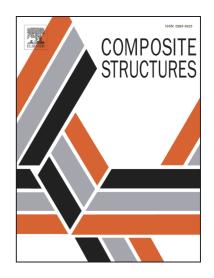
Accepted Manuscript

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PII: DOI: Reference:	S0263-8223(17)33021-0 https://doi.org/10.1016/j.compstruct.2017.11.063 COST 9129
To appear in:	Composite Structures
Received Date: Revised Date: Accepted Date:	15 September 201714 November 201721 November 2017



Please cite this article as: Barulich, N.D., Godoy, L.A., Dardati, P.M., Evaluation of cross-ply laminate stiffness with a non-uniform distribution of transverse matrix cracks by means of a computational meso-mechanic model, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.11.063

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Evaluation of cross-ply laminate stiffness with a non-uniform distribution of transverse

matrix cracks by means of a computational meso-mechanic model

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Abstract

This work addresses the evaluation of the stiffness of fiber-reinforced composite laminates, by means of a computational meso-mechanic model, considering two non-uniformly spaced transverse matrix cracks. Laminates with $[0_n/90_8]_S$ and $[90_8/0_n]_S$, with n = 1 and 8, have been studied. The meso-mechanic model includes a three dimensional Finite Element continuum model at meso-scale and the macro-scale contains a classical thin laminated plate model. Periodic boundary conditions were used and the stress resultants were evaluated accounting for the equivalence of mechanical power between scales (Hill-Mandel principle). The results obtained with the present model showed good agreement with numerical and experimental data reported in the literature. A parametric analysis allowed identifying the stiffness components which are more influenced by a non-uniform crack distribution. The results suggest that the model with uniformly distributed cracks underestimates the in-plane and bending stiffness, while the bending-extension coupling stiffness components are overestimated.

Keywords: composite laminate; intra-laminar cracks; finite elements; plate homogenization

1 Introduction

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