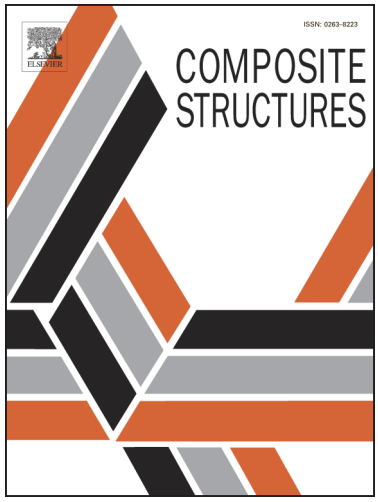

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Experimental and numerical study of strain-rate effects on the IFF fracture angle using a new efficient implementation of Puck's criterion

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Abstract

A new implementation of Puck's 3D Inter-Fibre Fracture criterion for unidirectional reinforced FRP laminates has been developed that improves the criterion in two main areas.

First, a new treatment of strain rate effects on the inter-fibre fracture plane orientation has been included to improve the predictive capability of Puck's criterion outside of the quasi-static loading regime.

Secondly, a series of numerical optimisations have been made in an attempt to eliminate the additional computational cost of the fracture angle search, putting the cost of Puck's criterion on par to much simpler alternatives (e.g. Hashin).

An LS-DYNA user-defined material subroutine using this new implementation was developed and validated against a set of in-house high-rate SHPB tests on HexPly® IM7-8552 off-axis compression specimens at four different orientations, as well as literature data from Koerber et al.

The results showed an improved ability to predict the fracture plane orientation at high strain rates and various benchmarking tests against a Hashin-based model showed only minor differences in computation time.

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