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An experimental study of fibre waviness and its effects on compressive properties of unidirectional NCF composites

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Abstract

In this paper a comprehensive experimental study on effects of different fibre waviness characteristics on the compressive properties of unidirectional non-crimp fabrics (NCF) composites is presented. The fibre waviness ranges from periodic to random with medium to large misalignment angles. As expected, fibre waviness is found to strongly impair the compressive mechanical properties of the composite. It is demonstrated that the maximum fibre misalignment alone can be used to accurately predict strength with analytical kinking criteria. Furthermore, there is a direct correlation between waviness and a knock-down factor on stiffness with approximately 5 %/degree mean fibre misalignment angle. Analysis of the extension of the misaligned regions (defects) provides additional evidence that defect extension in the transverse direction is more critical than in the longitudinal direction, supporting earlier theoretical predictions in the open literature.

Keywords: A. Carbon Fibres, A. Fabrics/textiles, D. Microstructural analysis, D. Mechanical testing

1. Introduction

With ever increasing traffic levels, the civil aircraft industry is in constant need of new technologies to make air travel environmentally sustainable [1]. One such technology is lightweight materials for reduced fuel consumption. For example, the amount of carbon fibre reinforced composites (CFRP) in the Airbus A350XWB is 53 % by weight [2], mainly in its fuselage and wings.

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