

# Graduate Student Paper Session

Saturday, November 17, 2007

## Session I – Hemenway Hall 305

8:00 AM – 8:15 AM      **Mathematical Models Of Sleep, Neurobehavioral Performance And Alertness**

Melissa A. St. Hilaire, Worcester Polytechnic Institute

Mathematical models of sleep homeostasis, circadian rhythms and their interactions are used to predict the effect of different sleep-wake schedules on neurobehavioral performance and subjective alertness. Although several such models exist in the literature, none are able to adequately predict both short and long-term effects of chronic sleep restriction. We present an existing mathematical model of sleep homeostasis, circadian rhythms and their interactions and discuss future refinements to the model to improve predictions under chronic sleep restriction.

8:20 AM – 8:35 AM      **Multiple Solutions for Asymmetric Nonlinear Boundary Value Problem**

Lisa Termine, University of Connecticut

We prove a conjecture regarding the number of solutions of a second order elliptic boundary value problem with an asymmetric nonlinearity. This proof makes use of several computer assisted techniques. First we compute approximate solutions using the Mountain Pass algorithm, and then we use Newton's Iteration to improve the accuracy of these solutions. Lastly, we use interval arithmetic to show that the exact solution is indeed close to our approximate solution.

## Session II – Hemenway Hall 307

8:00 AM – 8:15 AM      **Post's Problem For Strong Reducibilities**

Marcia Groszek, Dartmouth College

Abstract: The primary relation studied in Computability Theory is that of relative complexity. A set  $A$  of natural numbers is said to be reducible to  $B$  if, given access to information about  $B$ , we can compute  $A$ . We say  $A$  is computable if  $A$  is reducible to the empty set and computably enumerable (c.e) if there is a computer program that can list the elements of  $A$  (but not necessarily the complement of  $A$ .) Post's problem asks if there are noncomputable c.e. sets that don't compute all other c.e. sets. We will look at this question for strong reducibilities.

8:20 AM – 8:35 AM      **A Group Analogue Of Carmichael's Conjecture**

Jonathan Bayless, Dartmouth College

Carmichael's conjecture that there is no unique preimage for the Euler phi function is well-known and widely believed. We show that the analogue for the function  $U$ , which maps an integer  $n$  to the class of Abelian groups isomorphic to the unit group mod  $n$ , is false, and we give both a lower bound and an upper bound on the number of counterexamples up to  $x$ .