Mechanical Engineering Department

Chairperson
Fu-pen Chiang, Light Engineering Building 105 (631) 632-8311

Graduate Program Director
Lin-Shu Wang, Light Engineering Building 171 (631) 632-8816

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Mayra Santiago, Light Engineering Building 103 (631) 632-8340

Degrees Awarded
M.S. in Mechanical Engineering; Ph.D. in Mechanical Engineering

Web Site
http://me.eng.sunysb.edu/

Description of the Mechanical Engineering Department

The Department of Mechanical Engineering, in the College of Engineering and Applied Sciences, offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. The department offers a broad curriculum with concentrations in Design and Manufacturing, Solid Mechanics, and Thermal Sciences and Fluid Mechanics. Departmental brochures that provide a more detailed description of the graduate program are available upon request. Additional information is also available at the department’s Web site: http://me.eng.sunysb.edu.

Admission Requirements for the Department of Music

For admission to the M.S. and Ph.D. programs in Mechanical Engineering the following are required:

A. A bachelor’s degree in mechanical engineering, or a related field such as another engineering discipline, physical science, or mathematics.

B. A grade point average of at least B or equivalent in engineering, mathematics, and science courses.

C. Completion and submission of the Graduate Record Examination (GRE) General Test.

D. Acceptance by both the Department of Mechanical Engineering and the Graduate School.

Combined B.E./M.S. Degree

Undergraduate mechanical engineering majors with strong academic performance (GPA of 3.0 or above) may apply for admission to the special combined Bachelor of Engineering/Master of Science (B.E./M.S.) degree program in mechanical engineering at the end of their junior year. Once accepted into this program, students will be permitted to take up to 9 graduate credits in replacement of the required technical electives. These credits will be applied towards both their Bachelor’s degree and Master’s degree, which will be awarded together at the end of the program after they have fulfilled the requirements for both degrees. More information about this program may be obtained from the graduate program director or the Department Web site.

Facilities and Areas of Specialization for the Mechanical Engineering Department

Design and Manufacturing

Studies include computer-integrated engineering, CAD/CAM, kinematics and mechanisms, robotics, manufacturing systems, dynamics and vibration, control, design optimization, metrology, machine vision, mechatronics, microelectromechanical systems (MEMS), and micro/nano-technologies. Research topics cover the analysis and design of mechanical systems, such as high performance machinery and robots, mechanisms, and sensors, including dynamics, motion, control, and vibration-related problems; optical metrology, 3-D machine vision, and their applications to manufacturing; manufacturing process modeling, free abrasive machining, human augmented systems, and intelligent fault detection and diagnosis. Applied courses emphasize case studies, finite element methods, and computer graphics. Also featured are an array of equipment and software for research and teaching, such as mechatronic systems, robots, computer vision systems, CAD/CAM stations, CMM, desktop rapid prototyping machine, ProE, NX (I-DEAS), Autodesk Inventor and AutoCAD, and Matlab (including Simulink).

Mechatronics

Mechatronics synergistically integrates mechanical engineering, electrical engineering, software, and controls into smart electromechanical products and systems. Research in this area highlights modeling, analysis, design, control, and prototyping in a system-level approach, which requires a broad knowledge of mechanics, materials, mechanical design, manufacturing, vibration, dynamics, sensors, actuators, electronics, signals and control. Applications include industrial and laboratory automation, biomedical devices, servo machines, vehicle systems, smart structures, and energy systems.

Solid Mechanics

The mechanical behavior of advanced materials and structures is studied with emphasis on mathematical modeling and simulation of deformation, failure, stability, and microstructural transformation. These issues span a wide range of interests that focus on various materials, systems, and multiple length scales. Research topics include fracture mechanisms of embedded flaws in coatings and thin films, delamination in composites, and the mechanical properties and behavior of micron-scale structures and systems, such as microelectromechanical systems (MEMS) and microelectronic components. Also investigated are the constitutive modeling and failure characterization of ceramics, polymers, and heterogeneous multi-component materials, and nano- and micromechanics of defect formation and motion in bulk materials and thin films.

