

Accepted Manuscript

Dispersion curves of infinite laminate panels through a modal analysis of finite cylinders

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PII: S0165-2125(18)30321-4

DOI: <https://doi.org/10.1016/j.wavemoti.2018.08.007>

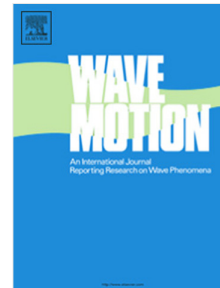
Reference: WAMOT 2269

To appear in: *Wave Motion*

Received date : 18 January 2018

Revised date : 18 May 2018

Accepted date : 2 August 2018



Please cite this article as:, Dispersion curves of infinite laminate panels through a modal analysis of finite cylinders, *Wave Motion* (2018), <https://doi.org/10.1016/j.wavemoti.2018.08.007>

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18 January 2018

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Research Highlights

The correct knowledge of how elastic waves freely behave inside a specific structure is mandatory for a correct modelling and analysis of the structure itself. Moreover, the frequency-dependent wavelengths, to be described in the modelling phase, must be known in advance for a correct discretization of the model.

Classic analytic methods are unable to deal with complex materials and structures, even being useful for their ease of use and rapidity. On the other hand most of the alternative procedures available in literature are affected by numerical conditioning and instabilities when an heading angle is imposed to analyse the wave propagation.

Some attempts to use a finite model, to gather information on an infinite waveguide, are present in literature, with much success in the identification of the periodic structural band-gaps, while, to authors knowledge, very few works are present when dealing with a full representation of the dispersion curves of a periodic waveguide.

In the present work, an alternative approach is proposed which allows to overcome most of the numerical instabilities and issues of calculating this curves for every heading angle, using an analogy between an infinite line and a circular path, transforming the original problem into a simple real modal analysis of a cylindrical finite element model, performable with any in-house or commercial Fe-based code available.

A validation for many test-cases is present in the paper draft attached.

Fabrizio Errico

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