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NONLINEAR GLOBAL/LOCAL ANALYSIS OF COMPOSITE STRUCTURES

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The present work involves the nonlinear analysis of metallic and composite structures using refined beam models based on advanced structural theories which are derived within the framework of the Carrera Unified Formulation (CUF) [1]. Using CUF, one can derive higher order beam models using refined structural theories, which are capable of modelling complex mechanical behaviour at a fraction of the degrees of freedom when compared to a full 3D finite element analysis.

Nonlinear analyses are generally computationally intensive and improving the efficiency of such an analysis is a subject of major research. Since nonlinearities often occur in a small region within the structure, such as for instance localised plastic zones or micro-buckling, an attractive technique to reduce computational costs would be to conduct the nonlinear analysis only within these critical regions. This can be implemented via global/local techniques, where a linear analysis is performed over the global structure, and a nonlinear analysis is reserved for the local region. In the current work, the linear global analysis was performed in a commercial software (MSc-NASTRAN, ABAQUS) while the local nonlinear analysis was performed in an academic code developed using CUF. The displacement result of the global analysis was applied on the local region, at the global/local interface, in order to drive the local analysis. The extent of the local region was estimated using indices based on the limit of the elastic theory. The results obtained from the nonlinear analysis using a global/local approach were in good agreement with reference monolithic nonlinear analyses performed in CUF and commercial software, with a significant (two-fold) reduction in the number of degrees of freedom.

REFERENCES

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