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Proportionally Damped Finite Element State-Space Model of Composite Laminated Plate with Localized Interface Degeneration

Authors : Shi Qi Koo, Ahmad Beng Hong Kueh

Abstract : In the present work, the finite element formulation for the investigation of the effects of a localized interfacial degeneration on the dynamic behavior of the [90˚/0˚] laminated composite plate employing the state-space technique is performed. The stiffness of the laminate is determined by assembling the stiffnesses of sub-elements. This includes an introduction of an interface layer adopting the virtually zero-thickness formulation to model the interfacial degeneration. Also, the kinematically consistent mass matrix and proportional damping have been formulated to complete the free vibration governing expression. To simulate the interfacial degeneration of the laminate, the degenerated areas are defined from the center propagating outwards in a localized manner. It is found that the natural frequency, damped frequency and damping ratio of the plate decreases as the degenerated area of the interface increases. On the contrary, the loss factor increases correspondingly.

Keywords : dynamic finite element, localized interface degeneration, proportional damping, state-space modeling
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