Applied Mathematics and Statistics

Chairperson
James Glimm, Mathematics Building P-139A (631) 632-8355

Graduate Program Director
Xiaolin Li, Mathematics Building P-137 (631) 632-8354

Graduate Secretary
Christine Rota, Mathematics Building P-134A (631) 632-8360

Advanced Graduate Certificate Awarded
Advanced Graduate Certificate in Operations Research

Degrees Awarded
M.S. in Applied Mathematics and Statistics; Ph.D. in Applied Mathematics and Statistics

Applied Mathematics and Statistics Department

The Department of Applied Mathematics and Statistics, within the College of Engineering and Applied Sciences, offers programs in computational applied mathematics, operations research, statistics, and computational biology leading to the M.S. and Ph.D. degrees. The department offers an integrated series of courses and seminars, supervised reading, and facilities for research. Emphasis is on the study of real-world problems, computational modeling, and the development of necessary analytical concepts and theoretical tools. A state-of-the-art, computational laboratory is operated for student education and research. A University-based, 100TF, BlueGene super computer and a 300 node linux cluster are available for student access. It also features a network of advanced Unix workstations and modern printing facilities. The laboratory’s full-time staff is available to help students become familiar with the laboratory facilities.

Students participate in joint research with 5 national laboratories, several industrial groups and various sciences, biomedical, and engineering programs. Students, who receive a broad training, find themselves excellently prepared for careers in government and industry in which mathematics is used as a computational or conceptual tool.

Faculty research programs receive significant external funding and provide students with an opportunity for active participation in a variety of projects in all areas of the department. Faculty interests include applied graph theory, biostatistics and computational biology, structure-based drug design, computational fluid dynamics, combinatorial optimizations, computational statistics, data analysis, flow through porous media, fracture mechanics, inverse problems, mixed-boundary value problems, nonlinear conservation laws, reliability theory, robust estimation, nonparametric statistics, stochastic modeling and sequential decision making, computational geometry and control theory. Most doctoral students are supported through either a research or teaching assistantship.

The Ph.D. program normally takes about four to five years for students with a strong analytical and computing background. The M.S. programs, when pursued on a full-time basis, may be completed in three or four semesters. Students who have taken graduate courses before enrolling at Stony Brook may request transfer of credit (limited to six credits). If such a request is approved, it may be possible to complete the M.S. degree in two semesters. It is strongly urged that all applicants develop some facility in computer programming.

A more detailed description of the graduate program is available from the departmental office. This includes specific distribution requirements, fields of specialization, and information on the preliminary and qualifying examinations. Interested students should request information and application forms as early as possible, especially if they plan to apply for financial aid.

Advanced Graduate Certificate Program in Operations Research
This advanced certificate program of 18 credits, consisting of six three-credit courses, trains students in the fundamental mathematical tools for working in the operations research profession. Operations research is the field of applied mathematics related to efficient management of the activities of private companies, government agencies and nonprofit organizations. The following courses are required for certificate: AMS 507 Introduction to Probability, AMS 540 Linear Programming, AMS 550 Stochastic Models, AMS 553 Simulation and Modeling, AMS 572 Statistical Methods for Social Scientists, Elective chosen by student in consultation with advisor.

Combined B.S./M.S. Degree
Undergraduate applied mathematics majors, with strong academic credentials (minimum of 3.0 in the applied mathematics major) may apply for admission to the special Bachelor of Science-Master of Science program in Applied Mathematics and Statistics at the end of the junior year. The combined B.S./M.S. program in applied mathematics and statistics allows students with superior academic records to use up to 9 graduate credits toward the B.S. and M.S. requirements. In essence, those 9 credits count toward two goals simultaneously. Normally, it would take 6 years to complete two separate degrees. With the combined B.S./M.S. program, there is only a 5 year commitment (10 semesters). The advantage of the combined program is that the M.S. degree can be earned in less time, thus costing less money, than that required by the traditional course of study.

In the first semester of the senior year, students in the B.S./M.S. program may take up to 6 graduate credits. In the second semester of the senior year, they become enrolled as graduate students, and continue on as graduate students during the fifth year. Because students in this program only need to earn 111 undergraduate credits, they are usually finished with undergraduate coursework by the first semester of their senior year. If needed, they may continue to take some undergraduate courses after they become graduate students.

