Self Study

2006

10-Year Review

Department of Applied Mathematics

University of Washington

Seattle

Washington

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Mission Statement:

The Department of Applied Mathematics discovers, applies, and promotes the use of mathematics to model and solve practical problems in many disciplines, ranging from engineering and science to medicine and business.

By nature our research is interdisciplinary. By exploiting the common underlying mathematical framework, we initiate the cross-fertilization of ideas and techniques from one discipline to another.

The Department of Applied Mathematics provides its graduate students opportunities for significant scholarly activities and original research. Through classes and individual faculty mentoring, our students learn to mathematically model and to develop combined analytical and computational techniques to solve problems. They learn to communicate, using the language of mathematics and the language of application disciplines, and to work with others to advance the frontiers of knowledge. They learn to respond to the mathematical needs of others by teaching, mentoring undergraduates and each other, working in industrial and government settings and on outreach projects in local schools.

The Department provides a core of undergraduate courses for students in the Applied and Computational Mathematical Sciences (ACMS) program as well as undergraduate and graduate service courses in applied mathematics to students from other departments. The Department also offers expert mathematical advice to the community through its Applied Mathematics Clinic and access to its courses through distance learning. Our students graduate with the knowledge, the experience, and the ability to be leaders in a society that exhibits increasing demands for competence in communication, computation and mathematics.

1. Introduction and Summary

With the explosive growth and development in many fields of sciences, engineering, medicine and social sciences over the past decade, the use of mathematics in these fields has increased tremendously, along with a rapid development of the techniques of applied mathematics needed for solving problems. The immediacy of these drastic changes demands a periodic reexamination of the way we educate applied mathematicians and the way we provide general mathematics education to non-mathematics majors. The Department of Applied Mathematics constantly examines our roles in a future university, and the implementation of major changes in our curriculum at all levels.

Our faculty is nationally and internationally acclaimed. Our Ph.D. program has appropriately been our faculty's pride and joy and will continue to be nurtured, as we strive to maintain scholarly excellence in applied mathematics research. About half of our Ph.D. graduates have moved on to successful teaching and research careers in academia with the other half to equally successful research careers in government laboratories or in industry. However, we have come to realize that the training of Ph. D. students cannot be our sole mission. In a public university and in an era of accountability to local constituents, it takes more to justify the existence of an elite graduate program, which, until about ten years ago, accepted few Washington State residents. Our task is to find ways to accomplish our multiple missions and still maintain the quality of our Ph.D. program, and to take advantage of our strength in research to infuse its excitement and relevance into our teaching at both the graduate and undergraduate levels. This is what a research university must offer, and more and more undergraduates are now experiencing the excitement of research and discovery by getting involved in research projects with our faculty. We believe that it is possible to incorporate the teaching of the applications and of an appreciation of the relevance of mathematics in our curriculum starting with freshman courses, and still be consistent with our College's vision of a liberal arts education. Logical thinking can be taught at any level within the context of application and usefulness. The Department of Applied Mathematics is well positioned to lead such a change in orientation at the undergraduate level at UW.

Our Department has 10.5 Full-Time-Equivalent Faculty, unchanged since the last review 10 years ago. With the retirement of Professor Criminale at the end of the 2005-2006 academic year, we are down to 9.5 FTE, but recruitment is under way for a new assistant professor (It is further down to 8.5 FTE at the resignation of Professor Peter Schmid in 2007). Our graduate program has over 50 students, rather large relative to the small size of the faculty (For 2005-2006, we have 53 graduate students, 41 of whom are US citizens. 44 are male and 11 female. 28 white, 3 Hispanic, 4 Asian, and the rest of undeclared ethnicity.) Median GRE scores in Quantitative for entering students are 780 for 2005-2006, 800 for 2004-2005, and 780 for 2003-2004. This is an average of MSc. and Ph.D. student pools. The governance of the Department is through authority delegated by the faculty to the Chair. Faculty Meetings are held at least once a month, and important decisions are made by faculty vote. Major strategic planning occurs through periodic retreats, although minor modifications occur throughout the year and are adopted by faculty vote.

Over the past 10-years we have granted an average of 4-5 Ph.D per year (4.4 per year for the past 5 years; 5 per year for the past 12 years). Appendix E lists 61 Ph.D students for the past 12 years

and their employment history—over half are in academic positions, about 23 are in professorial (assistant, associate and full professors) and other teaching positions (lecturer and instructor). The median time to degree is 5.75 years during the 10-year period. On average each PhD. thesis leads to at least 3 original publications by the student, an impressive record.

There has been an increase of Masters Degrees granted; we now grant 12-18 Master degrees each year. At the graduate level, there is an increasing demand for a Master in Applied Mathematics as a professional (terminal) degree, as adults are returning to school to upgrade their skills for our highly technological workplace. Seven years ago we were alerted to this "access" problem in the State by the Graduate School. Previously, we rarely accepted a student into our graduate program if his or her final degree goal was not the Doctorate. Since then we have implemented our Professional Master's Program, and streamlined our degree requirements and course schedules so that these requirements can be met by rigorous course work in one year.

This degree has now become a significant part of our graduate program. The Master's degree is also sought by a number of graduate students in other departments who need the more advanced level of mathematical training provided. This year, in partnership with the UW Extension, we completed the approval process for a Distance Learning Professional Masters Degree as a self-sustaining program and launched an advertisement campaign. We will continue to innovate and to introduce flexibility in order to meet a growing and diverse demand.

A new development since the last 10-year review is the start of an undergraduate degree program, the Applied and Computational Mathematical Sciences degree program, jointly offered by the departments of Applied Mathematics, Mathematics, Statistics and Computer Science. There are 150-180 undergraduate majors in the ACMS program, and about 50 B.Sc. degrees granted each year. It is worth noting that there has been no funding from the College for this new program. We have to donate some of our existing permanent allocation to the program for its operations and for Director teaching buy-out, in addition to staffing the courses needed for the new program. There has inevitably been some diversion of resources from our graduate program to this new undergraduate program.

In the British University system, applied mathematics programs traditionally take the form of independent departments, such as in Cambridge University and Oxford University. In the U. S., applied mathematical program takes several administrative forms. Some, like us, are independent applied mathematics departments. These include Brown University, California Institute of Technology, Northwestern University , Columbia University, University of Colorado (Boulder), Cornell University(where it is a Center), Delaware State University, Illinois Institute of Technology, Naval Postgraduate School, Princeton University(where it is a Program), Rice University, Santa Clara University, University of Arizona (where it is a Program), University of California at Santa Cruz, University of Chicago (where it is a Program), University of Illinois (where it is a Program), University of Iowa (where it is a Program), University of Maryland (Program), University of Minnesota (Institute), University of Notre Dame (Center), University of Texas at San Antonio, Yale University (Program).. . Some are together with Statistics. And a majority takes the form of an applied mathematics program within a larger mathematics department. We treasure the independence afforded by the separate administrative structure, while taking advantage of the scientific and educational interactions with UW's Mathematics Department and the Statistics Department.

The National Research Council is conducting its latest ranking of academic programs now, but the result will not be known in time for this review. The previous NRC ranking was done in 1995. At that time there was no category for Applied Mathematics. The University submitted data for two "mathematics" departments in the same university ---the criterion was that each program must have granted 5 Ph. D. degrees that year, and we happened to satisfy that criterion---- and we were erroneously ranked as one of the mathematics departments by mathematicians. Even so, we were ranked at the 71 percentile of all mathematics departments (41 out of 139). Only four universities submitted two entries in mathematics. The "second mathematics programs", which were the applied mathematics programs in these four universities, were ranked as: Brown (16), Rice (25), UW (41) and Johns Hopkins (50).

NRC ranking is based on reputation. Supplementing it is the objective ranking of The *Chronicle of Higher Education* on 166 large research universities and 61 smaller research universities according to faculty's scholarly output and impact. Using data compiled by Academic Analytics it "rates faculty members' scholarly output at nearly 7,300 doctoral programs around the country. It examines the number of book and journal articles published by each program's faculty, as well as journal citations, awards, honors, and grants received." In its most recent ranking, for 2005, our department is among the top 10 applied mathematics programs in the country (number 7). UW (with "12" faculty) is ranked behind 6 other applied mathematics programs: Michigan at Ann Arbor (with 43 faculty), Cornell (with 84 faculty), UT Austin (81 faculty), Princeton (10 faculty), Stanford (34 faculty) and Brown (32 faculty). UW's Statistics Department is ranked number 3 among statistics programs; the Mathematics Department at UW is not among the top 10 of mathematics programs, according to this ranking.

The faculty members in the Department bring into UW more federal grant dollars than they receive in salary from the State. The grant dollar amount per FTE faculty has been around $140K since 1999, with the exception of 2004-2005, when it was down to $120K, and 2005-2006, when it was further down to $90K. Part of the recent decline is attributable to the way joint grants are credited. For comparison with other math sciences departments in the university, we note that the grant dollar per FTE faculty in the Statistics Department also declined steadily from a peak of $140K in 1999-2000 to $60K in 2004-2005, and to $70K in 2005-2006. The Mathematics Department's grant dollar per FTE faculty has been steady at $20K until 2004-2005, when it was up to $30K and up further in 2005-2006 to $50K.

To summarize, our faculty research productivity and impact is nationally ranked. Our Outreach effort to the K-12 school committee is stronger than most much larger departments. We have one of the largest graduate programs in the College. In addition we do service teaching at both graduate and undergraduate levels. The impact of our Department in research, teaching and service belies our small size.

2. Service Teaching

Of all the colleges and professional schools at UW, the College of Arts and Sciences plays the greatest role in the service teaching of students. This is one of its unique roles. Students all across the University rely on departments in the College, such as Mathematics, Physics, Chemistry, Applied Mathematics, English, History and Psychology, to teach them prerequisites for their discipline and to provide breadth to their education. Mathematics and Applied Mathematics teach more undergraduate non-majors than majors. Applied Mathematics, in

addition, has a traditionally strong mission of graduate-level service teaching, and we teach more graduate students from other units than our own. We recognize this educational mission as our unique role in the University.

In fact, our Department---and more specifically, the Applied Mathematics Program that preceded it--- was formed because of such a perceived need on campus. In the 1960's, there was a proliferation of applied mathematics courses offered by most engineering and some science departments. Applied mathematical methods and education were deemed necessary for students in these departments. In 1969, a Committee on Mathematical Service, composed of 26 faculty members representing mathematics, physics, the social sciences, all areas of engineering, economics, and the medical sciences, compiled a list of all mathematically oriented courses offered at the University of Washington. In all 223 such courses were described; of these, 46 were offered by the Department of Mathematics, and almost four times as many, 177, were offered by the application departments themselves. Realizing the tremendous inefficiency in this duplication of effort, some of the professors who were teaching these courses, in the Departments of Aeronautical and Astronautical Engineering, Chemical Engineering, Mechanical Engineering and Oceanography, got together with a few applications-oriented professors from the Mathematics Department, and formed the Applied Mathematics Committee, and later the Applied Mathematics Program, for the purpose of consolidating the instruction of applied mathematics on campus. This mission continues today and is more important than ever as mathematical and computational techniques become even more widely used in other disciplines. It benefits our client departments for this trend to continue, instead of having each department develop its own applied mathematics courses specifically for its own students. It also calls upon our department to be responsive to the needs of students from the various application areas, and to be willing to revise and update our course contents to meet current needs.

We have detected trends that require us to change to better serve other graduate programs on campus: First, a few of our major clients now have graduate students who find our graduate sequence on methods of applied mathematics too advanced mathematically. We have accommodated these students with a sequence of (existing) courses at the 400 level. The contents of our 400-level courses are being revised to better respond to the needs of these graduate programs. In particular, instead of teaching a traditional ordinary differential equations course, we have introduced dynamical systems and chaos into the topic for AMATH 402. With a more attractive title, which includes the word "chaos", instead of the old title: "Methods of Applied Math II", we now have an enrollment of over 80 students compared to 40 previously. (However, it has come to light recently that the State's accounting of credit hours for graduate students taking 400-level courses is more complicated, and we may have to deal with the renumbering of these courses in the near future.) Second, as the use of mathematics spreads into formerly empirical fields such as Medicine, Biology, Economics and the Social Sciences, additional graduate students from these new fields have started to recognize the need for acquiring tools of applied mathematics for their research and education and have increasingly enrolled in our courses. However, many of these students do not have the mathematical prerequisites for our graduate courses. Many of them choose to enroll in our 300-level courses, for which they receive no credit toward their graduate degree. How best to accommodate these students is a challenge for us. Of more importance than the question of whether they receive graduate credit is whether these students can acquire tools they can put to immediate use when they take even our 300-level courses. Increasingly, the effective use of computers and high-level software packages may provide a partial solution to this dilemma. Third, students in many engineering and science

disciplines have too full a set of course requirements within their own major, and so do not have room in their curricula for our advanced level courses for both analytical and computational methods. We are working to combine modules from several of our courses into a coherent and compact sequence for them. At the undergraduate level, many engineering and sciences departments on campus now start to require their students take a MATLAB course from our Department, as a prerequisite to their other courses. The popularity of our MATLAB course at the sophomore level, AMATH 301, which is offered four times per year, with enrollments in some quarters exceeding one hundred, is an example of our effort in meeting that demand.

3. Undergraduate ACMS Program.

The Department of Applied Mathematics does not have its own undergraduate major and degree program. Before 1997 the involvement of Applied Mathematics in undergraduate education was primarily through service courses offered to students in other departments. During Autumn Quarter 1997, the new Bachelor of Science Degree in Applied and Computational Mathematical Sciences (ACMS) was introduced as an interdepartmental degree program administered jointly by the mathematical science departments: Applied Mathematics, Computer Science and Engineering, Mathematics, and Statistics. ACMS students take a set of common core courses, such as computing, linear algebra, differential equations and discrete and continuous mathematical modeling. These provide them with a solid mathematical foundation from which they can apply to one of the eight specialty areas or called pathways. They are:

- Biological and Life Sciences
- Engineering and Physical Sciences
- Scientific Computing and Numerical Algorithms
- Social and Behavioral Sciences
- Mathematical Economics
- Operational Research
- Discrete Mathematics and Algorithms
- Statistics

Within Applied Mathematics, the ACMS program is viewed as an important new aspect of the Department that brings undergraduates into much closer contact with our faculty and graduate students, with mutual benefits. All ACMS majors are required to take a core set of courses, which includes two courses in Applied Mathematics: AMATH 352 (numerical methods) and AMATH 383 (continuous modeling). Many students go on to take several other AMATH courses, particularly students in the Engineering and Physical Sciences option, the Biological and Life Sciences option, and the Scientific Computing and Numerical Algorithms options.

All of our courses at the undergraduate level are ACMS courses, some are required of all pathways, some specific pathways and one is an ACMS elective. All of our faculty members have taught ACMS courses at some time during the review period.

Required of all ACMS majors:
AMATH 352: Applied Linear Algebra and Numerical Analysis. The course is talk 4 times a year. Enrollment is usually limited by room capacity except summer), although recently there has been

a slight downward trend on enrollment. (Aut 04: 30; Win 05: 50; Spring 05: 40). Loyce Adams and Randy LeVeque typically taught it, as well as VIGRE postdocs and senior VIGRE fellows.
AMATH 383: Introduction to Continuous Mathematical Modeling. The course was taught 4 times a year until two years ago, when ACMS enrollment dropped. Starting 05-06 academic year, it is 3 times a year. (Aut 04: 35; Win 05: 21; Spring 05: 40) K.K. Tung typically taught it, as well as VIGRE postdocs and VIGRE fellows.

Required of some ACMS pathways:
AMATH 351: Introduction to Differential Equations. This course is an alternative to Math 307 for ACMS and Engineering majors. Typically taught 4 times a year. Bob O'Malley, Nathan Kutz, Bernard Deconinck typically taught it, as well as VIGRE postdoc and VIGRE fellows. (Aut 04: 29; Spring 05: 22; Spring 06: 34)
AMATH 353: Fourier Analysis & Partial Differential Equations. Typically taught twice to three times a year. Bill Criminale typically taught it, as well as K.K. Tung, Nathan Kutz and VIGRE postdocs and VIGRE fellows. (Win 05: 30; Spring 05: 23)
AMATH 401: Vector Calculus and Complex Variables. Mark Kot typically taught it. Taught only in Autumn (Aut 04: 54; Aut 05: 53)
AMATH 402: Nonlinear Dynamics and Chaos. Mark Kot, Bernard Deconinck and Hong Qian typically taught it. There is a noticeable increase in enrollment since the name change. Winter 07 enrollment : 84. (Win 05: 65; Win 06: 62)
AMATH 403: Partial Differential Equations, KK Tung and VIGRE postdoc typically taught it (Spring 05: 53; Spring 06: 54)
AMATH 422: Introduction to Mathematical Biology, once a year. Mark Kot and Hong Qian typically taught it. (Win 05: 20; Win 06: 26)
AMATH 423: Mathematical Biology, Stochastic Models. Once a year. Hong Qian typically taught it (Spring 05: 13; Spring 06: 14)

AMATH 441: Fluid Mechanics, Once a year. Bill Criminale typically taught it. Have not been taught in three years. Replaceable by a graduate version, AMATH 505.

ACMS elective:
AMATH 301: Beginning Scientific Computing. Taught 3 times a year. Nathan Kutz typically taught it. Some recent developments: Many engineering departments have won approval from their college to use AMATH 301 in place of CSE 142 as part of their programming requirements. We expect next year's enrollment to be 100-150 per quarter (Aut 04: 107; Win 05: 60; Spring 05: 63)

Several ACMS students have become involved in research projects. Interaction between undergraduates and our graduate students, postdocs, and faculty is encouraged by VIGRE (Vertical Integration Grant in Research and Education), a grant awarded through the Mathematical Sciences Directorate of the National Science Foundation. The UW Program, titled "Integration of Research and Education in the Applied and Computational Mathematical Sciences", is jointly administered by the departments of Applied Mathematics, Mathematics, and Statistics.

To attract undergraduates into research areas and to foster vertical integration, two AMATH graduate students run the Friday afternoon ACMS Seminar for ACMS students, as well as other undergraduates and VIGRE fellows. Invited speakers present interesting topics of current

research at a level accessible to undergraduates. Interested undergraduates can follow up by involving themselves in research with a faculty member, supported by the VIGRE grant. About 33 quarter-long projects are supported for each of the last two years by VIGRE.

4. Undergraduate Curriculum

In the field of applied mathematics, it has become less feasible to educate an applied mathematician in a traditional sequence, by starting at lower undergraduate levels with a solid foundation in abstract, axiomatic mathematics and then moving on in the upper undergraduate and graduate level to the applications of mathematics. Some countries, such as China, the former Soviet Union, and parts of Europe, still educate their applied mathematicians this way, but these educational systems force their students to specialize earlier than we do in our system, and hence offer a less "liberal" university education. An undergraduate at the University of Washington typically takes 15 credits, about 4 courses each term, starting with one year of Calculus as a freshman. If the traditional sequence were followed, a student would graduate without getting to the applied part. As a result, the student would not have gained an appreciation of the foundation being laid. The problem becomes even more acute for a science or engineering student because of the additional requirements of his or her major. An engineering student who finishes all his mathematics requirements for his degree has probably not acquired the mathematical tools necessary to solve problems he will encounter in his field.

The use of computers is having a great impact on methods of doing scientific research in all branches of the engineering, physical, and biological sciences. This requires additional training of students in computational methods and the software tools, which are necessary for understanding, acquiring, processing, manipulating, and interpreting data. Due to constraints on requirements, it is not feasible to impose additional coursework on already overloaded students. A solution to this dilemma is to incorporate the most significant computational tools and methods into existing coursework already required of undergraduates.

Nowhere is the incorporation of technology more important than in undergraduate education. Engineering and physical science students are facing an increasing demand for proficiency in such software packages as MATLAB, MAPLE and MATHEMATICA, in order to give them the capability to solve complex problems. This need for proficiency is key in preparing students for graduate work and, more importantly, in preparing students for the current professional job market. As a department, we have already begun to modify our undergraduate course sequences to use the MATLAB programming environment in conjunction with traditional lectures. Thus, an engineering student learning differential equations (AMATH 351) will not only learn the traditional analytic solution techniques, that solve the simplest problems, but will also be able to simulate and solve a wide variety of problems numerically and symbolically using MATLAB and MAPLE. The same is true for the second course in our current undergraduate sequence, which provides an introduction to numerical methods (AMATH 352). The numerical methods introduced provide a wide variety of practical approaches to analyzing problems ranging from linear algebra to differential equations. We use MATLAB as both a programming language and for data processing and graphics. The use of MATLAB is continued into the third quarter of our junior level sequence (AMATH 353), providing a much needed visualization package for increasing the understanding of partial differential equations, whose classical solutions are usually in the opaque form of multiple sums and integrals. AMATH 301 is a course on introductory scientific computing, which teaches the use of MATLAB and some of its toolboxes.

Our modeling course, AMATH 383, also encourages students to use MATLAB in their course projects.

Perhaps of the greatest importance is a student's ability, upon completing our coursework, to apply what he/she learned to problems that may not have exact and easy solutions. This is a great shortcoming of a traditional mathematics education, which only teaches one how to solve simple problems with analytical solutions. The range of problems which may be considered can be significantly increased with the aid of the computer. This then gives students an invaluable tool for their future pursuit of careers in the engineering and physical sciences.

Student enrollment in our 300-level courses has tripled. A large portion of the increase at this point is attributable to the ACMS program. We see a further, potentially larger, increase to come from engineering and other science majors, once the word about our courses and their usefulness has been disseminated through the advising offices.

Our upper division undergraduate courses and graduate courses are also infused with a variety of computational tools, which include MATLAB, MAPLE and MATHEMATICA. These are the standard computational tools available academically and in the work environment. It is our aim to continue to train students in using computers not by separate courses, but by providing computational methods hand in hand with analytical solution methods. This is especially important for our Masters and Ph.D. students, as there is a growing expectation from the academic and industrial community for graduates who are highly proficient with the standard computational methods and tools.

5. Instructional Technology

Technology is increasingly affecting our research, what we teach graduate and undergraduate students, and how we teach.

Our department has taken the lead in the College in moving our courses to the Web for over 10 years. We provide uniform templates and a central database for all our service courses. Instructors and teaching assistants have access to a common spreadsheet, constructed from the electronic version of the tenth-day class list, for entering and calculating grades; students can view their grades throughout the term using a password; homework assignments and solutions are posted online; lecture notes are available online, and include video demonstrations for some courses.

After a one-year feasibility study, we have introduced "Video Sections" for some of our oversubscribed service courses. Instead of Sections A, B and C for a course, which requires three instructors and three adequately sized classrooms at three different times, we will offer Section A live and Section B as the filmed version of Section A, through video streaming on the Internet. There is no need for a classroom for the Video Section and the student can attend the "lecture" anytime. The instructor and TA are available in person for help through extended office hours, e-mail and message boards. Such use of technology appears to be the only way a small department like ours can temporarily satisfy the demand for some service courses by students who need classes at different times to fit their other class or work schedules. The Mathematics Department, for example, often has 8 to 12 sections of a course taught at different times. We, however, do not have enough personnel to teach more than one section of any course on a regular basis.

Our research discipline is, likewise, profoundly affected by technology. The advent of fast computers has revolutionized the field of applied mathematics, especially its rate of change. The extensive use of numerical and approximation methods to solve problems is a characteristic of a modern applied mathematician, and all our graduate students are required to acquire such expertise. We are making a significant progress in extending the use of computers to the lowest level courses we teach.

6. Graduate Program

Appendix E is an expanded version of what the Graduate School requires for this program review. It includes a list of Ph.D. graduates and their employment history for the past 12 years. Over this 12 year period, we produced a total of 61 Ph.D. graduates. About half of the graduates were employed in academic positions (which include postdoctoral positions for the more recent graduates). If postdoctoral positions are not counted, 23 out of the 61 are in professorial/lecturer/instructor teaching positions in academic, more than one third. Our Ph.D. students' work leads to new original contributions to applied mathematics and application fields. A sense of that can be obtained from publications arising from thesis work. A list of 71 original publications from the past 5 years (when we graduated 22 Ph.D. students) by the graduating Ph.D. students is included at the end of Appendix E. Thus on average, each Ph.D. thesis leads to 3 refereed publications, an impressive accomplishment by our graduate students and their mentors.

