

Evaluation of Single Strain Gauges and Double Strain Gauges.

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Abstract - This paper describe about the evaluation between single strain gauges and double strain gauges. Besides that, to compare the accuracy between 5mm types of strain gauges and 8mm of strain gauges. The accuracy between single strain gauges and double strain gauges also was compared .Its will cover the design of the measurement circuit. The first important component of this work is the measurement circuit. It is design based on Wheatstone Bridge and amplifier. 2 types of strain gauges were selected, 5mm aluminum types and 8mm aluminum types .Micrometer transducer was used in this project

Keyword- strain gauges, Wheatstone bridge circuit, Operational Amplifier

1.0 INTRODUCTION

The strain gauges has been use for many years. The majority of strain gauges are foil types, available in a wide choice of shapes and size to suit a variety of application [1]. The strain gauge is connected into a Wheatstone Bridge with a combination of four active gauge, two gauges or commonly a single strain gauges [2]. There are many types of strain gauges, but each types has different accuracy and stability. So, for the best way to choose the strain gauges is test the strain gauge using micrometer transducer. But, before test the strain gauges, one important thing is to design the circuit, so that the strain gauges suit with circuit. Therefore, the main objective of this project is to prove that double strain gauge more accurate and stable compare to single strain gauges. Besides that, the other objective is to study the characteristics of strain gauges. In this experiment, it just consist two types of strain gauge, 8mm aluminum and 5mm aluminum strain gauges. Nowadays, it has many types of strain gauges, one of types of strain gauges is mild steel foil strain gauge 2mm and Aluminum foil strain gauges 2mm.

The Wheatstone bridge circuit had been widely used in various application, especially in measuring electrical values such as resistance. Wheatstone Bridge circuit is chosen because it is a well established technique for measuring high precision resistance measurement. Figure 1 shows the Wheatstone bridge circuit.

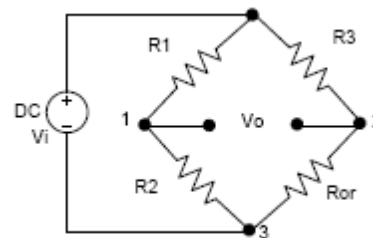


Figure 1 : Wheatstone Bridge Circuit.

Figure 2 and 3 shows that two types of strain gauges 5mm and 8mm.



Figure 2 : 5mm of Strain Gauges



Figure 3 : 8mm of strain gauges

2.0 METHODOLOGY

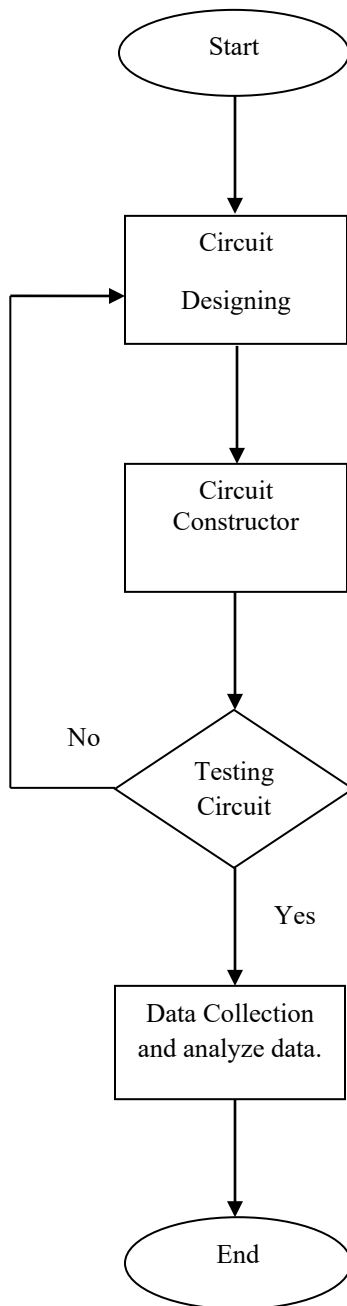


Figure 4 shows the flow process taken in this project.

In this project, 2 types of strain gauges were selected, 5mm aluminum types and 8mm aluminum types. In this project, 2 experiments were conducted, single strain gauge and double single. Micrometer transducer was used in this project. The data for 5mm single strain gauges and 8mm double strain gauge was compared. Besides that, the data between single strain and double strain gauges was compared.