When the student is accepted, permission will be granted to take 6 graduate credits that will be applied toward the master’s degree. The requirements for the B.S. degree must be completed before admission to the graduate program. At least 24 additional credits including the
requirements stated in the Graduate Bulletin must be earned to qualify the student for the master’s degree. Further information about the combined program may be obtained from either the graduate program director or the undergraduate program director.

Part-Time Graduate Studies
In addition to the full-time graduate program leading to the M.S. and Ph.D. degrees with specializations in computational applied mathematics, operations research, and statistics, the department conducts a part-time program on campus. The part-time program is governed by regulations governing the resident full-time program with the exception that students in the part-time program have greater flexibility in choosing the time for the qualifying examination if they are contemplating pursuing the Ph.D.

The purpose of the part-time program is to provide an opportunity for men and women who are employed full time to pursue graduate study leading to advanced degrees in applied mathematics, statistics, and operations research. Applicants who hold a bachelor’s degree in applied mathematics, mathematics, engineering, physical sciences, life sciences, or social sciences with a strong background in undergraduate mathematics will be considered for admission to this program. Qualified students may continue beyond the master’s degree for the Ph.D. degree.

Additional information may be obtained from the graduate program director at the Department of Applied Mathematics and Statistics, Stony Brook University, Stony Brook, NY 11794-3600.

Admission Requirements of Applied Mathematics and Statistics Department
For admission to graduate study, the minimum requirements are as follows:
A. A bachelor’s degree in engineering, mathematics, physics, chemistry, or the social sciences with a strong mathematics background.
B. A minimum grade point average of at least 3.00 in all courses in pertinent or related fields.
C. Results of the Graduate Record Examination (GRE) General Test.
D. Three letters of reference and all transcripts of undergraduate study completed.
E. Acceptance by both the Department of Applied Mathematics and Statistics and the Graduate School.
F. Students admitted provisionally must satisfy designated course and grade point average requirements during the first year of graduate study before being admitted to full degree candidacy.

Requirements for the M.S. Degree in Applied Mathematics and Statistics
In addition to the minimum Graduate School requirements, the following are required:

A. Course Requirements
The M.S. degree in the Department of Applied Mathematics and Statistics requires the satisfactory completion of a minimum of 30 graduate credits in letter-graded (A,B,C,F) graduate courses.

All credits in satisfaction of the degree must be at the graduate level. The department may impose additional requirements as described below. In addition, the average for all courses taken must be B or higher, and at least 18 credits of all courses taken must carry a grade of B or higher.

The student pursues a program of study planned in consultation with an academic advisor. The program and any subsequent modifications require approval by the graduate program director.

Core Requirements for the M.S. Degree
1. Applied Mathematics
AMS 501 Differential Equations and Boundary Value Problems
AMS 503 Applications of Complex Analysis
AMS 504 Foundations of Applied Mathematics
AMS 505 Applied Linear Algebra
AMS 526 Numerical Analysis I
AMS 527 Numerical Analysis II
AMS 595 Fundamentals of Computing

2. Computational Biology
AMS 507 Probability
AMS 510 Analytical Methods for Applied Mathematics and Statistics
MCB 520 Graduate Biochemistry OR
AMS 530 Principles in Parallel Computing
AMS 532 Laboratory Rotations & Journal Club in Computational Biology
AMS 533 Numerical Methods and Algorithms in Computational Biology
AMS 535 Intro to Computational Structural Biology & Drug Design
CHE 541 Biomolecular Structure and Analysis
CSE 549 Computational Biology

3. Operations Research
AMS 510 Analytical Methods for Applied Mathematics and Statistics
AMS 507 Introduction to Probability
AMS 540 Linear Programming
AMS 550 Stochastic Models
AMS 556, Dynamic Programming or AMS 553/CSE 529 Simulation and Modeling or
AMS 542/CSE 548 Analysis of Algorithms
One course in statistics
AMS 595 Fundamentals of Computing

4. Statistics
AMS 510 Analytical Methods for Applied Mathematics and Statistics
AMS 507 Introduction to Probability
AMS 570 Mathematical Statistics I
AMS 572 Exploratory Data Analysis
AMS 575 Internship in Statistical Consulting
AMS 578 Regression Theory
AMS 582 Design of Experiments
AMS 595 Fundamentals of Computing

Elective Requirements for the M.S. Degree
Any graduate-level AMS or other graduate-level courses in a related discipline approved by the graduate program director may be used to satisfy the credit requirement beyond the core course requirement.

