MATHEMATICS &

COMPUTER SCIENCE II

Section Moderator: Dr. Joan Lind
Room: Inman Health Sciences Building 310
Time: 7:00 -8:20 PM

7:00 – 7:20
"Modeling Human Reliability Using Fuzzy Math Techniques"

Callie S. Goyer
Faculty Advisor: Dr. Daniel C. Biles

Human Reliability on certain tasks is affected by a number of factors such as fatigue, stress level, and workload. We present the application of fuzzy modeling to such problems.

Discipline: Mathematics

7:20 – 7:40
"Generating n x n Hamiltonian Paths with Backbiting"

Luke Horsley, Neil E Kowalewski
Faculty Advisor: Dr. Joan Lind

In a paper entitled "Secondary Structures in Long Compact Polymers", statistical physicists developed a method known as backbiting to generate random Hamiltonian paths on an n by n grid. However, this technique is not yet on a solid mathematical foundation as it has not been proven that backbiting will yield every possible Hamiltonian path. Our research focuses on how such a foundation might be established. In our discussion, we will present an overview of the theoretical aspects of Hamiltonian path generation, a demonstration of a computer program that simulates the backbiting method, and ideas for future research based on our current results.

Discipline: Mathematics

7:40 – 8:00
"Making the Belmont Loewner Equation Analysis Tool"

Matthew C. Lefavor & Andrew B. Hill
Faculty Advisors: Dr. Joan R. Lind & Dr. William H. Hooper

Over the past semester, the BURST computer science team has implemented several improvements to the Belmont Loewner Equation Analysis Tool (BLEAT). Among these improvements are a completely restructured GUI, the ability to process several special fractal curves such as the Blancmange curve and variations thereof, an inverse mapping function to approximate a driving function from a user-defined conformal map, and a box dimension utility to quantify the space-filling behavior of the conformal maps.

The team also implemented and analyzed seven different methods of refining curves to optimize the default representations of driving functions for use with the mapping function. All of the methods of refinement are designed to improve the output maps as much as possible using the least possible computation time. These methods included several different slope and derivative-based methods of refinement, as well as distance-based refinements. Some of these have proved more useful than others, which allows us to better understand the relationship between the driving function and conformal map.

Discipline: Computer Science

8:00 – 8:20
"The Loewner Differential Equation and Ugly Curves"

Catherine P. Simpson, Sarah Claiborne, & Amy L. Valentine
Faculty Advisor: Dr. Joan R. Lind

The Belmont Undergraduate Research Student Team (BURST) is a group of undergraduate students who are studying the Loewner differential equation, which can be symbolized as a black box with functions as input and different curves as the output. One focus of the study has been to input both random and deterministic functions to see what the output may look like through computer generated pictures. One of our challenges has been to find input functions that give 'ugly' output curves. In particular, we would like to find input functions that will output a spiral or a space-filling curve. Another focus has been putting fractal functions, such as the blancmange, into the black box. The team is working on predicting and proving results about the geometry of output curves.

Discipline: Mathematics