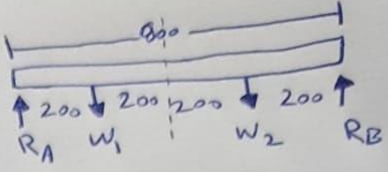
Experiment data and result

Sample of calculation:

الإسم: محمد نضال محمد امين سلمان 1832971

Sample of calculation:~

$\sigma = \frac{P}{A}$ & $\epsilon = \frac{\Delta L}{L_o}$



* we know that the moment of inertia is

$I = \frac{1}{12} b h^3 \Rightarrow \frac{20 * 4^3}{12} \Rightarrow 106.67$

* and we know that
Yields : 350 MPa
W_s : 520 MPa

then:

$M + 200 W_2 = 400 R_B$

$M = 400 R_B - 200 W_2$

$\Sigma F_y = 0,\ \Sigma M_A = 0$

- $\Sigma F_y = 0$

$R_A + R_B = W_1 + W_2$

- $\Sigma M_A = 0$

$200 W_1 + 600 W_2 = 800 R_B$

$R_B = \frac{200 W_1 + 600 W_2}{800}$

Now: we have to find R_B from the table we get that:

when $W_1 = 0$, $W_2 = 2.5$

from the relation $R_B = \frac{200 W_1 + 600 W_2}{800} \Rightarrow R_B = \frac{0 + 600(2.5)}{80}$