B. Final Recommendation
Upon the fulfillment of the above requirements, the faculty of the graduate program will recommend to the dean of the Graduate School that the Master of Science degree be conferred or will stipulate further requirements that the student must fulfill.

C. Time Limit
All requirements for the Master of Science degree must be completed within three years of the student’s first registration as a full-time graduate student.

Requirements for the Ph.D. Degree

A. Course Requirements
The course of study prescribed for the M.S. degree provides basic guidelines for doctoral study. The student pursues a program of study planned in consultation with an academic advisor. The program and any subsequent modifications require approval of the graduate program director.

B. Qualifying Examination
A student must pass a qualifying examination to be allowed to continue toward the Ph.D. degree. The qualifying examination is given twice a year at the beginning and the end of the Spring semester and is designed to test the student’s preparation to do research in
applied mathematics. Each student must demonstrate competency in algebra and analysis and in-depth knowledge in one of the following areas:

Computational Applied Mathematics
Computational Biology
Operations Research
Statistics

C. Research Advisor
After completion of at least one year of full-time residence and prior to taking the preliminary examination, the student must select a research advisor who agrees to serve in that capacity.

D. Preliminary Examination
This is an oral examination administered by a committee and given to the student when he or she has developed a research plan for the dissertation. The plan should be acceptable to the student’s research advisor.

E. Mathematical Writing Requirement
The mathematical writing requirement is associated with the preliminary oral examination. The student must submit a document, typically 20 to 25 double-spaced pages long, containing the literature search synopsis for the proposed dissertation as well as research work accomplished to date. It must be given to the members of the Preliminary Examination committee at least one week before the oral presentation.

The document must have the written approval for good English and writing style as well as correct content by the student’s thesis adviser and a faculty member, not of the Preliminary Examination Committee, who is appointed by the graduate program director. International students may need extensive writing assistance from the ESL Tutoring Center established to provide exactly this kind of technical writing tutorial support. Tutorial assistance in writing, if needed, will also be provided to native students.

F. Advancement to Candidacy
After successfully completing all requirements for the degree other than the dissertation, the student is eligible to be recommended for advancement to candidacy. This status is conferred by the dean of the Graduate School upon recommendation from the graduate program director.

G. Dissertation
The most important requirement of the Ph.D. degree is the completion of a dissertation, which must be an original scholarly investigation. The dissertation must represent a significant contribution to the scientific literature and its quality must be comparable with the publication standards of appropriate and reputable scholarly journals.

H. Dissertation Defense
The student must defend the dissertation before an examining committee. On the basis of the recommendation of this committee, the Department of Applied Mathematics and Statistics will recommend acceptance or rejection of the dissertation to the dean of the Graduate School. All requirements for the degree will have been satisfied upon successful defense of the dissertation. There must be at least one year between advancing to candidacy and scheduling a dissertation defense.

I. Minimum Residence
At least two consecutive semesters of full-time study are required.

J. Time Limit
All requirements for the Ph.D. degree must be completed within seven years after the completion of 24 graduate credits in the program. The time limits for the qualifying and preliminary examinations and advancement to candidacy are described in the departmental Graduate Student Handbook.

K. Teaching Requirement
One academic year long teaching experience required.

Faculty of Applied Mathematics and Statistics Department

Distinguished Professor
Glimm, James, Chairperson. Ph.D., 1959, Columbia University: Nonlinear equations, conservation laws; computational fluid dynamics; mathematical physics.

Distinguished Teaching Professor
Tucker, Alan, Ph.D., 1969, Stanford University: Graph theory; combinatorial algorithms.

Professors
Ahn, Hongshik, Ph.D., 1992, University of Wisconsin, Madison: Biostatistics; tree-structured regression
Arkin, Esther, Ph.D., 1986, Stanford University: Combinatorial optimization; network flows; computational geometry.


Feinberg, Eugene, Ph.D., 1979, Vilnius State University, Lithuania: Probability theory and statistics; control theory and applications in communication systems; transportation; computer networks and manufacturing.

Finch, Stephen, Ph.D., 1974, Princeton University: Robust estimation and nonparametric statistics.

Li, Xiaolin, Ph.D., 1987, Columbia University: Computational fluid dynamics; numerical analysis.

