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Stress Analysis of Tubular Bonded Joints under Torsion and Hygrothermal Effects Using DQM

Authors : Mansour Mohieddin Ghomshei, Reza Shahi

Abstract : Laminated composite tubes with adhesively bonded joints are widely used in aerospace and automotive industries as well as oil and gas industries. In this research, adhesively tubular single lap joints subjected to torsional and hygrothermal loadings are studied using the differential quadrature method (DQM). The analysis is based on the classical shell theory. At first, an approximate closed form solution is developed by omitting the lateral deflections in the connecting tubes. Using the analytical model, the circumferential displacements in tubes and the shear stresses in the interfacing adhesive layer are determined. Then, a numerical formulation is presented using DQM in which the lateral deflections are taken into account. By using the DQM formulation, the circumferential and radial displacements in tubes as well as shear and peel stresses in the adhesive layer are calculated. Results obtained from the proposed DQM solutions are compared well with those of the approximate analytical model and those of some published references. Finally using the DQM model, parametric studies are carried out to investigate the influence of various parameters such as adhesive layer thickness, torsional loading, overlap length, tubes radii, relative humidity, and temperature.

Keywords : adhesively bonded joint, differential quadrature method (DQM), hygrothermal, laminated composite tube
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