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Application of GA Optimization in Analysis of Variable Stiffness Composites

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Abstract : Variable angle tow describes the fibres which are curvilinearly steered in a composite lamina. Significantly, stiffness tailoring freedom of VAT composite laminate can be enlarged and enabled. Composite structures with curvilinear fibres have been shown to improve the buckling load carrying capability in contrast with the straight laminate composites. However, the optimal design and analysis of VAT are faced with high computational efforts due to the increasing number of variables. In this article, an efficient optimum solution has been used in combination with 1D Carrera’s Unified Formulation (CUF) to investigate the optimum fibre orientation angles for buckling analysis. The particular emphasis is on the LE-based CUF models, which provide a Lagrange Expansions to address a layerwise description of the problem unknowns. The first critical buckling load has been considered under simply supported boundary conditions. Special attention is lead to the sensitivity of buckling load corresponding to the fibre orientation angle in comparison with the results which obtain through the Genetic Algorithm (GA) optimization frame and then Artificial Neural Network (ANN) is applied to investigate the accuracy of the optimized model. As a result, numerical CUF approach with an optimal solution demonstrates the robustness and computational efficiency of proposed optimum methodology.

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