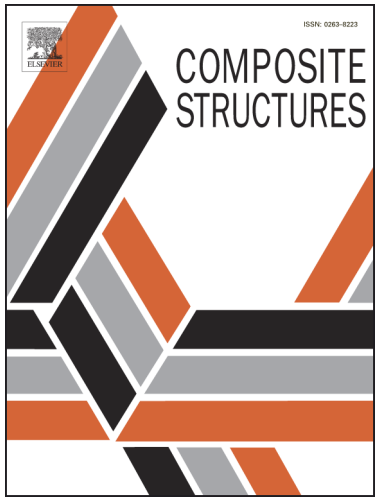

Flexural stiffness of thick walled composite tubes

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Flexural stiffness of thick walled composite tubes

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Abstract:

Composite tubes have been used in many applications such as pipes, robot arms, drive shafts, electrical conduits, printing rollers, tube structures for sports equipment, rocket structures, satellite truss structures, landing gears for helicopters, and structural building members etc. For thin wall tubes made of isotropic materials, the flexural stiffness is usually determined by using strength of material approach with the expression EI, where E is the material modulus and I the cross section inertia. For composite tubes where many layers with different orientations are involved, the situation is more complex. Comparison of the results obtained using strength of materials equation and equation based on elasticity shows a large difference. In order to be sure of the validity of the results, experimental validation is necessary.

This paper presents the experimental work done on the determination of the flexural stiffness of thick composite tubes. Thick composite tubes were manufactured using an automated fiber placement machine. A special test set up was developed to subject the tubes to pure bending. Both strain gages and Digital Image Correlation were used to determine the strains, and subsequently the flexural stiffness. Experimental flexural stiffnesses of the tubes were determined. Results are compared with those calculated using the different equations.

Introduction:

The case of a composite cylinder subjected to bending loading has received attention of many researchers. Several studies have applied the three-dimensional elasticity theories for analysis of