As discussed previously, we have streamlined our Master's degree program, so that a full time student can complete the degree in one year, as compared to two previously.

At the Ph.D. level, we have revamped our program in an attempt to cut the time-to-degree from the current 5-6 years to 4-5. Five years ago our faculty approved a new system, similar to that of the Applied Mathematics Department at Northwestern University. A Preliminary Exam in linear algebra, differential equations and advanced calculus is to be taken in January of the first year of graduate study, instead of the traditional five 3-hour written Qualifying Exams and subsequent oral exams in September after a student's first year of study. The General Examination must now be scheduled by the Spring of the second year of study, along with a thesis proposal. (Previously, General Exams were often delayed until the third or fourth year.) Our previous examination schedules often discouraged graduate students from starting a research project during their first summer here. The new system requires first-year students to form a Supervisory Committee by the Spring of their first year and encourages research with a faculty member during their first summer. The course requirements were also streamlined to provide students tools to start research earlier. We are making these changes pro-actively, recognizing that a robust U.S. economy and a shortage of high-tech workers will lead to a decreased economic incentive for a student to spend 5 or 6 years in pursuit of an advanced degree.

Since many of our Ph.D. students will become educators themselves, it is important that they gain teaching experience and learn how to communicate mathematical concepts to non-mathematicians. Through our outreach programs, especially the GK-12 program funded by NSF and directed by our Professor Loyce Adams, many students now serve as Mathematics Specialists in the local K-12 classrooms. We believe the experience provides a valuable

component of education for graduate students in Applied Mathematics, which was missing previously.

VIGRE. The primary goal intended by NSF is "increasing the number of well-prepared U.S. citizens and permanent residents who pursue careers in the mathematical sciences". The University of Washington was one of the first to be funded by VIGRE when the program started in 1999, and we are currently one of the very few to be awarded a *second* five year grant. In 1999, the departments of Applied Mathematics, Statistics and the more applied part of the Mathematics Department jointly proposed to NSF for our first VIGRE grant, and we were eventually funded at the $2.9 million level for the 5 years ending in August 2004. The PIs were Loyce Adams and Randy LeVeque of our Department and Peter Guttorp of the Statistics Department and Anne Greenbaum of the Mathematics Department. The second 5-year grant is also jointly proposed by the three departments (now including the full Mathematics Department), and is funded at $3.9 million. The PIs are Loyce Adams and Ka-Kit Tung of our Department, Douglas Lind and Selim Tuncel of the Mathematics Department, and Peter Guttorp of the Statistics Department. The second VIGRE grant supports 25 graduate students, 7 of those in Applied Mathematics. These VIGRE fellows are supported by the grant for two quarters each academic year, plus the summer. In the remaining quarter, the Department supports them either as a TA or as an Instructor. The opportunity as an Instructor of one's own course is sought after by our graduate students, as the job market for academic positions is very competitive. Having a strong teaching experience gives our graduates a competitive advantage for these jobs.

GK-12. This outreach program is run by Professor Loyce Adams and is funded by NSF. In fact this is the second round of 5-year funding received, and it is at the $2 million level. The program places graduate students in local K-12 schools to act as Math Specialists to help teachers to adopt new mathematics curriculum and to more effectively teach mathematics concepts to their students. Our graduate students learn teaching pedagogy and how to communicate mathematical concepts to the public. They are also exposed to a culture of outreach, especially to minority school districts.

A time table for monitoring and advising students in their progress towards a Ph.D. degree is listed on our department's website and reproduced below.

Time Table to Ph.D. Degree

Program Plan	Must be filled out by the student, signed by the advisor and approved by the Graduate Committee no later than the end of the third quarter of registration.
Preliminary Exam	Attempted in January of the first year of study, and passed no later than the third quarter of study.
Supervisory	Formed by the end of the academic year after the passage of the Preliminary

Committee	Exam, consisting initially of a Research Supervisor. Full Supervisory Committee must be formed four months prior to your general exam. All names of the committee members must be submitted to the Graduate School via its on-line form.
Admission to Ph.D. Program	Considered for admission by the Graduate Committee after completing AMATH 567, 568, 584, and 585 with a grade of 3.4 or better in each course, 60 total credits, passing the Preliminary Exam and the formation of the Supervisory Committee.
Annual Report to Supervisory Committee	By the end of each Winter quarter after admission to the Ph.D. program. A quorum (at least three members) of the Supervisory Committee must meet to assess the student's progress at least once a year. Meeting date must be listed on the Annual Report.
General Exam	Attempted by the end of second year of study; passed no later than the first quarter of the third year of study. Delays are possible by petition to the Graduate Program Coordinator. Up to two retakes are permitted by the Graduate School. A Candidate-for-PhD-Degree Certificate is awarded by the Graduate School. Students must submit his/her request to the graduate school three weeks before the proposed exam date. Request form is available at Graduate School Forms. The form must be signed by your Supervisory Committee prior to its submission for the approval to the Graduate School.
Reading Committee	Must be officially established before the scheduling of the Final Exam. The Reading Committee must read an entire draft of a dissertation and the voting members of the Supervisory Committee agree before you can schedule the Final Exam. Should normally reserve two weeks for the reading of your draft dissertation.
Final Exam	Scheduled no later than the end of the fourth year of fulltime study from the date of passage of Preliminary Exam. Otherwise the Supervisory Committee will meet to assess satisfactory progress. Final Exam cannot be scheduled in the same quarter as the General Exam. Request-for-Final-Exam form must be signed by all members of your Supervisory Committee, including the

	GSR and submitted to the Graduate School at least 3 weeks before the Exam, which implies that the draft dissertation should be provided to the Reading Committee normally 5 weeks before the Exam. Warrant for the exam is issued by the Graduate School. If the Final Exam is satisfactory, signed warrant is returned to the Graduate School by the last day of the quarter (last day of finals week).
Final Copy of Thesis	After the Final Exam, you have 60 days in which to submit a final dissertation to the Graduate School. If the 60 days time period expires, another Final Exam may be required. Registration as a graduate student is required the quarter that a Final Exam is taken AND the quarter the dissertation is submitted and the degree conferred.

Highlights of recent graduate student participation in the affairs and decisions of the Department, including formal and informal channels of communication with the faculty.

Graduate students participate through their representative (GSR) in the decisions of the Department. The GSR attends all faculty meetings, except Executive Sessions where particular students' performance is discussed, and where faculty merits are discussed. The GSR in turn provides students feedback to the faculty. All faculty decisions on changes to the graduate program and regulations wait for student feedbacks before implemented. About once a month and/or on request from students, the Chair has a lunch meeting with the students, with wide ranging questions and answers.

A description of the ways in which the Department supports travel, meeting fees, and the overall exposure of its grad students entering the job market:

The Department funds all graduate student travel requests. This includes domestic and international travel to conferences, to society meetings, job fairs and workshops, to present their research results to get exposure and to network. The money comes from a variety of sources: the VIGRE grant, Department indirect cost recovery and Chair's discretionary fund.

Statistics on fractions of incoming minority students in the past five years and a general comparison of their progress towards degrees relative to the entire graduate population.

Appendix A lists the number of ethnic minority students for each of the 10 years. From 2001-2002 to 2005-2006, the numbers are 1,5,5,6,7, about 10% of the student body. They are fully integrated into the student body and their progress is about average.

Breakdown of fractions of full-time PhD students and Masters, and their success in completing the degree program to the nearest 10%:

Virtually all students who come to our graduate program get a Master's degree. Most do so in a year. There are only two in the past five years who did not complete their Master's degree, one because of unsatisfactory progress in course work (due possibly to health issues), and one who already had a Master's degree from another institution and decided to go elsewhere to pursue a PhD degree.

As described in the Self Study, previously we did not generally accept students into the M.Sc. degree program if their ultimate degree is not Ph.D. So those applicants without research experience were usually rejected. Exceptions include Armed Forces officers on government support, and graduate students in other department on campus who also get Master's degree from Applied Mathematics. Most students admitted were expected to continue in the PhD program and they were offered financial assistance to do so. Since the change to a terminal M.Sc. degree (called Professional Master's degree on Departmental website), more unsupported students have been admitted. Most of the Master's degree students are unsupported. Those desiring to pursue Ph.D. degree with financial support need to first pass the Preliminary Exam. A small percentage of the Master's students pass the Prelims (3 out of 9 this year) and continue beyond the Master's.

It is more difficult to calculate the percentage of PhD students who fail to complete the PhD degree. This is because it depends on the definition of PhD students. There are many hurdles facing a graduate student on his/her path to a Ph.D degree: the Preliminary Exam, the General Exam and finding a suitable thesis topic and advisor. The Graduate School classifies a grad student a PhD candidate only after he/she passes the General Exam. In the Mathematics Department an incoming student can be classified as a PhD student upon admission with five years of financial support. For competitive reasons we have in recent years offered "PhD admissions" with 5-year financial support. We expect these students to pass the Preliminary Exams, and they usually do. This year only one such student failed, and another one did not take the exam for health reasons. In this year's class of 20, which included both Masters and Ph.D students, 12 passed the Preliminary Exam, and we now designate them as "PhD students", and we expect them to complete their PhD degree within 4 years. By this definition we now have 34 PhD students and 17 M.Sc. students out of a total student body of 51 in 06-07. A few would fail to finish their Ph.D degrees for a variety of reasons. For example in the current year, three took a leave of absence, which statistically is a prelude to dropping out of the PhD program.

7. Financial Support for Graduate Students

The financial support for our graduate students takes one of three forms: Teaching Assistantships, Research Assistantships and Fellowships, in addition to self supporting. With some of NSF DMS's shift in RA support from individual PI grants to large-scale block grants such as VIGRE and GK-12, the number of RAs in the Department has diminished, but this decline has been more than compensated by an increase in VIGRE and GK-12 support. There are very few university fellowships. With effort we have increased our number of endowments for graduate fellowship, mostly through the generosity of our current and former faculty members. However, this is still at a level too low to make a difference.

There is a structural problem related to TA positions allocated by the College. While we have a large graduate program, whose students are excellent TA candidates, the number of TAs allocated by the College is based mostly on entry level undergraduate enrollments. While the

Mathematics Department is allocated a large number of TA positions for the teaching of Calculus, the Applied Mathematics Department was traditionally a graduate program and had only a few TA positions (6 quarters) and Graduate Staff Assistants (8 quarters). Even these have been cut in the dollar amounts during the past decade. About 15 years ago, an argument was made that Applied Mathematics graduate students could make very good TAs for Calculus, and some of the Calculus TAs can be used to support Applied Mathematics graduate students. The College allocated 27 quarters of TAs, supporting nine students during the academic year, to Applied Mathematics graduate students, who are assigned to the Mathematics Department. This arrangement has been successful and beneficial to both departments. However, the number of TAs allocated this way to us has not gone up when more TAs are given to the Mathematics Department for Calculus sessions, and has even seen some cuts whenever there was a general College wide cut in TA budgets.

The University's TA support stipend of about $1,400-1,500 per month is not competitive nationally. The Department supplements these stipends using income from other sources, such as revenue from teaching distance-learning and non-matriculation students. The subsidized stipend is $1,656 per month for 9 months. Even so, the stipend is still low. VIGRE students' stipend is $2,045, and GK-12 fellows receive $3,000. These represent NSF's effort in increasing graduate student stipends, but they introduce inequity in our program.

Overall, we support less than half of our graduate students financially. Although over half of the entering students are not given financial aid, they are still willing to come to pursue a graduate degree (mostly at the Masters level, since most of our Masters students are not funded). This creates a tension among our students. Some of our students run into financial difficulty after they come. The problem is anticipated to become worse when VIGRE and GK-12 expire in two to three years. This is a problem we would like to solve in the next 5 years.

The fraction of PhD students who do not receive full financial support during all normal academic quarters (excluding summer):
Normally all PhD students receive full financial support for up to 5 years. The support is however contingent on satisfactory progress. Currently there are two PhD students (out of 34) not supported financially. One of them did not take the General Exam within the expected time, and other one did not take the required courses.

8. Faculty Teaching

The Department's nominal teaching load is four quarter-courses per academic year. However, the actual average teaching load is lower, at "3+1" courses per academic year (three regular courses of 3-5 credits each---including recitations---plus one special course of less than 3 credits). This is due to some special arrangements made with individual faculty members. Unlike other units in the College with comparable size of graduate programs, our Graduate Program Coordinator does not receive a partial salary from the College (the College has neglected the payment historically). The duties of a GPC for a graduate program of over 50 students are substantial. To compensate, the Department reduces the GPC's teaching load to two. The Department also has a disproportionably large K-12 outreach program directed by our Director of Outreach. To compensate for her time and as the Department's contribution to the valuable effort for our community, the Director's teaching load is reduced to two regular courses plus

three Applied Mathematics Clinics (one per quarter) created for the graduate students throughout UW involved in this outreach program. There are also special programs, such as the College's Junior Faculty Development program, the ADVANCE' transition programs, and research buyouts. Together these reduce our faculty's actual teaching load to less than four. The Department uses leave- recapture funds (leaves without pay, research buyout, sabbatical leaves, College's matching to VIGRE grant) to hire postdocs and senior graduate students on VIGRE fellowships to supplement faculty teaching. In the case of graduate students teaching their own courses, it has a tremendous benefit to our students to better prepare them for a competitive academic career, and is in fact part of our proposal to VIGRE for mentoring future academics in mathematical sciences. This teaching opportunity is sought after by VIGRE and non-VIGRE students alike. Due partly to the motivation of the students themselves to teach, and our rigorous selection and helpful mentoring processes, courses taught by our graduate students tend to receive average or above average Student Teaching Evaluations. It should be mentioned that our Department benefits greatly from the TA training programs offered by the Mathematics Department. We often send not just the students assigned to be Math TAs to the training, but also students who may become TAs in the future.

The Department evaluates the effectiveness of teaching by faculty, instructors and pre-doctoral lecturers through Student Teaching Evaluation, and collegial teaching evaluation by faculty.

Faculty's supervision of research with undergraduates, M. Sc. students and Ph.D. students is not counted as part of the "teaching" load, although these students register under AMATH 490,498, 499, 500, 600, 700 and 800.

9. Faculty Research and Productivity

Identification of major research areas and emphasis of the department, including the major participating faculty members

Mathematical Biology: Mark Kot, Hong Qian.
Numerical Analysis/Scientific Computing: Randy LeVeque, Loyce Adams, Peter Schmid (will resign),
Atmospheric Sciences: Chris Bretherton (.5 FTE), Ka-Kit Tung.
Fluid Mechanics: Peter Schmid (will resign), Bill Criminale (retired).
Differential Equations: Bob O'Malley, Bernard Deconinck
Nonlinear Waves: Nathan Kutz, Bernard Deconinck

Faculty research areas:

Loyce Adams: Numerical Linear Algebra, Recently one focus has been multigrid methods for solving nonsymmetric systems of equations arising from the discretization of elliptic partial differential equations with internal interfaces. Finding efficient and stable methods for the nonsymmetric eigenvalue problem is another interest. She also directs the University of Washington's GK-12 Program in Mathematics which places graduate students from across the University into K-12 classrooms to help with math lessons.

Christopher Bretherton: Numerical modeling of atmospheric convection and cloud-topped boundary layers, applications of fractals to fluid dynamics, and linear and nonlinear wave propagation in geophysical contexts.

William Criminale: Shear instability, transient amplifications in fluid flows.

Bernard Deconinck: Nonlinear Waves, Soliton Theory, Fluid Mechanics, Hamiltonian Systems, Stability, Bose-Einstein Condensates, Riemann Surface, Symbolical and Numerical Computation, Lie Algebras, Semi-Discrete Systems, Asymptotics, Theta Functions.

Mark Kot: His research is at the interface between applied mathematics and ecology and evolutionary biology. He models the dynamics of biological populations, uses mathematics to shed light on the abundance and distribution of biological populations, and uses biology to motivate interesting mathematical problems. In recent years, his research has centered on integrodifference equations. These are discrete-time, continuous-space models for the growth and spread of biological populations. Integrodifference equations readily incorporate a range of dispersal mechanisms. They appear to be both more flexible and more realistic than simple reaction-diffusion models. He is also interested in understanding how simple ecological models can give rise to complex or chaotic dynamics and in a broad range of other ecological and evolutionary models and analyses.

Nathan Kutz: is interested in phenomena in the optical sciences: laser dynamics and mode-locking in fiber lasers, soliton propagation and mode-coupling dynamics for optical fiber communications, and pattern formation and stability of optical structures in optical parametric oscillators. Mathematically, the analysis and computation of the above phenomena naturally fall within the context of the methods of contemporary dynamical systems, nonlinear wave propagation, perturbation and asymptotic methods, and bifurcation theory applied to the underlying nonlinear differential equations and partial differential equations.

Randall LeVeque: works primarily on the development and implementation of numerical methods for solving partial differential equations, particularly hyperbolic systems of equations arising from wave propagation problems. He develops software and is currently involved in scientific computing projects regarding geophysical flows and shock waves in medicine.

Robert O'Malley: ordinary differential equations, singular perturbation methods, singularly perturbed boundary value problems; renomalization group method for nonlinear oscillations, asymptotic methods, control theory; boundary layer resonance and its generalizations.

Hong Qian: *Computational systems biology*: large-scale metabolic and protein interaction networks, cellular signal transduction, and biophysics of muscle contraction and cell motility. *Physical chemistry of single molecules and fluctuation analysis*: stochastic macromolecular mechanics, fluorescence correlation spectroscopy, single-particle tracking, atomic force microscopy, and single-molecule enzymology. *Biophysical chemistry*: protein folding, DNA supercoiling, and molecular motors. *Mathematical modeling*: blood flow in vascular networks, cancer metastasis, and neural computation.

Peter Schmid: Computational Fluid Dynamics; Hydrodynamic Stability and Transition to Turbulence; Flow Control; Computational Physics.

Ka-Kit Tung: Atmospheric dynamics, Climate change, Ozone, Greenhouse gases, Global warming, Solar cycle, Quasi-biennial Oscillation; Data analysis; Modeling observed large-scale phenomena in the atmosphere; Geophysical fluid dynamics.

As mentioned in the Introduction, our Department's scholarly productivity is highly ranked nationally in terms of faculty scholarly productivity. Over 90% of our faculty members publish every year, although for some reason the *Chronicle of Higher Education* listed 75% for 2005 (probably because it listed more faculty than we had). The average number of journal articles published has been about 7. The *Chronicle of Higher Education* listed, for its 2005 survey of faculty scholarly productivity, 40 citations per faculty. The citation number is higher than any other applied mathematics programs in the top 10 except one; Princeton's is 45.

SOME AWARDS & RECOGNITIONS: President of SIAM (Society of Industrial and Applied Mathematics); Editor of SIAM Review, Book Review; Editor of SIAM Classics Book series; Editor of SIAM Review, Survey and Review Section; Chief Editor of Journal of Atmospheric Sciences; Two Editors of Journal of Atmospheric Sciences; Fellow of American Meteorological Society; Editor of Discrete and Continuous Dynamical Systems B; Editor of International Journal of Applied Mathematical analysis and Applications; Two Presidential Young Investigator Award; Guggenheim Fellowship; NASA Space Act Award; NSF CAREER Award; Woodrow Wilson Foundation Fellowship; Alexander-von-Humboldt Foundation Fellowship; Senior Research Award of Alexander-von-Humboldt Foundation; Royal Society Fellowship; Fellow of American Physical Society; Claire d'Excellence "junior" de Agence Nationale de Recherche.

10. Mentoring of Junior Faculty

The Department has a very successful mentoring system for our junior faculty, as witnessed by the speed with which our assistant professors achieved tenure and consequently were promoted through the ranks to full professor. Our process starts at hiring. We make the hard decisions up front. We hire only those assistant professors that we think will be successful at achieving tenure. Once hired, all junior faculty members are treated as full members of the Department, and the whole Department helps in building the portfolios needed for the next promotion for the junior faculty member. The portfolios include documentation of teaching excellence, research achievements and service. As a result, we have achieved 100% tenure rate for our junior faculty. The price we pay has been exhaustive faculty hiring searches that often take two years. We maintain very high standards at hiring and at tenure review.

11. Faculty Size

The current size of our departmental faculty is constraining our ambition. It would perhaps be adequate if our mission were solely to educate our own graduate students, which have numbered

about 50. It is, however, too small for fulfilling the multiple missions of undergraduate and graduate service teaching. We have outlined ways by which we can devote more effort to undergraduate courses without harming our graduate program, and we will continue to seek ways to maximize the impact of our small program within our environment of limited resources.

The size of our faculty has been 10.5 FTE. By 2007 we will be down to 8.5 FTE. In 2008 one new hire will replace a retiree (Professor Criminale) and we will be up to 9.5 FTE. A request for approval to search for the replacement of Professor Schmid is pending at the Dean's office. We envision a department of 13 FTE to allow us to expand our courses and the teaching of applied mathematics from 300- and 400-levels to the 100-level, while maintaining strength at the graduate level and introducing more scientific computing throughout our curriculum.

For our research specialties within applied mathematics, 13 FTEs are probably just about critical mass. We were brought below critical mass a few times in the past six years, and this introduced unfortunate discontinuities in Ph. D. supervision and uncertainty in graduate student recruitment. With 13 FTEs, we can provide the needed continuity of graduate programs and create more synergy among different research areas, while allowing our faculty to devote more energy to undergraduate teaching and toward achieving a coherent undergraduate program for both the non-majors and the ACMS majors. We have argued earlier in this document that it is desirable to have the teaching of applied mathematics start before the 300-level. With a larger faculty size we can make a greater impact, starting at the freshman level, where the needs will be most critical as UW enrollments increase.

With increasing enrollments and new funding to meet this increase, the College has a number of choices concerning how best to allocate its resources to address its growing teaching needs. Funding Applied Mathematics and assigning it an expanded service-teaching role seems to be a win-win situation for the College, the Department and, more importantly, the students who enroll.

12. Diversity

Although the Department does not believe in numerical quotas, we have consistently met or exceeded the University's goals for diversity, with only one exception. In the Annual Affirmative Action Update report prepared by the Assistant Provost for Equal Opportunity, the distribution of academic personnel in the Department has met the goals for *Total Minority* in general, and in *Hispanic* and *Asian* in particular as affected classes. There are no goals set by the University for the Department for *Black* or *American Indian* faculty hires, because of too low availability of the pool of affected class in our field and the small size of the department (10.5 FTE). We are still short of on *female* faculty (1), despite heightened efforts during the last faculty hiring searches, due to problems with spousal accommodation at the University. We will continue our recruitment efforts for female faculty in our future searches.

Our Department does not have undergraduate student majors. Our graduate student body consists of mostly US citizens. Diversity in our student body not only is beneficial in introducing an awareness of diversity in our students' education and in preparing them for the real world, it is also motivated by some key parts of our mission. Many of our graduate students become educators themselves, and their experiences with diversity propagate into the next academic or educational environment. Furthermore, while as graduate students here, some are involved in Outreach projects in local K-12 schools through the GK-12 program headed by Professor Loyce Adams. Through her, Applied Mathematics has taken a leading role in the

College and the University to reach out to minority (more that 75% African American) K-5 schools in the Seattle area. Presently, the GK-12 Program in Mathematics places 8 Fellows at Thurgood Marshall and 7 at Leschi Elementary to work in every classroom in those schools. The Fellows help the teachers implement a mathematics curriculum that meets State of Washington and NCTM Standards. One of the existing problems in elementary schools for black children is a lack of good role models in mathematics and science. Our black male and female Masters and PhD students have in the past provided such role models (We currently have no black graduate students). These successful minority students were mainly US citizens except one, who was from Zimbabwe.

We have open access for all the students in our program. Our department's size and the openness of the faculty give all graduate students access to faculty time. Minority students and female students certainly have the same access to faculty as white male students.