Stony Brook University Graduate Bulletin: www.stonybrook.edu/gradbulletin
Experimentially based research programs focus on the mechanical, thermomechanical, and failure behavior of a wide variety of materials such as metals, polymers, ceramics, hard and soft biological tissues, and composites under both static and dynamic loading conditions. Optical techniques of strain analysis including moiré methods, laser and white-light speckle methods, holographic interferometry, photoelasticity, and classical interferometry are developed and applied to solid mechanics problems such as fracture, wave propagation, metal forming, vibration, and deformation of micron-scale structures and systems such as MEMS. Characterization of micron and nano-scale materials and structures is accomplished with instrumented-indentation and scanning probe microscopy techniques for wear and harsh environment applications. Research is also conducted to characterize the failure mechanics of various engineered heterogeneous materials systems, ranging from functionally layered/graded coatings to nanocomposites under impact loading and high-temperature conditions. Specialized equipment includes high-speed digital cameras, scanning electron microscope, and split Hopkinson pressure bars, and in situ micromechanical high temperature fatigue testing system. Current research topics also include the characterization of mechanical properties of soft tissues and the pumping efficiency of an ischemic heart, both in vitro and in vivo.

**Thermal Sciences and Fluid Mechanics**

**Fluid Mechanics:** Current topics include advanced combustor design and flow control, and the behavior of chemically reacting species in turbulent flows. Numerical and theoretical studies include direct simulation of turbulent flows and turbulent transport at modest Reynolds numbers, stochastic modeling of the turbulent transport of temperature, and spectral closure approximations for chemically reactive flows. Other areas include microfluidics, interfacial fluid phenomena and wetting, multiphase flows, miscible flows, and complex fluids.

**Thermal Sciences:** Current topics include measurement of thermophysical properties, laser-material interaction, materials processing, and heat transfer in advanced energy systems. The ultra fast thermal processing and laser-based measurement laboratory has an amplified oscillator/regenerative amplifier, a femtosecond autocorrelator, and a host of optoelectronics and light sources. The thermal sciences research laboratory has a visualization and digital image processing system. Studies also include methods and analytical tools for predicting, modeling and correlating the thermodynamic/thermophysical properties of the fluids. Current studies include the development of statistical mechanical techniques to assess the relation between intermolecular forces and the thermodynamic, dielectric, optical, and transport properties of fluids, fluid mixtures, and suspensions. Research is also being conducted on the modern formalism of thermodynamics; on combustion heat engines, aiming at achieving high fuel efficiency and engine performance; and on building energy dynamics.

**Energy Technologies**

Thermal sciences and fluid mechanics are the core disciplines of the emerging field of energy technologies and sustainability science—a vibrant field of research and innovation. Although the broader field of sustainability science is an interdisciplinary field defined by the problems it addresses rather than by the disciplines it employs, the application of thermal sciences and fluid mechanics to energy technologies is and will remain an important part of global transition toward a sustainable future. The Graduate Program includes doctoral-thesis research projects in Energy Technologies and Sustainability Science as well as a concentration in Energy Technologies which offers `hands on` laboratory and design experience as well as theory–based courses focusing on energy transformation, transfer, and storage. The Energy Technologies Laboratory contains fuel cell, wind turbine, photovoltaic, thermoelectric, heat pump, optical and infrared sensors, and motor/generator/battery facilities.

Requirements of the Mechanical Engineering Department

**Academic Advisor**

Each graduate student is assigned an academic advisor in his or her area of interest before registration. The academic advisor will guide the student in course selection, research, and other areas of academic importance. Students receiving financial aid must select a thesis research advisor before the start of their second semester.

**Academic Standing**

An average GPA of 3.0 or higher in all coursework, exclusive of MEC 599 (M.S. Thesis Research), MEC 698 (Practicum in Teaching II), and MEC 699 (Ph.D. Dissertation Research), is a minimum requirement for satisfactory status in the graduate program. In the doctoral program, a 3.5 grade point average is expected.

Requirements for the M.S. Degree in Mechanical Engineering

A minimum of 30 credits is required for the M.S. degree.

**A. Course Requirements**

1. **M.S. with thesis:** 21 approved graduate course credits and an accepted thesis, which is registered as 9 credits of MEC 599 and MEC 696 (Special Problems in Mechanical Engineering) combined.

2. **M.S. without thesis:** 30 approved graduate credits. No credit for MEC 599 is approved for fulfilling this requirement. No more than 6 credits of MEC 696 may be applied toward the course requirements.

