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EVALUATION OF DAMAGE EFFECTS ON METALLIC AND COMPOSITE AEROSPACE STRUCTURES VIA REFINED MODELS

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Summary. *This paper presents the structural dynamics analysis of damaged structures by means of 1D (beam) advanced finite element models. Metallic and composite structures for aerospace applications are considered and the Component-Wise (CW) modelling approach is adopted. The structural models are obtained by means of the Carrera Unified Formulation (CUF)[1, 2]. By means of the CUF, arbitrarily refined 2D and 1D structural models can be implemented in a unified and hierarchical manner. CUF models provide extremely accurate results with very low computational costs. In particular, 1D CUF models require 10 to 100 times less degrees of freedom than shell and solid models, respectively. The use of Lagrange polynomials to model the cross-sectional displacement field leads to the CW modeling. The CW provides a detailed physical description of the real structure since each component can be modelled with its material characteristics, that is, no homogenization techniques are required. Furthermore, although 1D models are exploited, the problem unknown variables can be placed on the physical surfaces of the real 3D model. No artificial surfaces or lines have to be defined to build the structural model. Global and local damages are introduced by decreasing the stiffness properties of the material in the damaged regions as in [3]. In this paper, free vibration and dynamic response analyses are carried out to provide guidelines on the mechanical behavior of damaged structures.*

References

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