$R_B = 1.875$ then we can find the bending moment from the relation

$M = 400 R_B - 200 W_2 \Rightarrow M = (400)(1.875) - (200)(2.5)$

$M = 250$ N.m

finally: from the base relation $\sigma = \frac{Mc}{I}$

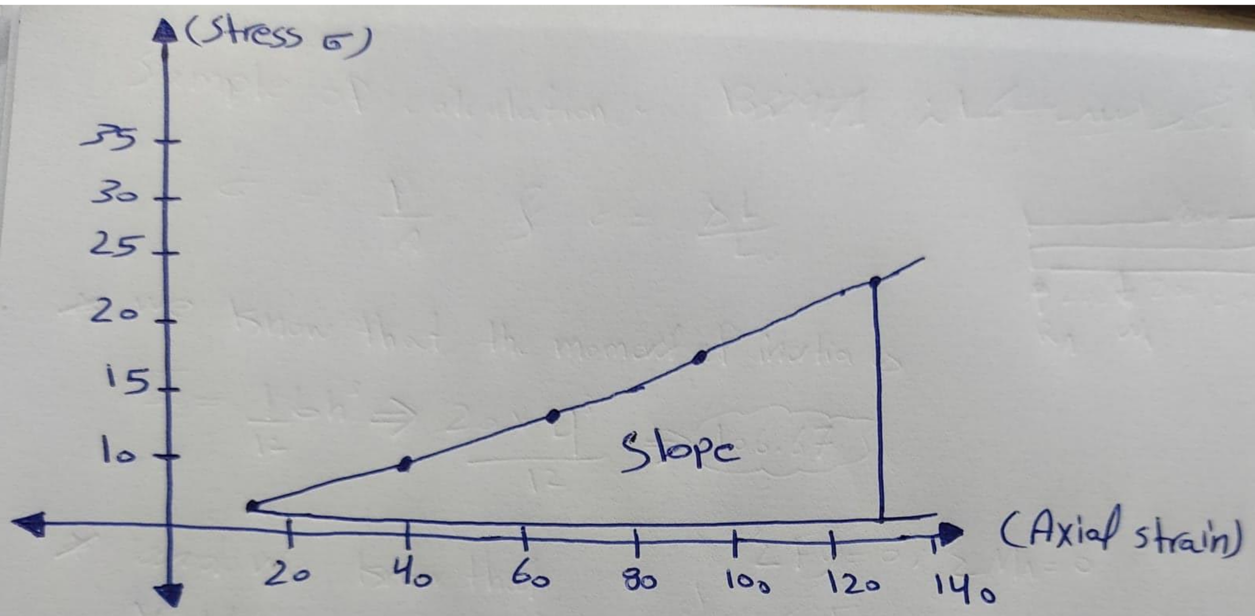
$c = 2$
$I = 106.67$
$M = 250$

$\sigma = \frac{250 * 2}{106.67}$

$\sigma = 4.68$ MPa

#

Plot **σ** versus ϵ_{axial} then find E and compare with theoretical values



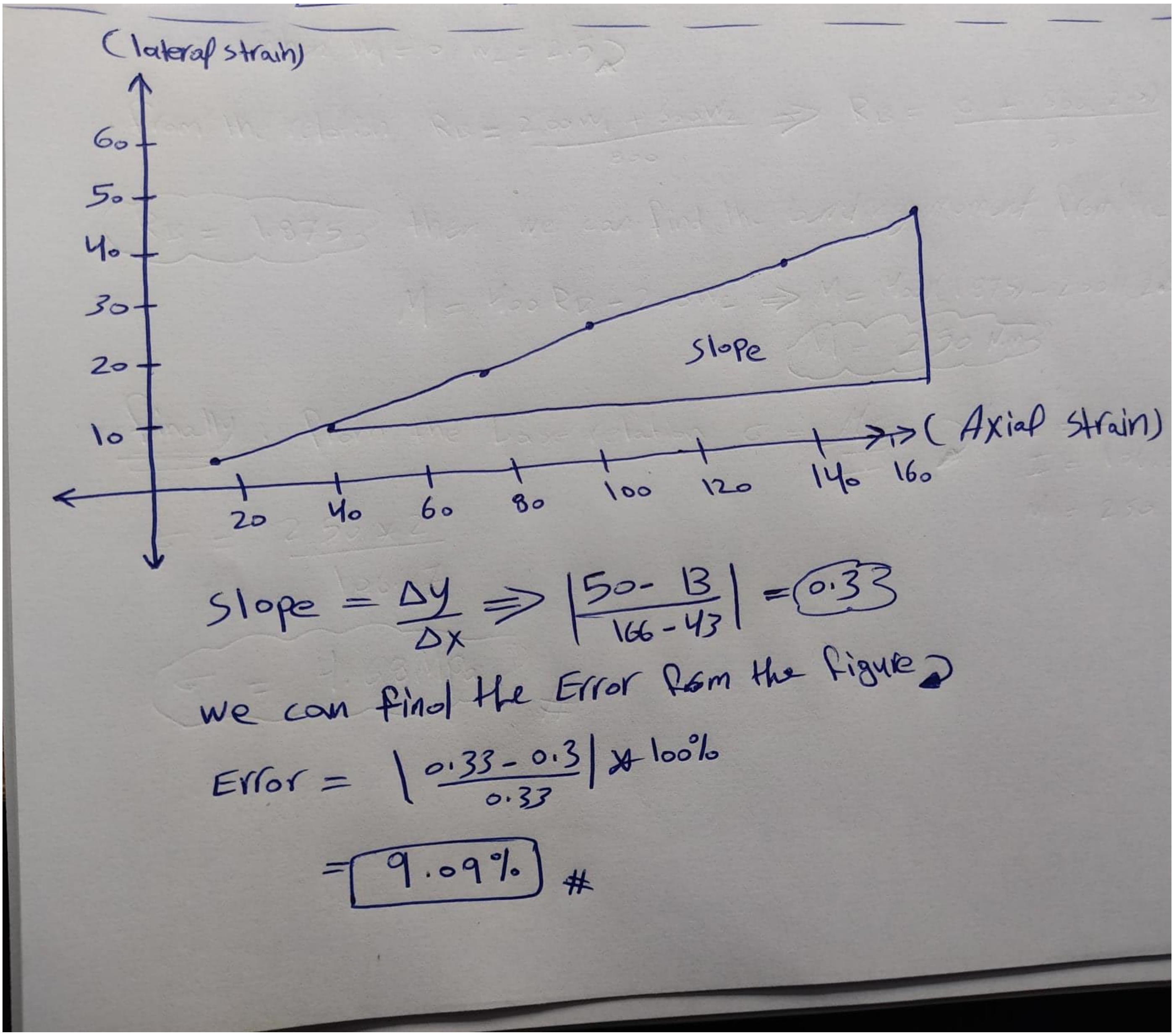
$$\text{Slope} = \frac{\Delta y}{\Delta x} \Rightarrow \frac{23.4 - 4.68}{130 - 16} = 164.2\,m$$

We can find the error from the figure:

$$\text{Error} = \left| \frac{210 - 164}{210} \right| \times 100\%$$

$$= 21.9\%$$ #

Plot ϵ_{axial} versus $\epsilon_{lateral}$ then find **V** and compare with theoretical values



State 3 applications of strain measurement using strain gauges.

1- Measuring strain gauge circuits

2- Cable bridge

3- Rail monitoring

Discussion and conclusion: From our experiment, we can conclude that application of **stress** on the load cell results to a **decrease** in output voltage. A load cell can measure several kinds of force, but load cells in weigh scales nearly constantly measure firmness. In a load cell, the strain gauge is positioned so that when the cell is loaded, the gauge is stressed, varying its resistance. The resistance change per unit of strain is real small, and necessitates sensitive circuitry to measure it precisely. The output voltage never changes linearly with the varying resistance.