

# Midwest Undergraduate Mathematics Symposium

**Saturday, April 1, 2006, 8:30 am - 3 pm**

**Carver Science Center  
Simpson College, Indianola, Iowa**

The Midwest Undergraduate Mathematics Symposium will be held on Saturday, April 1, 2006. The purpose of this symposium is to promote independent undergraduate study in the mathematical sciences. All undergraduate students and faculty in mathematics and related fields are invited to attend.

## Schedule

8:30 - 9:00 Registration, check-in, donuts and coffee

9:00 - 9:10 Welcome

9:10 - 10:10 "How can something  $10^{-6}$  meters in length affect the space shuttle?", Dr. Tim Breitzman

10:10 - 10:30 Break and equipment check out

10:30 - 11:45 Undergraduate Mathematics - Morning presentations

11:45 - 1:15 Lunch, Sudoku Tournament, Poster session, exhibits, informal discussions of undergraduate programs

1:15 - 2:05 Undergraduate Mathematics - Afternoon presentations

2:15 - 2:50 "Multi-scale analysis", Dr. Tim Breitzman

2:50 - 3:00 Closing session

## **Two plenary talks**

We are pleased to have Dr. Tim Breitzman give the plenary addresses. Dr. Breitzman received a Ph.D. in mathematics from Louisiana State University. His research is in material science and he currently works for the University of Dayton Research Institute. Dr. Breitzman will talk about the mathematics needed to study the behavior of cracks.

## **Student and faculty papers**

Undergraduate students will give 15-minute presentations on topics of mathematical interest including undergraduate research projects, expository talks on interesting areas of mathematics, mathematics education projects, work for the modeling contest or Putnam exam, etc.

Faculty will present 15-minute talks on programs in their departments which support undergraduate research or other independent work by undergraduates.

## **Exhibits**

Displays about graduate school, job opportunities and research experiences will be available during the lunch break. Some representatives from graduate schools will be available to discuss their programs.

## **Registration deadline**

Attendees may register on the morning of the conference. There is no registration fee and lunch is provided. To preregister, contact Murphy Waggoner ([waggoner@simpson.edu](mailto:waggoner@simpson.edu) or 515.961.1839).

## Abstracts

### **How can something $10^{-6}$ meters in length affect the space shuttle? (morning plenary address), Dr. Tim Breitzman, University of Dayton Research Institute**

Applications of composite materials are increasing in number every day. One difficult issue associated with composites has been the characterization of the effects of multiple length-scales. This talk will explore the effects of micron-sized carbon fibers on the overall strength of composite materials used to build equipment ranging from aerospace vehicles and satellites to crutches and bridges. The characterization of these effects makes use of an interdisciplinary set of scientific skills that hinges on the mathematical description of the physical system.

### **Multi-scale analysis (afternoon plenary address), Dr. Tim Breitzman, University of Dayton Research Institute**

Composite materials can have very complex structures. This complexity can be impossible to model explicitly. Thus simplifications are often made to enable calculations to be carried out on computer systems. Unfortunately, these simplifications do not always paint an accurate picture of the complex systems they represent. The multi scale strain analysis method is one way to recover information about the complex system from the simplified model. This talk will explore the central ideas of the multi scale strain analysis method. Pictorial evidence is shown to support conclusions about the need to consider the contributions of the microstructure and the prestress.