Our admission policy provides access for traditional as well as non-traditional students, and our televised instruction program provides access for military personnel, full-time workers at Boeing and other high tech companies. Our one-year Professional Masters program satisfies a local need for access to a job-enhancing and re-education program.

In evaluating graduate student applicants, we consciously seek to diversify our student body. We are most successful in adding females and they have become some of our most successful graduates. We also regularly seek support for minority applicants and encourage them to do so as well.

The Chair, Ka-Kit Tung, served on the University of Washington Diversity Council.

A summary of steps the Department has used to enhance its diversity of faculty, and graduate populations, and stats on how well it has succeeded. The focus of this question is on tactics, not outcomes:

Hiring of minority and female faculty by necessity is opportunistic and so needs to have the support of the College and the University. The Department constantly looks out for such opportunities and brings to the attention of our deans. The Department desires to increase its percentage of female faculty, and we have given high priority to interview such candidates whether or not we have a position to fill. Two years ago, with support from our Divisional Dean, we interviewed a tenured associate professor who is female and who expressed an interest to move to our Department. Laboratory space for a 50-foot water tank was a difficult condition to meet. When we finally met that condition, the situation had changed. Five years ago, in our search for an entry level assistant professor, we made an offer to a female candidate. The recruitment failed because her husband could not get a faculty position in UW's CSE department. During our search this year, we have a minority female candidate who is very qualified for our position, but she is at the tenured associate professor level while our approved position is at the entry assistant professor level. This case is still under discussion with the deans.

Recently, we have had some difficulty getting minority assistantships from the Graduate School, and have not been as successful in having our minority students accept our offer of admissions and financial aid. The competition for qualified minority graduate students is great, and we

cannot rely on university resources. We are going through fund raising to come up with alternative financial sources.

13. Relationship with Other Units

The Department maintains close relationship with other mathematical sciences departments: We share a joint undergraduate degree program, which requires close coordination. We jointly run the Math Sciences Computing Center. We have successful joint grants, most notably the VIGRE grant from NSF described above. Our GK-12 grant involves participation from the entire university.

We are part of a joint Ph.D. program, Computational and Molecular Biology Program, with various biological units on campus. Some of our faculty members have joint appointments with other departments: Mathematics, Atmospheric Sciences and Bioengineering. Our adjunct faculty members have primary appointments in many Engineering departments, the Department of Pathology in the Medical School, the Fred Hutchinson Cancer Research Center, the College of Forest Resources, and other departments within the College of Arts and Sciences. Our faculty members are regular participants of co-teaching in the School of Medicine as a free service, and in various courses in departments such as Bioengineering, Biology, Quantitative Ecology & Research Management(QERM) and Genome Sciences.

Professor Bretherton serves as the Director of the Program on Climate Change, an UIF funded interdisciplinary graduate program. Professor Kot will serve for one year next year as the Director of the interdisciplinary graduate program QERM.

14. Fulfilling Our Vision

Our mission is education and research. We educate applied mathematicians in our graduate degree program as researchers and educators. We educate undergraduate ACMS majors in the applied and computational aspects of the mathematical sciences and prepare them for the technological workplace or further advanced studies. We traditionally educate graduate students from other departments in the methods and tools of applied mathematics through our graduate service courses. We move increasingly to teach applied mathematics to undergraduates from other departments. Through our outreach programs we help local school districts in their effort to better prepare future university students.

Our vision is to make all these pieces of research and education a coherent whole and to extend the synergy to introductory service teaching. We have much to offer the College and the University in this substantial transformation.

Appendix A. Graduate Student Statistical Summery (10-year data)

Applied Mathematics

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Autumn Quarter Enrollment										
Enrollment History										
Total	33	34	43	40	41	45	49	49	52	53
Full-Time	29	32	40	36	37	42	41	44	41	47
Part-Time	4	2	3	4	4	3	8	5	11	6
Male	20	20	26	26	28	30	31	31	40	43
Female	13	14	17	14	13	15	18	18	12	10
Ethnic Minority	5	6	7	3	1	1	5	5	6	7
International	5	5	7	9	13	12	15	12	13	11
Wash. Resident	14	14	16	15	15	19	24	20	21	18
Non-Resident	19	20	27	25	26	26	25	29	31	35
New Student Enrollment	10	7	17	12	10	12	10	15	16	16
Continuing	21	25	25	27	30	33	37	34	36	37
Annual Applications (Sum-Spr qtrs)	63	73	60	63	55	80	95	107	98	
Autumn Quarter Application	62	69	58	63	51	75	94	105	97	88
Autumn Quarter Denials	36	47	21	24	16	4	60	57	27	23
Autumn Quarter Offers	26	21	37	37	26	25	28	44	54	48
Autumn Quarter Percentages										
% Denied (of Applications)	58.1%	68.1%	36.2%	38.1%	31.4%	5.3%	63.8%	54.3%	27.8%	26.1%
% Offers (of Applications)	41.9%	30.4%	63.8%	58.7%	51.0%	33.3%	29.8%	41.9%	55.7%	54.5%
% New Enrollees (of Apps)	16.1%	10.1%	29.3%	19.0%	19.6%	16.0%	10.6%	14.3%	16.5%	18.2%
% New Enrollees (of Offers)	38.5%	33.3%	45.9%	32.4%	38.5%	48.0%	35.7%	34.1%	29.6%	33.3%
Autumn Minority Admissions										
Applications	6	7	7	3	5	6	11	11	19	11
Denials	2	6	3	2	2	0	4	5	7	5
Offers	4	1	4	1	2	1	6	6	10	5
Autumn International Admissions										
Applications	26	21	21	19	24	40	48	42	26	23
Denials	22	18	17	16	14	4	42	33	13	9
Offers	4	2	4	3	6	5	5	5	5	3
Applicant Average GPA Denied	3.37	3.44	3.54	3.55	3.51	3.40	3.42	3.42	3.45	3.37
Accepted But Not Enrolled	3.84	3.75	3.74	3.72	3.67	3.66	3.68	3.70	3.69	3.74
Accepted and Enrolled	3.41	3.57	3.59	3.68	3.57	3.56	3.62	3.57	3.57	3.76
Applicant Average GRE Scores										
Denied										
Verbal Score	533	533	460	474	468	310	529	525	437	483
Quantitative Score	737	723	752	703	756	760	765	761	729	743
Analytical Score	669	661	619	629	654	660	705	659	584	618

Accepted But Not Enrolled										
Verbal Score	593	627	561	586	563	600	571	584	542	547
Quantitative Score	759	738	749	754	773	765	765	765	773	754
Analytical Score	722	717	696	706	695	696	707	726	668	686
Accepted and Enrolled										
Verbal Score	584	608	516	562	573	606	556	567	552	569
Quantitative Score	742	742	731	740	760	746	770	769	772	744
Analytical Score	644	752	666	710	671	657	714	693	580	700
Annual Degrees Awarded (Sum-Spr qtrs)										
Masters:	5	10	16	8	6	13	11	12	13	
Doctoral:	5	2	4	2	4	5	5	1	8	
Ph.D. Candidates:	2	7	5		7	4	12	2	3	
Autumn Quarter Financial Support										
Teaching Assistants	17	17	30	23	23	19	21	21	22	17
Research Assistants	8	9	5	6	7	7	8	6	9	8
Fellowships	2	5	3	5	10	10	10	14	8	12
Traineeships	0	0	1	0	0	0	0	0	0	

Appendix B. Academic Unit Profile

DEPARTMENTAL ACADEMIC PROFILE FOR 1997 BUDGET REVIEWS

APPLIED MATHEMATICS

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

BUDGET BY PROGRAM, SOURCE AND FISCAL YEAR

	FY 1993-94		FY 1994-95		FY 1995-96		FY 1996-97	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	902,012	60,658	926,325	40,881	403,352	1,470	409,527	1,470
02 - Research	-	14,232	-	24,060	-	23,124	-	15,768
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	56,870	-	54,342	-	53,040	-	60,740	-
Total	958,882	74,890	980,667	64,941	456,392	24,594	470,267	17,238

	FY 1993-94	FY 1994-95	FY 1995-96
Grant & Contract Expenditures	934,761	928,307	516,306

STAFFING, BUDGETED COUNT OR FTE BY PROGRAM, SOURCE AND FISCAL YEAR

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 94-95	FY 95-96	FY 96-97	FY 94-95	FY 95-96	FY 96-97	FY 94-95	FY 95-96	FY 96-97
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	10.5	4.5	4.5	1.8	1.0	1.0	3.8	3.6	3.6
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	1.1	1.0	1.0
Total	10.5	4.5	4.5	1.8	1.0	1.0	5.0	4.7	4.7

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 1995-96

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department		866		866
Majors Out of This Department	339	686		1,025
Pre & Extended Majors	41			41
Total	380	1,552	-	1,932

SCH & Enrollees by Course Offering Department, AY 1995-96

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	189	659
Sub-Total	189	659
500 & Above	366	1,253
Total	555	1,912

Enrollment Offerings, Utilization, and Average Class Size, AY 1995-96

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	511	190	37.0%	99.5%	16.2
Sub-Total	511	190	37.0%	99.5%	16.2
500 and Above	1,510	383	25.2%	99.5%	10.8
Total	2,021	573	28.2%	99.5%	13.0

SCH Instructed by the Department's Personnel, AY 1995-96

Faculty (01-10 & 20)	TAs (01-30)	Other	Total
295	-	2	297
807	24	-	831
1,102	24	2	1,128
1,225	-	-	1,225
2,327	24	2	2,353

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Ranked Fac	TA
Lower Division		
Upper Division	3.8	3.9
500 and Above	3.9	3.9

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career	
Readiness for Advanced Study	
Instruct Quality In Major	
Instruct Quality Out of Major	
Fac Interaction Outside of Class	
Fac Assistance-Pursuing Career	

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	4.5	4.3
Adequacy of:		
Research/Training Opportunities	4.5	3.8
Space, Facilities & Equipment	3.5	3.5
Supervision/Guidance	3.5	4.3

Time To Degree, AY 1995-96

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	5	3.65	108.8	103.0	10.9	7.6	8.8	1.8	
Doctorate	4	3.79	232.5	229.3	23.3	14.5	19.0	5.8	
Professional									
Transfer									
Bachelor									
Professional									

Planning & Budgeting
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DEPARTMENTAL ACADEMIC PROFILE FOR 1998

APPLIED MATHEMATICS

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

BUDGET BY PROGRAM, SOURCE AND FISCAL YEAR

	FY 1995-96		FY 1996-97		FY 1997-98		FY 1998-99	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	403,352	1,470	409,527	1,470	426,062	1,470	426,062	1,470
02 - Research	-	23,124	-	15,768	-	13,344	-	13,344
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	53,040	-	60,740	-	64,356	-	64,356	-
Total	456,392	24,594	470,267	17,238	490,418	14,814	490,418	14,814

	FY 1994-95	FY 1995-96	FY 1996-97	FY 1997-98
Grant & Contract Expenditures	928,307	516,306	478,245	481,615

STAFFING, BUDGETED COUNT OR FTE BY PROGRAM, SOURCE AND FISCAL YEAR

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
Program	FY 96-97 GOF & DOF	FY 97-98 GOF & DOF	FY 98-99 GOF & DOF	FY 96-97 GOF & DOF	FY 97-98 GOF & DOF	FY 98-99 GOF & DOF	FY 96-97 GOF & DOF	FY 97-98 GOF & DOF	FY 98-99 GOF & DOF
01 - Instruction	4.5	4.5	4.5	1.0	1.0	1.0	3.6	3.6	3.6
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	1.0	1.0	1.0
Total	4.5	4.5	4.5	1.0	1.0	1.0	4.7	4.7	4.7

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 1997-98

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department		1,072		1,072
Majors Out of This Department	743	682	11	1,436
Pre & Extended Majors	213			213
Total	956	1,754	11	2,721

SCH & Enrollees by Course Offering Department, AY 1997-98

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	328	1,092
Sub-Total	328	1,092
500 & Above	403	1,482
Total	731	2,574

Enrollment Offerings, Utilization, and Average Class Size, AY 1997-98

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	605	348	54.2%	94.3%	18.5
Sub-Total	605	348	54.2%	94.3%	18.5
500 and Above	1,183	403	34.1%	100.0%	11.9
Total	1,788	751	40.9%	97.3%	15.2

SCH Instructed by the Department's Personnel, AY 1997-98

Faculty (01-10 & 20)	TAs (01-30)	Other	Total
12	74	-	86
882	167	-	1,048
894	241	-	1,134
1,253	-	-	1,253
2,146	241	-	2,387

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Ranked Fac	TA
Lower Division		
Upper Division	3.8	
500 and Above	4.1	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

- Readiness for Career
- Readiness for Advanced Study
- Instruct Quality In Major
- Instruct Quality Out of Major
- Fac Interaction Outside of Class
- Fac Assistance-Pursuing Career

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.0	4.3
Adequacy of:		
Research/Training Opportunities	3.0	4.3
Space, Facilities & Equipment	4.0	4.0
Supervision/Guidance	4.0	4.7

Time To Degree, AY 1996-97

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	5	2.09	107.8	52.0	10.8	6.8	8.8	2.3	
Doctorate	5	3.78	257.0	250.6	25.7	16.0	23.2	6.8	
Professional									
Transfer									
Bachelor									
Professional									

Planning & Budgeting
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DEPARTMENTAL ACADEMIC PROFILE FOR 1999

APPLIED MATHEMATICS

COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 1996-97		FY 1997-98		FY 1998-99		FY 1999-00	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	409,527	1,470	426,062	1,470	435,691	1,470	505,983	-
02 - Research	-	15,768	-	13,344	-	12,888	-	14,358
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	60,740	-	64,356	-	65,580	-	68,076	-
Total	470,267	17,238	490,418	14,814	501,271	14,358	574,059	14,358

	FY 1995-96	FY 1996-97	FY 1997-98	FY 1998-99
Grant & Contract Expenditures	516,306	478,245	487,300	524,663

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 97-98	FY 98-99	FY 99-00	FY 97-98	FY 98-99	FY 99-00	FY 97-98	FY 98-99	FY 99-00
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	4.5	4.5	5.5	1.0	1.0	1.0	3.6	3.6	3.6
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	1.0	0.9	0.8
Total	4.5	4.5	5.5	1.0	1.0	1.0	4.7	4.6	4.5

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 1998-99

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department		1,337		1,337
Majors Out of This Department	846	989		1,835
Pre & Extended Majors	336			336
Total	1,182	2,326	-	3,508

SCH & Enrollees by Course Offering Department, AY 1998-99

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	441	1,478
Sub-Total	441	1,478
500 & Above	511	1,947
Total	952	3,425

Enrollment Offerings, Utilization, and Average Class Size, AY 1998-99

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	743	463	59.4%	95.2%	27.3
Sub-Total	743	463	59.4%	95.2%	27.3
500 and Above	1,436	513	35.6%	99.6%	12.4
Total	2,179	976	43.7%	97.5%	18.4

SCH Instructed by the Department's Personnel, AY 1998-99

Faculty (01-10 & 20)	TAs (01-30)	Other	Total
-	-	-	-
1,164	165	-	1,329
1,164	165	-	1,329
1,402	-	-	1,402
2,566	165	-	2,731

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Ranked Fac	TA
Lower Division		
Upper Division	3.9	4.6
500 and Above	3.9	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career	
Readiness for Advanced Study	
Instruct Quality In Major	
Instruct Quality Out of Major	
Fac Interaction Outside of Class	
Fac Assistance-Pursuing Career	

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.7	4.0
Adequacy of:		
Research/Training Opportunities	3.5	3.8
Space, Facilities & Equipment	2.8	3.3
Supervision/Guidance	3.0	3.8

Time To Degree, AY 1998-99

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	16	2.99	81.3	58.0	8.1	6.0	6.3	1.8	
Doctorate	4	3.70	181.5	166.3	18.2	12.3	16.5	3.9	
Professional									
Transfer									
Bachelor									
Professional									

DEPARTMENTAL ACADEMIC PROFILE FOR 2000

APPLIED MATHEMATICS

UNIVERSITY OF WASHINGTON - COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 1997-98		FY 1998-99		FY 1999-00		FY 2000-01	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	426,062	1,470	435,691	1,470	505,983	-	599,466	-
02 - Research	-	13,344	-	12,888	-	11,614	-	11,614
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	64,356	-	65,580	-	68,076	-	70,776	-
Total	490,418	14,814	501,271	14,358	574,059	11,614	670,242	11,614

	FY 1996-97	FY 1997-98	FY 1998-99	FY 1999-00
Grant & Contract Expenditures	478,245	487,300	524,663	1,033,348

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 98-99	FY 99-00	FY 00-01	FY 98-99	FY 99-00	FY 00-01	FY 98-99	FY 99-00	FY 00-01
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	4.5	5.5	6.5	1.0	1.0	1.0	3.6	3.6	3.6
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	0.9	0.8	0.8
Total	4.5	5.5	6.5	1.0	1.0	1.0	4.6	4.5	4.5

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 1999-00

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department		1,061		1,061
Majors Out of This Department	1,318	1,167		2,485
Pre & Extended Majors	545			545
Total	1,863	2,228	-	4,091

SCH & Enrollees by Course Offering Department, AY 1999-00

Course Level	Course Enrollees	SCH
Lower Division		
Upper Division	606	2,010
Sub-Total	606	2,010
500 & Above	435	1,785
Total	1,041	3,795

Enrollment Offerings, Utilization, and Average Class Size, AY 1999-00

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	930	630	65.2%	96.2%	28.8
Sub-Total	930	630	65.2%	96.2%	28.8
500 and Above	1,202	437	36.2%	99.5%	12.0
Total	2,132	1,067	48.8%	97.6%	20.1

SCH Instructed by the Department's Personnel, AY 1999-00

Faculty (01-10 & 20)	TAs (01-30)	Other	Total
-	-	-	-
1,558	-	-	1,558
1,558	-	-	1,558
1,344	-	-	1,344
2,902	-	-	2,902

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Ranked Fac	TA
Lower Division		
Upper Division	4.1	4.1
500 and Above	4.0	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career
Readiness for Advanced Study
Instruct Quality In Major
Instruct Quality Out of Major
Fac Interaction Outside of Class
Fac Assistance-Pursuing Career

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.4	4.0
Adequacy of:		
Research/Training Opportunities	3.6	4.0
Space, Facilities & Equipment	3.4	3.0
Supervision/Guidance	3.2	4.0

Time To Degree, AY 1999-00

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	8	3.10	91.6	67.1	9.2	6.3	8.1	1.8	
Doctorate	2	3.89	242.5	237.5	24.3	16.0	24.5	7.1	
Professional									
Transfer									
Bachelor									
Professional									

DEPARTMENTAL ACADEMIC PROFILE FOR 2001

APPLIED MATHEMATICS

UNIVERSITY OF WASHINGTON - COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 1998-99		FY 1999-00		FY 2000-01		FY 2001-02	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	435,691	1,470	505,983	-	599,741	-	672,248	-
02 - Research	-	12,888	-	11,614	-	14,563	-	14,563
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	65,580	-	68,076	-	70,776	-	72,060	-
Total	501,271	14,358	574,059	11,614	670,517	14,563	744,308	14,563

	FY 1997-98	FY 1998-99	FY 1999-00	FY 2000-01
Grant & Contract Expenditures	487,300	524,663	1,033,348	1,219,314

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 99-00	FY 00-01	FY 01-02	FY 99-00	FY 00-01	FY 01-02	FY 99-00	FY 00-01	FY 01-02
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	5.5	6.5	7.0	1.0	1.0	1.0	3.6	3.6	3.6
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	0.8	1.2	1.4
Total	5.5	6.5	7.0	1.0	1.0	1.0	4.5	4.9	5.1

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 2000-01

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department	12	1,104		1,116
Majors Out of This Department	1,567	1,047		2,614
Pre & Extended Majors	548			548
Total	2,127	2,151	-	4,278

SCH & Enrollees by Course Offering Department, AY 2000-01

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	710	2,184
Sub-Total	710	2,184
500 & Above	422	1,804
Total	1,132	3,988

Enrollment Offerings, Utilization, and Average Class Size, AY 2000-01

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisfied	Average Class Size
Lower Division	-	-			
Upper Division	1,072	722	66.2%	98.3%	32.8
Sub-Total	1,072	722	66.2%	98.3%	32.8
500 and Above	1,266	422	33.3%	100.0%	12.9
Total	2,338	1,144	48.4%	99.0%	22.8

SCH Instructed by the Department's Personnel, AY 2000-01

Faculty (01-10 & 20)	TAs (01-30)	Other	Total
860	105	-	965
1,562	344	-	1,906
2,422	449	-	2,871
1,586	-	-	1,586
4,008	449	-	4,457

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Ranked Fac	TA
Lower Division		
Upper Division	4.1	4.1
500 and Above	4.0	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career
Readiness for Advanced Study
Instruct Quality In Major
Instruct Quality Out of Major
Fac Interaction Outside of Class
Fac Assistance-Pursuing Career

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.8	4.0
Adequacy of:		
Research/Training Opportunities	3.6	3.8
Space, Facilities & Equipment	3.0	2.8
Supervision/Guidance	3.0	4.0

Time To Degree, AY 2000-01

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	6	2.35	91.0	39.2	9.1	6.3	7.2	1.8	
Doctorate	4	3.72	208.3	201.0	20.8	16.3	18.8	7.1	
Professional									
Transfer									
Bachelor									
Professional									

DEPARTMENTAL ACADEMIC PROFILE FOR 2002

APPLIED MATHEMATICS

COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 1998-99		FY 1999-00		FY 2000-01		FY 2001-02	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	435,691	1,470	505,983	-	599,741	-	673,847	-
02 - Research	-	12,888	-	11,614	-	14,563	-	19,907
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	65,580	-	68,076	-	70,776	-	72,060	-
Total	501,271	14,358	574,059	11,614	670,517	14,563	745,907	19,907

	FY 1998-99	FY 1999-00	FY 2000-01	FY 2001-02
Grant & Contract Expenditures	524,663	1,033,348	1,219,314	1,604,715

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 99-00	FY 00-01	FY 01-02	FY 99-00	FY 00-01	FY 01-02	FY 99-00	FY 00-01	FY 01-02
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	5.5	6.5	7.0	1.0	1.0	1.0	3.6	3.6	3.7
02 - Research	-	-	-	-	-	-	0.1	0.1	0.1
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	0.8	1.2	1.4
Total	5.5	6.5	7.0	1.0	1.0	1.0	4.5	4.9	5.2

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 2001-02

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department	61	1,319		1,380
Majors Out of This Department	1,680	1,137		2,817
Pre & Extended Majors	520			520
Total	2,261	2,456	-	4,717

SCH & Enrollees by Course Offering Department, AY 2001-02

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	707	2,375
Sub-Total	707	2,375
500 & Above	460	2,004
Total	1,167	4,379

Enrollment Offerings, Utilization, and Average Class Size, AY 2001-02

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	987	724	71.6%	97.7%	34.5
Sub-Total	987	724	71.6%	97.7%	34.5
500 and Above	1,306	460	35.2%	100.0%	16.4
Total	2,293	1,184	50.9%	98.6%	26.3

SCH Instructed by the Department's Personnel, AY 2001-02

Course Level	Faculty (01-10 & 20)	TAs (01-30)	Other	Total
Lower Division	-	-	-	-
Upper Division	1,878	207	-	2,085
Sub-Total	1,878	207	-	2,085
500 and Above	1,324	-	-	1,324
Total	3,202	207	-	3,409

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Faculty	TA
Lower Division		
Upper Division	4.3	3.6
500 and Above	4.3	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career	
Readiness for Advanced Study	
Instruct Quality In Major	
Instruct Quality Out of Major	
Fac Interaction Outside of Class	
Fac Assistance-Pursuing Career	

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	4.3	5.0
Adequacy of:		
Research/Training Opportunities	3.9	4.4
Space, Facilities & Equipment	2.9	3.0
Supervision/Guidance	3.5	4.4

Time To Degree, AY 2001-02

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	13	3.05	98.6	68.8	9.9	7.6	8.5	2.3	
Doctorate	5	3.62	225.4	217.4	22.5	17.4	21.2	6.0	
Professional									
Transfer									
Bachelor									
Professional									

DEPARTMENTAL ACADEMIC PROFILE FOR 2003

APPLIED MATHEMATICS

COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 2000-01		FY 2001-02		FY 2002-03		FY 2003-04	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	599,741	-	673,847	-	939,532	-	1,032,752	15,603
02 - Research	-	14,563	-	19,907	-	30,084	-	-
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	70,776	-	72,060	-	72,060	-	67,993	-
Total	670,517	14,563	745,907	19,907	1,011,592	30,084	1,100,745	15,603

	FY 2000-01	FY 2001-02	FY 2002-03	FY 2003-04
Grant & Contract Expenditures	1,033,348	1,219,314	1,604,715	1,487,294

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 01-02	FY 02-03	FY 03-04	FY 01-02	FY 02-03	FY 03-04	FY 01-02	FY 02-03	FY 03-04
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	7.0	9.5	10.5	1.0	0.9	0.9	3.7	3.7	3.8
02 - Research	-	-	-	-	-	-	0.1	0.1	-
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	1.4	1.4	1.0
Total	7.0	9.5	10.5	1.0	0.9	0.9	5.2	5.2	4.8

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 2003-04

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department		1,278		1,278
Majors Out of This Department	1,861	1,200		3,061
Pre & Extended Majors	537			537
Total	2,398	2,478	-	4,876

SCH & Enrollees by Course Offering Department, AY 2003-04

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	769	2,598
Sub-Total	769	2,598
500 & Above	425	1,939
Total	1,194	4,537

Enrollment Offerings, Utilization, and Average Class Size, AY 2003-04

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	1,002	808	76.7%	95.2%	36.5
Sub-Total	1,002	808	76.7%	95.2%	36.5
500 and Above	1,335	435	31.8%	97.7%	15.1
Total	2,337	1,243	51.1%	96.1%	26.8

SCH Instructed by the Department's Personnel, AY 2003-04

	Faculty			
Course Level	(01-10 & 20)	TAs (01-30)	Other	Total
Lower Division	-	5	-	5
Upper Division	2,434	-	-	2,434
Sub-Total	2,434	5	-	2,439
500 and Above	1,524	-	-	1,524
Total	3,958	5	-	3,963

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Faculty	TA
Lower Division		
Upper Division	4.1	
500 and Above	3.9	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career
Readiness for Advanced Study
Instruct Quality In Major
Instruct Quality Out of Major
Fac Interaction Outside of Class
Fac Assistance-Pursuing Career

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.4	3.6
Adequacy of:		
Research/Training Opportunities	3.3	3.4
Space, Facilities & Equipment	2.9	3.0
Supervision/Guidance	3.9	4.0

Time To Degree, AY 2003-04

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	11	3.28	101.0	77.5	10.1	7.3	8.1	1.8	
Doctorate	5	3.69	210.0	203.2	21.0	16.2	19.6	5.8	
Professional									
Transfer									
Bachelor									
Professional									

DEPARTMENTAL ACADEMIC PROFILE FOR 2004

APPLIED MATHEMATICS

COLL ARTS & SCIENCES

SECTION 1 - WHAT RESOURCES HAVE BEEN AUTHORIZED?

