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Individual fibre segmentation from 3D X-ray computed tomography for characterising the fibre orientation in unidirectional composite materials

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Abstract

The aim of this paper is to characterise the fibre orientation in unidirectional fibre reinforced polymers, namely glass and carbon fibre composites. The compression strength of the composite is related to the orientation of the fibres. Thus the orientation is essential when designing materials for wind turbine blades. The calculation of the fibre orientation distribution is based on segmenting the individual fibres from volumes that have been acquired through X-ray tomography. The segmentation method presented in this study can accurately extract individual fibres from low contrast X-ray scans of composites with high fibre volume fraction. From the individual fibre orientations, it is possible to obtain results which are independent of the scanning quality. The compression strength for both composites is estimated from the average fibre orientations and is found to be of the same order of magnitude as the measured values.

Keywords: A: Polymer-matrix composites (PMCs), B: Strength, D: Non-destructive testing, Misalignment

1. Introduction

The load carrying parts of large wind turbine blades are mainly made of unidirectional (UD) fibre reinforced polymers where the fibres are aligned with the main load

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