

# Mathematics Department Colloquium

**Speaker:** Dr. Hien Tran, Director of the Center for Research in Scientific Computation, North Carolina State University

**Title:** Modeling, Machine Learning, and Control: Real-World Applications

**Date and Time:** Monday, March 9, 2020 at 3:30 pm

**Place:** James Hall 1112

**Abstract:** In this talk, we highlight several interdisciplinary research projects from the Center for Research in Scientific Computation that have made an impact in providing interdisciplinary research-related experiences for students and faculty members while contributing to the research efforts of industrial partners. One project, which is a joint collaboration between North Carolina State University and Calabazas Creek Research, Inc., is the design of a multiple-beam electron gun using advanced three-dimensional computational tools and modern optimization routines. The research showed that new advanced electron beam devices, which were previously considered impractical, may now be achieved using the processes and design tools developed in this project. Another collaborating project is with MIT Lincoln Laboratory on using machine learning to predict the next pitch thrown by a pitcher in a major league baseball game. We used data from three seasons, 2013 - 2015, to compare individual pitcher predictions based on multi-class linear discriminant analysis, support vector machines, and classification trees to lead to the development of a real-time, live-game predictor. Finally, we present the real-time implementation of control methodologies for the swing up and balance in the upright, vertical position of an inverted pendulum mounted on a moving cart.