The quasi-reversibility method for thermoacoustic tomography in a heterogeneous medium

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Abstract

In this talk we consider thermoacoustic tomography as the inverse problem of determining from lateral Cauchy data the unknown initial conditions in a wave equation with spatially varying coefficients. Using the method of quasi-reversibility, the original ill-posed problem is replaced with a boundary value problem for a fourth order partial differential equation. We find a weak H^2 solution of this problem and show that it is a well-posed elliptic problem. Error estimates and convergence of the approximation follow from observability estimates for the wave equation, derived via a Carleman estimate. We derive a numerical scheme for the solution of the quasi-reversibility problem by a B-spline Galerkin method, for which we also give error estimates. Finally, we present numerical results supporting the robustness of this method for the reconstruction of initial conditions.

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