3. All full-time graduate students are required to register for MEC 691 (Mechanical Engineering Seminar) each semester and obtain a satisfactory grade.

4. A minimum of 18 graduate credits, of which 15 credits are in courses other than MEC 599 and MEC 696, must be taken in the Department of Mechanical Engineering. All courses taken outside the department for application to the graduate degree requirements are subject to approval of the student’s advisor and the graduate program director.

**B. Transfer Credits**
A maximum of 12 graduate credits may be transferred from other programs toward the M.S. degree. These may include up to 6 credits from other institutions. The maximum also includes any credits received from taking Mechanical Engineering courses while having non-degree status at Stony Brook as an SPD or GSP student. Credits used to obtain any prior degrees are not eligible for transfer. All requests for transfer of credits require the approval of the graduate program director.

C. Thesis Requirements
A student choosing the thesis option must select a research advisor. Upon completion, the thesis must be defended in an oral examination before a faculty committee of at least three members of which at least two must be Mechanical Engineering faculty. A student choosing the thesis option may not switch to the non-thesis option without permission of the graduate program committee. A student who has ever been appointed as a teaching, graduate, or research assistant must choose the thesis option unless otherwise approved by the graduate program committee.

Requirements for the Ph.D. Degree in Mechanical Engineering

A. Course Requirements
1. 18 approved graduate course credits beyond the M.S. degree requirement. A minimum of 9 credits, excluding MEC 599, MEC 696 and MEC 699, must be taken in the department.

2. MEC 507. The graduate program director may waive this requirement if the student has taken sufficient applied mathematics courses elsewhere.

3. All full-time graduate students are required to register for MEC 691 each semester and obtain a satisfactory grade.

4. All courses taken outside the department for application to the graduate degree requirements are subject to approval of the student’s advisor and the graduate program director. The advisor may impose additional course requirements.

B. Transfer Credits
A maximum of 6 graduate credits from other programs, including those of other institutions, may be transferred toward the Ph.D. degree. Credits used to obtain any prior degrees are not eligible for transfer. Requests for transfer of credits must be approved by the graduate program director.

C. Written Qualifying Examination
The written qualifying examination is offered once every year, usually in January. Students who enter the graduate program with an M.S. degree from another institution are encouraged to take the examination the first time it is offered after they begin academic residency. Students who enter the graduate program without an M.S. degree are encouraged to take the examination the first time it is offered following three academic semesters in residence. Both categories of students who fail to take this opportunity must take the examination the next time it is offered during their residency. Part-time students should follow a rule based on graduate course credit hours (determined by the equivalence of 9 credits with one semester in residence). Each student can take the written qualifying examination two times before being dismissed from the Ph.D. program.

The written qualifying examination consists of two parts. Part I covers applied mathematics. Part II corresponds to the student’s core area of concentration, selected from one of the following:

1. Design and Manufacturing
2. Solid Mechanics
3. Thermal Sciences and Fluid Mechanics

More precise information on the exam, including a list of suggested courses for each subject in the exam, is available in the departmental office, as are samples of previous examination questions.

Each student taking the examination is required to submit a written statement to the graduate program director with a declaration of both areas chosen at least one month before the announced exam date.

D. Minor Area of Concentration
In addition to the major area of concentration, each student must select a minor area from the following list: Thermodynamics and Heat Transfer, Fluid Mechanics, Solid Mechanics, Design and Manufacturing, Electrical Engineering, Material Science and Engineering, Computer Science, Applied Mathematics, and Biomedical Engineering. A petition to select a minor area that is not contained in this list must be approved by the Graduate Program Director.

A student will be required to take a coherent sequence of three graduate level courses in the minor area and obtain a grade of B or better in each of the courses. However, students must submit a list of five courses from the proposed minor field no later than the time he or she applies to take the qualifying exam. The courses in the minor field must be approved by the Graduate Program Director, with the recommendation of the student’s advisor. Upon submission of the list of five courses, students must provide an explanation for the list, how the courses are related, and the rationale for the courses. Note that students are not required to have taken the courses in the minor field before taking the qualifying exam. However, the minor requirement must be satisfied before the student can be admitted to candidacy.

E. Advancement to Candidacy
A student will be advanced to candidacy for the Ph.D. degree when all formal coursework has been completed and all the requirements listed in items A through E have been satisfied. These requirements must be completed within one calendar year after passing the written qualifying
examination. Advancement to candidacy must be one year before the beginning of the semester in which a student plans to defend his/her dissertation.

