MECHANICAL & AEROSPACE ENGINEERING GRAD STUDENT SEMINAR

A Tale of Two Journeys: Random Particles in Complex Domains

Friday, November 20
11:00 AM
AME Room 106



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ABSTRACT: Random motion plays a central role in many physical and biological systems, from molecular diffusion in crowded environments to organisms or particles navigating complex landscapes. In this talk, I will present two such "journeys", each involving stochastic particles trying to reach their own "best of times".

The first journey is that of Brownian particles navigating an unbounded domain while trying to reach a target domain (their "best of times") without wandering too far off to infinity (their "worst of times"). The probability density of the particles' arrival time has a very long tail, necessitating a numerical method that can solve a PDE for this probability at very late times. I will describe one such method that avoids standard time stepping altogether. Examples will illustrate how complex geometric arrangements can funnel, shield, or delay particles on their way to an absorbing target.

The second journey explores a generalization of the classical "N bugs on a square" problem. Here, the particles are randomly initialized on a compact manifold and pursue one another cyclically. Depending on their initial conditions, all particles either converge to one another (their "best of times"), or they end up in an infinite pursuit with particles not catching the ones they pursue (their **"worst of times").**

Together, these two stories highlight how randomness interacts with geometry to produce unexpected pathways, delays, and patterns.

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