GGAM DEGREE PROGRAMS

THE GRADUATE GROUP offers programs leading to the M.S. and Ph.D. degrees in Applied Mathematics. In addition to formal courses, the GGAM and the Department of Mathematics sponsor a regular colloquium series and several seminars. The graduate group places a strong emphasis on original research, and both the M.S. and Ph.D. programs require a thesis.

ADMISSION TO THE GRADUATE PROGRAMS

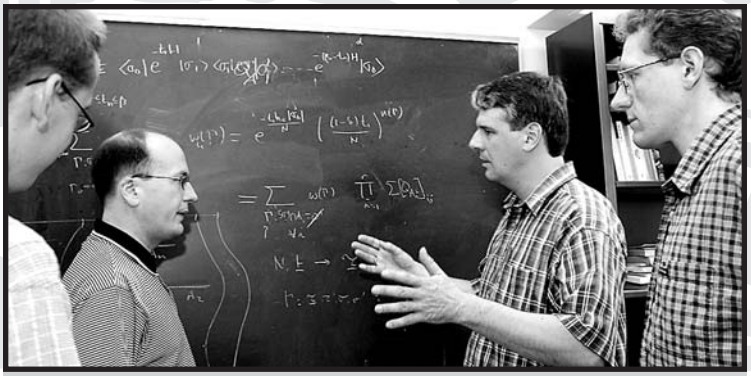
MASTER'S DEGREE

Minimum requirements for admission are a 3.0 overall grade point average, with undergraduate courses in calculus (including vector calculus), linear algebra, and ordinary differential equations. Advanced calculus (introduction to real analysis) is strongly recommended. Additional background in probability, partial differential equations, and/or numerical analysis is a plus. The program admits qualified students with a bachelor's degree in mathematics, physics, chemistry, engineering, economics, the life sciences and related fields. General and advanced mathematics GRE scores are required, and applicants should display evidence of strong quantitative skills. Meeting these minimum requirements, however, does not guarantee admission.

PH.D. DEGREE

The minimum admission requirements for the Ph.D. are the same as for the Master of Science.

Admission decisions are made by the Committee on Admissions and Advising of the Graduate Group.



Researchers Tom Michoel, Daniel Ueltschi, Bruno Nachtergaele and Wolfgang Spitzer strategize.

GENERAL PROGRAM REQUIREMENTS

Each graduate student is assigned a graduate adviser to help the student design a program and to guide progress toward a stated goal. New students must consult with their graduate adviser during the week preceding the start of classes to discuss their proposed program, and continuing students must consult with their adviser every quarter. Every program and any changes in the program must have the approval of the adviser. Failure to have such approval may mean that credit toward the degree will not be received for courses taken, and normal progress will therefore be delayed.

During the spring quarter of each year, the Committee on Admissions and Advising performs a review of each student, based on information provided by the student, the adviser, and the student's transcript. The main objective of this evaluation is to determine whether the student is making satisfactory progress and to communicate to the student expectations for future progress. The results of these evaluations are used in the award process of financial support for the summer quarter and the following academic year.

SEMINARS AND COLLOQUIA

The Graduate Group, with the support of the Department of Mathematics, runs a colloquium series that meets on a weekly basis. Students are strongly encouraged to attend all colloquia in the series. Another seminar of particular interest is a combined Applied and Mathematics student-run series of talks by faculty and students in our programs. These talks serve as an introduction to the research activities in applied mathematics and mathematics on the Davis campus. Students supported on an NSF VIGRE fellowship are required to participate in one of the VIGRE Research Focus Groups, of which the topics rotate each year:

http://www.math.ucdavis.edu/research/vigre/

All these activities help students focus their research interests and help them find a thesis advisor.

degree requirements

m.s. in applied math

M.S. IN APPLIED MATHEMATICS

1. Course Requirements

The student must complete a program of advanced study consisting of at least 40 units, at least 20 of which must be at the graduate level. The program must be approved by the Committee on Admissions and Advising or an adviser assigned to the student by that committee. Students whose cumulative GPA falls below 3.0 may be subject to dismissal.

The units must be subdivided as follows:

A. MAT 119A, MAT 201ABC	16 units
B. Numerical Analysis and Computation	8
C. Field of Emphasis	8
D. Field of Application	4
E. Elective	4
Total Advanced Study Units	**40**

A. MAT 119A and 201ABC are the core courses in the Applied Math program, and they cannot be taken on an S/U basis. A GPA of 3.0 must be maintained in MAT 201ABC.