STRAIN GAUGES

The strain gauge sensor is connected to a simple circuit which consists Wheatstone bridge, resistor, DC supply and operational amplifier. Figure 5 shows the schematic circuit used in this experiment:

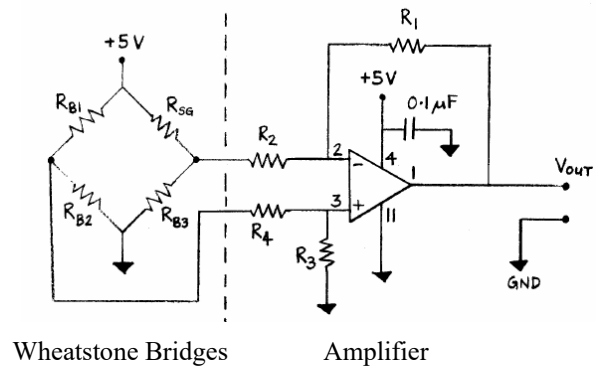


Figure 5 : The Measurement of Circuit.

This circuit consists 2 parts which are 1 part is Wheatstone Bridges and another part is amplifier. The voltage output from the Wheatstone Bridges is amplified by 741 operational amplifier. R_1 and R_3 are the same value which is the both value that resistor is 1 M and R_2 and R_4 also same value which is that value is 10k. So the gain R_1 over r_2 is 100.

R_{sg} of the Wheatstone bridge arm is replaced by strain gauge sensor. During period of measurement, the data were taken in two ways, toward and backward. The data for 5mm single strain were taken five times to get the result more accurate.

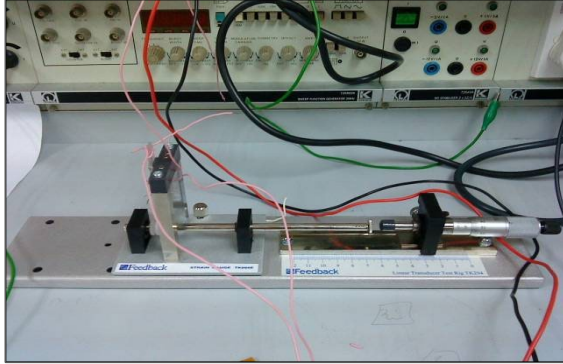


Figure 6 : Micrometer transducer

3.0 RESULTS AND DISCUSSIONS

Single Strain Gauges (5mm)

Distance (mm)	Output (v)
0.00	0.633068
0.25	0.632322
0.50	0.629040
0.75	0.627858
1.00	0.624588
1.25	0.623272
1.50	0.620546
1.75	0.619420
2.00	0.616916
2.25	0.615768
2.50	0.613088
2.75	0.611856
3.00	0.609264

Table 1 : Single Strain Gauges (5mm)

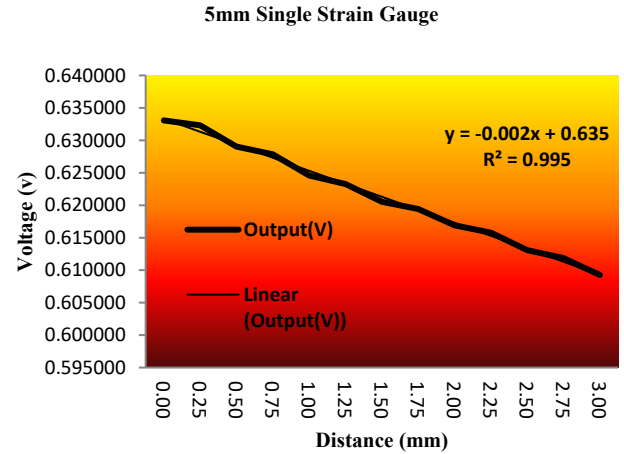


Figure 7: 5mm Single Strain Gauges

Single Strain Gauges (8mm)

Distance (mm)	Output (v)
0.00	2.73738
0.25	2.72277
0.50	2.69719
0.75	2.63093
1.00	2.60661
1.25	2.58771
1.50	2.58500
1.75	2.57389
2.00	2.53300
2.25	2.52458
2.50	2.51148
2.75	2.49017
3.00	2.47702

