University of Houston
SIAM and AMS Student Chapters
at Department of Mathematics

2016 Graduate Student Paper Presentations

Speakers: Graduate Students, Department of Mathematics

Friday, April 8, 2016
Lunch at 12pm, Talks begin 12.30pm
SEC 105

Details of the presentations

UH SIAM and UH AMS invite you to attend the Graduate Students Paper Presentations Event of the Department of Mathematics at University of Houston. A panel of professors (Drs. Tomforde, Ott, Climenhaga, Kalantar, Mamonov) will evaluate the talks, and three presentations will be awarded. The details of the talks are as follows:

1. **Wanli Cheng (12.30-12.45 pm) - Finite Stopping Time of Freely Oscillating Droplet of a Yield Stress Fluid**

Abstract

The paper addresses the question if there exists a finite stopping time for an unforced motion of a yield stress fluid with free surface. First, a variation inequality formulation is deduced for the problem of yield stress fluid dynamics with a free surface. Free surface is assumed to evolve passively by the flow; while capillary forces act along the free surface. Based on the variational inequality formulation an energy equality is deduced, where kinetic and free energy rate of change is in balance with the internal energy visco-plastic dissipation and the work of external forces. Further, the paper considers free small-amplitude oscillations of a droplet of Herschel-Bulkley fluid under the action of surface tension forces. For this problem, it is shown that the finite stopping time T_f exists once the yield stress parameter is positive and the flow index α satisfies ($\alpha \geq 1$). An estimate of the finite stopping time

in terms of problem parameters is given. Results of several numerical experiments illustrate the analysis and reveal the dependence of T_f on problem parameters.

2. **Daniel Poll (12:45-1 pm) - Persistent Search in Confined Domains: a Velocity-Jump Process Model**

Abstract

We analyze velocity-jump process models of persistent search for a single target on a bounded domain. The searcher proceeds along ballistic trajectories and is absorbed upon collision with the target boundary. When reaching the domain boundary, the searcher chooses a random direction for its new trajectory. For circular domains and targets, we can approximate the mean first passage time (MFPT) using a Markov chain approximation of the search process. Our analysis and numerical simulations reveal that the time to find the target decreases for targets closer to the domain boundary. When there is a small probability of direction-switching within the domain, we find the time to find the target decreases slightly with the turning probability. We also extend our exit time analysis to the case of partitioned domains, where there is a single target within one of multiple disjoint subdomains.

3. **Francois A Ouegnin (1-1.15 pm) - Estimation of the Drift and Diffusion Using Spectral Data**

Abstract

This talk addresses the inference from time series data of the drift and diffusion components of Stochastic Differential Equations (S.D.E.) using the spectrum of the associated infinitesimal generator. First introduced by Crommelin and Vanden-Eijnden(2006), we present the key idea of this estimation method, a simple example where the inference is successfully applied, the limitations of such approach and finally some possible applications in the field mathematical finance. This talk is intended for a general audience.

15 Minute Break

4. **Mozahid Haque (1.30-1:45 pm) - Banach-Tarski Paradox**

Abstract

The Banach-Tarski paradox is a well-known counter-intuitive view of our basic geometric intuition regarding volume (or size) preservation under rigid transformations. Can we really cut a pea up, rearrange it, and glue it back up to get something the size of the sun? In this talk, we present the basic outline of the proof of the paradox. Then, we briefly show different versions of this paradox.

5. **Brett Geiger (1:45-2 pm) - Large Deviations and Applications**

Abstract

In this talk, we will present the basic idea behind large deviations. Then, we shall apply large deviation theory to a linear stochastic delay differential equation (SDDE) to demonstrate the construction of optimal trajectories given an initial state and a final state.

6. **Cameron Williams (2-2.15 pm) - Integral Transforms and Their Associated Harmonic Oscillator-like Systems**

Abstract

The uncertainty principle is very important in mathematics and physics. The usual uncertainty principle is codified in the language of Fourier transforms. In this talk, I will present a generalization of the uncertainty principle to Fourier-like transforms.