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COMPUTATIONAL METHODS FOR INVERSE WAVE PROBLEMS

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ABSTRACT

Computational methods for wave propagation are essential in many fields of application, such as acoustics, structural dynamics, geophysics, electromagnetics and fluid-structure interaction. In recent years there has been an increased interest in advanced computational methods for this wide class of problems, which cross the borders of specific applications.

This minisymposium will concentrate on computational methods for *inverse wave problems*. Applications are numerous, and include problems in which waves are present to begin with, such as that of identifying sources of noise in an aircraft or a car, and problems in which waves are actively introduced for the purpose of identification, such as the problem of identifying damage in a structure (non-destructive testing), identifying the under-surface structure of the earth, identifying an object or obstacle underwater (such as a submarine), identifying an ill tissue in the human body, and many more examples.

Inverse problems in general, and inverse wave problems in particular, are notoriously hard; not only are they usually strongly nonlinear, but they are also almost always ill-posed. In order to be effective, methods for the solution of inverse wave problems must be robust, efficient, and perform well even in the presence of noisy data. Additional interesting and important challenges arise from the computationally-intensive solution methods required.

Computational and analysis techniques of various types will be presented and discussed in this minisymposium, including topology-sensitivity based analysis, arrival time methods, time-reversal methods, PDE-constrained optimization and adjoint-based methods, Bayesian approaches, qualitative methods such as linear sampling, model or parameter-space reduction in inversion algorithms, and more.