

# Boundary Value Problems on Networks: Some Application to Random Walks

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## Abstract

In this communication we consider random walks on networks and study some concepts related to their as the mean exit time and the escape probability, obtaining explicit expressions for that concepts. The mean exit time from a subset  $F$  of a network is the solution of certain Dirichlet problem. That solution can be characterized as the equilibrium measures for the subset  $F$ . On the other hand, the escape probability can be obtained either as the energy of the solution of a Dirichlet problem or from the solution of a Poisson equation. So, we analyze general boundary value problems on networks. For that we define the involved discrete operators such as the gradient, the divergence and the laplacian. After studying the existence and uniqueness of such a problems, and in order to obtain closed expressions and qualitative properties of their solutions, we construct explicit expressions of its Green functions in terms of equilibrium measures for the involved subsets. The equilibrium measures can be obtained by applying the extremal charge method developed by the authors in previous works.