University of Georgia

Proposal

for

Doctor of Philosophy with Major in Engineering

Institution: University of Georgia **Date:** May 23, 2011

College / Unit: Institute of the Faculty of Engineering

Name of the Proposed Program: Doctor of Philosophy with major in Engineering

Degree: Ph.D. **Major:** Engineering

Starting Date: Fall 2012

Approved by: ______________________
E. Dale Threadgill, Director, Faculty of Engineering

______________________ ______________________
Sr. Vice President and Provost President of the University

Prepared by the Faculty of Engineering:
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1. PROGRAM ABSTRACT

Provide in a one or two page abstract a summary of the proposed program. This section should be written in a manner suitable for presentation to the Board of Regents and should briefly state the objectives of the program, identify the needs which the program would meet, and include information related to costs, curriculum, faculty, facilities, desegregation impact, enrollment, etc.

This is a proposal from the University of Georgia (UGA) Faculty of Engineering (FE) to offer a “Doctor of Philosophy with major in Engineering” degree. The goal is to educate engineer-scholars and future teachers needed for opportunities of the 21st Century. Specific objectives are:

1. *To educate future engineers in the discovery of knowledge through a curriculum in advanced engineering science that fosters independent research and scholarship, and prepares next generation thinkers and change makers to understand the intricacies of problems in the complex webs of interconnections of the 21st Century and integrate discoveries and knowledge of multiple fields for creating farsighted solutions;*

2. *To educate students in the application of new knowledge and entrepreneurial skills in a responsive learning environment that prepares future engineers to innovate 21st Century technology; and*

3. *To educate students in the teaching of new knowledge to future generations of scholars and practitioners.*

Graduate degree programs at the Ph.D. level are the backbone of a research university. Graduate students are a critical link to frontier research. Outstanding faculty cannot be recruited without access to outstanding graduate students. The proposed degree will enable the creation of advanced technologies through discoveries of scientific research, particularly in biological and other complex systems where the University of Georgia has nationally prominent programs, and also meet society’s future needs for engineers who are integrators, innovators and problem solvers in the complex-interconnected world of globalization. The proposed Ph.D. in Engineering degree is not designated to any specialized engineering discipline or field but open to making new and unique connections with disciplines and fields of study important for future needs. As compared to a Ph.D. in a “named” area of engineering (e.g., Mechanical Engineering or Electrical Engineering), the Ph.D. in Engineering will encourage exploration of new engineering approaches and would not require renaming the degree with the emergence of new engineering fields. The rigor for quality and an open structure for connecting and integrating for solving problems at the interstices of *complex webs* are what this degree will offer. Increasingly there are more nontraditional students who wish to interface multiple disciplines and choose an engineering degree at the graduate level after a degree in science or mathematics. These students bring additional perspectives to the graduate engineering experience. This is a direction by which future engineering knowledge and practice will benefit. It will also provide leaders and scholars needed by the state and nation to maintain a leadership position in our highly competitive world.

Addressing the question of student demand passively by only considering past trends, (i.e., number of U.S. engineering graduates and job projections) is not likely to serve the region well in the future and create the desired *Global Georgia.* While addressing the market for engineers, Charles Vest, President of the National Academy of Engineering, asked: "The world is changing remarkably fast, and leadership in science and engineering will drive it. Where will this leadership come from? China? India? The United States? The choice is ours to make." Studies report that Georgia relies on immigration from other states and other countries to fill nearly half of all engineering jobs in the state, and less than two-thirds of the qualified Georgia high school graduates (SAT scores of 1100 to 1600) with an expressed interest in majoring in engineering were enrolled in engineering in USG institutions of higher education. Additionally, USG is expecting a continued increase in enrollment in the coming decade. No institution in the state offers a Ph.D. in Engineering degree similar to the proposed degree objectives.

The University of Georgia, with the arts, humanities and all sciences underpinning engineering, provides the opportunity to develop genuine engineering scholars and thinkers capable of integrating diverse perspectives and innovating solutions for problems in commerce, finance, education, health care, infrastructure, transportation, communication, and many other sectors of interacting societies. This degree at UGA will be supported by exceptional faculty and outstanding facilities in sciences and arts and a series of interdisciplinary centers of excellence. UGA faculty and academic resources will support needs for the degree through the new engineering programs recently approved and funded.

UGA has a very strong commitment to recruiting students from underrepresented groups. Under the leadership of President Michael Adams the University has made significant progress. The open structure that invites non-traditional students and opportunity to integrate such disciplines as biology, ecology and public health are particularly attractive to women and other underrepresented groups. This program will actively recruit students and faculty from these groups and build partnerships with colleges and universities whose student body is predominantly from them. UGA already has more than 50 percent women students who will be targeted for this degree program. Partnerships with the Honors program and active participation with the Center for Undergraduate Research Opportunity (CURO) will invite outstanding undergraduate non-engineering majors to this program. There is strong evidence that public health, biology, ecology/environment, and the interplay among sustainable systems, technology and society, attract women and underrepresented minorities.

