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On the prediction of interlaminar shear stresses in a thick laminated general shell. (English)

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Summary: A post-processing semi-analytical approach, for prediction of the interlaminar shear stress distribution through the thickness of an arbitrarily laminated general shell, is presented. The starting point of the approach is an assumed displacement finite element analysis, based on the assumptions of transverse inextensibility and layerwise constant shear-angle theory (LCST).

First, the problem is posed in the context of Taylor series expansions of the interlaminar shear stresses in terms of the thickness coordinate, dictated by the LCST assumption and the shell curvature. An "exact" (in the context of the problem thus posed) and three progressively approximate semi-analytical methods for prediction of interlaminar shear stresses are then presented. The through-thickness distribution of interlaminar shear stresses in an arbitrarily laminated thick plate can be obtained as a special case of the present solution. Numerical results are presented for two-layer thin and thick tubes with simply-supported edges, using the Cartesian-like local Riemann coordinate approximation (CLRC) and are compared to the corresponding analytical solutions, based on the classical lamination theory (CLT). Results for thin laminated tubes prove the accuracy of the present approach, while hitherto unavailable results for a thick laminated tube are expected to serve as baseline solutions for future comparisons.

MSC:

74E30	Composite and mixture properties
74G70	Stress concentrations, singularities in solid mechanics
74K15	Membranes
74S05	Finite element methods applied to problems in solid mechanics

Keywords:

post-processing semi-analytical approach; interlaminar shear stress distribution; displacement finite element analysis; transverse inextensibility; layerwise constant shear-angle theory; Taylor series expansions; exact; progressively approximate semi-analytical methods; Cartesian-like local Riemann coordinate approximation (CLRC)

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