Structural approximations for composite optimisation

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Abstract

A way to approximate the response of, variable stiffness, composites for optimisation is explained. A two-level approximation scheme is proposed inspired by traditional approximation concepts such as force approximations. First an approximation in terms of the in- and out-of-plane stiffness matrices is made. In the stiffness approximation a generalised convex linearisation approach is used: compliance, stress and inverse buckling load are approximated in terms of the linear and reciprocal stiffness matrices. Either the lamination parameters, or the nodal fibre angle distribution are used as design variables. A quadratic approximation is used to build the approximations in fibre angle space. Conservativeness is guaranteed by adding a convex damping function to the approximations. The method of conservative, convex separable approximations is used for the optimisation.

Keywords: Optimisation, variable stiffness, approximations, multi-level.