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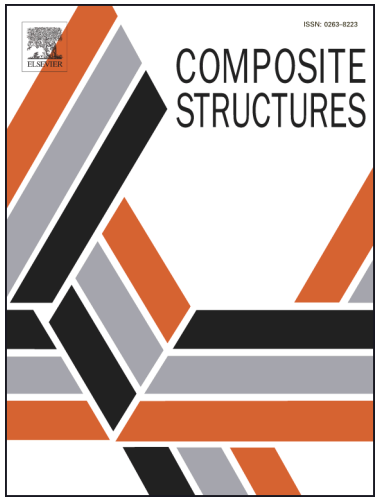

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ACCEPTED MANUSCRIPT

Compression properties of a novel foam-core sandwich cylinder reinforced with stiffeners

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Abstract

To obtain a strong and weight-efficient cylindrical shell, a novel foam-core sandwich cylinder was proposed with glass fibre-reinforced plastic (GFRP) stiffeners inserted between the faces and the foam core. This novel cylinder possessed the advantages of both stiffened cylinders and sandwich cylinders to resist buckling. A cost-effective vacuum-assisted resin infusion (VARI) method was used to manufacture the structure. We performed axial compression tests on two representative samples to investigate the compression strength and failure modes of the novel structure. Thereafter, a theoretical model was developed to predict the collapse strengths associated with three typical failure modes. The analytically predictions showed great agreement with the experimentally observed failure mode and load. Results indicated that, benefitting from the combination advantage of stiffened cylinder and sandwich cylinder, this novel cylinder can resist or postpone various buckling failure, instead failing via face crushing with high strength. Combined with the simplified manufacturing technology, this novel cylinder is a desirable alternative in engineering structures.

Keywords: Sandwich structure; Stiffener; Cylinder; Mechanical testing; Analytical modelling

Introduction

Composite thin-walled cylinders are widely used in structural engineering because of their excellent properties, such as high strength, high stiffness, and low weight

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