

DEPARTMENT OF MATHEMATICS

VIGRE Funding Report**(due 30 days after semester of support)****Semester/Summer and Year:**

Spring 2008

Name: Carlos Chiquete

List the graduate courses you have taken this semester (including independent studies), your grades, and the instructors:

| Course | Title | Grade | Instructor |
|----------|--------------------------|-------|-----------------|
| A ME535 | Boundary Layers | A | Tumin |
| A ME649 | Aeroacoustics | A | Kerschen |
| MATH900 | Research | S | Tumin |
| MATH597T | Pro. dev. teaching. mat. | A | Laetsch/Varecka |
| | | | |

List the title, date and location of any talks you have given, either here or elsewhere:

1. Receptivity of plane idealized one-reaction detonation to three-dimensional perturbations. January 9th, 2008. AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
2. Receptivity of plane idealized one-reaction detonation to three-dimensional perturbations. February 29th, 2008. Los Alamos Daze, Albuquerque, NM.
3. Stability of detonation waves, March 10th, 2008. Joint Program in Applied Mathematics and Department of Mathematics Recruitment Workshop, Tucson, AZ.
4. Receptivity of plane idealized one reaction detonation to one dimensional perturbations. April 4th, 2008. Program in Applied Mathematics Brown Bag Colloquium, Tucson, AZ.

If you are working on your dissertation, include a one paragraph description of your research progress. If you have not yet begun dissertation research, describe your progress toward finding a dissertation topic and advisor and beginning that research.

My dissertation advisor will be Dr. Anatoli Tumin from the Department of Aerospace and Mechanical Engineering and my research topic will be the stability of detonation waves in combustible gas mixtures. We had started work in this area as part of the third semester project within the Program in Applied Mathematics in Fall of 2007. During the Spring 2008 semester, we focused on preparation for the Oral Comprehensive Examination. Our dissertation work will begin in the following summer and fall.

List publications, if any.

Chiquete, C., Shalaev, I. and A. Tumin. 2008. Receptivity of plane idealized one-reaction detonation to three-dimensional perturbations. 46th American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January, 2008. Paper # AIAA-2008-1038.

Check all activities you completed during the funded period:

Academics:

- Independent Study
- Oral Comprehensive Exam
- Commence Thesis Research
- Conference attendance
- Conference participation
- Complete PhD

Professional development and outreach:

- AP Calculus Visit
- High School Workshops
- Undergraduate Research Project
- Undergraduate Research Seminar
- Super TA
- Mentoring junior graduate students for the qualifying exams
- RTG (help organize)
- Research Seminar (help organize)

Other (please specify)

Under professional development, tutored calculus students at the Minority Access to Research Careers at the UA.

Attach a brief statment about your academic progress and professional development during the period of support.

VIGRE Final Narrative Report

Spring of 2008

CARLOS CHIQUETE
Program in Applied Mathematics

June 6th, 2008

1 Overview

My goals for the now past semester were largely accomplished thanks to the support of the VIGRE fellowship. Primarily, I was able to pass the Oral Comprehensive Examination which is part of the PhD program in Applied Mathematics. Additionally, a number of other professional and academic objectives were met during the course of the semester. The following is a brief chronological narrative of my progress.

2 Academics

The semester began in January with the resounding hum of a jet engine as I flew to Reno, NV for the 46th AIAA¹ Meeting and Exhibit. I presented our research² on stability of detonation waves and submitted a paper to the conference proceedings. Unexpectedly, the opportunity arose to attend the Los Alamos Daze mini-conference on the campus of the University of New Mexico in Albuquerque, NM. Therefore, I again presented our work on detonation waves at this workshop in February. Locally, I also presented this work at the joint Recruitment Workshop in March and the Brown Bag colloquium in April.

As for classes, I took A ME535, A ME639 and MATH597T³. I also took some oral exam preparatory credits in MATH900. The results of the coursework were obviously increased knowledge of the subject matter in question, and the completion of the requirements for the Aerospace Engineering PhD minor which consists of completing 12 credits of graduate level courses with grades of B or higher. Also, the MATH597T course sequence was completed in order to satisfy the requirement for first-time teaching at the U of A math department.

As mentioned previously, the main focus of the semester was preparing for the oral examination. The committee members included my advisor Anatoli Tumin (A ME), as well

¹American Institute of Aeronautics and Astronautics

²With Dr. Anatoli Tumin and Ivan Shalaev from the A ME department

³Boundary Layers, Aeroacoustics, and Professional Development Workshop in Teaching Mathematics, respectively

as Edward Kerschen (A ME), Moysey Brio (MATH), Ken McLaughlin (MATH) and Alain Goriely (MATH). My talk during the examination focused on two papers concerning the stability of detonation waves to one-dimensional perturbations. The preparation bore fruit on May 18th, 2008, when I successfully completed the exam. This was a great step forward in completing the program on a timely basis.

3 Professional and outreach activities

Beyond academics, the semester was successful as well. As per my VIGRE proposal, I tutored at the MARC⁴ program in calculus (all three courses) and even some pre-calculus. This went on the whole semester from the second week to the last. A total of 38 hours were spent tutoring a group of about 12 students.

The other activity in my proposal was high school visitations. However, I decided to switch this to mentoring an undergraduate research project as part of the MATH485 Mathematical Modeling course. The group of undergrad students included Isaac Jenkins, Christina Birch, Tina Eagar and Patrick Whalen who worked in the subject of “Controlling the Spread of Epidemics”. We met weekly for about an hour where we talked about the project, discussing questions about the mathematics of dynamical systems and the biological mechanisms of diseases which involve a parasite and host. Their end result was a talk, poster and written report on a particular model of tick-borne disease which spreads as ticks attach themselves to deer.

Finally, I served as SIAM⁵ Student Chapter vice president and thus helped organize the SIAM chapter meetings which mainly involve research talks from professors or graduate students in all areas of applied mathematics. As VP, I was responsible for advertising talks, creating posters, providing food/refreshments etc... As a group the executive committee was responsible for the finding of speakers. For example, we brought Dr. Sumit Mazumdar from the Physics department to talk about superconductors. Another highlight of the semester was a panel discussion about opportunities for students of applied mathematics in industry, including input from representatives from Raytheon, IBM and the Breault Research Organization (Optics). Overall, it was a good experience in learning about the hard work that goes into organizing talks that are both useful and interesting.

4 Research

My future thesis research will focus on detonation waves and I will work with Dr. Anatoli Tumin from A ME. Detonation waves are supersonic combustion-driven shock waves that can propagate in gaseous or solid material. The thesis work begins in earnest in the summer of 2008, and will continue in subsequent semesters.

⁴Minority Access to Research Careers

⁵Society of Industrial and Applied Mathematics

5 Conclusion

The semester was eventful and I feel successful. Academics-wise, passing the oral exam represents a big step in my objective of finishing within 5 years of my entry into the PhD program. I was also able to complete a minor in Aerospace Engineering during the semester. Conference participation is also an integral part of academic training, and there was a good number of talks that I was able to give to a diverse range of audiences, from professors to incoming graduate students. As for professional development, I had substantial interactions with undergraduate students, specially within the mentoring project, as we talked about things beyond just their immediate class responsibilities, i.e. graduate school and other career opportunities. Serving in the SIAM executive committee was also an illuminating experience in organization and leadership.

Finally, I would like to thank the VIGRE fellowship and the people who made it possible for graduate students to benefit from it in the first place.