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A new analytical solution for spring-in of curved composite parts

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Abstract

A new analytical solution considering three dimensional effects on spring-in of curved composite parts has been proposed based on modification of the model presented by Wisnom *et al.* (2007). In the new analytical solution the composite part is assumed in generalized plane strain condition between gelation and vitrification rather than in plane stress condition as proposed by Wisnom *et al*. (2007). The material properties are assumed to present a step change in the vitrification point with constant values in each state. Consequently the new solution not only considers the effect of the cure process generated strain in the rubbery state in the through-thickness direction but also the strain in the length direction for prediction of the cure-induced spring-in of curved composites parts. The proposed new analytical solution is verified by the good agreement between the experimentally measured spring-in angels presented by previous studies and analytically predicted results presented by author for both the unidirectional and cross-ply C-sections composite parts. Further investigation by numerical analysis also provides a favourable comparison with experimental findings and analytical results.

Keywords
Cure behaviour; Residual stress; Finite element analysis (FEA); Analytical modelling

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