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DYNAMIC RESPONSE ANALYSIS OF STRUCTURES THROUGH COMPONENT-WISE MODELS

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Summary. *This paper investigates the enhanced capabilities of the Component-Wise approach (CW) in the case of dynamic loadings. 1D (beam) advanced finite element models and the Newmark time integration scheme are employed as in [1]. The structural models are obtained by means of the Carrera Unified Formulation (CUF)[2, 3]. 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, e.g. 10 to 100 times less degrees of freedom than shell and solid models. 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. In this paper, a number of numerical assessments are carried out. Closed form solutions and shell/solid models are employed for comparison purposes. Compact and thin-walled structures are considered. Isotropic and composite materials are used. The results prove that the present 1D CW approach offers shell- and solid-like accuracy with lower computational costs.*

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