New perspectives offers by overlaps to design transparent boundary conditions in waveguides.

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This work is motivated by the numerical simulation of ultrasonic Non Destructive Testing (NDT) experiments. NDT is an industrial procedure that aims at checking the integrity of a structure by studying its response to an ultrasonic excitation. More specifically, we are interested in NDT in waveguides, that is to say structures with a tube shape, for which we can take advantage of guided waves. Indeed, guided waves can propagate over large distances without loss of energy, so that we can inspect wide areas or inaccessible areas without moving the sensors. Yet, this method also raises some issues such as the interpretation of the complex experimental results or the design of optimized control configurations. To tackle these problems, it is required to have efficient numerical simulation tools.

In this presentation, we consider the time harmonic diffraction problem by a bounded defect in an infinite anisotropic elastic waveguide. One specificity of this work is the fact that we consider anisotropic media (which enables to model complex structures such as composite materials). In particular, due to the anisotropy, classical methods (such as Transparent Boundary Conditions [1] or Perfectly Matched Layers [3]) to restrict the computational domain around the defect fail. We propose to adopt another strategy based on overlapping domain decomposition method and which was previously used for the Helmholtz equation in [4]. We emphasize the advantages of this approach both for handling the difficulty due to the anisotropy and also for designing efficient numerical method of resolution [2]. Numerical results (in 2D and 3D) will be shown.

References

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