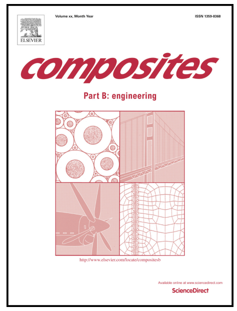

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BUCKLING AND POST-BUCKLING OF FILAMENT WOUND COMPOSITE TUBES UNDER AXIAL COMPRESSION: LINEAR, NONLINEAR, DAMAGE AND EXPERIMENTAL ANALYSES

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Abstract

Identification of the boundary between failure by buckling, collapse and material failure in cylindrical tubes under axial compression is still challenging. The focus of this research is to investigate the response of carbon/epoxy filament wound cylindrical tubes under axial compression. Three approaches have been studied: (i) linear buckling; (ii) nonlinear buckling; and (iii) progressive damage modeling (PDM). For that, analytical, numerical and experimental approaches have been followed. Key results show that thinner tubes fail by buckling followed by a post-buckling field, whereas material failure due to transverse compression and in-plane shear stresses occur for thicker tubes. Both analytical and linear numerical models predicted very well the critical buckling load for all [±α] tubes, and nonlinear buckling model satisfactorily predicted axial displacement over the loading history. For multilayered tubes, the developed damage model provided better predictions compared to the nonlinear buckling model. Furthermore, for thicker tubes, a hoop layer at the outermost, instead of middle or innermost, improves buckling/compressive resistance.

Keywords: buckling; progressive damage; finite element modeling; analytical modeling; composite tube; filament winding.

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