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Experimental investigation of wave propagation in light weight structures undergoing flexural vibration

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Abstract: The wave approach in structural dynamics focus on local properties such as the dispersion relations, phase and group velocities, waves modes and energy transmission. This is in contrast to the modal approach, which typically focus in global properties such as the natural frequencies and modes shapes. Experimental technics for modal analysis are well stablished and have been successfully applied in the past decades unlike the experimental approaches for wave propagation. This paper aims to investigate experimental approaches for the identification of the wavenumber in light weight structures undergoing flexural vibration, such as metamaterial beams. Different estimation techniques are used, such as the Inhomogeneous Wave Correlation (IWC) and Discrete Fourier Transform (DFT) based approaches and the influence of measurement points distance, positioning along the structures are investigated. Upper and lower limits of the frequency bands for the analysis are given for light weight structures such as metamaterial beams produced from additive manufacturing with locally resonant band gaps. Results are compared to an available analytical and numerical solutions show good agreement.

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