**EXPERIMENTAL RESULTS**

**1. Thin Cylinder with Open Ends**

**a. The stress relationship**

- The data table calculates the hoop stress for each pressure reading. Select one pressure reading (other than zero) and check the calculation of stress using the equations given in the previous section and the data on the front panel of the SM1007.

- From your examination of the positioning of the strain gauges you will have noticed that gauges 1 and 6 have been placed so that they are measuring the hoop strain in the cylinder. Examine the results for gauges 1 and 6, what can you say about the magnitude of the hoop strain as you move along the axis of the cylinder?

- Plot a graph of Average Hoop Stress versus Hoop Strain and find a value of the Young's Modulus for the cylinder material from the graph.

**b. The Ratio of Hoop Strain to Longitudinal Strain in an Open Cylinder**

Plot a graph of the Longitudinal Strain Versus Average Hoop Strain and find gradient of the graph (magnitude of the gradient/slope is called Poisson's ratio, $\nu$).

**2. Thin Cylinder with Closed Ends**

Calculate theoretical principle strains with a pressure 3 MPa, a Poisson's ratio, $\nu = 0.33$ and a Young's Modulus E = 70 MPa.

**3. Thick cylinder**

In all calculations the following values for Young's Modulus and Poisson's ratio are used:

$E = 73.1$ GPa $\quad\quad \nu = 0.33$

a. Outlines the method for calculating the theoretical strain values from the theory outlined earlier. Calculate the values for $\varepsilon_H$ and $\varepsilon_R$ and tabulate them along with the measured values in table below.

b. Plot the two (experimental & theoretical) strain distributions.

c. Outlines the method for calculating the theoretical stress values and also the method of calculating the derived stress values from the measured strains. Tabulate the two set of value for $\sigma_H$ and $\sigma_R$ in a table below.

d. Plot the two (experimental & theoretical) stress distributions.

**DISCUSSION** (N.B. This part of the report must at least describe or discuss the following, but not necessarily limited to those ideas. This must be done in the paragraphs format rather than the points form format)

- Explain and discuss the main results and observations obtained in this work and explain any discrepancies observed.

- In experiment 1, the Young's Modulus varies from material to material but is a constant for each material, so as long as it has uniform properties (homogenous and isotropic). For the aluminum alloy used for the thin cylinder, the Young's Modulus is nominally 70 GPa. Does the value of Young's Modulus from your graph agree with the theoretical value stated? If there is discrepancy between the values, then name any sources of error that may be present.

- In thin cylinder analysis (open ends), the thin cylinder is manufactured from an aluminum alloy that has a Poisson's ratio of 0.33. Compare this to the gradient of your graph and give your comment about the differences.

**CONCLUSION**

Give your conclusion and summary of this experimental work. State whether its main objectives have been achieved or not.

**QUESTIONS**

1. Steel is approximately three times stiffer than aluminum having a Young's Modulus of 210 GPa. If the cylinder had been made of steel would the measured strain be higher or lower for the same stress? Justify your answer.

2. In experiment 1, there is no direct longitudinal strain ($\varepsilon_L$) in the open ends conditions. However, the gauge, which measures the longitudinal strain, does not register zero reading. Explain this phenomenon and give your reason why it happened.

3. Give two examples for each category of pressure vessels in industry that you could consider as the thin and thick cylinders.