Bike Crank (Part 2) - Exercises

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Exercises

1. Consider a strain gauge of length 0.083-inches and width 0.063-inches mounted on the front face of the crank. The distance of the gauge center from the middle of the support hole is 2.448 inches in the x direction. Also, the gauge center is 0.270-inches above the x-axis (which is also the neutral axis). The long side of the gauge is along the x-direction.

(a) Using Euler-Bernoulli beam theory, calculate the strain value at the center of the gauge. The gauge measures the strain along its length (which is the x-direction in this case).

(b) Using ANSYS, calculate the strain value you would expect from this gauge using one surface element to model the gauge. Refine your mesh for the bike crank until you obtain a value that is reasonably independent of the mesh. Include details of your calculations and a snapshot of your crank geometry with the strain gauge added. Show enough work so that a reader can tell how you arrived at the values you obtained.

Digital image correlation (DIC) technology was used to experimentally determine the strain distribution on the crank face on which the gauge is mounted. At the location of your strain gauge, this experimental method found the normal strain in the x-direction to equal 918 × 106.

Present a table comparing the ANSYS strain values you obtained on the different meshes, the expected value from beam theory and the measured value from DIC. How well do these compare?

2. Redo part 1 but with your strain gauge rotated 45 degrees clockwise from the x-direction. The location of the gauge center is unchanged from part 2 above. Compare your result with Beam theory only. How well do the ANSYS and Beam theory results compare?

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