Budget By Program, Source And Fiscal Year

	FY 2001-02		FY 2002-03		FY 2003-04		FY 2004-05	
Program	GOF	DOF	GOF	DOF	GOF	DOF	GOF	DOF
01 - Instruction	673,847	-	939,532	-	1,032,752	15,603	1,057,137	15,603
02 - Research	-	19,907	-	30,084	-	-	-	-
03 - Public Service	-	-	-	-	-	-	-	-
04 - Primary Support Services	72,060	-	72,060	-	67,993	#N/A	69,396	-
Total	745,907	19,907	1,011,592	30,084	1,100,745	#N/A	1,126,533	15,603

	FY 2001-02	FY 2002-03	FY 2003-04	FY 2004-05
Grant & Contract Expenditures	1,033,348	1,219,314	1,604,715	1,487,294

Staffing, Budgeted Count Or FTE By Program, Source And Fiscal Year

	Faculty Count (01-10 & 01-20)			TA Count (01-30)			Other FTE (01-40, 01-50, 01-60,etc)		
	FY 02-03	FY 03-04	FY 04-05	FY 02-03	FY 03-04	FY 04-05	FY 02-03	FY 03-04	FY 04-05
Program	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF	GOF & DOF
01 - Instruction	9.5	10.5	10.4	0.9	0.9	0.9	3.7	3.8	3.8
02 - Research	-	-	-	-	-	-	0.1	-	-
03 - Public Service	-	-	-	-	-	-	-	-	-
04 - Primary Support Services	-	-	-	-	-	-	1.4	1.0	1.0
Total	9.5	10.5	10.4	0.9	0.9	0.9	5.2	4.8	4.8

SECTION 2 - HOW WERE THESE RESOURCES USED?

Student Credit Hour Enrollment, By Type of Major, AY 2004-05

Type of Major	Undergrad	Graduate	Profess.	Total
Majors From This Department	33	1,343		1,376
Majors Out of This Department	2,141	1,040	3	3,184
Pre & Extended Majors	606			606
Total	2,780	2,383	3	5,166

SCH & Enrollees by Course Offering Department, AY 2004-05

Course Level	Course Enrollees	SCH
Lower Division		
Upper Divsion	889	2,847
Sub-Total	889	2,847
500 & Above	451	1,896
Total	1,340	4,743

Enrollment Offerings, Utilization, and Average Class Size, AY 2004-05

Course Level	Offered Enrollment	Total Enrollment Demand	% Offered Enrollment Taken	% Enr Demand Satisified	Average Class Size
Lower Division	-	-			
Upper Division	1,292	923	68.8%	96.3%	38.2
Sub-Total	1,292	923	68.8%	96.3%	38.2
500 and Above	1,286	453	35.1%	99.6%	14.4
Total	2,578	1,376	52.0%	97.4%	27.4

SCH Instructed by the Department's Personnel, AY 2004-05

	Faculty			
	(01-10 & 20)	TAs (01-30)	Other	Total
Lower Division	2,290	2	-	2,292
Upper Division	2,511	224	-	2,735
Sub-Total	4,801	226	-	5,027
500 and Above	1,650	-	-	1,650
Total	6,451	226	-	6,677

SECTION 3 - WHAT WERE THE OUTCOMES?

Student Course Evaluation (5 to 1 scale with 5=Excellent)

Course Level	Faculty	TA
Lower Division		4.2
Upper Division	4.2	3.6
500 and Above	4.2	

Undergrad Satisfaction - 6 Months After Graduation (5 to 1 scale with 5 = Excellent)

Readiness for Career
Readiness for Advanced Study
Instruct Quality In Major
Instruct Quality Out of Major
Fac Interaction Outside of Class
Fac Assistance-Pursuing Career

Grad Student Rating of UW Experience Upon Graduation (5 to 1 scale with 5 = Highest Rating)

Criteria	Masters	Doctoral
Overall Program Quality	3.4	3.6
Adequacy of:		
Research/Training Opportunities	3.3	3.4
Space, Facilities & Equipment	2.9	3.0
Supervision/Guidance	3.9	4.0

Time To Degree, AY 2004-05

Degree and Status	Number of Degrees	GPA	Average UW Degree Credits Attempted	Average UW Degree Credits Earned	Average FTE Quarters	Avg Number Qrt Enrolled at UW Full Time	Avg Number Qrt Enrolled at UW Total	Calendar Yrs Median	Grad Effic. Index
Non-Transfer									
Bachelor									
Masters	12	3.27	85.2	64.4	8.5	6.1	8.7	1.9	
Doctorate	1	3.68	238.0	233.0	23.8	22.0	24.0	6.8	
Professional									
Transfer									
Bachelor									
Professional									

Appendix C. List of special pathways, options, certificates, etc. within degree

No special pathways, certificates and options.

Appendix D. List of faculty by rank; include list of dissertation committees chaired for past five years

Name	Rank		
Adams, Loyce M.	Professor	Chair	Slemons, J. Wiest, D.
Bretherton, Chris	Professor	Chair	Back, L. E. Comstock, K. Peters, M. De Szoeke, S.P.
Criminale, William O.	Professor		
Deconinck, Bernard	Associate Professor	Chair	Nivala, M. Patterson, M. Bale, B. Oliveras, K.
Kot, Mark	Associate Professor	Chair	Toth, D. Gomez, M. Seo, G. Reluga, T. Medlock, J.
Kutz, J. Nathan	Professor	Chair	Bale, B. Farnum, E. Hewitt, S. Frigyik, B.
LeVeque, Randall J.	Professor	Chair	George, D. Fagnan, K. Pelanti, M. Carrasco Teja, M.
O'Malley, Robert E.	Professor	Chair	Curtis, C. Williams, D. Mudavanhu, B. Knaub, K.
Qian, Hong	Associate Professor	Chair	Cooksey, M. Jeon, J. Srivastava, S. Gull, D. Lind, C. Heuett, W. Bleyhl, J.
Peter J. Schmid	Professor		
Tung, Ka Kit	Professor	Chair	Gkioulekas, E. Paranjpye, A. Coughlin, K.

			Hammond, R.

Appendix E. Placement of graduates, last 3 years (include data on placements outside the academy). Expanded version to include last 12 years

(1)George, David L. (Summer 2006)
Thesis Title: Finite Volume Methods and Adaptive Refinement for Tsunami Propagation and Inundation
Advisor: Randall J. LeVeque
Postdoc, University of Utah

(2)Toth, Damon J.A. (Summer 2006)
Thesis Title: Analysis of Age-Structured Chemostat Models
Advisor: Mark Kot
Spent a few months after graduation, traveling the world with his new wife, then accepted a NSF "Research Training GRant in Mathematical Biology" postdoctoral position at the University of Utah.

(3)Gkioulekas, Elef (Spring 2006)
Thesis Title: The Nastrom-Gage Energy Spectrum of the Atmosphere, Proposed Theoretical Explanations and the Double Cascade Theory
Advisor: Ka Kit Tung
Accepted a 4-year Visiting Assistant Professor position after Ph.D., at the Mathematics Department, University of Central Florida

(4)Rafael Meza (Spring 2006)
Thesis Title: Some Extensions and Applications of Multistage Carcinogenesis Models
Advisor: Suresh Moolgavkar
Research Associate, Biostatistics/Public Health Science Division, Fred Hutchinson Cancer Research Center

(5)Pelanti, Marica (Winter 2005)
Thesis Title: Wave Propagation Algorithms for Multicomponent Compressible Flows with Applications to Volcanic Jets
Advisor: Randall J. LeVeque
Postdoctoral Fellow, Seismology, Institut de Physique du Globe de Paris, France

(6)Komuro, Rie (Winter 2005)
Thesis Title: Multi-Objective Evolutionary Algorithms for Ecological Process Methods
Advisor: E. David Ford
Research Scientist, Bioengineering Institute, The University of Auckland

(7)Farnum, Edward (Spring 2005)
Thesis Title: Stability and Dynamics of Solitary Waves in Nonlinear Optical Materials
Advisor: J. Nathan Kutz

Assistant Professor, Center for Science and Technology Education, Kean University

(8)Peters, Matthew (Spring 2005)
Thesis Title: Moist Convection and the Large Scale Tropical Calculation
Advisor: Chris Bretherton
Postdoctoral Fellow, Department of Earth and Planetary Sciences, Harvard University

(9)Williams, David B. (Spring 2005)
Thesis Title: Solving Singular Perturbation Problems: An Amplitude Equation Approach
Advisor: Robert E. O'Malley
Assistant Professor, Mathematics, Clayton State University

(10)Heuett, William J. (Autumn 2005)
Thesis Title: New Methods for Modeling Large-Scale Biochemical Networks
Advisor: Hong Qian
First job, postdoctoral research associate, Department of Physics, University of Colorado, Boulder. Current tenure-track assistant professorship offers from Department of Mathematics, Marymount University, Department of Mathematics and Biostatistics, University of Wisconsin, Stout, and Department of Mathematics, University of Edinburg.

(11)Hsu, Viktoria Regine T. (Spring 2004)
Thesis Title: Ion Transport through Biological Cell Membranes: From Electro-Diffusion to Hodgkin-Huxley via a Quasi Steady-State Approach
Advisor: Hong Qian
Research Assistant Professor, Mathematics, University of Utah

(12)Hewitt, Sarah E. (Summer 2004)
Thesis Title: Dynamics and Stability of Periodic Spatial Patterns in the Optical Parametric Oscillator
Advisor: J. Nathan Kutz
Senior Research Analyst, Washington Mutual.

(13)Reluga, Timothy Charles (Summer 2004)
Thesis Title: Some Results on Temporal and Spatial Heterogeneity in Theoretical Ecology
Advisor: Mart Kot
Spent a year as a postdoc in the Department of Epidemiology and Public Health at Yale University Medical School, another year as a postdoc in the Theoretical Biology and Biophysics Group at Los Alamos National Laboratory. Recently offered a tenure-track faculty positon at Western Ontario University, and also a tenure-track assistant professorship at Penn State University, 2/3 in the Mathematics Department and 1/3 in the Biology Department.

(14)Medlock, Jan Patrick (Autumn 2004)

Thesis Title: Integro-Differential-Equation Models in Ecology and Epidemiology
Advisor: Mark Kot
Offered a tenure-track faculty position at the University of Montana straight out of his PhD, but because of a two-body problem he opted to take a postdoc in the lab of Alison Galvani in the Department of Epidemiology and Public Health, Yale Medical School. Soon afer arriving at Yale, Jan applied for and received a Yale fellowship to study HIV through a program called the Center for Interdisciplinary Research on AIDS (CIRA), funded by a training grant from the National Institutes of Mental Health. Jan remains at Yale.

(15)Coughlin, Kathleen T. (Spring 2003)
Thesis Title: Stratospheric and tropospheric signals extracted using the empirical mode decomposition method
Advisor: Ka Kit Tung
Postdoc at UW, then Research Scientist at University of Reading, UK, Department of Meteorology. Recently becoming head of the hurricane statistical modeling group at RMS, London, an insurance risk management company.

(16)Hammond, Rebecca A. Crabb (Spring 2003)
Thesis Title: A dynamic game for managing a conservative pollutant in an estuary
Advisor: Thomas Leschine
Chair: Ka-Kit Tung
Mother of three children, moved around the world with her husband. Part-time Instructor: Mathematics and Computer Science, St. Mary's University, Halifax, Nova Scotia, Canada

(17)Kusiak, Steven J. (Spring 2003)
Thesis Title: The scattering support and the inverse scattering problem at fixed frequency
Advisor: John Sylvester
His first job is a CNRS postdoctoral fellow at Laboratoire Poems, France. Now a Technical Staff, Lincoln Laboratory, MIT, Lexington, MA

(18)Long Lee (June 2002)
Thesis Title: Immersed interface methods for incompressible flow with moving interfaces
Advisor: Randall J. LeVeque
First postdoc at University of North Carolina for three years, now Assistant Professor, Department of Mathematics, University of Wyoming

(19)James Rossmanith (June 2002)
Thesis Title: A wave propagation method with constrained transport for ideal and shallow water magnetohydrodynamics
Advisor: Randall J. LeVeque
First as a VIGRE postdoc at Michigan University, now Assistant Professor, Department of Mathematics, University of Wisconsin

(20)Dolven, Eric Thomas (Summer 2002)
Thesis Title: Seaquake waves – standing wave dynamics with faraday excitation and radiative losses
Advisor: Harry Yeh
Scientist, Cray Inc.

(21)Mudavanhu, Blessing (Spring 2002)
Thesis Title: Renormalization approach for solving weakly nonlinear differential equations
Advisor: Robert E. O'Malley
Vice President, Merrill Lynch & Company

(22)Bale, Derek S. (Winter 2002)
Thesis Title: Wave propagation algorithms on curved manifolds with applications to relativistic hydrodynamics
Advisor: Randall J. LeVeque
Application Physicist, Compound Semiconductor Group, eV Products

(23)Fogarty, Tiernan R. (Autumn 2001)
Thesis Title: Finite volume methods for acoustics and elasto-plasticity with damage in a heterogeneous media
Advisor: Randall J. LeVeque
First an Instructor then Assistant Professor, Department of Mathematics, Oregon Institute of Technology

(24)Knaub, Karl R. (Summer 2001)
Thesis Title: On the asymptotic behavior of internal layer solutions of advection-diffusion-reaction equations
Advisor: Robert E. O'Malley
After Ph.D. took a job as Assistant Professor at Bucknell University, then worked a year for the National Security Agency. Now Financial Analyst, Washington Mutual.

(25)Luke, David Russell (Spring 2001)
Thesis Title: Analysis of optical wavefront reconstruction and deconvolution in adaptive optics
Advisor: James Burke
After postdoctoral appointments at Gottingen and Simon Fraser, now Assistant Professor, Department of Mathematics, University of Delaware

(26)Moskowitz, Benjammin Michael (Autumn 2000)
Thesis Title: An analysis of frictional feedback in the Madden-Julian oscillation
Advisor: Chris Bretherton
Works for a family Financial Services company in Bellevue, WA.

(27)Obrist, Dominik (Autumn 2000)

Thesis Title: On the stability of the swept leading-edge boundary layer
Advisor: Peter J. Schmid
Started at Tera Computers, which later became Cray, Inc, as application support for large scale fluid simulations, and then in sales for the Swiss banch office. He is currently an Assistant Professor at Institute of Fluid Dynamics, ETH Zurich, Switzerland

(28)Kim, Arnold D. (Summer 2000)
Thesis Title: Optical pulse propagation, diffusion, and depolarization in discrete random
Advisor: Akira Ishimaru
Spent 4 years at Stanford University as a Postdoctoral Fellow, then Assistant Professor, now Associate Professor, School of Natural Science, University of California, Merced

(29)Yong, Darryl H. (Spring 2000)
Thesis Title: Solving boundary-value problems for systems of hyperbolic conservation laws with rapidly varying coefficients
Advisor: Jirair Kevorkian
Von Karman Instructor at Caltech, then Assistant Professor, Department of Mathematics, Harvey Mudd College

(30)Martin, Mark A. (Winter 2000)
Thesis Title: The influence of seasonal and climatic environmental changes on plankton in the marine mixed layer
Advisor: Mark Kot
Scientist, Portland Bioscience

(31)Calhoun, Donna Ann (Spring 1999)
Thesis Title: A Cartesian grid method for solving the streamfunction vorticity equations in irregular geometries
Advisor: Randall LeVeque
After PhD worked as a postdoc at the Courant Institute with Marsha Berger, then at UW working with LeVeque, and then an Acting Assistant Professor in the Mathematics Department at UW. She is now a researcher at Commissariat a l'Energie Atomique, Paris.

(32)Swanson, Kristin R. (Spring 1999)
Thesis Title: Mathematical modeling of the growth and control of tumors
Advisor: James D. Murray
Research Assistant Professor, Department of Pathology, University of Washington

(33)Jackson, Trachette L. (Summer 1998)
Thesis Title: Mathematical models in two-step cancer chemotherapy
Advisor: James D. Murray
Associate Professor, Department of Mathematics, University of Michigan. Co-director of Mathematical Biology Program.

(34)Nelson, Patrick W. (Summer 1998)
Thesis Title: Mathematical models of HIV pathogenesis and immunology
Advisor: James D. Murray
Assistant Professor, Department of Mathematics, University of Michigan. Co-director of Mathematical Biology Program.

(35)Stollnitz, Eric Joel (Spring 1998)
Thesis Title: Reproducing color images with custom inks
Advisor: Loyce Adams
A computer scientist at Microsoft for the past 5 years. Prior to that was at Alias for 10 years. .

(36)Thompson, Christopher J. (Winter 1998)
Thesis Title: A linear, stochastic, dynamical model of El Nino/southern oscillation
Advisor: Ka Kit Tung
Research Scientist at NOAA.

(37)Salinger, David H. (Spring 1997)
Thesis Title: A splitting algorithm for multistage stochastic programming with application to hydropower scheduling
Advisor: R. Tyrrell Rockafellar
Research Scientist, 1997-2005, Columbia Basin Research, School of Aquatic and Fishery Sciences, UW, then Research Scientist, Bioengineering, University of Washington

(38)Stern, Louis G. (Autumn 1996)
Thesis Title: An explicityly conservative method for time-accurate solution of hyperbolic partial differential equations on embedded Chimera grids
Advisor: Randall LeVeque
First as a Research Scientist at Tempress Technologies, Kent, WA, then joined Tera Computer Company, which later became Cray, Inc., as a Senior Applications Engineer. Now a Senior Engineer at the Boeing Co., Computational Fluid Dynamics Software Development.

(39)Welch, Wendall Tyler (Autumn 1996)
Thesis Title: Nonlinear baroclinic adjustment and wavenumber selection as a mechanism for atmospheric heat transport
Advisor: Ka Kit Tung
After Ph. D. worked at National Center for Atmospheric Research as an Advanced Studies Fellow, later accepted a position at Yale University as an Instructor, then moved to National Center for Atmospheric Research because of new husband, and later as planned, stays home raising two children

(40)Yang, Zhiyun (Autumn 1996)

Thesis Title: A Cartesian grid method for elliptic boundary value problems in irregular regions
Advisor: Loyce Adams
First job was at Pacific Northwest Laboratories, in Richland WA. Second job was at Enron. Present job is at Calpine, as the Information Systems Director for merchant systems.

(41)Manoussaki, Daphne (Summer 1996)
Thesis Title: Modelling formation of vascular networks in vitro
Advisor: James D. Murray
Since 2004 Assistant Professor, Department of Mathematics, Vanderbilt University. Was Visiting Fellow at National Institute of Health (97-99), Postdoctoral Associate, Institute of Neuroradiology, University Hospital Zurich (99-00), Visiting Assistant Professor, University of Crete, Greece (00-04)

(42)Tyson, Rebecca C. (Spring 1996)
Thesis Title: Pattern formation by E. coli and S. typhimurium – mathematical numerical investigation of a biological phenomenon
Advisor: James D. Murray
After 6 months as a postdoctoral associate at University of Colorado, Boulder, returned to UW as a Mathematics Study Skills Instructor in the Minority Affairs Office for three years. Then became a Visiting Assistant Professor in the Department of Mathematics and Statistics at University of Arizona for 8 months, before moving to the Department of Mathematics and Statistics at Okanagan University College, and became a tenure-track Assistant Professor. The university is now part of University of British Columbia.

(43)Young, Cynthia Y. (Spring 1996)
Thesis Title: The two-frequency mutual coherence function of a Gaussian beam pulse in weak turbulence
Advisor: Akira Ishimaru
Became Assistant Professor right after Ph.D., now Associate Professor, Department of Mathematics, University of Central Florida

(44)Zhang, Chaoming (Spring 1996)
Thesis Title: Immersed interface methods for hyperbolic systems of partial differential equations with discontinuous coefficients
Advisor: Randall J. LeVeque
After Ph.D. took a position at Rice University as a postdoctoral fellow. Now runs his own company, Veritas Tech, which specializes in compact separation of multiphase flows (oil and gas and water), in Houston and China.

(45)Fang, Ming (Autumn 1995)
Thesis Title: On the axisymmetric circulation of the atmosphehre
Advisor: Ka Kit Tung

After Ph.D. spent two years at Princeton University as a Postdoctoral Research Fellow, then went to Wall Street working on asset pricing. Returned to school and obtained a Ph.D. degree in Financial Economics from Yale University in 2006. Now is Associate Director, PartnerRe Asset Management.

