Section \_\_\_\_\_\_ Group # \_\_\_\_\_\_

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1. After completing the experiment and filling out the data sheet, enter data from Data Sheet into Position and Strain columns of Table I. Calculate Experimental Stresses at the five strain gage locations. Include a sample hand calculation for Experimental Stress in the space provided below.

|  |  |  |  |
| --- | --- | --- | --- |
| Gage | Position, y (in) (measured from centroid, from data sheet) | Strain (**x10-6 in/in**) (“Change in Strain” from Data Sheet) | Experimental Stress (psi)$$σ\_{exp}=ε\_{exp}E$$ |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |

Table : Experimental Data

Equation 1: Uniaxial Hooke’s Law Hand Calculation

1. Plot Stress vs. Gage Position in Excel. Add a linear trendline and write the trendline equation in the space provided below:

**Excel Trendline Equation for Exp. Stress as a function of Position from Centroid:**

|  |  |
| --- | --- |
| $$σ\_{exp}=m\_{exp}y+b\_{exp}$$ |  |

1. Using the trendline from step 2, calculate the experimental position of the neutral axis, experimental maximum compressive stress, and experimental tensile compressive stress. Include a sample hand calculation for “Equation 2: Experimental Position of the Neutral Axis” in the space provided below

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|  |  |
| --- | --- |
| Experimental Position of Neutral Axis (at σexp=0) |  |
| Experimental Maximum Compressive Stress (at y = -h/2) |  |
| Experimental Maximum Tensile Stress (at y = +h/2) |  |

Equation 2: Experimental Neutral Axis Hand Calculation

1. Find the theoretical stress vs. position equation using Equation 3. You should have stress as a function of y. Plot this equation on the same graph you created in step 2 and use a different line type to differentiate lines for the theoretical and experimental data. Include your hand calculation for Equation 3 in the space below.

Equation 3: Theoretical Stress vs. Position Equation Hand Calculation

Write the final theoretical stress vs. position equation in the space below.

**Theoretical Equation for Theoretical Stress as a function of Position from Centroid:**

|  |  |
| --- | --- |
| $$σ\_{theo}=m\_{theo}y+b\_{theo}$$ |  |

1. Using the equation from step 4, calculate the theoretical position of the neutral axis, theoretical maximum compressive stress, and theoretical tensile compressive stress.

|  |  |
| --- | --- |
| Theoretical Position of Neutral Axis (at σtheo=0) |  |
| Theoretical Maximum Compressive Stress (at y = -h/2) |  |
| Theoretical Maximum Tensile Stress (at y = +h/2) |  |

1. Summarize your results in Table II:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Experimental Results** | **Theoretical Values** | **Percent Error** |
| **Neutral Axis Location (measured from centroid, in)** |  |  |  |
| **Maximum Compressive Stress (psi)** |  |  |  |
| **Maximum Tensile Stress (psi)**  |  |  |  |

Table : Summary of Results

In the space below, briefly discuss how well your experimental results match the theory. Also, give reasons for any large differences between the theory and your results. Turn in this worksheet with your data sheet and Excel plot attached.

**Equations**

|  |  |
| --- | --- |
| (1) Uniaxial Hooke’s Law$$σ\_{i}=Eε\_{i}$$σi = stress at gage i location, psiE = modulus of elasticity, psiεi = axial strain on gage i, in/in | (2) Experimental Neutral Axis$$y\_{NA, exp}=\frac{-b\_{exp}}{m\_{exp}}$$yNA, exp = location of exp. NA, inbexp = y-intercept from trendline, psimexp = slope from trendline, psi/in |
| (3) Theoretical Stress vs. Position$$σ\_{theo}=\left(\frac{Pe}{I\_{c}}\right)y-\frac{P}{A}=m\_{theo}y+b\_{theo}$$σtheo = theoretical stress, psiP = applied load (change in load), lbe = offset distance, iny = position from centroid, inA = cross sectional area, in2Ic = moment of inertia about centroid, in4mtheo = slope of theoretical line, psi/inbtheo = intercept of theoretical line, psi |  |