Edge resonance in micro-structured waveguides and convergence to the corresponding continuum case

Giorgio Carta*[1], Michael Nieves[2], Michele Brun[1], and Vincent Pagneux[3]

[1]University of Cagliari – Italy
[2]Keele University – United Kingdom
[3]Université du Maine - CNRS – Laboratoire d'Acoustique de l'Université du Maine – France

Abstract

We study the scattering problem of Lamb waves at the edge of a semi-infinite triangular lattice strip. To this aim, we employ two approaches: the first one is based on mode matching, while the second one makes use of the Z-transform. With both methods, in the low-frequency range we derive the complex edge resonance frequency, at which localization of waves and trapped modes are observed in proximity of the strip's edge. By increasing the number of lattice's rows while keeping the width of the strip constant, we show that the complex edge resonance frequency of the discrete structure converges to the analogous quantity in the corresponding effective continuum, with the imaginary part being characterized by a non-monotonic trend. In addition, we demonstrate the orthogonality between the total displacement at the edge of the lattice strip and the stress produced by the incident wave, analogously to the continuum problem. Finally, we point out that the analytical results are confirmed by independent finite element simulations.

*Speaker