(46)Kulesa, Paul M. (Spring 1995)
Thesis Title: A model mechanism for the initiation and spatial patterning of teeth primordial in the alligator
Advisor: James D. Murray
After Ph.D. spent three years at Caltech as a postdoctoral fellow, then one year at Oxford University's Center for Mathematical Biology as a Visiting Research Associate, then returned to Caltech for three years as a Senior Postdoctoral Fellow. Now an Assistant Professor of Cell Biology and Anatomy at the University of Kansas School of Medicine, and Director of Imaging Center, Stowers Institute for Medical Research

(47)Milac, Thomas I. (Spring 1995)
Thesis Title: The linear elastostatics of spherical shells
Advisor: Frederick Y.M. Wan
Between 96 and 97, as Visiting Assistant Professor at UC, Irvine. From 1997 to 04 as Research Assistant Professor at UW, then as Lecturer. Now took a position in a startup company.

(48)Wang, Lei (Spring 1995)
Thesis Title: Asymptotic analysis of a class of three-degree-of-freedom Hamiltonian Systems near stable equilibria.
Advisor: Jirair Kevorkian
Research Scientist, Seagate Technology.

(49)Cook, Julian (Winter 1995)
Thesis Title: Mathematical models for dermal wound healing: Wound contraction and scar formation
Advisor: James D. Murray
After Ph.D. went to UCLA as an Assistant Professor in the School of Medicine. Health interrupted his promising academic career. Now is mentoring young teenagers in England.

(50)Rand, Hugh Austin (Winter 1995)
Thesis Title: Mesoscale dynamics of the marine atmospheric boundary layer
Advisor: Christopher Bretherton
First as a postdoc at UW. Then as a Senior Research Scientist at Amgen, Inc.

(51)White, Katrin Anne Jane (Winter 1995)
Thesis Title: Territoriality and survival in wolf-deer interactions
Advisor: James D. Murray

After Ph.D., spent two years at Cambridge University on a Wellcome Biomathematics Research Training Fellowship, and then took up an academic position at University of Bath. Now a Senior Lecturer in Applied Mathematics and Co-Director, Center for Mathematical Biology, Department of Mathematical Sciences, University of Bath

(52)Brown, Margaret (Winter 1994)
Thesis Title: Geophysical Inverse Methods Applied to the Deduction of the Emissions of Atmospheric Source Gases
Advisor: Ka Kit Tung
After Ph.D. spent two years as a Research Scientist at Pacific Northwest Laboratories at Richland, WA, then returned to Seattle, and now Principle Engineer, Microvision

(53)Zhu, Mei (Spring 1994)
Thesis Title: Mechanisms for biological pattern formation – nonlinear effects
Advisor: James D. Murray
Has been an Assistant Professor then Associate Professor with tenure at Department of Mathematics, Pacific Lutheran University. Recently became Department Chair.

(54)Stevens, David (Autumn 1994)
Thesis Title: An adaptive multilevel method for boundary layer meteorology
Advisor: Christopher Bretherton
Took a postdoctoral position at Courant Institute of Mathematical Sciences, and is now a computer scientist working on advanced parallel numerical computing methods at CASC, a division of Lawrence Livermore National Labs.

(55)Neubert, Michael (Spring 1994)
Thesis Title: The nonlinear dynamics of predator-prey growth and dispersal
Advisor: Mark Kot
After PhD, took a position at the Biology Department of Woods Hole Oceanographic Institution as a Postdoctoral Scholar for two years, the n became an Assistant Scientist for 4 years. In 2000 was promoted as an Associate Scientist, and granted tenure in 2005. Currently serves as Education Coordinator, Biology Department, Woods Hole Oceanographic Institution.

(56)Mell, William (Ruddy) (Summer 1994)
Thesis Title: An investigation of closure models for nonpremixed turbulent reacting flow
Advisor: George Kosaly
Scientist at National Institute of Standards and Technology

(57)Maschhoff, Kristi (Autumn 1994)
Thesis Title: Methods for solving large symmetric eigenvalue problems associated with configuration interaction electronic structure calculations
Advisor: Loyce M. Adams

A manager at Cray, Inc.

(58)Li, Zhilin (Summer 1994)
Thesis Title: The immersed interface method – A numerical approach for partial differential equations with interfaces
Advisor: Randall J. LeVeque
After Ph.D. was a CAM Instructor at UCLA for two years, spent one year as Assistant Professor at Mississippi State University, and then moved to North Carolina State University, where he is now Full Professor in the Mathematics Department.

(59)Chen, George H.G. (Autumn 1994)
Thesis Title: Forward backward splitting techniques: Theory and applications
Advisor: R. Tyrrell Rockafellar
A manager at Microsoft Research, Beijing; left to form his own business venture.

(60)Gu, Chonghua (Summer 1994)
Thesis Title: Shear center of plates with variable thickness
Advisor: Frederic Y.M. Wan
Deceased. Previously taught at Seattle Community College and worked at Mathsoft, Inc.

(61)Laforgue, Jacques G. (Summer 1994)
Thesis Title: Using exponential asymptotics to study the metastability and supersensitivity of shock and transition layers
Advisor: Robert E. O'Malley
Associate Professor at Universidad De Oriente, Venezuela

Graduate Publications
Recent PhD Students
2002−2007

David L. George
Advisor: Randall J. LeVeque
Graduation Date: Summer, 2006
George, D. L. 2007. Wave based Riemann solvers for the shallow water equations and the steady state wave. Submitted to *Journal of Computational Physics*.
George, D. L. and LeVeque, R. J. 2006. Finite volume methods and adaptive refinement for global tsunami propagation and local inundation. *Science of Tsunami Hazards*, **24**, 319−328.
George, D. L. and LeVeque, R. J. 2006. High resolution methods and adaptive refinement for tsunami propagation and inundation. In *Hyperbolic Problems: Theory, Numerics, Applications, Proc. 11'th Intl. Conf. on Hyperbolic Problems*. In press.
LeVeque, R. J. and George, D. L. 2007. High-resolution finite volume methods for the shallow water equations with bathymetry and dry states. In *Advanced Numerical Models for Simulating Tsunami Waves and Runup*, P. L.-F. Liu, H. Yeh, and C. Synolakis, editors. In press.

Damon J. A. Toth
Advisor: Mark Kot
Graduation Date: Summer, 2006
Toth, D. 2007. Finding Hopf bifurcations in a chemostat model for an age-structured predator and its prey. Submitted to *Bulletin of Mathematical Biology*.
Toth, D. J. A. 2007.
Strong resonance and chaos in a single-species chemostat model with periodic pulsing of resource. *Chaos, Solitons & Fractals*. In press.
Toth, D. and Kot, M. 2006. Limit cycles in a chemostat model for a single species with age structure. *Mathematical Biosciences*, **202**, 194−217.

Elef Gkioulekas
Advisor: Ka Kit Tung
Graduation Date: Spring, 2006
Gkioulekas, E. 2007. On the elimination of the sweeping interactions from theories of hydrodynamic turbulence. *Physica D*, **226**, 151−172.
Gkioulekas, E. and Tung, K. K. 2005. On the double cascades of energy and enstrophy in two-dimensional turbulence. Part 1. Theoretical formulation. *Discrete and Continuous Dynamical System. Series B*, **5**, 79−102.
Gkioulekas, E. and Tung, K. K. 2005. On the double cascades of energy and enstrophy in two-dimensional turbulence. Part 2. Approach to the klb limit and interpretation of experimental evidence. *Discrete and Continuous*

Dynamical System. Series B, **5**, 103−124.
Gkioulekas, E. and Tung, K. K. 2006. Recent developments in understanding two-dimensional turbulence and the Nastrom-Gage spectrum. *Journal of Low Temperature Physics*, **145**, 25−57.
Gkioulekas, E. and Tung, K. K. 2007. Is the subdominant part of the energy spectrum due to downscale energy cascade hidden in quasi-geo strophic turbulence? *Discrete and Continuous Dynamical System. Series B*, **7**, 293−314.
Gkioulekas, E. and Tung, K. K. 2007. A new proof on net upscale energy case in 2D and QG turbulence. *Journal of Fluid Mechanics*, **576**, 173−189.

Rafael Meza
Advisor: Suresh Moolgavkar
Graduation Date: Spring, 2006
Meza, R., Luebeck, E. G., and Moolgavkar, S. H. 2005. Gestational mutations and carcinogenesis. *Mathematical Biosciences*, **197**, 188−210.
Meza, R., Moolgavkar, S. H., and Luebeck, E. G. 2006. Radiation induced gestational mutations and cancer. Submitted to *Advances in Space Research*.
Reluga, T., Walton, D. B., Meza, R., and Galvani, A. 2006. Reservoir interactions and emerging infectious diseases. Submitted to *Theoretical Population Biology*.

Marica Pelanti
Advisor: Randall J. LeVeque
Graduation Date: Winter, 2005
LeVeque, R. J. and Pelanti, M. 2001. A class of approximate Riemann solvers and their relation to relaxation schemes. *Journal of Computational Physics*, **172**, 572−591.
Pelanti, M. 2002. Pressure linearization method for the computation of real fluids. In *Hyperbolic Problems: Theory, Numerics, Applications, Proc. 9'th Intl. Conf. on Hyperbolic Problems*, T. Hou and E. Tadmor, editors. Springer, New York, New York, USA, pp. 797−806.
Pelanti, M. and LeVeque, R. J. 2006. High-resolution finite volume methods for dusty gas jets and plumes. *SIAM Journal on Scientific Computing*, **28**, 1335−1360.
Pelanti, M., Quartapelle, L., and Vigevano, L. 2001. Low dissipation entropy fix for positivity preserving Roe's scheme. In *Godunov Methods: Theory and Applications*, E. F. Toro, editor. Kluwer/Plenum Academic Press, New York, New York, USA, pp. 685−690.

Rie Komuro
Advisor: E. David Ford
Graduation Date: Winter, 2005
Komuro, R., Ford, E. D., and Reynolds, J. H. 2006. The use of multi-criteria assessment in developing a process model. *Ecological Modelling*, **197**, 320−330.

Edward Farnum
Advisor: J. Nathan Kutz
Graduation Date: Spring, 2005
Farnum, E. D., Butson, L., and Kutz, J. N. 2006. Theory and simulation of dualfrequency mode-locked lasers. *Journal of the Optical Society of America B*, **23**, 257−264.
Farnum, E. D. and Kutz, J. N. 2004. Variational dynamics of spatial solitons in quasi-phase-matched quadratic media. *Journal of Optics B*, **6**, 405−410.

Matthew Peters
Advisor: Chris Bretherton
Graduation Date: Spring, 2005
Bretherton, C. S., Blossey, P. N., and Peters, M. E. 2006. Interpretation of simple and cloud-resolving simulations of moist convection-radiation interaction with a mock-Walker circulation. *Theoretical and Computational Fluid Dynamics*, **20**, 421−442.
Bretherton, C. S., Peters, M. E., and Back, L. E. 2004. Relationships between water vapor path and precipitation over the tropical oceans. *Journal of Climate*, **17**, 1517−1528.
Peters, M. E. and Bretherton, C. S. 2005. A simplified model of the Walker circulation with an interactive ocean mixed layer and cloud-radiative feedbacks. *Journal of Climate*, **18**, 4216−4234.
Peters, M. E. and Bretherton, C. S. 2006. Structure of tropical variability from a vertical mode perspective. *Theoretical and Computational Fluid Dynamics*, **20**, 501−524.
Sobel, A. H., Bretherton, C. S., Gildor, H., and Peters, M. 2004. Convection, cloud-radiative feedbacks and thermodynamic ocean coupling in simple models of the Walker circulation. In *Earth's Climate: The Ocean-Atmosphere Interaction*, C. Wang, S.-P. Xie, and J. A. Carton, editors. *Geophysical Monograph Series*, **147**. American Geophysical Union, Washington, D.C., USA, pp. 393−405.

David B. Williams
Advisor: Robert E. O'Malley
Graduation Date: Spring, 2005
Knaub, K. R., O'Malley, R. E., and Williams, D. B. 2005. The slow motion of shock layers for advection-diffusion-reaction equations. *Applied Numerical Mathematics*, **52**, 299−310.
Mudavanhu, B., O'Malley, R. E., and Williams, D. B. 2005. Working with multiscale asymptotics. *Journal of Engineering Mathematics*, **53**, 301−336.
O'Malley, R. E. and Williams, D. B. 2006. Deriving amplitude equations for weakly-nonlinear oscillators and their generalizations. *Journal of Computational and Applied Mathematics*, **190**, 3−21.

William J. Heuett
Advisor: Hong Qian
Graduation Date: Autumn, 2005
Heuett, W. J. and Qian, H. 2006. A stochastic model of oscillatory blood testosterone levels. *Bulletin of Mathematical Biology*, **68**, 1383−1399.
Heuett, W. J. and Qian, H. 2006. Grand canonical Markov model: A stochastic theory for open nonequilibrium biochemical networks. *Journal of Chemical Physics*, **124**, 044110.
Heuett, W. J. and Qian, H. 2006. Combining flux and energy balance analysis to model large-scale biochemical network. *Journal of Bioinformatics and Computational Biology*, **4**, 1227−1243.

Viktoria Regine T. Hsu
Advisor: Hong Qian
Graduation Date: Spring, 2004
Hsu, V. R. T. 2005. Almost Newton method for large flux steady-state of 1D Poisson-Nernst-Planck equations. *Journal of Computational and Applied Mathematics*, **183**, 1−15.

Sarah E. Hewitt
Advisor: J. Nathan Kutz
Graduation Date: Summer, 2004
Hewitt, S. E., Intrachat, K., and Kutz, J. N. 2004. Dynamics and stability of a new class of periodic solutions of the optical parametric oscillator. *Optics Communications*, **240**, 423−436.
Hewitt, S. E. and Kutz, J. N. 2005. Dynamics of the optical parametric oscillator near resonance detuning. *SIAM Journal on Applied Dynamical Systems*, **4**, 808−831.
Osting, B., Hewitt, S. E., and Kutz, J. N. 2005. Stability and dynamics of transverse field structures in the optical parametric oscillator near resonance signal detuning. *Journal of Physics B*, **38**, 3461−3475.

Jan Patrick Medlock
Advisor: Mark Kot
Graduation Date: Autumn, 2004
Kot, M., Medlock, J., Reluga, T., and Walton, D. B. 2004. Stochasticity, invasions, and branching random walks. *Theoretical Population Biology*, **66**, 175−183.
Medlock, J. and Kot, M. 2003. Spreading disease: Integro-differential equations old and new. *Mathematical Biosciences*, **184**, 201−222.

Timothy Charles Reluga
Advisor: Mark Kot

Graduation Date: Summer, 2004
Kot, M., Medlock, J., Reluga, T., and Walton, D. B. 2004. Stochasticity, invasions, and branching random walks. *Theoretical Population Biology*, **66**, 175−183.
Qian, H. and Reluga, T. 2005. Nonequilibrium thermodynamics of a nonlinear biochemical switch in a cellular signaling process. *Physical Review Letters*, **94**, 028101.
Reluga, T. 2004. Analysis of periodic growth-disturbance models. *Theoretical Population Biology*, **66**, 151−161.
Reluga, T. 2004. A two-phase epidemic driven by diffusion. *Journal of Theoretical Biology*, **229**, 249−261.
Reluga, T. 2005. On antibiotic cycling and optimal heterogeneity. *Mathematical Medicine and Biology*, **22**, 187−208.
Reluga, T. and Viscido, S. 2005. Simulated evolution of selfish herd behavior. *Journal of Theoretical Biology*, **234**, 213−225.

Kathleen T. Coughlin
Advisor: Ka Kit Tung
Graduation Date: Spring, 2003
Coughlin, K. and Tung, K. K. 2001. QBO signal found at the Extratropical Surface through Northern Annular Modes. *Geophysical Research Letters*, **28**, 4563−4566.
Coughlin, K. and Tung, K. K. 2004. Eleven-year solar cycle signal throughout the lower atmosphere. *Journal of Geophysical Research-Atmospheres*, **109**, D21105.
Coughlin, K. and Tung, K. K. 2005. Tropospheric wave response to decelerated stratosphere seen as downward propagation in northern annular mode. *Journal of Geophysical Research-Atmospheres*, **110**, D01103.
Coughlin, K. and Tung, K. K. 2005. Empirical mode decomposition of climate variability. In *Hilbert-Huang Transform and Its Applications*, N. E. Huang and S. S. P. Shen, editors. World Scientific, Singapore, pp. 173−193.
Coughlin, K. T. and Tung, K. K. 2004. 11-year solar cycle in the stratosphere extracted by the empirical mode decomposition method. *Advances in Space Research*, **34**, 323−329.
Coughlin, K. T. and Tung, K. K. 2006. Misleading patterns in correlation maps. *Journal of Geophysical Research-Atmospheres*, **111**, D24102.

Steven J. Kusiak
Advisor: John Sylvester
Graduation Date: Spring, 2003
Haddar, H., Kusiak, S., and Sylvester, J. 2006. The convex back-scattering support. *SIAM Journal on Applied Mathematics*, **66**, 591−615.
Kusiak, S. and Sylvester, J. 2003. The scattering support. *Communications on Pure and Applied Mathematics*, **56**, 1525−1548.

Kusiak, S. and Sylvester, J. 2005. The convex scattering support in a background medium. *SIAM Journal on Mathematical Analysis*, **36**, 1142−1158.
Potthast, R., Sylvester, J., and Kusiak, S. 2003. A 'range test' for determining scatterers with unknown physical properties. *Inverse Problems*, **19**, 533−547.

Rebecca A. Crabb Hammond
Advisor: Thomas Leschine
Two journal articles published in applied mathematics and mathematical biology related to her M.Sc. thesis, but unrelated to Ph.D. thesis.

Graduation Date: Spring, 2003
Long Lee
Advisor: Randall J. LeVeque
Graduation Date: June, 2002
Lee, L. and LeVeque, R. J. 2003. An immersed interface method for incompressible Navier-Stokes equations. *SIAM Journal on Scientific Computing*, **25**, 832−856.

James Rossmanith
Advisor: Randall J. LeVeque
Graduation Date: June, 2002
Bale, D., LeVeque, R. J., Mitran, S., and Rossmanith, J. A. 2002. A wave-propagation method for conservation laws and balance laws with spatially varying flux functions. *SIAM Journal on Scientific Computing*, **24**, 955−978.
Rossmanith, J. 2002. A constrained transport method for the shallow water MHD equations. In *Hyperbolic Problems: Theory, Numerics, Applications, Proc. 9'th Intl. Conf. on Hyperbolic Problems*, T. Hou and E. Tadmor, editors. Springer, , pp. 851−860.
Rossmanith, J. A. 2004. A high-resolution constrained transport method with adaptive mesh refinement for ideal MHD. *Computer Physics Communications*, **164**, 128-133.
Rossmanith, J. A. 2006. A wave propagation method for hyperbolic systems on the sphere. *Journal of Computational Physics*, **213**, 629−658.
Rossmanith, J. A., Bale, D. S., and LeVeque, R. J. 2004. A wave propagation algorithm for hyperbolic systems on curved manifolds. *Journal of Computational Physics*, **199**, 631−662.
Rossmanith, J. A. and LeVeque, R. J. 2000. A wave propagation algorithm for the solution of PDEs on the sphere. In *Proc. 8'th Intl. Conf. on Hyperbolic Problems*, H. Freistuhler and G. Warnecke, editors. Birkhauser, Boston, Massachusetts, USA, pp. 643−652.

Eric Thomas Dolven
Advisor: Harry Yeh
Graduation Date: Summer, 2002

Blessing Mudavanhu
Advisor: Robert E. O'Malley
Graduation Date: Spring, 2002

Mudavanhu, B. and O'Malley, R. E. 2001. A renormalization group method for nonlinear oscillators. *Studies in Applied Mathematics*, **107**, 63−79.
Mudavanhu, B. and O'Malley, R. E. 2003. A new renormalization method for the asymptotic solution of weakly nonlinear vector systems. *SIAM Journal on Applied Mathematics*, **63**, 373−397.
Mudavanhu, B., O'Malley, R. E., and Williams, D. B. 2005. Working with multiscale asymptotics. *Journal of Engineering Mathematics*, **53**, 301−336.

Derek S. Bale
Advisor: Randall J. LeVeque
Graduation Date: Winter, 2002

Bale, D. S. and Helzel, C. 2000. Crossflow instabilities in the approximation of detonation waves. In *Proc. 8'th Intl. Conf. on Hyperbolic Problems*, H. Freistuhler and G. Warnecke, editors. Birkhauser, Boston, Massachusetts, USA, pp. 119−128.
Bale, D. and LeVeque, R. J. 2000. Wave propagation algorithms for hyperbolic systems on curved manifolds. In *Proc. 8'th Intl. Conf. on Hyperbolic Problems*, H. Freistuhler and G. Warnecke, editors. Birkhauser, Boston, Massachusetts, USA, pp. 609−618.
Bale, D., LeVeque, R. J., Mitran, S., and Rossmanith, J. A. 2002. A wave-propagation method for conservation laws and balance laws with spatially varying flux functions. *SIAM Journal on Scientific Computing*, **24**, 955−978.
LeVeque, R. J. and Bale, D. S. 1998. Wave-propagation methods for conservation laws with source terms. In *Proc. 7'th Intl. Conf. on Hyperbolic Problems*, R. Jeltsch, editor. Birkhauser, Boston, Massachusetts, USA, pp. 609−618.
Rossmanith, J. A., Bale, D. S., and LeVeque, R. J. 2004. A wave propagation algorithm for hyperbolic systems on curved manifolds. *Journal of Computational Physics*, **199**, 631−662.

Appendix F. Academic Unit's Mission Statement

The Department of Applied Mathematics discovers, applies, and promotes the use of mathematics to model and solve practical problems in many disciplines, ranging from engineering and science to medicine and business.

By nature our research is interdisciplinary. By exploiting the common underlying mathematical framework, we initiate the cross-fertilization of ideas and techniques from one discipline to another.

The Department of Applied Mathematics provides its graduate students opportunities for significant scholarly activities and original research. Through classes and individual faculty mentoring, our students learn to mathematically model and to develop combined analytical and computational techniques to solve problems. They learn to communicate, using the language of mathematics and the language of application disciplines, and to work with others to advance the frontiers of knowledge. They learn to respond to the mathematical needs of others by teaching, mentoring undergraduates and each other, working in industrial and government settings and on outreach projects in local schools.

The Department provides a core of undergraduate courses for students in the Applied and Computational Mathematical Sciences (ACMS) program as well as undergraduate and graduate service courses in applied mathematics to students from other departments. The Department also offers expert mathematical advice to the community through its Applied Mathematics Clinic and access to its courses through distance learning. Our students graduate with the knowledge, the experience, and the ability to be leaders in a society that exhibits increasing demands for competence in communication, computation and mathematics.

Appendix G. Abbreviated Faculty Curriculum Vitae

LOYCE M. ADAMS
Department of Applied Mathematics, Box 352420
University of Washington
Seattle, WA 98195
(206) 543-5077
adams@amath.washington.edu

DEGREES:

BS in mathematics, summa cum laude, West Virginia Institute of Technology, May 1975.
MS in applied mathematics, University of Virginia, August 1978.
PhD in applied mathematics, University of Virginia, January 1983.

EXPERIENCE:

Assistant Professor of Mathematics and Computer Science, West Virginia Institute of Technology, Montgomery, West Virginia (9/79--6/80).
Research Scientist, Institute for Computer Applications in Science and Engineering (ICASE), NASA Langley Research Center, Hampton, Virginia (10/82--8/84).
Adjunct Assistant Professor, UCLA Mathematics Department, Los Angeles, CA (7/84--7/85).
Assistant Professor of Applied Mathematics and Adjunct Assistant Professor of Computer Science, University of Washington, Seattle, WA (9/85--9/88).
Associate Professor of Applied Mathematics and Adjunct Associate Professor of Computer Science, University of Washington, Seattle, WA (9/88--6/01).
Associate Professor of Applied Mathematics, University of Washington, Seattle, WA (6/01--9/06).
Professor of Applied Mathematics, University of Washington, Seattle, WA (9/06--present).

