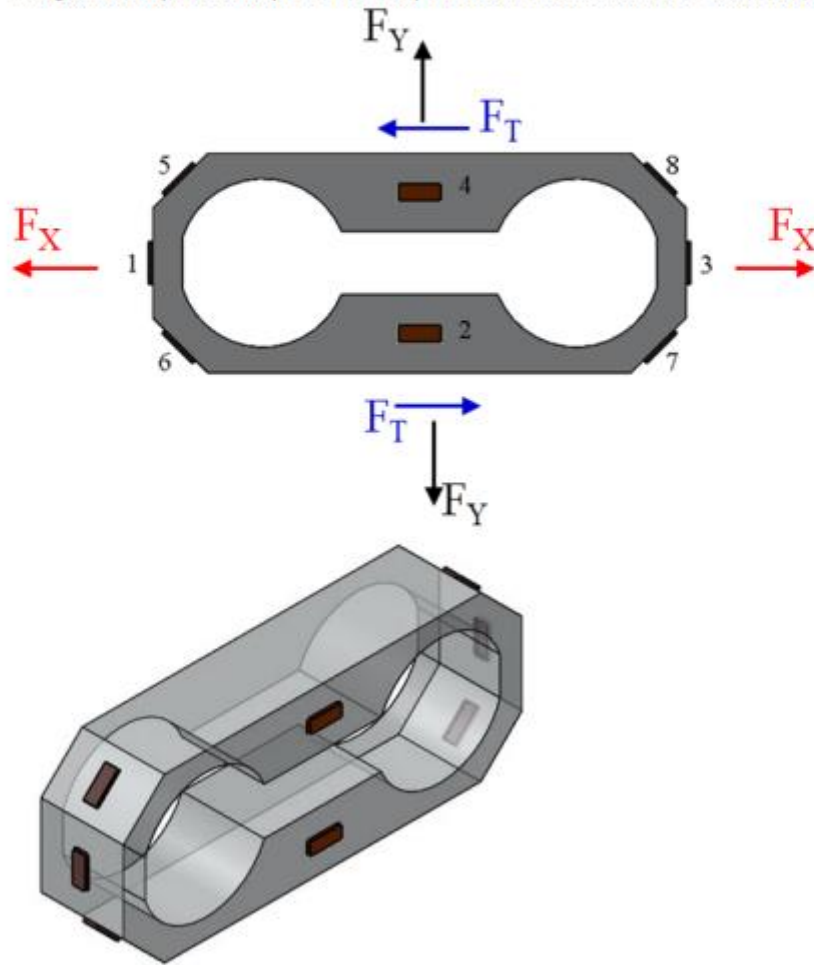




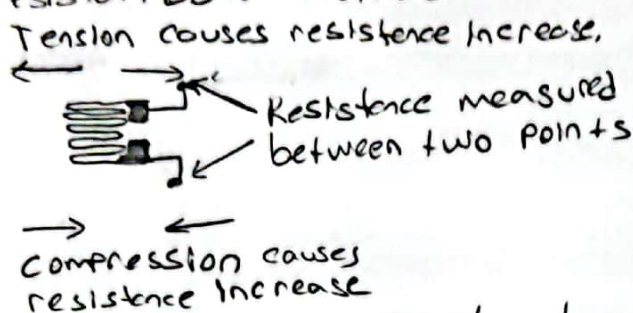
YILDIZ TECHNICAL UNIVERSITY
INDUSTRIAL MEASUREMENT SYSTEMS
MKT 4171
KEMALETTİN KARA 1806A004
HOMEWORK 3
LECTURER: KADIR ERKAN

