An Interior Point Method for the Inverse Medium Problem

Johannes Huber *

Many engineering and science problems in such diverse areas as wave propagation, atmospheric sciences, image registration, medicine, structural-fluid interactions, and chemical process industry can be expressed in the form of a PDE-constrained problem. The common difficulty is that the PDE solution is just a subproblem associated with the optimization problem. Moreover, the inverse problem is often ill-posed despite the well-posedness of the forward problem, and the inverse problem can have numerous local solutions. For these reasons the optimization problem is often significantly more difficult to solve than the simulation problem. The size, complexity, and infinite-dimensional nature of PDE-constrained optimization problems present significant challenges for general-purpose optimization algorithms, and Tikhonov regularization, iterative solvers, preconditioning, inexactness, and parallel implementations are typically necessary to cope with the numerical challenges.

In this talk a inverse medium problem is presented. We follow the discretize then-optimize approach resulting in a large scale, nonconvex optimization problem. We discuss a primal dual interior point method to solve this and present numerical examples in 2D and 3D.

*Mathematisches Institut, Universität Basel, Rheinsprung 21, CH-4051 Basel, E-Mail: johannes.huber@unibas.ch