

A FE-Based Scheme for Computing Wave Interaction with Nonlinear Damage and Generation of Harmonics in Layered Composite Structures

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Abstract : A Finite Element (FE) based scheme is presented for quantifying guided wave interaction with Localised Nonlinear Structural Damage (LNSD) within structures of arbitrary layering and geometric complexity. The through-thickness mode-shape of the structure is obtained through a wave and finite element method. This is applied in a time domain FE simulation in order to generate time harmonic excitation for a specific wave mode. Interaction of the wave with LNSD within the system is computed through an element activation and deactivation iteration. The scheme is validated against experimental measurements and a WFE-FE methodology for calculating wave interaction with damage. Case studies for guided wave interaction with crack and delamination are presented to verify the robustness of the proposed method in classifying and identifying damage.

Keywords : layered structures, nonlinear ultrasound, wave interaction with nonlinear damage, wave finite element, finite element

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