B. The Numerical Analysis and Computation course requirement is to complete a minimum of 8 units from MAT 228ABC or MAT 229AB.

C. The Field of Emphasis course requirement is to complete a minimum of 8 units in one of the following areas: Optimization and Control (e.g., MAT 258AB), Differential Equations (e.g., MAT 218AB, MAT 219), Probability and Statistics (e.g., MAT 235ABC, MAT 236AB), Discrete Mathematics (e.g., MAT 245, MAT 246), Mathematical Physics (e.g., MAT 265, MAT 266), Mathematical Biology (e.g., MAT 222, MAT 227, ECL 231), Harmonic Analysis and Signal Processing (e.g., MAT 271, EEC 265, EEC 266).

D. The Field of Application course requirement is to complete a minimum of 4 units in an applied area, usually outside of Mathematics.

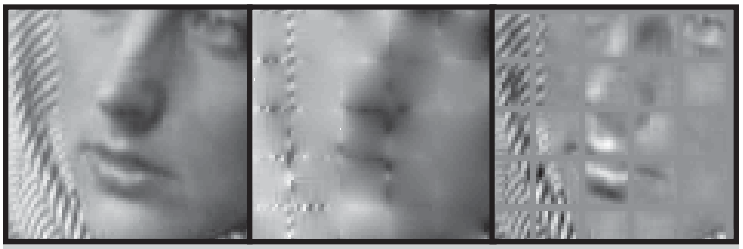
E. When choosing electives it is important to keep in mind that no more than 6 units of MAT 210, and no more than 9 units of research and seminars (MAT 290, 298, 299) can be counted toward the required 40 units.

There is no language requirement for the M.S. degree and no written or oral exam. However, students planning to pursue a Ph.D. should take the Ph.D. preliminary exam no later than the Winter Quarter of their second year.

2. Master's Thesis

Each student must complete a master's thesis on a topic selected by the student under the guidance of the thesis adviser. The adviser also recommends a program of study in the student's area of application. Students are expected to choose a thesis adviser during their first year. It is very important to choose a thesis adviser as early as possible for timely completion of the degree.

Using modern methods of applied mathematics, the master's thesis will normally consist of the solution of a problem or problems, from the student's area of specialization. The thesis will be read and approved by a committee of three faculty members, which includes the thesis adviser as chair of the committee. The thesis should be completed and submitted to Graduate Studies no later than the end of summer quarter of the student's second year.



Above is pictured a hierarchical image decomposition using the Polyharmonic Local Sine Transform: we first cut an image [top figure] into local pieces (e.g., 17 x 17 pixel blocks), then decompose each piece further into two components: the polyharmonic and the residual components. The former is obtained by solving the polyharmonic equation (e.g., Laplace equation) with the pixel values along the borders of that piece as boundary values [middle figure]. The latter is obtained by subtracting the former from the original data [bottom figure]. The Fourier sine series expansion of the residual component has quickly decaying coefficients since its boundary vanishes. Thus, this transform is useful for various image analysis tasks such as image compression and zooming/interpolation.

Plots courtesy of Prof. Naoki Saito, Dept. of Mathematics, UC Davis.

ph.d. in applied math

PH.D. IN APPLIED MATHEMATICS

1. Course Requirements

Each student must complete a program of advanced study approved by the Committee on Admission and Advising. This program must include:

A. All course requirements of the M.S. degree or their equivalents.

B. Six advanced courses from the following list:

MAT 202	Functional Analysis
MAT 204	Applied Asymptotic Analysis
MAT 205	Complex Analysis
MAT 206	Measure Theory
MAT 215ABC	Topology
MAT 218AB	Partial Differential Equations
MAT 219	Ordinary Differential Equations
MAT 221AB	Mathematical Fluid Dynamics
MAT 227	Mathematical Biology
MAT 228ABC	Numerical Differential Equations
MAT 229AB	Numerical Linear Algebra
MAT 235ABC	Probability Theory
MAT 236AB	Stochastic Dynamics
MAT 240ABC	Differential Geometry
MAT 245,246	Combinatorics
MAT 250ABC	Algebra
MAT 258A	Numerical Optimization
MAT 258B	Variational Analysis
MAT 261AB	Lie Groups and Their Representations
MAT 265	Mathematical Quantum Mechanics
MAT 266	Statistical Mechanics and Quantum Field Theory
MAT 271	Applied and Computational Harmonic Analysis

C. Fifteen units in a field of specialization.

Courses taken to partially fulfill the M.S. requirements (A) can also partially fulfill requirements (B) and (C). Each student must complete six graduate courses with a grade A or A-. Students whose cumulative GPA falls below 3.0 may be subject to dismissal. There is no language requirement for the Ph.D. degree.