Table 2 : Single Strain Gauges (8mm)

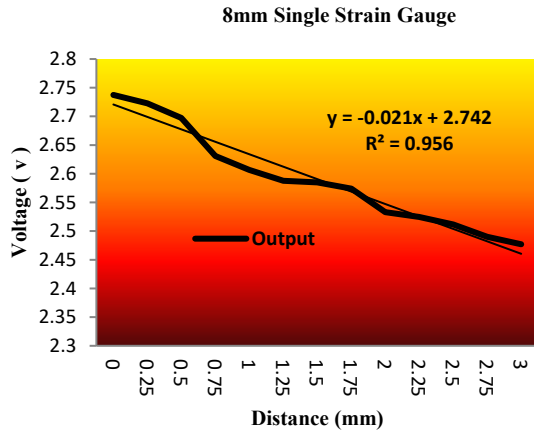


Figure 8 : 8mm Single Strain Gauges

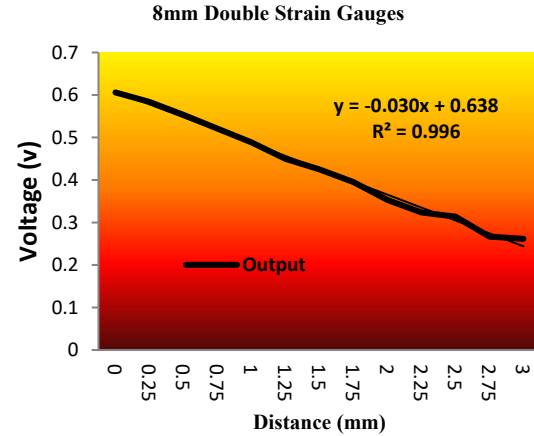


Figure 9: 8mm Double Strain Gauges

Double Strain Gauges (8mm)

Distance (mm)	Output
0	0.60601
0.25	0.583731
0.5	0.553175
0.75	0.520911
1	0.488509
1.25	0.449787
1.5	0.424815
1.75	0.394962
2	0.352853
2.25	0.323466
2.5	0.313636
2.75	0.266937
3	0.261579

Table 3: 8mm Double Strain Gauges

From the figure 7, it shows that the output voltage using 5mm single strain gauge. From the graph, the linearity using this types of strain gauges is 0.995. The distance was measured start from 0 mm until 3mm. The distance was measured for forward distance. This graph also shows the maximum output voltage is 0.633068 v and the minimum output voltage is 0.609264 v. The data were taken 5 times and the graph above is the average of 5 times data were taken.

From the figure 8, it shows that the output voltage using 8mm single strain gauges. From the graph, the linearity using this types of strain gauges is 0.956. The distance was measured same as using 5mm single strain gauges. This graph also shows the maximum output voltage is 2.73738 v and the minimum output voltage is 2.47702 v. The data also were taken 5 times and the graph above is the average of 5 times data were taken same as using 5mm single strain gauges.

From the figure 9, it shows that the output voltage using 8mm double strain gauges. From the graph, the linearity using this types of strain gauges is 0.996. The distance was measured same as using the other types before. This graph also shows the maximum output voltage is 0.60601 v and the minimum voltage is 0.261579 v. The data also were taken 5 times and the graph above is the average of 5 times data were taken same as using 5mm single strain gauges.

4.0 CONCLUSIONS

From the experiment, it can be concludes that double strain gauges better than single strain gauges. It's because double strain gauges more linear and more stable. However ,when compared between 5mm of single strain gauges and 8mm of single strain gauges,5mm single strain gauges types more accurate .It's because the measurement of output voltage more linear compared 8mm single strain gauges.

Different types of strain gauges has different accuracy .So, types of strain gauges is one important thing and should be consider when doing the project. Besides that, it can know more details about the characteristics of strain gauges and how the strain gauges works.

5.0 FUTURE WORKS

Strain gauges one of the most popular sensor have been used. So, its recommended that to apply the strain gauge with other experiment. For example, to measure the water content in stem using the different types of strain gauges.

6.0 REFERENCES

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