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# Influence of ply orientation on free-edge effects in laminates subjected to in-plane loads.

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## Abstract

An analysis of the influence of fibre orientation on the interlaminar stresses near the free edge of composite laminates was carried out. The study of these stresses is relevant due to the fact that they contribute to a number of failure mechanisms, such as delamination and shear stress cracking at the laminate edge. The presence of a displacement gradient was demonstrated using a numerical model, which showed that the maximum value is dependent on the orientation of the plies in the laminate. A solid correlation of the model predictions with experimental results was obtained. A classic finite difference scheme similar to that proposed by Pipes and others was implemented, though on this occasion modified via the use of non-dimensional variables. The displacement gradient is related to interlaminar stresses, which in turn are dependent on fibre orientation. In order to study the dependence of the out-of-plane stresses on these two parameters, an analysis of symmetric laminates with varying stacking sequences and ply orientations was carried out.

**Keywords:** A. Lamina/ply; B. Stress concentrations; C. Laminate mechanics; C. Numerical Analysis; Edge effect.

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