VISITING POSITIONS:

Gastprofessorin, Dept. of Informatik, ETH Z\"urich, (4/89--7/89).
Visiting Member, Courant Institute, NYU, (1/90--3/90).
Gastprofessorin, Dept. of Informatik, ETH Z\"urich, (10/90--7/91).
Visiting Scientist, National Center for Atmospheric Research,
and Program in Applied Math, UC Boulder, (10/94--7/95 - sabbatical)

CONSULTANT EXPERIENCE:

Consultant, Dr. Emily Cooper, MD, data modelling and analysis, (7/04--present).
Consultant, ICASE, NASA Langley Research Center, Hampton, VA., (9/84--9/95)

RECENT PROFESSIONAL ACTIVITIES:

SIAM Committee on Education, September 2000--present.

Reviewer for NSF panels, NSF site visits

PHD STUDENTS:

Joseph W. Manke, September 1989
Maria Elizabeth Go Ong, October 1989
Kevin E. Gates, August 1991
Zhiyun Yang, November 1996
Jason Slemons -- present

SELECTED GRANT AWARDS

NSF Vertical Integration Grant in Research and Education (VIGRE), PI,
(Anne Greenbaum, Peter Guttorp, and Randy LeVeque, Co-PIs), (Sept. 1998--Sept. 2002), $1,745,000.
VIGRE Supplement for K-12 Outreach, (Aug. 1999 - Aug. 2000), PI, $90,400.
VIGRE Supplement for Graduate Student Outreach, (Sept. 1999--Sept. 2000), PI, $99,900.
NSF GK-12 Program in Mathematics, PI, (Ramesh Gangolli, Virginia Warfield, and Lillian McDermott, Co-PIs), (March 2001--March 2002), $492,000.
NSF GK-12 Program in Mathematics, year 2 renewal, after successful site visit, (July 2002), PI, $492,000.
NSF GK-12 Program in Mathematics, year 3 renewal, after successful site visit, (July 2002), PI, $492,000.
VIGRE Years 4 Continuation after NSF site-visit, PI, (May 2002), $502,160.
VIGRE Year 5 Continuation after NSF site-visit, PI, (August 2002), $502,160.
VIGRE Graduate Fellow Salary Supplement, (August 2002), PI, $109,308.
University of Washington NSF ADVANCE Award, one quarter teaching buyout plus five months graduate student support, PI, January 2003-present.
NSF GK-12 Supplemental grant, help fund 25 fellows for 2003-2004, PI, $343,000.
GK-12 Track-2 grant, PI, (Virginia Warfield and Lillian McDermott, Co-PIs), (Aug. 2004--Aug. 2009), $2,000,000.
NSF VIGRE grant, (joint with Amath, Math, Statistics departments), (Aug. 2004--Aug. 2009), Doug Lind (PI), (Co-PI with Ka-Kit Tung, Selim Tuncel, Peter Guttorp), $3,900,000.

PRESENT DEPARTMENTAL SERVICE:

Director of Applied Mathematics Outreach, (Sept. 1998--present).
VIGRE Program Director, (May 1999--Sept. 2002, Sept. 2005-Sept 2006).
GK-12 Program in Mathematics Director, (March 2001--present).
University of Washington SIAM Student Chapter, Faculty Advisor, January 2004-present.
Co-PI, VIGRE Program (New Grant), Aug. 2004--Aug. 2009.

SELECTED JOURNAL ARTICLES:

Towards a Divide and Conquer Algorithm for the Real Nonsymmetric Eigenvalue Problem, with Peter Arbenz, *SIAM J. Matrix Anal. Appl*., **Vol**. **15**, No. 4, Oct. 1994, pp. 1333-1353.

New Parallel SOR Method by Domain Decomposition, with Dexuan Xie, *SIAM J. on Scientific Computing*, **Vol. 20**, No. 6, 1999, pp. 2261-2281.

The Immersed Interface/Multigrid Methods for Interface Problems, with Zhilin Li, *SIAM J. on Scientific Computing*, **Vol. 24**, No. 2, 2002, pp. 463-479.

New Geometric Immersed Interface Multigrid Solvers, with Timothy P. Chartier, *SIAM J. on Scientific Computing*, **Vol 25**, No 5, pp. 1516-1533, June 2004. (available as electronic publication at epubs.siam.org/sam-bin/dbg/article/42170)

A Comparison of Algebraic Multigrid and Geometric Immersed Interface Multigrid Methods for Interface Problems, with Timothy P. Chartier, *SIAM J. on Scientific Computing*, March 2004, galleys completed Aug. 2004, 23 pages.

CHRISTOPHER STEPHEN BRETHERTON
email: breth@atmos.washington.edu
http://www.atmos.washington.edu/~breth

Education

Ph. D., Massachusetts Institute of Technology, Mathematics, September, 1984.
B. S., California Institute of Technology, Applied Mathematics, June, 1980

Professional Experience

06/2006-present	Director, University of Washington Program for Climate Change
02/2002-present	Affiliate Scientist, Climate and Global Dynamics Division National Center for Atmospheric Research
07/2000-06/2001	Visiting Scientist, Climate and Global Dynamics Division National Center for Atmospheric Research
09/1996-present	Professor of Atmospheric Science and Applied Mathematics, University of Washington.
09/1989-08/1996	Associate Professor of Atmospheric Science and Applied Mathematics, University of Washington.
06/92-07/92, 08/94	Scientific consultant, European Center for Medium Range Weather Forecasting, Reading, England
01/1993-05/1993	Visiting Scientist, Mesoscale and Microscale Meteorology Division, National Center for Atmospheric Research
09/1992-12/1992	Houghton Visiting Professor, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology.
09/1988-09/1989	Assistant Professor of Applied Mathematics and Atmospheric Science, University of Washington.
10/1985-09/1984	Assistant Professor of Applied Mathematics, University of Washington.
10/1984-09/1985	Postdoctoral Fellow, Advanced Study Program, National Center for Atmospheric Research.

National Committees and Science Teams (only current activities listed)

VOCALS (VAMOS Ocean Cloud Atmosphere Land Study) Scientific Working Group 1/01-present, chair 1/01-3/04, co-chair 3/04-present.
Boundary Layer Cloud Working Group, GCSS (GEWEX Cloud Systems Study), 7/93-present. Chair 1/02-present.
Lead PI, US CLIVAR Low-Latitude Cloud Feedbacks on Climate Sensitivity Climate Process Team, 10/03-present.
Community Climate System Model (CCSM) Scientific Steering Committee, 1/02-present.
EPIC (East Pacific Investigation of Climate) Science Team and Scientific Steering Committee, 10/00-present.

Refereed Papers and Book/Monograph Chapters (since 2004)

Sobel, A. H., S. E. Yuter, C. S. Bretherton, and G.N. Kiladis, 2004: Large-scale meteorology and deep convection during TRMM KWAJEX. *Mon. Wea. Rev.*, **132**, 422-444.

Bretherton, C. S., J. R. McCaa, and H. Grenier, 2004: A new parameterization for shallow cumulus convection and its application to marine subtropical cloud-topped boundary layers. Part I: Description and 1-D results. *Mon. Wea. Rev*., **132**, 864-882.

McCaa, J. R., and C. S. Bretherton, 2004: A new parameterization for shallow cumulus convection and its application to marine subtropical cloud-topped boundary layers. Part II: Regional simulations of marine boundary layer clouds. *Mon. Wea. Rev*., **132**, 883-896.

Bretherton, C. S., M. E. Peters, and L. E. Back, 2004: Relationships between water vapor path and precipitation over the tropical oceans. *J. Climate*, 17, 1517-1528.

Bretherton, C. S., R. Ferrari, and S. Legg, 2004: Climate Process Teams: A new approach to improving climate models. *U.S. CLIVAR Variations*, Vol. 2, No. 1, 1-6.

DeSzoeke, S. P. , and C. S. Bretherton, 2004: Quasi-Lagrangian large eddy simulations of cross-equatorial flow in the east Pacific atmospheric boundary layer. *J. Atmos. Sci.*, **61**, 1837-1858.

Bretherton, C. S., T. Uttal, C. W. Fairall, S. Yuter, R. Weller, D. Baumgardner, K. Comstock, and R. Wood, 2004: The EPIC 2001 stratocumulus study. *Bull. Amer. Meteor. Soc.*, **85**, 967-977.

Wood, R., and C. S. Bretherton, 2004: Boundary layer depth, entrainment and decoupling in the cloud-capped subtropical and tropical marine boundary layer. *J. Climate*, **17**, 3575-3587.

Raymond, D. J., and coauthors, 2004: EPIC2001 and the coupled ocean-atmosphere system of the tropical East Pacific. *Bull. Amer. Meteor. Soc.*, **85**, 1341-1354..

Durran, D. R., and C. S. Bretherton, 2004: Comments on "The Roles of the Horizontal Component of the Earth's Angular Velocity in Nonhydrostatic Linear Models". *J. Atmos. Sci.*, **61**, 1982-1986.

Zhu, P., and C. S. Bretherton, 2004: A simulation study of shallow moist convection and its impact on the atmospheric boundary layer. *Mon. Wea. Rev.*, 132, 2391-2409.

Kuang, Z., and C. S. Bretherton, 2004: Convective influence of the heat balance of the tropical tropopause layer: A cloud-resolving model study. *J. Atmos. Sci*., **23**, 2919–2927.

Sobel, A. H., C. S. Bretherton, H. Gildor and M. Peters, 2004: Convection, cloud-radiative feed backs and thermodynamic ocean coupling in simple models of the Walker circulation. *Ocean- atmosphere interaction and climate variability*, Chunzai Wang, Shang-Ping Xie, and Jim Carton, Eds. Amer. Geophys. Union Geophysical Monograph 147, 393-405.

Comstock, K. K., R. Wood, S. E. Yuter, and C. S. Bretherton, 2004: Reflectivity and rain rate in and below drizzling stratocumulus. *Quart. J. Roy. Meteorol. Soc.*, **130**, 2891-2918.

Kuang, Z., P. N. Blossey, and C. S. Bretherton, 2005: A DARE approach for 3D cloud resolving simulations of large scale atmospheric circulation. *Geophys. Res. Lett.*, **32**, L02809, doi: 10.1029/2004GL021024.

Stevens, B., G. Vali, K. Comstock, R. Wood, M. C. van Zanten, P. H. Austin, C. S. Bretherton, and D. H. Lenschow, 2005: Pockets of open cells (POCs) and drizzle in marine stratocumulus. *Bull. Amer. Meteor. Soc.*, **86**, 51–57.

DeSzoeke, S. P., C. S. Bretherton, N. A. Bond, M. F. Cronin, and B. M. Morley, 2005: EPIC 95W observations of the eastern Pacific atmospheric boundary layer from the cold tongue to the ITCZ. *J. Atmos. Sci.*, **62**, 426-442.

Quadrelli, R., C. S. Bretherton, and J. M. Wallace, 2005: On sampling errors in empirical orthog onal functions. *J. Climate*, **18**, 3704-3710.

Stevens, B., and coauthors, 2005: Observations of nocturnal marine stratocumulus as represented by large eddy simulation. *Mon. Wea. Rev.*, **133**, 1443-1462.

Zhu, P., and coauthors, 2005: Intercomparison and interpretation of single column model simulations of a nocturnal stratocumulus topped marine boundary layer. *Mon. Wea. Rev.*, **133**, 2741-2758.

Caldwell, P., C. S. Bretherton, and R. Wood, 2005: Mixed-layer budget analysis of the diurnal cycle of entrainment in SE Pacific stratocumulus. *J. Atmos. Sci.*, **62**, 3775-3791.

Comstock, K. K., C. S. Bretherton, and S. E. Yuter, 2005: Mesoscale variability and drizzle in southeast Pacific stratocumulus. *J. Atmos. Sci.*, **62**, 3792-3807.

Back, L. E., and C. S. Bretherton, 2005: The relationship between wind speed and precipitation in the Pacific ITCZ. *J. Climate*, **18**, 4317-4328.

Peters, M. E., and C. S. Bretherton, 2005: A simplified model of the Walker circulation with an interactive ocean mixed layer and cloud-radiative feedbacks. *J. Climate*, **18**, 4216-4234.

Bretherton, C. S., P. N. Blossey, and M. Khairoutdinov, 2005: An energy-balance analysis of deep convective self-aggregation above uniform SST. *J. Atmos. Sci.*, **62**, 4273-4292.

De Szoeke, S. P., and C. S. Bretherton, 2005: Variability in the southerly flow into the eastern Pacific ITCZ. *J. Atmos. Sci.*, **62,** 4400-4411.

Cornish, C. R., C. S. Bretherton, and D. B. Percival, 2006: Wavelet analysis of marine boundary layer turbulence during EPIC. *Bound.-Layer Meteor.*, doi:10.1007/s10546-005-9011-y.

Raymond, D. J., C. S. Bretherton, and J. Molinari, 2006: Dynamics of the intertropical convergence zone of the east Pacific. *J. Atmos. Sci.*, **63**, 582–597.

Wyant, M. C., M. Khairoutdinov, and C. S. Bretherton, 2006: Climate sensitivity and cloud response of a GCM with a superparameterization, *Geophys. Res. Lett.*, **33**, L06714, doi:10.1029/2005GL025464.

Wyant, M. E., C. S. Bretherton, J. T. Bacmeister, J. T. Kiehl, I. M. Held, M. Zhao, S. A. Klein, and B. A. Soden, 2006: A comparison of tropical cloud properties and responses in GCMs using mid-tropospheric vertical velocity. *Climate Dyn.*, **27**, 261-279.

Collins, W. D., and coauthors, 2006: The Community Climate System Model: CCSM3. *J. Climate*, **19**, 2122-2143.

Kuang, Z., and C. S. Bretherton, 2006: A mass flux scheme view of a high-resolution simulation of transition from shallow to deep cumulus convection. *J. Atmos. Sci.*, **63**, 1895-1909.

Bony, S., and coauthors, 2006: How well do we understand climate change feedback processes? *J. Climate*, **19**, 3445-3482.

Bretherton, C. S., P. N. Blossey, and M. E. Peters, 2006: Comparison of simple and cloud-resolving models of moist convection-radiation interaction with a mock-Walker circulation. *Theor. Comp. Fluid. Dyn.*, doi:10.1007/s00162-006-0029-7.

Peters, M. E., and C. S. Bretherton, 2006: Structure of tropical variability from a vertical mode perspective. *Theor. Comp. Fluid. Dyn.*, doi:10.1007/s00162-006-0034-x.

Back, L. E, and C. S. Bretherton, 2006: Geographic variability in the export of moist static energy and vertical motion profiles in the Tropical Pacific. *Geophys. Res. Lett.*, **33**, L17810, doi:10.1029/2006GL026672.

Current Doctoral and Pre-Doctoral Students, Expected Graduation and Areas of Interest:

Peter Caldwell, Atmospheric Science (COGS Wi05); Larissa Back, Atmospheric Science (COGS Sp05); Eeho Jung, Aeronautics and Astronautics; Junya Uchida, Applied Mathematics.

Self-Study Applied Mathematics

William O. Criminale
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Education

B.S. Physics and Mathematics, University of Alabama, 1955.
Ph.D. Aeronautics, The Johns Hopkins University, 1960

Employment

Assistant Professor, Department of Aerospace and Mechanical Sciences, Princeton University, 1962-68.
Associate Professor, Department of Oceanography and Geophysics Program, UW, 1968-73.
Professor, Oceanography and Geophysics, UW 1973-2006.
Professor and **Chair**, Applied Mathematics, UW 1976-84.
Professor, Applied Mathematics, 1976-2006.
Professor Emeritus, 2006-

Consultant

Numerous government and industrial centers.

Honors & Awards

Recipient of Boris A. Bakhmeteff Memorial Fellowship in the Mechanics of Fluids.
Exchange Scientist to U.S.S.R., program conducted by National Academy of Sciences.
Recipient of Senior Research Award, Alexander von Humboldt Foundation, Germany.
Recipient, Faculty Research Award, Joint Center for Graduate Study, Battelle Pacific Northwest Laboratories.
Royal Society Fellow, United Kingdom.
American Men and Women of Science, *Who's Who in the East, Who's Who in the West*, International Scholars Directory, Men of Achievement, American Academy of Mechanics.
Fellow, American Physical Society.

Guest Professor

Germany, England, Scotland, Sweden, France, Italy, Crete, Canada.

Referee

Numerous journals and publishers; research agencies.

Selected Publications

The Initial-Value Problem for a Modelled Boundary Layer (with P.G. Drazin), *Physics of Fluids*, **A12**, 366-374, 2000.
Limit Cycle-Strange Attractor Competition (with T.L. Jackson & P.N. Nelson), *Studies in Applied Mathematics*, 112:133-160, 2004.
Initial-Value Problem in Free Shear Flows (with P.N. Blossey and L.S. Fisher), submitted to *Journal of Fluid Mechanics*, 2006.

Book

Theory and Computation in Hydrodynamic Stability, (with T.L. Jackson and R.D. Joslin), Cambridge Monographs on Mechanics, Cambridge University Press, 2003.

Other

Proceedings and chapters in numerous proceedings.

Self-Study Applied Mathematics

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Areas of Interest

General: Applied Mathematics, Mathematical Physics, Partial Differential Equations
Emphasis: Nonlinear Waves, Soliton Theory, Fluid Mechanics, Hamiltonian Systems, Stability, Bose-Einstein Condensates, Riemann Surface, Symbolical and Numerical Computation, Lie Algebras, Semi-Discrete Systems, Asymptotics, Theta Functions.

Education

- Ph.D. in Applied Mathematics, University of Colorado, Boulder, 5/1998, Thesis on *The initial value problem for quasiperiodic solutions of the KP equation*
- M.S. in Applied Mathematics, University of Colorado, Boulder, 12/1995
- Diploma in Electrical Engineering (Physics Option), University of Ghent, Ghent, 6/1993, Thesis on *Nonlinear Plasma Waves*

Employment History

- Assistant Professor, Department of Applied Mathematics, UW, since 09/2003
- Assistant Professor, Department of Mathematics, Colorado State University, 08/2001-08/2003
- NSF Postdoctoral Fellow, Department of Applied Mathematics, UW, 07/2000-08/2001
- VIGRE Postdoctoral Fellow, Department of Applied Mathematics, UW, 09/1999-06/2000

Research Activities

Grants and External Support

- NSF-DMS-0139093, Focused Research Group: Fully nonlinear, three-dimensional, surface water wave in arbitrary depth, 08/15/2002-07/31/2005; $48,710

Selected Publications

Synopsis: 25 papers in refereed research journals, or accepted/submitted for such journals, 2 refereed proceedings, 2 chapter in a book, 3 contributions to an encyclopedia, and 2 theses. More important papers are given below.

In Refereed Journals

- B. Deconinck and M. Nivala, *Symbolic integration and summation using homotopy methods*, submitted for publication.
- J.D. Carter and B. Deconinck, *Instabilities of one-dimensional trivial-phase solutions of the two-dimensional cubic nonlinear Schrödinger equation*, Physica D214, 42-54, 2006.
- B. Deconinck, D.E. Pelinovsky and J.D. Carter, *Transverse instabilities of deep-water solitary waves*, accepted for publication (Proceedings of the Royal Society A).
- B. Deconinck and J.N. Kutz, *Computing spectra of linear operators using Hill's method*, accepted for publication (Journal of Computational Physics).
- B. Deconinck, M. Heil, A. Bobenko, M. van Hoeij and M. Schmies, *Computing Riemann theta functions*, Math. Of Computation 73, 1417-1442 (2004).
- B. Deconinck and J.N. Kutz, *Singular instability of exact solutions of the nonlocal Gross-Pitaevskii equation*, Phys. Lett. A319, 97-103 (2003).
- B. Deconinck, B. Frigyik, and J.N. Kutz, *Dynamics and stability of Bose-Einstein condensates: the nonlinear Schrödinger equation with periodic potential*, J. Nonlinear Sci. 12, 169-205 (2002).
- B. Deconinck and M. van Hoeij, *Computing Riemann matrices from Riemann surfaces*, Pnysica D152-153, 28-46 (2001).
- J.C. Bronski, L.D. Carr, B. Deconinck, and J.N. Kutz, *Bose-Einstein condensates in standing waves: the cubic nonlinear Schrödinger equation with a periodic potential*, Phys. Rev. Lett. 86, pp. 1402-1405 (2001).

Contributions to books

- Bernard Deconinck, *Riemann Theta Functions*, Chapter in the *Digital Library of Mathematical Functions*, National Institute for Standards and Technology, F.W.J. Olver, editor, scheduled for publication 2006, submitted for final review.
- Bernard Deconinck, *The Kadomtsev-Petviashvili Equation*, *Periodic Spectral Theory, Poisson Brackets*, Sections for the *Encyclopedia of Nonlinear Sciences*, A. Scott, editor, Routledge Publishers, 2005.
- W. Hereman, M. Colagrosso, R. Sayers, A. Ringler, B. Deconinck, M. Nivala, and M. Hickman, *Continuous and Discrete Homotopy Operators with Applications in Integrability Testing*, in Differential Equations with Symbolic Computation, Dongming Wang and Zhiming Zheng, editors, Birkhäuser, 2005.

Software

- B. Deconinck and M. Nivala, *INT, SUM*, Maple program, released Fall 2005, available from http://www.amath.washington.edu/bernard/papers.html
- B. Deconinck, F. Kiyak, J.D. Carter, and J.N. Kutz, *SpectrUW*, released Fall 2005.

- B. Deconinck, and M. Nivala, *conser*, Maple program, released Winter 2005, available from http://www.amath.washington.edu/bernard/papers.html
- B. Deconinck and M. van Hoeij, *Riemann Theta*, Maple program, included in Maple 8, released Spring 2002.

Professional Activities and Services

Conference Organizer

- Organizing Committee, 2nd SIAM-SIAG conference on Nonlinear Waves and Coherent Structures (7 plenary talks, 43 mini-symposia, 50 contributed talks, post session), UW, September 9-12, 2006.
- Co-principle organizer, Workshop on Stability of Nonlinear Waves (a 4 mini-course tutorial for graduate students and postdoctoral fellows), UW, September 7-9, 2006.
- Session organizer, 4th IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, (session on ``Symbolical and Numerical Computation for Differential Equations'' (7 speakers), University of Georgia, Athens, GA, April 11-14, 2005.
- Co-principal organizer, Workshop on Free Surface Water Waves, (35 talks, post session, 52 participants), Fields Institute for the Mathematical Sciences, Toronto, CA, June 14-18, 2004. Also session chair for the session on Kinetic Transport Models.
- Session organizer, Joint Central and Western Section AMS Meeting, (Session on ``Nonlinear Waves'' (20 speakers)), University of Colorado, Boulder, October 2-4, 2003.
- Minisymposium organizer, Fifth International Congress on Industrial and Applied Mathematics, ICIAM 2003, (Minisymposia on ``Surface waves in water of arbitrary depth'' (4 speakers) and "Symbolic computation in the theory of integrable systems'' (4 speakers)), Sydney, Australia, July 7-11, 2003.

Editorial service

- Member, Advisory Board, Journal of Physics A, 3/2006-
- Member, Editorial Board, International Journal of Applied Mathematical Analysis and Applications, 8/2005-

Supervisory Committee Member

Currently serving as a member of 9 PhD. Committees (Christopher W. Curtis (Applied Mathematics, Christine L. Lind (Applied Mathematics), Katie Oliveras (Applied Mathematics; chair), Jacon C. Slemons (Applied Mathematics), Brandon G. Bale (Applied Mathematics; co-chair), Mathew S. Patterson (Applied Mathematics; chair), Dhanakorn Iamratanakul (Aeronautics and Astronautics; GSR), Andrea M. Munro (Chemistry; GSR), Marloes Maathuis (Statistics; GSR).

Also supervised research projects with 7 undergraduate students.

