Experimental Stress Analysis

Assignment # 1

Review of Solid Mechanics

1. In a two dimensional problem without resorting to the Mohr's circle approach, how would you find the principal stresses and their corresponding directions uniquely?

2. The stress tensor with respect to x, y, z axes is given as $[\tau]$. If the x and y axes are given a rotation θ_z, determine the stress tensor in the new transformed co-ordinate system x', y' and z'.

3. What is the mathematical definition of a free surface? Specify the stress tensor on free outward corners. Justify your answer.

4. Draw the BMD and SFD of a three point bend specimen. Sketch the variation of normal stress and shear stress distribution across a general cross-section as specified by the engineering theory of beams. Mention the procedure for solving the problem using theory of elasticity. Compare the two solutions for shear stress distribution along a line very close to the central load.

5. (a). Derive the compatibility conditions in terms of stress components for plane stress and plane strain problem. Comment on the influence of elastic constants.

   (b). Write down the Beltrami-Mitchell equations of equilibrium. Comment on the influence of elastic constants.
