FOURTEENTH ANNUAL UNIVERSITY OF ALABAMA SYSTEM

APPLIED MATHEMATICS MEETING

SATURDAY, NOVEMBER 10, 2018

All sessions will be held on the campus of the University of Alabama in Huntsville in Room 114 of the Business Administration Budiling (located on the campus on Ben Graves Drive in Huntsville, Alabama).

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09:30 Refreshments

10:15 Welcoming Remarks Department Chair, Dr. Toka Diagana

11:30 Faculty Presentation:
Dongsheng Wu (UAH), Sharp Space-Time Regularity of the Solution to Stochastic Heat

11:30 Graduate Student Presentation:
Abinash Nayak (UAB), A new parameter-free regularization method for inverse problems

11:30 Graduate Student Resentation:
Keisha Cook (UA), A Parallel Implementation of the Delay SSA

11:50 **Lunch at area restaurants**

1:00 Faculty Presentation:
Logan Hoehn (UAB), A complete classification of homogeneous compact spaces in the plane

1:40 Graduate Student Presentation:
Cuiping Wang (UAH), Global Stability of the Two-Competing –Prey and One-predator Lotko-Valterra System

2:00 Faculty Presentation:
Mojdeh Rasoulzadeh (UA), Effective models of flow in highly heterogeneous multiscale porous media

2:40 **Break/Refresment**

3:00 **Discussions**

Faculty	Room 114
Graduate Students	Room 121

Titles and Abstracts

Keisha Cook (UA)

Title: A Parallel Implementation of the Delay SSA

Abstract: Biochemical reaction systems are commonly modeled by simulating their trajectories over time. This is executed by using the method known as the Stochastic Simulation Algorithm (SSA). Given a well-stirred system, the SSA allows us to numerically simulate the time evolution of a system, while taking into account randomness that may occur. The SSA is a Monte Carlo approach for generating sample paths of the chemical master equation. Complex biochemical reaction systems such as those that model tumor growth have an additional element called delay. When modeling tumor growth it is necessary to account for the time it takes to complete certain reactions. In this case, we consider the Delay SSA. A prevalent setback of the SSA is computational time. When we incorporate delay, the computational time becomes longer. The approach in the paper is to speed up the computational time by implementing parallel processing.

Dr. Logan Hoehn (UAB)

Title: A complete classification of homogeneous compact spaces in the plane

Abstract: A topological space X is homogeneous if for every pair of points in X, there is a homeomorphism of X to itself taking one point to to the other. This concept was first introduced by Sierpinski, and in 1920 Knaster and Kuratowski asked whether the circle is the only homogeneous compact connected space (continuum) in the plane consisting of more than one point. Explorations of this problem fueled a significant amount of research in continuum theory, and among other things, led to the discovery of two new homogeneous spaces in the plane: the pseudo-arc and the circle of pseudo-arcs. I will present some of the history of work in this area, and describe our recent result which implies that there are no more undiscovered homogeneous compact spaces in the plane. This is joint work with Lex G. Oversteegen.

Abinash Nayak (UAB)

Title: A new parameter-free regularization method for inverse problems

Abstract: Inverse problems arise in a wide spectrum of applications in fields ranging from engineering to scientific computation. Connected with the rise of interest in inverse problems is the development and analysis of regularization methods, which are a necessity in most inverse problems due to their ill-posedness. However, the commonly practiced parameter-based regularization methods, like Tikhonov regularization, have certain inherent problems associated with them; the most important one being the calculation of the optimal value of the relevant regularization parameter. In this talk I will discuss a regularization technique where there is no dependence on any external parameter, which avoids all the difficulties associated with such parameters. To illustrate the effectiveness and computational viability of this method we apply this technique to solve some of the classical inverse problems including numerical differentiation,

deconvolution, parameter identification in a diffusion equation. The numerical results corresponding to the these problems are also provided.

Dr. Mojdeh Rasoulzadeh (UA)

Effective models of flow in highly heterogeneous multiscale porous media

Cuiping Wang (UAH)

Title : Global Stability of the Two-Competing –Prey and One-predator Lotko-Valterra System

Abstract: The predator-prey models play important role in the theoretical studies of species interaction in ecology. The models with one prey and one predator have been extensively investigated and well understood. However, the problem on global dynamical structure for models with two-predator and one prey remains largely open. In this talk we present a global stability result for a Lotka-Volterra type of two-competing –prey and one-predator system when the parameters satisfy certain conditions. Our result is obtained by performing a careful analytical analysis, combined with the application of dynamical theories, such as omega and alpha limit theorems.

Dr. Dongsheng Wu (UAH)

Title: Sharp Space-Time Regularity of the Solution to Stochastic Heat Equation

Abstract: In this talk, we study a stochastic heat equation driven by a fractional-colored Gaussian noise, whose "spatial operator" is the infinitesimal generator of a Lévy process. After establishing the existence of solution for the stochastic heat equation, we study the regularity of the solution field in both time and space variables. Under mild conditions, we give the exact uniform modulus of continuity and a Chung-type law of iterated logarithm for the solution field. Our results generalize and strengthen the corresponding results of Balan and Tudor (2008) and Tudor and Xiao (2017). The main tool used in our derivation is the strong local nondeterminism of the solution field. This talk is based on joint works with R. Herrell, R. Song and Y. Xiao.