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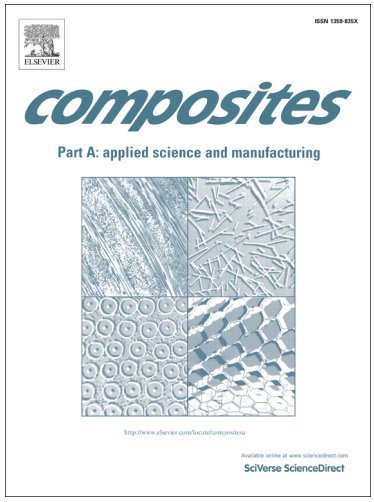

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COMPACTION BEHAVIOUR OF DENSE SHEARED WOVEN PREFORMS: EXPERIMENTAL OBSERVATIONS AND ANALYTICAL PREDICTIONS

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ABSTRACT

Yarn-scale modelling of textile preforms relies on the realistic reconstruction of internal geometry. The paper presents a model of fabric compaction, which shows that fine features of dense woven preforms, conventionally neglected in consolidation analysis, have a significant impact on thickness and consequently on fibre volume fraction and yarn crimp inside the composite. The model relies on single yarn compaction test and geometrical characteristics of preform in compacted and original configurations. The model is validated against compaction experiments on dense sheared single ply and nested carbon twill 2/2 fabrics. This exercise aims at decreasing or eliminating phenomenological parameters being introduced when calibrating geometrically and physically complex numerical models at the yarn scale.

KEYWORDS

A. Fabrics/textiles; C. Analytical modelling; E. Consolidation; E. Preform

1. INTRODUCTION

One of the essential control issues of resin infusion is the behaviour of draped preforms in compression. In contrast to the RTM process where a rigid upper mould is typically used, a flexible film constraints the impregnated material when vacuum pressure is applied. Pressure imposed by the film is sometimes complemented by added weight. Drape affects the yarn architecture and the fibre volume fraction (FVF), leading to a variation of preform properties when it is laid on a tool. Reconfiguration of yarns results in substantial increase in thickness of preform and yarns, as measured, for instance, by Chang et al [1] for carbon satin fabric by