Imaging electrical conductivities from their induced current and network tomography for random walks on graphs

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I will talk about the inverse problem of recovering the electrical conductivity σ inside a body $\Omega \subset R^n$ $(n \geq 2)$ from the knowledge of the induced current density vector field J inside Ω and Dirichlet or Neumann boundary conditions. I will also discuss this problem on electrical networks, i.e. the problem of determining the conductivity matrix of an electrical network from the induced current along the edges. These problems are closely related to the inverse problem of determining transition probabilities for random walks on graphs from the knowledge of the net number of times the walker passes along the edges of the graph as well as the problem of determining transition probabilities from the escape probability of the nodes, i.e. probability of hitting Γ_1 before Γ_2, where Γ_1 and Γ_2 are two distinct sets of nodes and the walker stops after hitting Γ_1 or Γ_2. These basic questions hold potential for applications in medical imaging, analysis of computer and social networks, cryptography, epidemiology, economics, and biology.