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EDUCATION

Ph.D. (1987) Ecology and Evolutionary Biology. University of Arizona, Tucson, Arizona

M.S. (1987) Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona

M.S. (1984) Applied Mathematics, University of Arizona, Tucson, Arizona

M.S. (1979) Theoretical and Applied Mechanics, Cornell University, Ithaca, New York

B.A. (1977) Physics/Applied Mathematics, New College, Sarasota, Florida

CAREER HISTORY

2000 - Associate Professor, Department of Applied Mathematics
University of Washington, Seattle, Washington

1995 -2000 Associate Professor, Department of Mathematics/Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee

1994 -1996 Associate Professor, Department of Applied Mathematics,
University of Washington, Seattle, Washington

1990 -1994 Assistant Professor, Department of Applied Mathematics, University of Washington, Seattle, Washington

1987 -1989 Assistant Professor, Department of Mathematics, University of Tennessee, Knoxville, Tennessee

BOOKS

Kot, M., Lewis, M., and Neubert, M. G. 2006. *Spatial Population Dynamcis with Integrodifference Equations*. Princeton University Press. In Preparation.

Kot, M. 2001. *Elements of Mathematical Ecology*. Cambridge University Press, Cambridge, UK, ix + 453 pp. (2nd corrected printing in 2003)

PAPERS

Toth, D. and Kot, M. 2006. Limit cycles in a chemostat model for a single species with age structure. *Mathematical Biosciences*, In Press.

Kot, M. 2005. Torus bubbling in a discrete-time predator-prey model. *Journal of Difference Equations and Applications*, **11**, 431 -441.

Kot, M., Medlock, J., Reluga, T., and Walton, D. B. 2004. Stochasticity, invasions, and branching random walks. *Theoretical Population Biology*, **66**, 175 -184.

Medlock, J. and Kot, M. 2003. Spreading disease: integro-differential equations old and new. *Mathematical Biosciences*, **184**, 201 -222.

Kot, M. 2003. Zipf's law and the diversity of biology newsgroups. *Scientometrics*, **56**, 247 -257.

Wang, M.-H., Kot, M., and Neubert, M. G. 2002. Integrodifference equations, Allee effects, and invasions. *Journal of Mathematical Biology*. **44**, 150 -168.

Silverman, E. D., Kot, M. and Thompson, E. 2001. Testing a simple stochastic model for the dynamics of waterfowl aggregations. *Oecologia*, **128**, 608 -617.

Wang, M.-H. and Kot, M. 2001. Speeds of invasion in a model with strong or weak Allee effects. *Mathematical Biosciences*, **171**, 83 -97.

Neubert, M. G., Kot, M., and Lewis, M. A. 2000. Invasion speeds in fluctuating environments. *Proceedings of the Royal Society of London B*, **267**, 1603 -1610. (Errata: 267, 2568 -2569).

Silverman, E. and Kot, M. 2000. Rate estimation for a simple movement model. *Bulletin of Mathematical Biology*, **62**, 351 -375.

Kot, M., Lewis, M., and van den Driessche, P. 1996. Dispersal data and the spread of invading organisms. *Ecology* **77**, 2027 -2042.

King, A. A., Schaffer, W. M., Gordon, C., Treat, J., Kot, M. 1996. Weakly dissipative predator-prey systems. *Bulletin of Mathematical Biology* **58**, 835 -859.

Gittleman, J. L., Anderson, C. G., Kot, M. and Luh, H.-K. 1996. *Comparative tests of evolutionary lability and rates using molecular phylogenies*. In, New Uses for New Phylogenies ((P. H. Harvey, A. J. Leigh Brown, J. Maynard Smith, and S. Nee, eds.), pages 289 -307. Oxford University Press, Oxford.

Gittleman, J. L., Anderson, C. G., Kot, M., Luh, H.-K. 1996. *Phylogenetic lability and rates of evolution: A comparison of behavioral, morphological, and life history traits*. In, Phylogenies and the Comparative Method in Animal Behavior (E. P. Martins, ed.), pp. 166 -205. Oxford University Press, Oxford.

Neubert, M. G., Kot, M., and Lewis, M. A. 1995. Dispersal and pattern formation in a discrete-time predator-prey model. *Theoretical Population Biology*, **48**, 7 -43.

Edwards, S. and Kot, M. 1995. Comparative methods at the species level: geographic variation in morphology and group size in Grey-crowned Babblers (Pomatostomus temporalis). *Evolution*, **49**, 1134 -1146.

Funasaki, E. and Kot, M. 1993. Invasion and chaos in a pulsed mass-action chemostat. *Theoretical Population Biology* **44**, 203 -224.

Neubert, M. and Kot, M. 1992. Subcriticality and population collapse in some simple discrete-time predator-prey models. *Mathematical Biosciences* **110**, 45 -66.

Kot, M., Sayler, G. S., and Schultz, T. W. 1992. Complex dynamics in a model microbial system. *Bulletin of Mathematical Biology* **54**, 619 -648.

Kot, M. 1992. Discrete-time travelling waves: ecological examples. *Journal of Mathematical Biology* **30**, 413 -436.

Gittleman, J. L. and Kot, M. 1990. Adaptation: statistics and a null model for estimating phylogenetic effects. *Systematic Zoology* **39**, 227 -241.

Stafford, S. A., Kot, M., and Roth, J. R. 1990. Investigation of the nonlinear behavior of a partially ionized, turbulent plasma in a magnetic field. *Journal of Applied Physics* **68**, 488 -499.

Bingham, S. and Kot, M. 1989. Multidimensional trees, range searching, and a correlation dimension algorithm of reduced complexity. *Physics Letters A* **140**, 327 -330.

Kot, M. 1989. Diffusion-driven period-doubling bifurcations. *BioSystems* **22**, 279 -287.

Kot, M., Schaffer, W. M., Truty, G. L., Graser, D. J., and Olsen, L. F. 1988. Changing criteria for imposing order. *Ecological Modelling* **43**, 75-110.

Kot, M. and Schaffer, W. M. 1986. Discrete-time growth-dispersal models. *Mathematical Biosciences* **80**, 109 -136.

Schaffer, W. M., Ellner, S., and Kot, M. 1986. Effects of noise on some dynamical models in ecology. *Journal of Mathematical Biology* **24**, 479 -523.

Schaffer, W. M. and Kot, M. 1986. *Differential systems in ecology and epidemiology*. In Chaos, A. V. Holden (Ed.), pp. 158 -178. Princeton University Press, Princeton.

Schaffer, W. M. and Kot, M. 1986. Chaos in ecological systems: the coals that Newcastle forgot. *Trends in Ecology and Evolution* **1**, 58 -63.

Schaffer, W. M. and Kot, M. 1985. Nearly one-dimensional dynamics in an epidemic. *Journal of Theoretical Biology* **112**, 403 -427.

Schaffer, W. M. and Kot, M. 1985. Do strange attractors govern ecological systems? *Bioscience* **36**, 342 -350.

Kot, M. and Schaffer, W. M. 1984. The effects of seasonality on discrete models of population growth. *Theoretical Population Biology* **26**, 340 -360.

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RESEARCH INTERESTS

Numerical methods and scientific computing, dynamical systems, bifurcation theory, linear and nonlinear wave propagation, perturbation and asymptotic methods, nonlinear analysis, variational methods, soliton theory, nonlinear optics, mode-locked lasers, Bose-Einstein condensation.

EDUCATION

Ph. D. Applied Mathematics, Northwestern University, Evanston, IL, 1994
Dissertation: Pulse Propagation in Nonlinear Optical Fibers using Phase-Sensitive Amplifiers (Advisor: William L. Kath)

B. S. Physics and Mathematics, University of Washington, Seattle, WA, 1990

ACADEMIC AND PROFESSIONAL POSITIONS

- 9/98- Professor, University of Washington, Department of Applied Mathematics Assistant Professor (9/98-9/01), Associate Professor (9/01-9/05),
- Professor (9/05-present)
- 9/95-8/97 Visiting Research Fellow: Princeton University, Program in Applied and Computational Mathematics, Department of Mathematics, Princeton, NJ
- 9/95-8/97 Visiting Fellow: Bell Laboratories, Mathematical Sciences Research Center and Division of Theoretical Physics, Murray Hill, NJ
- 9/94-8/95 Postdoctoral Fellow: University of Minnesota, The Institute for Mathematics and its Applications, Department of Mathematics, Minneapolis, MN

VISITING ACADEMIC POSITIONS

- 1/07-3/07 Universita di Roma ``La Sapienza", Department of Physics, Rome, Italy
- 3/06-5/06 University of Surrey, Department of Mathematics, Guildford, United Kingdom
- 8/04-12/04 University of Sydney, School of Physics, Sydney, Australia
- 4/03-6/03 Columbia University, Department of Electrical Engineering, New York, NY
- 6/98-9/98 Universite Libre de Bruxelles, Optique Nonlineaire Theorique, Brussels, Belgium
- 2/98-5/98 Fondazione Ugo Bordoni, Optical Communications Division, Rome, Italy

- 9/97-1/98 Hong Kong Polytechnic University, Department of Electronic Engineering, China
- 7/96-8/96 Stanford University, Department of Mathematics, Stanford, CA

HONORS AND AWARDS

2001-2006 NSF CAREER Award
2001-2002 Woodrow Wilson National Fellowship Foundation: Career Enhancement Fellowship
March 2000 Department of Applied Mathematics Excellence in Teaching Award
1998-2000 3M Corporation New Faculty Award
1997-1999 Hughes Research Laboratories Research Award
1997-1998 NSF International Research Fellow Award
1997-1999 NSF-NATO Postdoctoral Fellowship
1995-1997 NSF Mathematical Sciences University-Industry Postdoctoral Fellowship
1991-1994 DOD--National Defense Science and Engineering Graduate Fellowship

RECENT FUNDING SOURCES

2006-2009 Stability and dynamics of dispersive waves in nonlinear media, National Science Foundation Award (DMS-0604700), Arlington, VA.
2006-2007 Wave-guide arrays for optical fiber lasers, Royalty Research Fund Award, University of Washington, Seattle, WA
2001-2006 Dispersive Waves in Nonlinear Media: Dynamics and Applications, National Science Foundation CAREER Award (DMS-0092682), Arlington, VA.

SELECTED PROFESSIONAL ACTIVITIES

- 2007-2009 Program Director: SIAM activity group on Nonlinear Waves and Coherent Structures
- Sept. 2007 Scientific committee: OSA Conference on Nonlinear Photonics, Quebec City, Canada
- Sept. 2006 Organizing committee: SIAM Conference on Nonlinear Waves and Coherent Structures, University of Washington, Seattle, WA
- April 2003 Scientific Committee: IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA
- March 2003 Plenary Speaker: 13th Annual MATH DAY, University of Washington
- 2001-2003 Consultant: nLight Photonics Corporation, Seattle, WA

BOOK CHAPTERS

1. *Mode-Locking of Fiber Lasers via Nonlinear Mode-Coupling, Dissipative Solitons*, *Lecture Notes in Physics*, Eds. N. N. Akhmediev, A. Ankiewicz, 241-265 (Springer-Verlag, Berlin, 2005) (Kutz).
2. *Dynamics of dispersion-managed solitons in optical communications: a geometric interpretation, New Trends in Optical Soliton Transmission Systems*, Ed. A. Hasegawa,

183-195 (Kluwer Academic, Dordrecht, Netherlands, 1998) (Kutz, Evangelides, & Gordon)

FEATURED ARTICLES

1. Virtual Journal of Ultrafast Science, 4, issue 8 (2005) http://www.vjultrafast.org/ultrafast/, featuring Passive Mode-Locking by use of Waveguide Arrays, Optics Letters 30 (2005) 2013-2015 (Proctor & Kutz)
2. Mode-locking Technique Well Suited for Fiber Lasers, Photonics Spectra, (September 2005) 96-98, featuring Optics Letters 30 (2005) 2013 (Proctor & Kutz)

SELECT JOURNAL PUBLICATIONS

1. Computing spectra of linear operators using Hill's method, *Journal of Computational Physics* **219** (2006) 296-321 (Deconinck & Kutz)
2. Mode-locked Soliton Lasers, *SIAM Review* **48** (2006) 629-678 (Kutz)
3. Theory and Simulation of Dual Frequency Mode-Locked Lasers, *Journal of the Optical Society of America B* **23** (2006) 257-264 (Farnum, Butson & Kutz)
4. Theory of Q-Switching in Actively Mode-Locked Lasers, *Journal of the Optical Society of America B* **23** (2006) 652-662 (Proctor & Kutz)
5. Dynamics of the Optical Parametric Oscillator near Resonance Detuning, *SIAM Journal on Applied Dynamical Systems* **4** (2005) 808-831 (Hewitt & Kutz)
6. Passive mode-locking via nonlinear mode-coupling: application of waveguide arrays, dual-core fibers, and/or fiber arrays, *Optics Express* **13** (2005) 8933-8950 (Proctor & Kutz)
7. Enhanced Supercontinuum Generation in Dispersion-Managed Fiber, *Optics Express* **13** (2005) 3989-3998 (Kutz, Lynga & Eggleton)
8. The Evans function for nonlocal equations, *Indiana Journal of Mathematics* **53** (2004) 1095-1126 (Kapitula, Kutz & Sandstede)
9. Dynamics and Stability of Bose-Einstein Condensates: the Nonlinear Schrodinger Equation with Periodic Potential, *Journal of Nonlinear Science* **12** (2002) 169-205 (Deconinck, Frigyik & Kutz)
10. Bose-Einstein condensates in standing waves: The cubic nonlinear Schrodinger equation with periodic potential, *Physical Review Letters* **86** (2001) 1402 (Bronski, Carr, Deconinck, & Kutz)

OTHER PROFESSIONAL ACTIVITIES

- 1994-2007 Referee for Opt. Lett., J. Opt. Soc. Am. B, J. Nonlinear Sci., J. Lightwave Tech., Physica D, J. Mathematical Ana. and App., J. Comp. Physics, Opt. Comm., J. Phys. B, J. Opt. B, IEEE Pho. Tech. Lett., IEEE J. Quantum Elec., J. Physics A, Phys. Lett. A, Opt. Fiber Tech., Phys. Rev. E, Physica D, Opt. Express, SIAM J. App. Math., SIAM J. App. Dyn. Sys. and SIAM J. Math. Anal.
- 1994-2007 Member SIAM, OSA, IEEE

Self-Study Applied Mathematics

Randall J. LeVeque

Degrees:

BA in mathematics, summa cum laude, Revelle College, University of California at San Diego, 1977.

PhD in computer science, Stanford University, 1982.

Advisor: Joseph Oliger.

Title: Time-split methods for partial differential equations.

Positions:

Courant Institute of Mathematical Sciences, New York University.

NSF Fellow and Visiting Member, 1982-83.

Postdoctoral advisor: Charles Peskin.

University of California at Los Angeles.

Hedrick Assistant Professor of Mathematics, 1983-85.

University of Washington, Department of Mathematics and Department of Applied Mathematics.

Assistant Professor, 1985-1987.

Associate Professor, 1987-1990.

Professor, since 1990.

ETH Zürich, Mathematics Department.

Professor, 1990--91.

Recent Visiting Positions:

National Center for Atmospheric Reserach (NCAR), Boulder, Sabbatical visit, 1994--95.

Newton Institute of Mathematical Sciences, Cambridge, Sabbatical visit, 2003.

Awards and Honors:

Presidential Young Investigator Award, 1987.

NASA Space Act Award (for work with H.\ Yee), 1995.

Boeing Professor of Applied Mathematics, 2001-02.

Invited Lecturer, International Congress of Mathematicians, Madrid, 2006.

Recent Professional Activities

Associate Editor, *Journal of Computational Physics*, 1995--98.

Associate Editor, *International Series of Numerical Mathematics*, Birkhäuser Verlag, Basel.

Member of SIAM Council, 2002--2004, 2005--2007.

Survey and Review Section Editor, *SIAM Review*, 2003--2005.

Survey and Review Section Associate Editor, *SIAM Review*, 2005--.

Recent University Service

Director of interdepartmental degree program in Applied and Computational Mathematical Sciences (ACMS), 1996--2001.

Co-PI on interdepartmental VIGRE grant from NSF, 1999--2004.
Faculty Senate representative, 2003--2005, 2005--2007.
Royalty Research Fund Review Committee, 2003--2005.

Software

CLAWPACK --- Conservation LAWs PACKage, available on the Web at the URL
\verb+http://www.amath.washington.edu/~claw/+

Books

- *Numerical Methods for Conservation Laws*, ``ETH Lectures in Mathematics'' Series, Birkhäuser Verlag, Basel, 1990 (214 pp.).
- *Computational Methods in Astrophysical Fluid Flow*, by R.J. LeVeque, D. Mihalas, E. Dorfi and E. Müller, Twenty-seventh Saas-Fee Course, (A. Gautschy and O. Steiner, editors) Springer-Verlag, 1998.
- *Finite Volume Methods for Hyperbolic Problems*, Cambridge University Press, 2002 (557 pp.).

Selected publications (from 52 journal and 30 proceedings papers):

- A study of numerical methods for hyperbolic conservation laws with stiff source terms, with H.C. Yee, *J. Comput. Phys.* **86** (1990), 187-210.
- The immersed interface method for elliptic equations with discontinuous coefficients and singular sources, with Z. Li, *SIAM J. Numer. Anal*. **31** (1994), 1019--1044.
- Two-dimensional front tracking based on high resolution wave propagation methods, with Keh-Ming Shyue, *J. Comput. Phys.* **123** (1996), 35--368.
- Wave propagation algorithms for multi-dimensional hyperbolic systems, *J. Comput. Phys*. **131** (1997), 327-353.
- Balancing source terms and flux gradients in high-resolution Godunov methods: The quasi-steady wave-propagation algorithm, *J. Comput. Phys*. **146** (1998), 346--365.
- Adaptive mesh refinement using wave-propagation algorithms for hyperbolic systems, with M. J. Berger, *SIAM J. Numer. Anal*. **35** (1998) 2298-2316.
- High-resolution finite volume methods for acoustics in periodic or random media, with T. Fogarty, *J. Acoust. Soc. Am*. **106** (1999), pp. 17-28.
- Solving the advection-diffusion equation in irregular geometries, with D. Calhoun. *J. Comput. Phys*. **156** (2000), pp. 1--38.
- A class of approximate Riemann solvers and their relation to relaxation schemes, with M. Pelanti, *J. Comput. Phys.* **172** (2001), 573-591.
- Time evolution of cosmic-ray modified plane shocks, with H. Kang, T. W. Jones and K. M. Shyue. *Astrophysical Journal* **550** (2001), 737-751.
- A wave-propagation method for conservation laws with spatially varying flux functions, with D. S. Bale, S. Mitran, and J. A. Rossmanith, *SIAM J. Sci. Comput*. **24** (2002), 955-978.
- Solitary Waves in Layered Nonlinear Media, with D. H. Yong, *SIAM J. Appl. Math.* **63** (2003), 1539-1560.

- *H*-box methods for the approximation of one-dimensional conservation laws on irregular grids, with M. J. Berger and C. Helzel, *SIAM J. Numer. Anal*. **41** (2003), 893-918.
- An immersed interface method for incompressible Navier-Stokes equations, with L. Lee, *SIAM J. Sci. Comput*. **25** (2003), 832-856.
- The dynamics of pressureless dust, *J. Hyperbolic Differential Equations* **1** (2004), 315-327.
- A wave propagation algorithm for hyperbolic systems on curved manifolds, with J. A. Rossmanith and D. S. Bale, *J. Comput. Phys*. **99** (2004), 631-662.
- A high-resolution rotated grid method for conservation laws with embedded geometries, with C. Helzel and M. J. Berger, *SIAM J. Sci. Comput*. **26** (2005), 785-809.
- High-Resolution Finite Volume Methods for Dusty Gas Jets and Plumes, with M. Pelanti, *SIAM J. Sci. Comput*., to appear.

Recent PhD students:
Christiane Helzel, Mathematics, Otto-von-Guericke-Universität Magdeburg,
2000 (advised jointly with Prof. G. Warnecke, Magdeburg): *Numerical Approximation of Conservation Laws with Stiff Source Term for the Modelling of Detonation Waves.* First position: Postdoc, Courant Institute. Current position: University of Bonn.

Tiernan Fogarty, Applied Math. Dept., 2001: *Finite volume methods for elastic-plastic wave propagation in heterogeneous media.* First position: Instructor, Oregon Institute of Technology. Current position: Assistant Professor, Oregon Institute of Technology.

Derek S. Bale, Applied Math. Dept., 2002: *Wave propagation algorithms on curved manifolds with applications to relativistic hydrodynamics.* First position: CTO, Esoli, Inc., Seattle
Current position: II-VI Incorporated, Pennsylvania.

Long Lee, Applied Math. Dept., 2002: *Immersed interface methods for incompressible flow with moving interfaces.* First position: Postdoc, UNC, Chapel Hill. Current position: Assistant Professor, University of Wyoming.

James A. Rossmanith, Applied Math. Dept., 2002: *A Wave Propagation Method with Constrained Transport for Ideal and Shallow Water Magnetohydrodynamics.* First position: VIGRE postdoc, University of Michigan. Current position: Assistant Professor, University of Wisconsin.

Marica Pelanti, Applied Math. Dept., 2005: *Wave Propagation Algorithms for Multicomponent Compressible Flows with Applications to Volcanic Jets.* First/Current position: postdoc, Paris VI.

Current PhD students:

Kirsten Fagnan, Applied Math. Dept.
David George, Applied Math. Dept.
David Ketcheson, Applied Math. Dept.
Kyle Mandli, Applied Math. Dept.

Robert E. O'Malley, *Professor, Graduate Program Coordinator*

I came to the University of Washington in 1990 after serving at New York University, the University of Arizona, and Rensselaer Polytechnic Institute, with shorter stays elsewhere. Much of my work and interests are summarized in Introduction to Singular Perturbations (1974), Singular Perturbation Methods for Ordinary Differential Equations (1991), Thinking about Ordinary Differential Equations (1997) and a number of papers concerning singularly perturbed boundary value problems, asymptotic methods, computation, and control theory. I've held a number of editorial positions and offices, especially with SIAM. I was its president in 1991-1992 and continue to serve as editor of its Classic book series and its SIAM Review book reviews. I also served actively on the ICIAM Council.

Recent publications include:

- A renormalization group method for nonlinear oscillators, Studies in Applied Mathematics 107 (2001), 63-79 (with Blessing Mudavanhu)
- A new renormalization method for the asymptotic solution of weakly nonlinear vector systems, SIAM J. Appl. Math. 63 (2003), 373-397 (with Blessing Mudavanhu)
- The motion of internal layers for advection-reaction-diffusion equations, Studies in Applied Math. 112 (2004), 1-15 (with Karl Knaub)
- On the numerical solution of a challenging class of turning point problems, SIAM J. Sci. Computing 25 (2004), 927-941 (with Ping Lin)
- The slow motion of shock layers for advection-diffusion-reaction equations, Appl. Numerical Math 52 (2005), 299-310 (with Karl Knaub and David B. Williams)
- On the renormalization method of Chen, Goldenfeld, and Oono, in Analyzable Functions and Applications, O. Costin, M. D. Kruskal, and A. Macintyre, editors, AMS Contemporary Mathematics 373 (2005), 337-345 (with Blessing Mudavanhu)
- Singular Perturbations and Hysteresis, SIAM, Philadelphia, 2005 (edited with M. Mortell, A. Pokrovskii, and V. Sobolev)
- Deriving amplitude equations for weakly-nonlinear oscillators and their generalizations, J. Comp. Appl. Math. 190 (2006), 3-21 (with David B. Williams)
- Working with Multi-scale Asymptotics: Solving weakly-nonlinear oscillator equations on long-time intervals, J. Eng. Math. 53 (2005), 301-336 (with Blessing Mudavanhu and David B. Williams)
- International Workshop on Hysteresis & Multi-scale Asymptotics, Journal of Physics Conference Series 22 (2005), Institute of Physics, Bristol (edited with M. Mortell, A. Pokrovskii, and V. Sobolev)

- ***Much of this work has been done with the following PhD students***:
- Karl Knaub, On the asymptotic behavior of internal layer solutions of advection-reaction-diffusion equations, 2001 (now at Washington Mutual, Seattle, after an assistant professorship at Bucknell University and a position at the National Security Agency)

- Blessing Mudavanhu, A new renormalization method for the asymptotic solution of multiple scale singular perturbation problems, 2002 (now at Merrill Lynch, New York, after a position with AIG, New York)
- David Williams, Solving singular perturbation problems: an amplitude equation approach, 2005 (now an assistant professor at Clayton University)

Current work concerns boundary layer resonance and its generalizations. Some material is nearly ready for publication. Related work is being done by Chris Curtis, a current PhD student.

