LARGE DEFLECTION ANALYSIS OF CANTILEVER BEAMS WITH AN OPENING

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Numerical solutions have been obtained for analyzing the elastic deflection and stresses of a cantilever beam with a variable cross-sectional area. The variable cross-section was due to a circular, an elliptical and a square opening/hole/slot having the same cross- sectional area placed at different positions of the beam's span. An extensive numerical simulation was carried out using both the small and large deflection theories to calculate the stresses and the deflections of the same beam. A computer code in "*C*" has been developed using the Runge-Kutta technique for the purpose of simulation. The position of the opening over the beam's span is found to have significant effect on the beam's response under a tip load. Results show the linear theory fails to account for the change in curvature at high intensity loadings and underestimates the deflections. If same amount of material is removed considering different cross-sectional area (square, circle and ellipse), it is found that the maximum deflection is developed for the circular holes and the square slots, while the circular holes cause to develop the maximum stress. The discrepancy between the linear and nonlinear solutions is the maximum if the hollow section is near the fixed end. Among the three types of openings, the elliptic slots develop the minimum stress and tip deflections.

Key words: geometric nonlinearity, elliptic slot, circular hole, square slot, slot positions.

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