F. Teaching
Ph.D. students are required to take 3 credits of MEC 698 Practicum in Teaching II or obtain approval of equivalent teaching experience from the Graduate Program Director as part of the degree requirement. MEC 698 is taken under a faculty advisor who is responsible for proving feedback and making a formal evaluation of the student's work. The form of this practicum may include making class presentations, teaching in recitation classes, and preparation and supervision of laboratory classes. All Teaching Assistants are required to take MEC 697 Practicum in Teaching I, which does not meet this requirement.

G. Dissertation
The student chooses a dissertation topic in consultation with his/her doctoral dissertation advisor as soon as possible after passing the written qualifying examination. Dissertation research is an apprenticeship for the candidate, who, under the supervision of the dissertation advisor, independently carries out original work of significance. Within one year after passing the written qualifying examination, a dissertation examining committee is established. The committee must include at least three members from the Department of Mechanical Engineering, including the dissertation advisor, and at least one member from another program or from outside the University. The committee must be approved by the graduate program director upon recommendation by the dissertation advisor. The official recommendation for the appointment of the dissertation examining committee is made to the Dean of the Graduate School.

The dissertation examining committee provides a means of exposing the candidate’s ideas to a variety of views, and helps to guide and oversee the candidate’s research progress, which is reviewed by the committee each year. The chairperson of the committee must submit a written report to the graduate program director on the student’s progress after each review.

Dissertation Proposal: In addition, the student is required to submit a written dissertation proposal and present it in an oral examination conducted by the dissertation examining committee. The written dissertation proposal must be distributed to the committee members at least two weeks before the oral examination. The oral examination probes the doctoral student’s ability and examines the progress, direction and methodology of the dissertation research. The student will be examined on the dissertation topic and its objective, the problem formulation, research approach, and knowledge in related areas. The majority of the dissertation examining committee must approve the student’s performance.

Dissertation Defense: At the completion of the dissertation, approval of the dissertation involves a formal oral defense. The formal defense is open to all interested members of the University community. A candidate must fill out the Doctoral Degree Defense Form (available on the Graduate School Web page) with dissertation abstract as well as other relevant details, and submit the Form to the graduate program director at least three weeks in advance of the proposed event. The Form is forwarded by the graduate program director to the dean of the Graduate School, which will be responsible for advertising the defense to the University community. Copies of the dissertation are to be distributed to the committee members at least two weeks before the dissertation defense; one copy is to be kept in the departmental office for examination by the faculty. The final approval of the dissertation must be by a majority vote of the dissertation examining committee.

Faculty of Mechanical Engineering Department

Professors

Chiang, Fu-pen, SUNY Distinguished Professor and Chairperson, Ph.D., 1966, University of Florida: Experimental mechanics; solid mechanics; photoelasticity; moiré and laser methods for stress analysis; mechanics of soft tissues and heart.

Ge, Q. Jeffrey, Professor and Deputy Chair, Ph.D., 1990, University of California, Irvine: Design kinematics; robotics; CAD/CAM; mechanical systems analysis and simulation.

Kao, Imin, Professor. Ph.D., 1991, Stanford University: Robotics; stiffness control; wire saw manufacturing process; manufacturing automation; Taguchi methods.

Kincad, John, Professor, Ph.D., 1974, Rockefeller University: Statistical mechanics; thermodynamics, and energy technology.

Nakamura, Toshio, Professor, Ph.D., 1986, Brown University: Solid mechanics; composite materials; computational fracture mechanics.

Sharma, Satya, Professor, Ph.D., 1975, University of Pennsylvania: Manufacturing and production.

Tasi, James, Emeritus, Ph.D., 1962, Columbia University: Solid mechanics; shock waves in crystal lattices.

Associate Professors

Kukta, Robert V., Ph.D., 1998, Brown University: Solid mechanics; mechanics of thin films; micromechanical modeling of defects in crystals, crystal growth, self-assembly, surface science.

Ladeinde, Foluso, Ph.D., 1988, Cornell University: Supersonic and hypersonic flows, flow control, turbulent flows, computational fluid dynamics, aircraft engines, combustion, and numerical mathematics.

