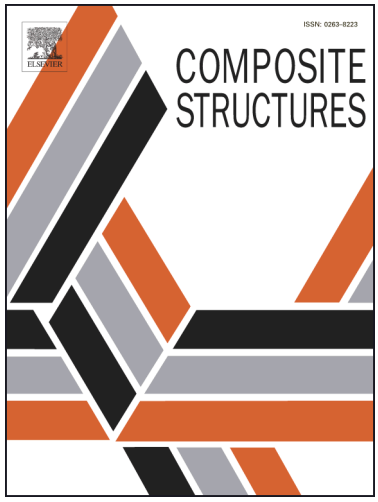

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Hot spot Analysis in complex composite material structures

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Abstract

In this paper, failure initiation in composite structures due to high out-of-plane load components is predicted. The predictions are based on finite element models built with shell elements, intended for global models. The full 3D stress state is estimated through stress recovery by the extended 2D FEM approach. Failure initiation is predicted with state of the art failure criteria for transversely isotropic composite materials. The approach is validated for a range of geometries with different modelling resolutions. Finally, the methodology is verified on a complex composite structure. With the proposed approach, using shell elements, efficient modelling strategies of large structures can be pursued using hot spot analyses to identify critical locations.

Keywords: Carbon fibre composites, Finite Element, Textile, Global-local analysis, Failure initiation

1 Introduction

Carbon fibre reinforced polymers (CFRPs) are becoming increasingly common across applications due to their superior material properties, e.g. specific strength and stiffness [1]. In the past, these fairly exclusive material systems have been used in industries that can accept their cost and more complex design schemes. Development of composite material systems over the past decade have decreased their cost and made it possible to introduce these materials in new industrial applications. To be able to take

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