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An analytical model of square CFRP tubes subjected to axial compression

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Abstract

A novel analytical model has been developed to predict the mean crushing force of square carbon fibre reinforced plastic (CFRP) tubes subjected to axial crushing. The model has captured the experimentally observed major energy dissipating mechanisms of CFRP tubes under axial compression, i.e. crack propagation, transverse shearing and friction. Transverse shearing has been taken into account for the first time in this model. Quasi-static compressive tests have been conducted on 16 square CFRP tubes with various side lengths and wall thicknesses to determine their mean crushing forces. The discrepancy between analytically predicted and experimentally measured mean crushing forces of these square CFRP tubes is no more than 7%. Moreover, the proposed analytical model is very simple with only several parameters, which can be determined via relatively simple experimental tests.

Keywords

CFRP tube; Analytical model; Energy absorption; Axial crushing; Mean crushing force.

1. Introduction

Thin-walled tubular structures have been extensively employed as energy absorbers in many applications such as vehicle crash boxes, bumper beams and anti-intrusion beams. Nowadays, composite materials have been widely used in luxury cars. One promising

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