University of Houston
SIAM, AMS, AWM, and PME Student Chapters
at Department of Mathematics

2017 Graduate Student Paper Presentations

Speakers: Graduate Students, Department of Mathematics

Friday, April 7, 2017
Lunch at 12:30 pm, Talks begin 1:00 pm
PGH 232

Details of the Event

UH SIAM, AMS, AWM, and PME 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, Gorb, and Haynes) will evaluate the talks, and three presentations will be awarded. We will have pizza, salad, and soft drinks from Luigi's. We will also have snacks and coffee throughout the day. The event will roughly follow the schedule below:

Lunch/Introduction	12:30 - 1:00
Session 1	1:00 - 2:15
Break	2:15 - 2:25
Session 2	2:25 - 3:30
Judging	3:30 - 3:40
Winners Announced	3:40 - 3:50

The list of speakers, titles, and abstracts are as follows:

Session 1 Speakers

1. **Daria Kurzanova (1:00-1:10) - Efficient numerical scheme for high-contrast problems modeling highly dense composites.**

   This research concerns the case of high-contrast problems with almost touching injections. The Dirichlet-Neumann domain decomposition algorithm yields a Schur complement linear system with the block corresponding to highly dense part of the domain being impossible to obtain in practice. An approximation of this block is proposed by using a discrete Dirichlet-to-Neumann map. Process of construction of discrete map together with all its properties is described and numerical illustrations with comparison to the solution obtained by direct method are provided.

2. **Daewa Kim (1:10-1:20) - A kinetic theory approach to pedestrian motion.**

   In this talk, I would like to introduce one of mathematical modeling of pedestrian motion based on the kinetic theory approach. The modeling approach considers dynamics caused by interactions of pedestrians not only with all the other pedestrians, but also with the geometry of the domain. There are four factors of interactions, which are the goal to reach the exit and the desire to avoid the collision with walls, and the tendency to look for less congested areas and to follow the stream unconsciously.

3. **Zhenhua Wang (1:20-1:30) - Jordan Operator algebra with contractive approximate identities.**

   In this talk, we will discuss some results in Jordan Operator algebra which is norm-closed Jordan subalgebra of $B(H)$. We will mostly focus on generalizing some of the more recent theory from papers of Blecher, Read, Neal, Hay. This is joint work with David Blecher and Matthew Neal.

4. **Victoria Muravina (1:30-1:40) - Analysis of Log-Rank and Wilcoxon tests**

   In medical research the survival times data is often right censored. This means that for some of the patients we do not have exact time of death only that they died later then a known survival time. This happens for several reasons patients drop out of the study, die of non-related cause or the study ends causing the end patient status recording. When we have two patient populations with right censored survival times we often want to know how likely that the factor under consideration affects survival times. This could be done using parametric and non-parametric tests. Log-Rank and Wilcoxon tests are two most commonly used non-parametric tests. These two tests have been around for a long time since before advent of powerful computing, due to this no studies have been done on the strengths and weaknesses of these tests. We are going to use simulations to analyze the tests and decide which one is better.

5. **Nikolaos Karantzas (1:40-1:50) - On sufficient conditions for constructing multi-dimensional Parseval wavelet frames.**

   In this talk we discuss how the construction of multi-dimensional Parseval wavelet frames characterized by the capacity to capture informative features in 2-photon microscopy data can help us quantify the structural effects of disorders such as autism in the brains of live animal models.

6. **Kayla Bicol (1:50-2:00) - Deconvolution-based LES Method for Incompressible Flows**

   Computational Fluid Dynamics can be a useful tool in a clinical setting; however, we need a way to balance computational time and accuracy of simulations. Thus, this talk will present a method that implements a Large Eddy Simulation technique using a deconvolution-based nonlinear filter that is able to address these needs.

Session 2 Speakers

1. **Adrian Radillo (2:25-2:35) - Change rate inference in dynamic environments**

   Decision-making theory in contemporary Neuroscience makes use of ideal-observer models to benchmark animal performance. I will present the discrete- and continuous-time versions of one such model, for a generic Two-Alternative Forced-Choice task in dynamic environment with noisy observations. I will also discuss a moment-closure approximation to the model, together with future directions for my research.

2. **Krithika Rathinakumar (2:35-2:45) - Pedestrian Dynamics**

   The main goal is to analyse pedestrian dynamics through a microscopic approach of force based space continuous model. Space continuous models permit higher resolution of geometry and time, and also describe the pedestrian movements quantitatively well but they lead to overlaps and oscillations. These drawbacks are analysed quantitatively. The model is then validated by measuring macroscopic quantities flow and density with empirical data.

3. **Robert Mendez (2:45-2:55) - Binary Parseval Group Frames as Binary Codes**

   For a given group, the collection of binary Parseval frames whose vectors are orbits under a representation of the group admits a pair of nested classifications that rely only on properties of the acting group. These partitionings respect efficacy attributes of the frames viewed as error-correcting codes, including rate and minimum distance. The goal of this talk is to provide a basic understanding of binary Parseval group frames within the context of binary codes in order to make some meaningful statements about the benefits of these classifications.

4. **Rita Stanaityte (2:55-3:05) - Two-parameter ILU preconditioner for the discrete linearized incompressible Navier-Stokes problem.**

   This presentation concerns numerical properties of incomplete LU factorizations applied to the discrete linearized incompressible Navier-Stokes problem. Stabilized and unstabilized finite element method that was used for the Navier-Stokes problem leads to the system of algebraic equations of a saddle point type which has a 2×2-block structure. Numerical experiments for a model problems of a driven cavity flow, and flow over a backward-facing step illustrate the performance of the two-parameter ILU factorization as a preconditioner.

5. **Kyle Williams (3:05-3:15) - The Variational Multiscale Method**

   In the numerical solving of Partial Differential Equations, there have been many methods that aim to overcome numerical instability. The Variational Multiscale Method is one such method, and provides a paradigm on how to view other stabilization methods. This is accomplished through treating small scales that are unresolved by the discretization exactly in terms of the solution, and modifying the equations being solved to incorporate the information contained in the small scales. In this sense it is both a multiscale method as well as a stabilization method.