My recent teaching has centered on complex variables, ordinary differential equations, and asymptotic methods. I've been the department's graduate program coordinator for some time and am pleased with the talented group of students we've attracted. I also serve on various review and advisory committees.

HONG QIAN

Education & Training

1992-1994 Postdoctoral Fellow, California Institute of Technology, Pasadena.
Mathematical biology and neural computation (with J.J. Hopfield)

1990-1992 Postdoctoral Fellow, University of Oregon, Eugene.
Biophysical chemistry of peptides, proteins, and DNA (with J.A. Schellman)

1983-1989 Ph.D., Washington University, St. Louis. Biochemistry and Biophysics.
Dissertation: Biophysical characterization of biopolymer solutions and gels by fluorescence fluctuation studies (with E.L. Elson)

1978-1982 B.A., Peking University, Beijing. Astrophysics.
Thesis: On the effect of finite z-distributions in the density wave theory of spiral structures of galaxies

Professional Experience

2006- Professor of Applied Mathematics, University of Washington.
2003-2006 Associate Professor of Applied Mathematics, University of Washington.
2003- Adjunct Associate Professor, Bioengineering, University of Washington.
2005.6-2005.7 Visiting Professor, Center for Theoretical Biology, Peking University.
1997-2003 Assistant Professor of Applied Mathematics, University of Washington.
1997-2003 Adjunct Assistant Professor, Bioengineering, University of Washington.
1997- Associate Director, National Simulation Resource, UW.
1994-1997 Adjunct Assistant Professor of Biomathematics, UCLA School of Medicine.

Honors & Awards

1992-1994 Fellow, Program in Mathematics and Molecular Biology at the University of California at Berkeley, supported by the National Science Foundation.
2002-2003 Royalty Research Fund, University of Washington.
2007-2008 Boeing Endowed Professorship, University of Washington.

Professional Activities

2004 Member,NIH Modeling & Analysis of Biological Systems Study Section.
2004 Organizer, Institute of Pure and Applied Mathematics Workshop on Molecular Machines, Los Angeles, May, 2004.
2004 Organizer, Symposium on Stochastic Modeling in Biology, Annual Meeting of Society for Mathematical Biology, Ann Arbor, July, 2004.
2004- Member, Editorial Board, *Mechanics & Chemistry of Biosystems*.
2004- Member, Advisory Board, *Biophysical Chemistry*.
2005 Member, Program Committee, IEEE Computer Society Bioinformatics Conference, Stanford, August, 2005.
2005 Member, NSF-NIGMS Mathematical Biology Grant Applications Review Panel.
2006 Member (*ad hoc*), NIH Modeling and Analysis of Biological Systems (MABS) Study Section.

Research Interests

(1) *Computational systems biology*: large-scale metabolic and protein interaction networks, cellular signal transduction, and biophysics of muscle contraction and cell motility.
(2) *Physical chemistry of single molecules and fluctuation analysis*: stochastic macromolecular mechanics, fluorescence correlation spectroscopy, single-particle tracking, atomic force microscopy, and single-molecule enzymology.
(3) *Biophysical chemistry*: protein folding, DNA supercoiling, and molecular motors.
(4) *Mathematical modeling*: blood flow in vascular networks, cancer metastasis, and neural computation.

Current Research Grants:

Co-PI, 2004-2008, (PI: D.A. Beard) "*Integrated Modeling of Cardiac Metabolism and Transport*", NIH R01 HL072011, $1,168,760 total.
Co-PI, 2004-2008, (PI: D.A. Beard) "*Quantitative Approach to the Analysis of Complex Biological Systems*", NIH R01 GM068610, $200,000 per year.
Co-PI, 2004-2008, (PI: K. Bomsztyk) "*Energy-based Protein Interaction Networks Application to hnRNP K protein*", NIH R01 GM04134/G232JA, $107,845 per year.
Investigator, 2005-2008, (PI: J.B. Bassingthwaighte) "*Multiscale Modeling of Cardiac Functions*", NIH R01 BES0506477, $343,000 total.
Investigator, 2005-2007, (PI: J. Mittler) "*Modeling the Flagella Regulon in Salmonella*", NIH R21 AI059513 $275,000 total.

Recent Refereed Research Publications

Qian, H. A Motor Protein with Nonequilibrium Potential: Its Thermodynamics and Efficiency. *Physical Review E*, **69**, 012901:1-4 (2004).
Qian, H. and Elson, E.L. Fluorescence Correlation Spectroscopy with High-order and Dual-color Correlation to Probe Nonequilibrium Steady-states. *Proceedings of the National Academy of Sciences USA*, **101**, 2828-2833 (2004).
Beard, D.A., Babson, E., Curtis, E., and Qian, H. Thermodynamic Constraints for Biochemical Networks. *Journal of Theoretical Biology*, **228**, 327-333 (2004).
Kim, K.H. and Qian, H. Entropy Production of Brownian Macromolecules with Inertia. *Physical Review Letters*, **93**, 120602 (2004).
Beard, D.A. and Qian, H. Thermodynamic-based Computational Profiling of Cellular Regulatory Control in Hepatocyte Metabolism. *Am. J. Physiology: Endocrinology and Metabolism*, **228**, E633-E644 (2005).
Qian, H. and Beard, D.A. Thermodynamics of Stoichiometric Biochemical Networks in Living Systems Far From Equilibrium. *Biophysical Chemistry*, **114**, 213-220 (2005).
Yang, F., Qian, H., and Beard, D.A. *Ab Initio* Prediction of Thermodynamically Feasible Reaction Directions from Biochemical Network Stoichiometry. *Metabolic Engineering*, **7**, 251-259 (2005).
Qian, H. and Reluga, T.C. Nonequilibrium Thermodynamics and Nonlinear Kinetics in Cellular Signaling Switch. *Physical Review Letters*, **94**, 028101 (2005).
Qian, H. Cycle Kinetics, Steady-state Thermodynamics and Motors -- A Paradigm for Living Matter Physics. *Journal of Physics: Condensed Matter*, **17**, S3783-S3794 (2005).

Min, W., Jiang, L., Yu, J., Kou, S.C., Qian, H. and Xie, X.S. Nonequilibrium steady state of a nanometric biochemical system: determining the thermodynamic driving force from single enzyme turnover time traces.. *Nano Letters*, **5**, 2373-2378 (2005).
Qian, H. Nonequilibrium Potential Function of Chemically Driven Single Macromolecules via Jarzynski-type Log-mean-exponential Work. *Journal of Physical Chemistry B*, **109**, 23624-23628 (2005).
Qian, H. An Asymptotic Comparative Analysis of the Thermodynamics of Non-covalent Association. *Journal of Mathematical Biology*, **52**, 277-289 (2006).
Heuett, W.J. and Qian, H. A stochastic model of oscillatory blood testosterone levels. *Bulletin for Mathematical Biology,* **68**, 1383-1399 (2006).
Heuett, W.J. and Qian, H. Grand canonical Markov model: a stochastic theory for open nonequilibrium biochemical networks. *Journal of Chemical Physics*, **124**, 044110 (2006).
Saffarian, S., Qian, H., Collier, I.E., Elson, E.L. and Goldberg G. Powering a burnt bridges Brownian ratchet: A model for an extracellular motor driven by proteolysis of collagen. *Physical Review E*, **73**, 041909 (2006).
Qian, H. and Xie, X.S. Generalized Haldane Equation and Fluctuation Theorem in the Steady State Cycle Kinetics of Single Enzymes. *Physical Review E (Rapid Communication)*, **74**, 010902 (2006).
Qian, H. and Wang, H. Continuous time random walks in closed and open single-molecule systems with microscopic reversibility. *Europhysics Letters*, **76**, 15-21 (2006).
Qian, H. Open-system nonequilibrium steady-state: statistical thermodynamics, fluctuations and chemical oscillations. *J. Phys.l Chem. B (Feature Article)*, **110**, 15063-15074 (2006).
Li, Q.L., Barkess, G. and Qian, H. Chromatin looping and probability of transcription. *Trends in Genetics*, **22**, 197-202 (2006).
Qian, H. and Beard, D.A. Metabolic futile cycles and their functions: a systems analysis of energy and control. *IEE Proceedings-Systems Biology*, **153**, 192-200 (2006).
Shi, Y.Y., Miller, G.A., Qian, H. and Bomsztyk, K. Free energy distribution of binary protein-protein binding suggests cross-species interactome differences. *Proceedings of the National Academy of Sciences USA*, **103**, 11527-11532 (2006).
Heuett, W.J. and Qian, H. Combining flux and energy balance analysis to model large-scale biochemical networks. *J. Bioinformat and Computational Biology*, **4**, 1227-1243 (2006).
Qian, H. Reducing intrinsic biochemical noise in cells and its thermodynamic limit. *Journal of Molecular Biology*, **362**, 387-392 (2006).
Qian, H. Phosphorylation energy hypothesis: open chemical systems and their biological functions. *Annual Review of Physical Chemistry*, **58**, 113-142 (2007).
Breard, D.A. and Qian, H. Relationship between thermodynamic driving force and one-way fluxes in reversible chemical reactions. *PLoS ONE*, **2**, e144 (2007).
Vellela, M. and Qian, H. A quasi-stationary analysis of a stochastic chemical reaction: Keizer's paradox revisited. *Bulletin of Mathematical Biology*, in press.
Wang, H. and Qian, H. On detailed balance and reversibility of semi-Markov processes and single-molecule enzyme kinetics. *Journal of Mathematical Physics*, in press.
Kim, K.H. and Qian, H. Fluctuation theorems of a molecular refrigerator. *Phys. Rev. E*, in press.

Curriculum Vitae

Peter J. Schmid
Applied Mathematics, Box 352420
University of Washington
Seattle, Washington 98195-2420
Email: pjs@amath.washington.edu

Research Interests

- Hydrodynamic Stability and Transition to Turbulence
- Flow Control
- Computational Fluid Dynamics
- Fluid Dynamics and Computational Physics

Professional Experience/Positions

- Center National de la Recherche Scientifique, Palaiseau, France
- Directeur de Recherche (DR2), 09/2005-present
- University of Washington
- Full Professor of Applied Mathematics, 09/2004 – present
- Associate Professor of Applied Mathematics, 09/1996-09/2004
- Assistant Professor of Applied Mathematics, 09/1993-09/1996

Education

- Massachusetts Institute of Technology, Cambridge MA
- PhD in Mathematics, 05/1993
- Thesis advisor: Professor Dan S. Henningson
- Technical University Munich
- Diplom-Ingenieur in Aeronautics/Astronautics, 05/1989
- Thesis advisor: Professor Hans Wengle

Research Experience/Visits (abridged)

- National University of Singapore, Singapore
- Institute of Mathematical Sciences, visiting member, 12/2004
- CNRS-École Polytechnique, Palaiseau, France
- Laboratoire d'Hydrodynamique (LadHyX), chercheur poste rouge, 10-12/2003
- Technische Universität München, München, Germany
- Lehrstuhl für Fluidmechanik, A.v.Humboldt Fellow, 07-09/2003
- CNRS- École Polytechnique, Palaiseau, France
- Laboratoire d'Hydrodynamique (LadHyX), chercheur poste rouge, 04/2003
- Université Pierre et Marie Curie, Paris, France
- Laboratoire de Modélisation en Mécanique (LMM), enseignant invité, 03-04/2003
- New York University, New York, NY
- Courant Institute of Mathematical Sciences, visiting member, 03/2000-02/2001

Royal Institute of Technology, Stockholm, Sweden
Department of Mechanics, 08-09/1997, 05-06/1998, 09/1999

Honors and Awards

Chaire d'Excellence ``junior'' de Agence Nationale de Recherche, 2005-2008
Boeing Professorship, University of Washington, 2004-2006
Research Fellowship of the Alexander-von-Humboldt Foundation, 2003-2006
Alfred P. Sloan Doctoral Dissertation Award, 1992-1993
MIT Graduate Student Fellowship, 1991-1992
DAAD Foreign Exchange Fellowship, 1989

Publications (abridged)

Books

Schmid, P.J.; Henningson, D.S.: Stability and Transition in Shear Flows, Springer Verlag, New York, 2001, xiii+556 pages.

Journals

1. Reddy, S.C.; Schmid, P.J.; Henningson, D.S.: Pseudospectra of the Orr-Sommerfeld operator, SIAM J. Appl. Math., Vol. 53, No. 1, pp. 15-47, 1993
2. Schmid, P.J.; Kytömaa, H.K.: Transient and asymptotic stability of granular shear flow, J. Fluid Mech., 264, pp. 255-275, 1994.
3. Schmid, P.J.; Henningson, D.S.: Optimal energy density growth in Hagen-Poiseuille flow, J. Fluid Mech., 277, pp. 197-225, 1994
4. Henifi, A.; Schmid, P.J.; Henningson, D.S: Transient growth in compressible boundary layer flow, Physics of Fluids 8, pp. 826-837, 1996
5. Darmofal, D.L.; Schmid, P.J.: The importance of eigenvectors for local preconditioners of the Euler equations, J. Comp. Phys., 127, pp. 346-362, 1997
6. Reddy, S.C.; Schmid, P.J.; Baggett, J.S.; Henningson, D.S.: On stability of streamwise streaks and transition thresholds in plane channel flows, J. Fluid Mech., 365, pp. 269-303, 1998
7. Trefethen, A.E.; Trefethen, L.N.; Schmid, P.J.: Spectra and pseudospectra for pipe Poiseuille flow, Comput. Methods Appl. Mech. Engrg., 1926, pp. 413-420, 1999
8. Hristova, H.; Roch, S.; Schmid, P.J.; Tuckerman, L.S.: Transient growth in Taylor-Couette flow, Physics of Fluids, 14, pp. 3475-3484, 2002
9. Schmid, P.J.; Henningson, D.S.: On the stability of a falling liquid curtain, J. Fluid Mech., 463, pp. 163-171, 2002
10. Kerswell, R.R.; Obrist, D; Schmid, P.J.: On smoothed turbulent shear flows: bounds, numerics and stress-reducing additives, Physics of Fluid, 15, pp. 78-83, 2003
11. Obrist, D; Schmid, P.J.: On the linear stability of swept attachment-line boundary layer flow, Part I: Spectrum and asymptotic behavior, J. Fluid Mech., 493, pp. 1-29, 2003

12. Obrist, D.; Schmid, P.J.: On the linear stability of swept attachment-line boundary layer flow, Part II: Nonmodal effects and receptivity, J. Fluid Mech., 493, pp. 31-58, 2003
13. Schmid, P.J.; de Langre, E.: Transient growth before coupled-model flutter, ASME J. App. Mechanics, 70, pp. 894-901, 2003
14. Schmid, P.J.; Rossi, M.: Three-dimensional stability of a Burgers vortex, J. Fluid Mech., 500, pp. 102-112, 2004
15. Hémon, P.; de Langre, E.; Schmid, P.J.: Experimental evidence for transient growth in coupled-mode flutter, J. Fluid Struct., 22, pp. 391-400, 2006
16. Guegan, A.; Schmid, P.J.; Huerre, P.: Optimal control of energy growth in swept Hiemenz flow, J. Fluid Mech., 2006 (in press)
17. Schmid, P.J.: Nonmodal stability analysis, Ann. Rev. Fluid Mech., 2006 (in press)

Biographical Data of Ka-Kit Tung

PROFESSIONAL PREPARATION

California Institute of Technology, Pasadena, CA
B.S. in Engineering Science, 1972
M.S. in Aeronautics, 1972
Harvard University, Cambridge, MA
Ph.D. in Applied Mathematics
Center for Earth and Planetary Sciences, 1977
Thesis Advisor: Professor R.S. Lindzen. Thesis Title: Stationary Atmospheric Long Waves and the Phenomena of Blocking and Sudden Warming
Postdoctoral Research Fellow, Center for Earth and Planetary Physics under Professor R.S. Lindzen, July 1977 - September 1979

APPOINTMENTS

University of Washington
Professor of Applied Mathematics, Department of Applied Mathematics, January 1989 - Present
Department Chair, August, 1993 - present
Adjunct Professor of Atmospheric Sciences, Department of Atmospheric Sciences, September 1989 - Present

Clarkson University
Professor of Mathematics and Computer Science and Director of Atmospheric Sciences Program
July 1986 - June 1988

Massachusetts Institute of Technology
Associate Professor of Applied Mathematics, Department of Mathematics, July 1984 - June 1986
Assistant Professor of Applied Mathematics, Department of Mathematics, July 1979 - June 1984

HONORS

John Simon Guggenheim Fellow (1985-1986)
Boeing Endowed Professorship (2003-2005)

PROFESSIONAL AFFILIATIONS

Editor Journal of Atmospheric Sciences (Editor in Chief)

	Journal of Discrete and Continuous Dynamical Systems, B.
Member:	AMS (American Meteorological Society)
	AGU (American Geophysical Union)
Fellow:	Royal Meteorological Society (U.K.)
Committees:	AMS Committee on Waves and Stability (1991-1992)
	Middle Atmosphere Program, Stratospheric – Troposphere Exchange, Interaction with Biosphere (1991-1992)

GRADUATE STUDENTS (13) AND POSTDOCTORAL ASSOCIATES (9)

Prescilla Cehelsky, Hu Yang, Godelieve DeBlonde, Robert Warsam, Margaret Brown, Wendell Welch, Ming Fang, Elef Gkioulekas, Katie Coughlin, Charles Mannix, Christopher Thompson, Avanti Paranjpye, Rebecca Crabb, Eduardo P. Olaguer, Shun-Der Ko, Arthur Rosenthal, Jonathan Kinnersley, Yongyun Hu, Charles David Camp.

RECENT GRANTS

Empirical decomposition of low-frequency atmospheric variability for climate dynamics studies, National Science Foundation, Climate Dynamics Division, 11/01/2003-present, $446,885 plus $22,000 supplement. PI.

CMG: Anisotropic atmospheric dynamics across a wide range of scales, Division of Mathematical Sciences, 8/01/2003-7/31/2007, $665,625. PI (with Co-PI Greg Hakim).

NSF VIGRE grant, (joint with Amath, Math, Statistics departments), (Aug. 2004--Aug. 2009), Doug Lind (PI), (Co-PI with Loyce Adams, Selim Tuncel, Peter Guttorp), $3,900,000.

BOOK

Topics in Mathematical Modeling, Princeton University Press, March 2007.

10 RECENT REFEREED JOURNAL PUBLICATIONS (out of over 80)

C.D. Camp and K.K. Tung, 2007: Influence of the solar cycle and QBO on the late winter polar vortex, *J. Atmos. Sci.*, **64**, No. 4.

C.D. Camp and K.K. Tung, 2007: Stratospheric polar warming by ENSO, a statistical study, *Geophys. Res. Lett.* **34**, L04809, doi:10.1029/2006GL028521.

K.K. Tung, 2007: Simple Climate Model, *Discrete and Continuous Dynamical Systems B*, **7,** 651-660.

E. Gkioulekas and K.K. Tung; 2007: A new proof on net upscale energy cascade in 2D and QG turbulence, *J. Fluid Mech.,* **576**, 173-189.

E. Gkioulekas and K. K. Tung, 2007: "Is the subdominant part of the energy spectrum due to downscale energy cascade hidden in quasi-geostrophic turbulence?", *DCDS B* **7**, 293-314.

K. T. Coughlin and K. K. Tung, 2006: Misleading patterns in correlation map, *J. Geophys. Res*. **111,** D24102, doi:10.1029/2006JD007452.

E. Gkioulekas and K.K. Tung; 2006: "Recent developments in understanding two-dimensional turbulence and the Nastrom-Gage spectrum", *J. Low Temp. Phys*., accepted.

Y. Hu, K.K. Tung, and J. Liu; 2005: "A closer comparison of early and late winter atmospheric trends in the Northern-Hemisphere" *Journal of Climate*, **18**, 3204-3216.

K. Coughlin and K.K. Tung; 2005: "Empirical Mode Decomposition of Climate Variability in the Atmospheric" paper in Hilbert-Huang Transform: Introduction and Applications; edited by N. Huang and S. Shen; World Scientific Publishing.

E. Gkioulekas and K.K. Tung; 2005: "On the Double Cascades of Energy and Enstrophy in Two Dimensional Turbulence. Part 1. Theoretical Formulation" *Discrete and Continuous Dynamical Systems B*, **5**, 79-102.

E. Gkioulekas and K.K. Tung; 2005: "On the Double Cascades of Energy and Enstrophy in Two Dimensional Turbulence. Part 2. Approach to the KLB Limit and Interpretation of Experimental Evidence" *Discrete and Continous Dynamical Systems B*, **5**, 103-124.

K. Coughlin and K.K. Tung; 2004: "Eleven-Year Solar Cycle Signals throughout the Lower Atmosphere" *J. Geophys. Res*., **109**, d21105, doi:10.1029/2004JD004873.

Appendix H. HEC Board Summary

A: Name of unit authorized to offer degrees: Applied Mathematics
B: School or College(s) as applicable: Arts and Sciences
C: Exact title(s) of degrees offered: Doctor of Philosophy (PhD) in Applied Mathematics, Master of Science (MS) in Applied Mathematics.
D: Year of last review: 1995

E: Brief description of the field and its history at the University of Washington

The Department of Applied Mathematics discovers, applies, and promotes the use of mathematics to model and solve practical problems in many disciplines, ranging from engineering and science to medicine and business.

The Department of Applied Mathematics was established in 1985. From 1981 to 1985, it was organized as a Program in Applied Mathematics in the Graduate School. From 1976 to 1981, it was known as the Applied Mathematics Group. The Group obtained authorization from the State's Higher Education Council to offer Master of Sciences and Doctor of Philosophy in Applied Mathematics in 1976. The Department's first 10-year review was done in 1995.

F: Documentation of continuing need for your program

The Department is fulfilling its educational, research and service mission exceptionally well. There is a continued and increasing demand for our M. Sc. and Ph.D programs. Our graduates are well placed in academic and industrial careers.

G: Assessment information relating to student learning outcomes and program effectiveness

Graduate student learning outcomes are assessed in several ways. During the first year of their graduate study, there is a 6-hour written Preliminary Exam in January on three subjects. Those who pass are reviewed for admission into the Ph. D. degree program. The performance in the student's first-year core courses is considered in this review. During the Spring of their first year of study, a Ph. D. student shall form a Supervisory Committee and start exploratory research projects. By the end of the second year of study, he/she then takes the General Examination. This is an oral examination of two specialty areas in applied mathematics chosen by the student from the list of subjects and courses offered in the second-year graduate sequence in applied mathematics. The student is tested on his/her ability to synthesize what is learned in classrooms and the masterly of the tools required for carrying out research. In addition, the student presents a Ph.D. proposal.

Exit surveys are conducted on program effectiveness. The Department is rated significantly higher than the College or the University as a whole on a range of measures. In the categories of "quality of faculty", "response to recent developments or trends", and "overall quality of the program", our Ph.D. graduates rated the Department at 5, the highest level possible in the latest exit survey.

Student Teaching Evaluation for each faculty member is done every year. The rating places the Department at about the average for the College as a whole.

H: Please complete the following grid:

Number of undergrad majors graduating from unit (ACMS) in each of the last three years	2003-2004 74	2004-2005 77	2005-2006 47
Number of master's degrees granted in each of the last three years	12	14	18
Number of doctoral degrees granted in each of the last three years	1	8	5

I: Plans to improve the quality and effectiveness of the program:

As discussed in this Self Study, the effectiveness depends on our program maintaining its critical mass of faculty. Thus, replacing retiring faculty and faculty leaving for other institutions is important and represents opportunities for renewal. Our strategy plan calls for the next two hires to be in the areas of Mathematical Biology and Scientific Computing/Numerical Analysis. Financial support for graduate students needs to be strengthened, and one way may involve a structural change in the way Teaching Assistantships are allocated by the College.