SCHOLARSHIP

My academic training in applied mathematics gives me the ability to work on problems from a wide range of disciplines. My research interests have evolved from the existence and uniqueness of solutions to equations of fluid motion to the dynamics of vortex filaments. After numerous discussions with biology faculty, I am currently studying fluid dynamic models and disease epidemic models in mathematical biology.

Papers Published in Refereed Journals

- **James Peirce**, "Local well-posedness of the anisotropic Lagrangian averaged Navier-Stokes equations with Stokes Projector Viscosity." *Communications in Partial Differential Equations*, **31**, pp. 1139-1149, 2006.

  The averaged Navier-Stokes equations are modern mathematical model for large scale fluid motion. Because of their broad applications to physics and engineering, the equations have been the focus of many research questions regarding the mathematical properties of the solutions. This paper shows that unique classical solutions to an averaged fluid equation exist for a finite amount of time. It extends previously known results providing an essential step towards understanding averaged fluid flow in bounded fluid containers. Work on this paper began in graduate school and was completed during my first year at La Crosse.

Funded Faculty Research Activities

- In October 2005, I submitted a proposal to *Research & Grants Committee* titled "**Motion of a vortex filament in an averaged velocity field.**" The proposal was fully funded at a budget of $6,772.

  To understand weather patterns during strong storms, meteorologists (both professional and amateur) can use the motion of tornados to predict the direction of the overall storm. A similar approach is used to model fluid motion in turbulent regimes. By studying the motion of small swirling eddies, we can understand the general motion of the fluid. The center of these eddies are called vortex filaments. The rapid rotation of the filament causes the fluid to move at a large range of spatial scales. In order to capture the velocity of the surrounding fluid induced by the filament, previous research makes the limiting assumption that that the vortex filament has a core thickness. Recently a new direction has been proposed by considering a vortex filament moving in an averaged velocity field where the small scales of motion are averaged out. My previous research on averaged velocity fields is used to naturally replaced the filament by a fatter, smoothed out, vorticity. The velocity solutions to the new equation can be divided into local and nonlocal contributions.

  - I presented results about the local contributions at the **American Mathematical Society (AMS) Session on Partial Differential Equations** during the AMS - Mathematical Association of America (MAA) Joint Mathematics Meeting on January 2007. The session was well attended.

I have recently finished work on the nonlocal contributions and am currently preparing a paper for publication. Results of this paper will be of interest to mathematicians, engineers, and physicists.

Scholarship of Teaching and Learning

- In November, 2006 I received the **2007-2008 Wisconsin Teaching Fellowship** supported by the University of Wisconsin System Office for Professional and Instructional Development. The Wisconsin Teaching Fellows group includes outstanding early-career, untenured faculty and teaching academic staff who show exceptional promise as college teachers. Each Fellow undertakes a significant Scholarship of Teaching and Learning project, records the projects progress on an electronic poster tool, and disseminates the results in public forums. My project measures the students' connections between biological scenarios and mathematical models in a new course on biomathematics. I received summer support of $4,000. This project is ongoing.

Talks Presented

- The Motion of a Vortex Filament in an Averaged Velocity Field. AMS-MAA National Joint Meetings, New Orleans, 2007.

Current Work in Progress

- **Mathematical Biology.** On January 10-11, 2006 I participated in the AMS Short Course on *Modeling and Simulation of Biological Networks* in San Antonio, TX.

  Mathematical biology is currently one of the fastest growing areas in mathematics. After talking with biology faculty on campus, I am currently studying mathematical models for both micro-organisms motion and infectious diseases. These projects utilize my previous training in applied mathematics.

Professional Organizations

- Mathematical Association of America (MAA)