Report on VIGRE, January, 2010
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1. VIGRE crew

In the Spring of 2009, I ran a seminar VIGRE "crew" on Waves in Complex Media:
Scattering of Waves by Periodic Structures. Four graduate students and eight undergraduate students were involved. For the undergraduates, it turned out to be a very rewarding and educational experience. Two groups worked on separate but related projects and did a poster and oral presentation to the Math Department at the end of the semester. One group presented their poster at the annual conference of SIAM in Denver in July, 2009, and is nearly ready to submit a paper on the results to a physics journal. Proceedings from the course are online at
http://www.math.lsu.edu/~shipman/courses_09A-4999.html

The three graduate students presented special topics during one or two sessions each. I felt that, in order to make the course profitable and sufficiently challenging for undergraduate students, the material needed to be at a level substantially lower than what a graduate student would benefit from. The course was ideal for the engagement of graduate students in the role of mentors of undergraduates, but it was not possible to recruit graduate students for this role because, without compensation, this is not a preferred use of their time. Thus very little mentoring took place in this course.

2. Undergraduate research

I have been working with undergraduate student Tristan Arbour since October, 2009, on a project on ``Wave Scattering by Layered Structures". The objective is to develop a graphical user interface that will allow general users to view online calculations and graphs of energy transmission, guided modes, nonlinearity, and statistics of scattering by acoustic and electromagnetic waves by a variety of layered structures. Tristan has begun in January, 2010, to collaborate with another student, Jessica Dowd, on this project; Jessica is supported by Chancellor's Aid.

Through this project, the students will learn about the equations and phenomena of acoustics and photonics, the solution of differential equations including the use of Matlab for nonlinear equations, statistical analysis, and the online sharing of results through a GUI. The GUI will be highly practical because it will allow the user to see all aspects of scattering by arbitrary layered

materials, which comprise an important class of structures used in engineering. The calculations are tedious to do by hand in the linear case and impossible in the nonlinear case, and a single applet available online that gives results with the click of a button will be a valuable tool.