יום חמישי 18.12.2008 בשעה 12:00-11:00 בפיקוס 202
Thursday 18.12.2008 on 11:00-12:00, Fikus 202

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Joint work with A. Singer, Princeton University, and D. Holcman, WIS

THE NARROW ESCAPE PROBLEM

Abstract

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The narrow escape problem in diffusion theory, which goes back to Lord Rayleigh, is to calculate the mean first passage time, also called the narrow escape time (NET), of a Brownian particle to a small absorbing window on the otherwise reflecting boundary of a bounded domain. The renewed interest in the NET problem is due to its relevance in molecular biology and biophysics. The small window often represents a small target on a cellular membrane, such as a protein channel, which is a target for ions, a receptor for neurotransmitter molecules in a neuronal synapse, a narrow neck in the neuronal spine, which is a target for calcium ions, and so on. The determination of a higher order asymptotic expansion of the NET depends on determining the singularity of the Neumann function for the Laplacian in a three-dimensional domain with a Dirac mass on the boundary. In addition to the usual Coulomb singularity, the Neumann function also has an additional weaker logarithmic singularity. By calculating the coefficient of this logarithmic singularity, we calculate the second term in the asymptotic expansion of the NET and in the expansion of the principal eigenvalue of the Laplace equation with mixed Dirichlet-Neumann boundary conditions, with small Dirichlet and large Neumann parts. We also determine the leakage flux of Brownian particles that diffuse from a source to an absorbing target on a reflecting boundary of a domain, if a small perforation is made in the reflecting part.

מתאמים : ד״ר י. סטאנצ׳סקו, ד״ר ש. מיברג, פרופ׳ י.גולדמן ופרופ׳ ד. פישלוב

אפקה- המכללה האקדמית להנדסה בתל-אביב, מבצע קדש 38, תל-אביב