Longtin, Jon P., Ph.D., 1995, University of California, Berkeley: Heat transfer at fast time scales; ultrafast laser liquid- and laser-solid interactions; laser processing, measurement and diagnostics for thermal systems; surface tension effects.
Rastegar, Jahangir, Ph.D., 1976, Stanford University: Mechanical design.

Wang, Lin-Shu, Ph.D., 1966, University of California, Berkeley: Thermodynamic theory; building energy dynamics; sustainability science.

Assistant Professors

Alkhader, Maen, Assistant Professor. Ph.D., 2008, Illinois Institute of Technology, Chicago, IL: Experimental solid mechanics; time-dependent materials; time dependent materials, cellular materials and composites, dynamic failure of materials, mechanics of novel materials for energy technology.

Babajimopoulos, Aristotelis, Assistant Professor. Ph.D., 2005, University of Michigan, Ann Arbor: Internal combustion engines, combustion, fuels, hybrid vehicles, advanced powertrains, energy conversion.

Chang, Qing (Cindy), Assistant Professor. Doctor of Engineering, 2006, University of Michigan; Real-time production control, manufacturing system modeling, simulation and intelligent maintenance, real-time energy management of manufacturing system.

Cubaud, Thomas, Assistant Professor, Ph.D., 2001, Paris-Sud University/ESPCI, France: microfluidics, interfacial fluid phenomena and wetting, multiphase flows, miscible flows, and complex fluids.

Hwang, David (Jae-Seok), Assistant Professor. Ph.D., 2005, University of California at Berkeley: Micro- and nanoscale heat transfer, laser-assisted solar photovoltaic manufacturing and diagnostics, advanced diagnostics of light-matter interaction.

Korach, Chad S., Visiting Assistant Professor, Ph.D., 2004, Northwestern University: Solid mechanics, micro and nanoscale tribology, thin films for wear applications, friction and wear modeling, composite degradation, hard and soft biological material mechanics.

Machtay, Noah, Research Assistant Professor, Ph.D. 2009, Stony Brook University.

Purwar, Anurag, Research Assistant Professor, Ph.D., 2005, Stony Brook University: CAD/CAM, computational kinematics, design automation, robotics.

Sesay, Juldeh, Visiting Assistant Professor, Ph.D., 2005, Stony Brook University.

Zhou, Yu, Visiting Assistant Professor, Ph.D., 2004, Johns Hopkins University: Robot kinematics, dynamics, planning, sensing and control, multi-robot systems, stochastic modeling, macromolecular mechanics.

Zuo, Lei, Ph.D., 2005, Massachusetts Institute of Technology: Passive and active vibration, energy harvesting, dynamic systems and control, mechatronics system design, biosensors and instrumentation.

Adjunct Faculty

Hodson, Donald, Adjunct Instructor, M.S., 1969, SUC at Buffalo: CAD, industrial arts, desktop publishing.

Rohatgi, Upendra Singh, Adjunct Professor, Brookhaven National Laboratory, Ph.D., 1975, Case Western Reserve University: Fluid mechanics, heat transfer, two-phase flow, numerical analysis, and turbomachinery.

Yuan, Lifang, Adjunct Assistant Professor, Ph.D., 2001, Stony Brook University: Cam integrated high-speed mechanisms, smart materials, robotics, optimal machine design.

Affiliated Faculty

Cess, Robert D., SUNY Distinguished Professor and Distinguished Service Professor Emeritus, Marine Sciences Research Center, Ph.D., 1959, University of Pittsburgh: Atmospheric sciences; climate modeling; greenhouse effect; nuclear winter theory.

Einav, Shmuel, Professor and Associate Dean, College of Engineering and Applied Sciences, Ph.D., 1972, Stony Brook University: Biomedical engineering, two dimensional flow systems.

Mahajan, Devinder, Research Professor, Department of Materials Science and Engineering, Ph.D., 1979, University of British Columbia, Canada: Clean fuels, energy technologies.

Sampath, Sanjay, Professor, Center for Thermal Spray Research, Ph.D. 1989, Stony Brook University: Thermal spraying, coatings, direct write electronics, thick film sensors, multifunctional systems.

Wong, Teng-Fong, Professor, Department of Geosciences, Ph.D., 1980, Massachusetts Institute of Technology: Experimental rock physics; fault mechanics.
Number of teaching, graduate, and research assistantships, fall 2011: 24

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