Lindquist, Brent, Ph.D., 1981, Cornell University: Flow in porous media; Computational fluid dynamics.

Mendell, Nancy, Ph.D., 1972, University of North Carolina at Chapel Hill: Biostatistics.

Mitchell, Joseph, Ph.D., 1986, Stanford University: Operations research; computational geometry; combinatorial optimization.

Srivastav, Ram P., Emeritus Ph.D., 1958, Lucknow University, India; Ph.D., 1963, D.Sc., 1972, Glasgow University, Scotland: Fracture mechanics; integral equations; mixed boundary value problems.

Tewarson, Reginald P., Emeritus. Ph.D., 1961, Boston University: Numerical analysis and computational methods; sparse matrices; generalized inverses and large nonlinear systems; mathematical models of diffusion problems in biology and medicine.

Zhu, Wei, Ph.D., 1996, University of California, Los Angeles: Biostatistics; optimal experimental design; linear models; structural equation modeling.

Assistant Professors


Assistant Professors

Green, David, Ph.D., 2002, MIT: Computational biology, protein structure.

Hu, Jiaqiao, Ph.D., 2006, University of Maryland: stochastic optimization, dynamic programming.

Jiao, Xiangmin, Ph.D., 2001, University of Illinois: numerical analysis, computational geometry.

Xing, Haipeng, Ph.D. 2003, Stanford University: Statistical methods in finance, change-point detection.

Research Professors


Research Associate Professor


Research Assistant Professor

Yu, Yan, Ph.D., 2005, Stony Brook University: Numerical analysis and computational fluid dynamics.

Adjunct Faculty

Bender, Michael, Associate Professor, Ph.D., 1996, Harvard University, combinatorial algorithms.
Chen, John\textsuperscript{11}, Ph.D. 1999, University of California, Berkeley: Biostatistics.

Dubey, Pradeep\textsuperscript{1}, Professor, Ph.D., 1975, Cornell University: Game theory; mathematical economics.

Ferguson, David\textsuperscript{8}, Professor. Ph.D., 1980, University of California, Berkeley: Mathematics education; educational technology.

Grove, John\textsuperscript{4}, Professor. Ph.D., 1984, Ohio State University: Conservation laws; front tracking.

Pinezich, John\textsuperscript{12}, Adjunct Professor, Ph.D.. 1998, SUNY at Stony Brook: Radar, ballistics, sonar, acoustics.

Powers, Scott\textsuperscript{13}, Adjunct Professor, Ph.D., 1982, Columbia University: Genetic basis of cancer.

Reinitz, John\textsuperscript{14}, Ph.D., 1988, Yale University: Theory of fundamental biological processes; bioinformatics; optimization, developmental biology and gene regulation.

Sharp, David\textsuperscript{4}, Professor. Ph.D., 1963, California Institute of Technology: Mathematical physics; computational fluid dynamics.

Simmerling, Carlos\textsuperscript{9}, Associate Professor, Ph.D., 1995, University of Illinois at Chicago: Protein structure.

Skiena, Steven\textsuperscript{3}, Professor, Ph.D., 1988, University of Illinois: Combinatorial algorithms; computational geometry; data structures.

Skorin-Kapov, Jadranka\textsuperscript{2}, Professor, Ph.D., 1988, University of British Columbia, Canada: Mathematical programming; production management.

Sheldon Weinig, Professor, Ph.D., 1955, Columbia University: Manufacturing management, material sciences.


Zhang, Michael\textsuperscript{13}, Ph.D., 1987, Rutgers University: computational biology, systems biology.

Number of teaching assistant and research assistants, fall 2007:75

1) Department of Economics

2) College of Business

3) Department of Computer Science

4) Los Alamos National Laboratory

5) Recipient of the State University Chancellor’s Award for Excellence in Teaching, 2008

6) Recipient of the State University Chancellor’s Award for Excellence in Teaching, 2002

7) Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1996

8) Department of Technology and Society

9) Department of Chemistry

10) Department of Electrical and Computer Engineering

11) Department of Preventive Medicine

12) Advanced Acoustical Concepts

13) Cold Spring Harbor Laboratory

14) University of Chicago Statistics Department

\textit{NOTE: The course descriptions for this program can be found in the corresponding program PDF or at COURSE SEARCH.}