

## Thermal Effect on Wave Interaction in Composite Structures

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**Abstract :** There exist a wide range of failure modes in composite structures due to the increased usage of the structures especially in aerospace industry. Moreover, temperature dependent wave response of composite and layered structures have been continuously studied, though still limited, in the last decade mainly due to the broad operating temperature range of aerospace structures. A wave finite element (WFE) and finite element (FE) based computational method is presented by which the temperature dependent wave dispersion characteristics and interaction phenomenon in composite structures can be predicted. Initially, the temperature dependent mechanical properties of the panel in the range of -100 °C to 150 °C are measured experimentally using the Thermal Mechanical Analysis (TMA). Temperature dependent wave dispersion characteristics of each waveguide of the structural system, which is discretized as a system of a number of waveguides coupled by a coupling element, is calculated using the WFE approach. The wave scattering properties, as a function of temperature, is determined by coupling the WFE wave characteristics models of the waveguides with the full FE modelling of the coupling element on which defect is included. Numerical case studies are exhibited for two waveguides coupled through a coupling element.

**Keywords :** finite element, temperature dependency, wave dispersion characteristics, wave finite element, wave scattering properties

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