2. Ph.D. Preliminary Examination

The Ph.D. preliminary exam is a written examination covering MAT 119A and MAT 201ABC. The exam is offered at the beginning of Fall and Winter quarters every year. All students wishing to enter the Ph.D. program must take the preliminary exam by the Winter quarter of their second year in the GGAM. Students admitted directly into the Ph.D. program are also required to take the preliminary exam by the Winter quarter of their second year.

The results of this examination will be used by the Admissions Committee to determine whether the student can enter or continue in the Ph.D. program.

If a student fails the preliminary exam in the Winter of the second year, the examination may be taken one more time, at the earliest opportunity. There is no penalty for attempting the exam during the first year of study in the GGAM.

Samples of previous exams are posted on the GGAM webpage:

http://www.math.ucdavis.edu/students/grad/ggam/exams/

3. Ph.D. Qualifying Examination

The purpose of this examination is to determine if the student is capable of independent research. The examination will be administered by a committee of five faculty members; at least one committee member should be from outside the Graduate Group. The committee is

recommended to Graduate Studies by the Committee on Admission and Advising, in consultation with the student and the thesis adviser. The chairperson of the Qualifying Examination Committee may not be the thesis advisor who, upon the student's advancing to candidacy, will become the chair of the Dissertation Committee.

The student must submit a written dissertation proposal to the examination committee and to the Committee on Admissions and Advising at least six weeks prior to the date of the exam. This dissertation proposal should be between one and three pages in length and should contain an outline of the general context of the thesis research, a description of the specific problem(s) to be addressed, and an indication of the methods and techniques to be used. The examination will begin with a detailed presentation of the proposed research. The student will be questioned on the proposed research and on related material from advanced courses in mathematics and from courses in the student's area of specialization.

Under normal circumstances, this examination will be completed after two years of study in the program and no later than by the end of the student's third year in the program.

All requirements for the Ph.D., except the dissertation, must be completed before taking the qualifying exam.

4. Dissertation

The doctoral dissertation is the main part of this program. A topic will be selected by the student under the advice and guidance of the thesis committee. Students will be expected to begin some research activity during the first year of their Ph.D. program. A good way to get started is by taking a reading course during the spring quarter of the first year and to start research in the summer after the first year.

The dissertation presented to the thesis committee must contain an original contribution to applied mathematics. In some cases the dissertation will expand the knowledge of some area of applied mathematics. In other cases methods of applied mathematics may be used to solve some substantial problem in an applied discipline such as engineering, biology, chemistry, economics, or the physical sciences.

5. Thesis Defense

The student must give a one hour seminar, open to the public, on the thesis subject. After the seminar, the student's thesis committee will meet privately with the student to discuss the contents of the thesis.

PROGRESS TOWARD THE DEGREES

While students proceed with varying speed towards their goal, a schedule for normal progress is given below. We also indicate a schedule for minimal progress. For students with TA support, minimal progress must be maintained to ensure preference for continuing TA support. Of students on fellowship, including Non-Resident Tuition Fellowship, at least normal progress is expected. Students entering the program with a bachelor's degree are expected to complete the M.S. in two years and the Ph.D. in five years or less. Students entering the program with a master's degree are expected to complete the Ph.D. in four years or less.

Requirement	Normal Progress	Minimal Progress
Course preparation for prelim	Year 1	Year 1
Pass prelim	September, prior to year 2	January, year 2
M.S.		
Find thesis advisor	Year 1	Year 1
Complete course work	Year 2	Year 2
Complete thesis	Spring quarter, year 1	Fall quarter, year 3
Ph.D.		
Find thesis advisor	Explore: Year 1 Settle: Year 2	By beginning of year 3
Complete course work	Spring quarter, year 2	Fall quarter, year 3
Pass Ph.D. Qualifying Exam	Fall quater, year 3	Spring quarter, year 3
Complete dissertation	Spring quarter, year 4	Spring quarter, year 5