Problem Set 3

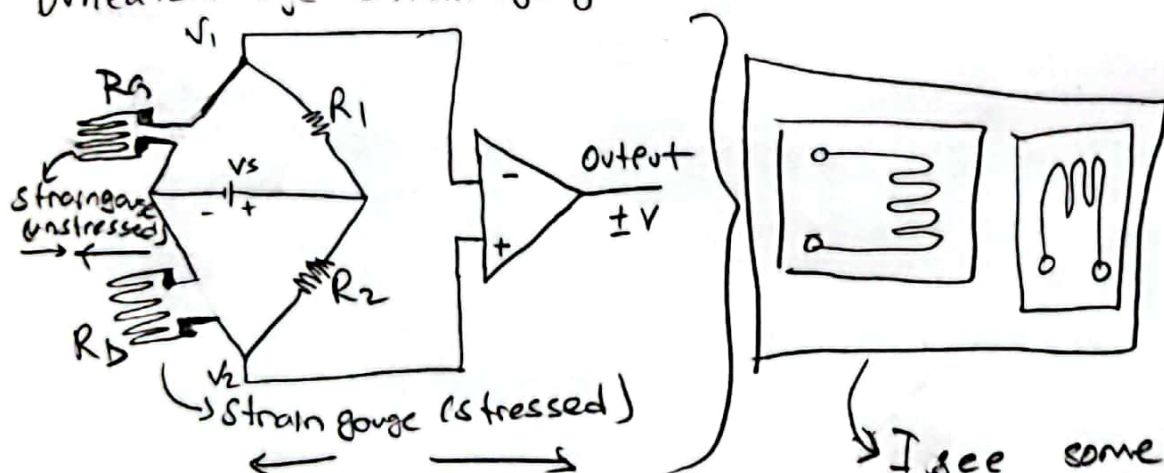
- 1) Consider a general strain measurement tool as shown in the figure below. Show the proper circuits for given strain-gauge configuration below to measure strains under 3 conditions as indicated (F_X , F_Y and F_T cases, separately applied, not at the same time) considering the temperature compensation, show the output voltage equations according to the circuits you design, and explain how you do the experiments to measure the strains on this part.



⊛ According to my research; In strain gauge, strain measurement Piezoresistor, LDR method is used.

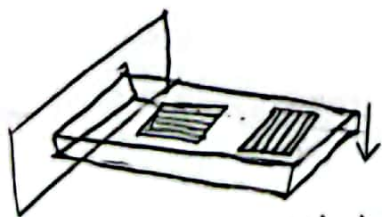


And many Bridge circuit's design can be used. I will use Wheatstone strain gauge circuit with completion Half-bridge.



I see some research gauge positioned like that and There are so much position for Strain gauge.

End This system will be used In my design because other ones for only bending strain only!



strain gauge will be replaced like that.

⊛ When metallic conductor is strained, electrical resistance will change and this resistance change with strain This called GAGE FACTOR.

GF.
$$GF = \frac{\Delta R/R}{\Delta L/L} = \frac{\Delta R/R}{E \rightarrow \text{strain.}}$$

And Sensitivity K_t will be $K_t = \frac{GF(\text{Transverse})}{GF(\text{Longitudinal})}$

For Circuit

$$V_1 = \frac{V_s R_1}{R_1 + R_2} \quad V_2 = \frac{V_s R_3}{R_3 + R_4} \rightarrow \Delta V = V_s \frac{(R_1 R_4 - R_2 R_3)}{(R_1 + R_2) \cdot (R_3 + R_4)} \quad (2)$$

These formulas for unbalanced strain gauge

If the strain gauge balanced; Bridge's resistors have the same value and $R + \Delta R$

$$\Delta V = V_s \cdot \frac{\Delta R}{4R + 2\Delta R} \rightarrow \Delta R \approx \frac{4R \Delta V}{V_s} \quad (3)$$

From first equation $\epsilon = \frac{\Delta R / R}{GF}$

→ According to my research for homework. GF is given from manufacturer.

Example

$$R = 60 \Omega \text{ and } GF = 4$$

$$\Delta R = \frac{240 \Delta V}{V_s} \text{ and } \epsilon = \frac{\Delta R / 60}{4}$$

Using these circuits and formulas we can calculate F_x, F_y, F_z For each because there are strain gauge

According to manufacturer research Ni Engineer Ambitiously company's Datas.

References For Homework 3

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