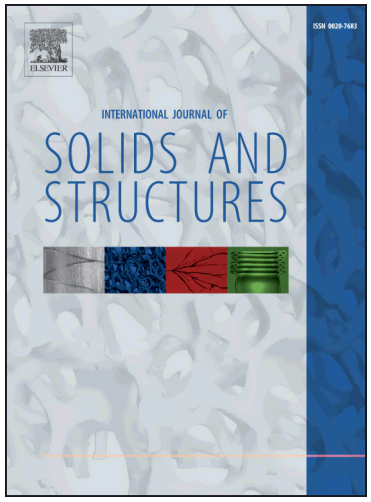

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Wave Propagation in Periodically Undulated Beams and Plates

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Abstract

This paper investigates the effects of periodic geometric undulations on the dispersion properties of 1D and 2D elastic structures. Periodic undulations result from the spatial modulation of the curvature of beams and plates, which leads to the coupling of transverse and in-plane motion. Such coupling affects the modal structure, and leads to interactions that produce complete, modal and partial frequency bandgaps along with directional wave motion. The effects of relevant geometrical parameters defining the undulation, such as spatial period and undulation amplitude, are investigated through the application of the Plane Wave Expansion Method and a Finite Element-based analysis of dispersion. Experimental illustration of the bandgap behavior of undulated beams, and numerical simulations of wave motion in plates serve as partial validations of the analytical predictions, and as demonstrations of the potential application of the concept for the design of structural components and elastic waveguides with tailored bandgap and directional properties.

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