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Draping simulation of carbon/epoxy plain weave fabrics with non-orthogonal constitutive model and material behavior analysis of the cured structure

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ABSTRACT

The aim of this study is to estimate the mechanical behavior including material failure of cured draped structures. Based on the basic tests for representative mechanical properties of woven fabric prepregs, non-orthogonal constitutive VUMAT code for draping simulation was developed. To calibrate the simulation code, experimental validation was carried out. The local shear deformation of the plain weave fabric draped onto the hemispherical structure was simulated, and the results showed that the simulation successfully followed the actual draping behavior with very low level of errors in the deformation of the prepregs and it predicted the shear angles in local area of the draped structures accurately. The deformation behavior with material failure of the cured hemisphere under compression was estimated with consideration of the local property changes. By using the above analysis technique, the initial mechanical behavior and the failure mode of the hemisphere were accurately estimated using the simulation technique.

Keywords: A. Fabrics/textiles; B. Mechanical properties; B. Anisotropy; C. Finite element analysis (FEA).

Nomenclatures

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