Recovering the conductances on grids

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In this work, we present an algorithm to the recovery of the conductance of a \(n\)-dimensional grid. The algorithm is based in the solution of some overdetermined partial boundary value problems defined on the grid; that is, boundary value problem where the boundary conditions are set only in a part of the boundary (partial), and moreover in a fix subset of the boundary we prescribe both the value of the function and of its normal derivative (overdetermined).

Our goal is to recover the conductance of a \(n\)-dimensional grid network with boundary using only boundary measurements and global equilibrium conditions. This problem is known as inverse boundary value problem. In general, inverse problems are exponentially ill-posed, since they are highly sensitive to changes in the boundary data. However, in this work we deal with a situation where the recovery of the conductance is feasible: grid networks.

The recovery of the conductances of a grid network is performed here using its Schrödinger matrix and boundary value problems associated to it, which have been extensively studied in [2]. We will use some important results of this paper. Moreover, we use the Dirichlet-to-Robin matrix, also known as response matrix of the network, which contains the boundary information. It is a certain Schur complement of the Schrödinger matrix, and it was introduced in [1]. The Schur complement plays an important role in matrix analysis, statistics, numerical analysis, and many other areas of mathematics and its applications.


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