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Invited Speaker Presentations

Modal approach for the development of tools to simulate nondestructive evaluation techniques based on elastic guided waves

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Invited Talk: January 18, 2024, 14:00 - 14:30

This presentation aims to show a set of models and associated simulation tools that have been developed at CEA-LIST over the last 20 years for simulating nondestructive evaluation techniques based on elastic guided waves and providing modal solutions. A significant part of the models discussed in this presentation was presented over the years at AFPAC and published in its proceedings. The presentation will show the overall long-term consistency of the modal approach.

We will focus on models developed under several formal constraints. i) For the various problems to be treated, these models deal with modal bases of guided waves wherever possible so that final results are given as modal solutions. ii) They are designed to be easily chained together. iii) When modal bases do not exist, local finite element (FE) computations are involved, that include specific artificial boundary conditions to ensure both their transparency and to decompose FE results at these boundaries onto modal solutions available in regions connected to the FE zone (hybrid modelling).

Models for a set of connected unidirectional guides and for plate-like structures will be discussed and exemplified (tube, rail inspections, radiation by arbitrary sources in a composite plate of finite size, scattering by a stiffener).

All these works were initiated by doctoral theses and then, were the subject of numerical implementation within the very constrained framework of development of the commercial NDE simulation platform CIVA.

Special thanks to Laura Taupin, Marouane El Bakkali, Mathilde Stévenin, Amond Allouko who carried out their doctoral thesis (co-)supervised by Alain Lhémery (as did the co-authors of this paper who are now his colleagues) on works which were discussed in this presentation.