BOUNDARY VALUE PROBLEMS ON NETWORKS: THE EFFECTIVE RESISTANCE.

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Abstract

We aim here at obtaining the effective resistance between two subsets of an electrical network. It is well known that the effective resistance can be obtained as an extremum problem for the Dirichlet energy. On the other hand, our previous work allow to obtain the solution of Boundary Value Problems (BVPs) on networks systematically by using equilibrium measures considering the Laplacian of the network as a kernel in the framework of Potential Theory. Therefore, we calculate the effective resistance as a condenser problem. Moreover, we extend this problem to subnetworks in which some parts of the boundary are supposed insulated and we solve it as a mixed BVP (Dirichlet-Neumann). We examine the probabilistic counterpart of the results here obtained. In particular, the expected number of steps before absorption for each starting state (Green function, equilibrium measure) and the escape probability (effective resistance). All the results depend on the knowledge of the equilibrium measures that can be obtained by solving Linear Programming Problems in which the Laplacian kernel acts as the coefficient matrix of the general linear constraints.