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AN ADAPTATIVE COMPUTATIONAL "WAVE" APPROACH

Pierre Ladevèze*, Benjamin Sourcis, Hervé Riou, Béatrice Faverjon

LMT-Cachan
(ENS de Cachan / CNRS UMR8535 / UPMC / Universud Paris)
61, avenue du Président Wilson
F-94235 CACHAN CEDEX, France
ladeveze@lmt.ens-cachan.fr

* EADS Foundation Chair "Advanced Computational Strutural Mechanis"

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ABSTRACT

A multiscale approach called "Variational Theory of Complex Rays" (VTCR) has been proposed in [1], in order to compute the vibrations of slightly damped elastic structures over the medium-frequency range. This method can be considered as a "wave" approach, for it uses a set of propagative plane waves shape functions. The computation of their amplitude has become possible thanks to a variational formulation of the vibration problem over the domain boundaries.

This formulation is a key feature of the VTCR, for it enables discontinuities of the shape functions across element boundaries, thus giving great flexibility and robustness to the strategy. Different approximations can actually be used in each element to figure the solution. This method was fully developed for structural vibrations ([2, 3]) and a first extension to acoustics problems has been proposed in [4].

This method is intended to be extended to three-dimensional problems, especially in acoustics. But comparing to 2D problems, 3D problems could involve a very high computation cost. In order to get round this problem, we introduce in this paper a new adaptative procedure based on an error indicator, leading to an adaptative discretization of the wave amplitudes in term of their directions.

The problem can therefore be discretized more efficiently in propagative directions, for only waves having a meaningful energetic participation will be taken into account, which bring down widely the size of the problem.

The method will be illustrated with academic examples.

REFERENCES

[1] P. Ladevèze. A new computational approach for structure vibrations in the medium frequency range. Compte Rendus de l'Académie des Sciences de Paris, 322(II b) :849-856, 1996.
[2] P. Ladevèze, P. Rouch, H. Riou, X. Boniheust. Analysis of medium-frequency vibrations in a frequency range. Journal of Computational Acoustics, 11 : 255-283, 2003.
[3] P. Ladevèze, H. Riou. Calculation of medium-frequency vibrations over a wide frequency range. Computer Methods in Applied Mechanics and Engineering, 194(27/9):3167-3191, 2005.
[4] H. Riou, P. Ladevèze, B. Sourcis. The multiscale VTCR approach applied to acoustics problems. Journal of Computational Acoustics, In Press.