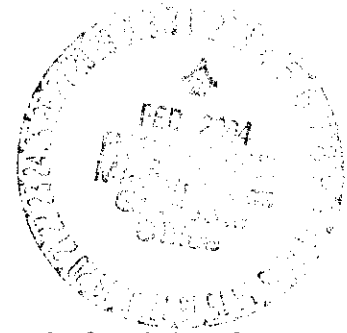


VIGRE REPORT- Fall 2003
Sarah E. Frey



Dissertation Progress

This semester I have primarily focused on continuing laying the foundations for my understanding and research in non-linear elasticity theory. I have been working on problems given to me by Dr. Tabor to develop my skills in this field. Throughout the semester, I met weekly with Dr. Tabor, Dr. Goriely and Dr. Tongen to discuss the applications of elasticity theory that each of us was pursuing. Specifically, I have been working on the problem of creating a non-linear elastic system to model the deformation of a sphere due to self-gravity. It is hoped that by studying this system and the stability of its solutions that some light may be shed on why instabilities are observed in the simplified linear elastic system for the tidal deformation of the sphere. At this point, I have a system set up but am still searching for a way in which to solve this complicated non-linear system of equations.

I have also been working on polishing the results I obtained over the summer for the tidal case in which density is radially dependent. I have run some more cases of my code and generated new plots that illustrate the singular behavior of the solutions. I have also began writing up these results for publication, which will hopefully be ready for submission some time in February.

Finally, I have just started working on the creation of a time dependent numerical model for the tidal deformation of a sphere. It is hoped that this time dependent simulation will allow us to gain greater insight as to the runaway behavior and cause of this instability. I have been looking into the program FEMLAB in hopes of exploiting some of its predesigned grids and finite element schemes in this modeling.

This semester I also had two papers which I had written previously, accepted for publication. The citations for these papers are given below.

"Numerical Evaluation of Love's Solution for Tidal Amplitude: Amplified tidal effects near singularities" with T.A. Hurford and R. Greenberg.

Published in the Proceedings of the IAU Conference on Tides, 2002.

Accepted for publication in *Celestial Mechanics and Dynamical Astronomy*, 2003.

"Data Assimilation with Extended Kalman Filtering for Impact Shock-Wave Dynamics" with J. Kao, et. al..

Accepted for publication in the *Journal of Computational Physics*.

Courses Taken

Audited MATH 565A - Stochastic Processes taught by Dr. Watkins

Research Talks/ Seminars

"Instabilities in the Problem of Elastic Planetary Tides"; Applied Mathematics Brown Bag Seminar; Univ. of Arizona; September 5th, 2003

"Characterization of Instabilities in the Tidal Deformation of a Planetary Body"; Joint Mathematics Meeting, AMS Special Session on Celestial Mechanics; Phoenix, AZ; January 10th, 2004