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A new procedure for the determination of structural characteristics of sandwich plates in medium frequencies

Christophe Droz[a,1], Olivier Bareille[a], Mohamed N. Ichchou[a]

[a] *École Centrale de Lyon, 36 Avenue Guy de Collongue, 69134 Écully Cedex, France*

Abstract

This paper presents a new wave-based material identification strategy for sandwich panels, able to estimate their tensile and equivalent shear moduli from single shot measurements. The proposed algorithm is based on the determination of the maximal wave speed in the bending-to-shear transition bandwidth. A definition is proposed for the transition phenomenon resulting from the conversion of flexural waves in the composite waveguide, and the existence of a local energy velocity maxima is demonstrated using the 4^{th}-order sandwich theory. Analytical expressions are derived for the equivalent bending and shear parameters in terms of the transition frequency and the maximal group velocity. An practical iterative procedure is also proposed for the experimental identification of the transition bandwidth, while a Hilbert Transform magnitude is employed to measure time of arrivals of the flexural wave pulses. The robustness of the method is highlighted using a numerical case study and an experimental validation is finally conducted on a sandwich panel with composite faces. Results are compared with static measurements and a wave-based technique (Inhomogeneous Wave Correlation) and show significant accuracy improvements while ensuring reduced post-processing times.

Keywords: Honeycomb, sandwich panel, inverse identification, group velocity, wave

Email address: christophe.droz@gmail.com (Christophe Droz)

[1] Current address: KU Leuven, Department of Mechanical Engineering, Division PMA, Celestijnenlaan 300 - box 2420, Leuven, Belgium