2. OBJECTIVES OF THE PROGRAM

List the program objectives and indicate how they are related to the mission and strategic plan of the institution, as filed with the Office of the Vice Chancellor for Research and Planning.

This is a proposal from the University of Georgia (UGA) Faculty of Engineering (FE) to offer a "Doctor of Philosophy with major in Engineering" degree. The goal is to educate engineer-scholars and future teachers needed for opportunities of the 21st Century. Specific objectives are:

1. *To educate future engineers in the discovery of knowledge through a curriculum in advanced engineering science that:1) fosters independent research and scholarship, 2) prepares next generation thinkers and change makers to understand the intricacies of problems in the complex webs of interconnections of the 21st Century, and 3) integrate discoveries and knowledge of multiple fields for creating farsighted solutions;*

2. *To educate students in the application of new knowledge and entrepreneurial skills in a responsive learning environment that prepares future engineers to innovate 21st Century technologies; and*

3. *To educate students in the teaching of new knowledge to future generations of scholars and practitioners.*

Graduates are expected to be leaders with advanced technical knowledge in science and engineering, a creative mindset and entrepreneurial skills. They will be prepared for successful careers as teachers, researchers, and inventive engineers in a world of unpredictable future changes. They will learn about university-industry-government interactions by preparing research proposals, papers, and disclosures of intellectual property for competitive peer evaluation. They will also have opportunities to master essential skills for introducing products in start-up and large company environments.

This program is consistent with the University of Georgia's social contract as a land- and sea-grant institution to provide citizens of Georgia with opportunities to study and learn, to expand the bounds of old knowledge, to discover new knowledge, and to improve the quality of life.

UGA's Strategic Plan, *The First Decade of the 21st Century*, included "Comprehensive Engineering: A Strategic Institutional Initiative." The goal of this initiative was to establish new academic studies in engineering and research inspired simultaneously by considerations of use and by the quest for fundamental understanding. It would not pursue a traditional model with separated departments and academic specialties, but would instead implement an evolutionary approach designed to bring many disciplines to bear on the complex problems of our time.

The UGA Faculty of Engineering (FE) has been a model for this since its inception on October 1, 2001. The present proposal mirrors the essential interdisciplinarity of the FE, and now endeavors to take this to the next level by forging it into a formal graduate academic program inspired by the same goals that not only serve UGA's Strategic Plan, but also the University System of Georgia's (USG) Strategic Goals as follows:

USG Strategic Goal One – *Renew excellence in undergraduate engineering education to meet students' 21st century educational needs*

Graduate students enrolled in the proposed PhD-E degree program will be exemplars for undergraduate and Masters-level engineering students and will create a "near-peer" learning environment that contributes to undergraduate engineering education excellence.

USG Strategic Goal Two – *Create enrollment capacity to meet needs of 100,000 additional students by 2020*

The proposed PhD-E degree will add enrollment capacity to meet the increasing demand in Georgia and the nation for U.S.-educated engineer-scholars and teachers.

USG Strategic Goal Three – *Increase the USG's participation in research and economic development to the benefit of a Global Georgia.*

The central objective of the proposed PhD-E degree is to address this strategic goal. Graduates of the program will fill a key role in the continuum between discovery and knowledge transfer to invent and introduce new technology for economic development, and will serve as a lynchpin in the "Global Georgia" concept.

USG Strategic Goal Four – *Strengthen the USG's partnership with the state's other education agencies*.

This proposed major in "*Engineering*" is an important element in the education of engineers for 2020 and beyond. The degree will be adaptive and responsive to opportunities accorded by unpredictable combinations of discoveries from the multiple fields of science. In Georgia, the University of Georgia is uniquely positioned to offer a Ph.D. degree with these unique characteristics because of its academic programs in all areas of sciences, applied sciences, humanities and the arts, as well as the recent addition of public health and medicine. This proposed degree program does not duplicate other engineering programs, rather it complements them and promises to create an environment in which students will be catalysts and faculty will forge partnerships with other USG institutions to benefit from their strengths, and they from ours.

3. JUSTIFICATION AND NEED FOR THE PROGRAM

a. Indicate the societal need for graduates prepared by this program. Describe the process used to reach these conclusions, the basis for estimating this need, and those factors that were considered in documenting the program need.

During the past five years numerous studies have concluded that there are growing concerns about the need for more U.S.-educated engineers, and for future engineering to differ from past engineering to better address the needs of the 21st century. Most compelling studies are:

Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education, The Millennium Project, The University of Michigan, (Duderstadt, 2008)
Moving Forward to Improve Engineering Education, National Science Board (NSB, 2007)
The National Innovation Initiative, Council of Competitiveness (Council of Competitiveness, 2006)
Rising Above the Gathering Storm: Energizing and Employing America for Brighter Economic Future, National Academies (Augustine, 2005)
Engineering Research and America's Future: Meeting the Challenges of a Global Economy, National Academy of Engineering (Duderstadt, 2005)
Educating the Engineer of 2020: Adapting Engineering Education to the New Century, National Academy of Engineering, (G. Wayne Clough, 2005)
The Engineers of 2020: Visions of Engineering in the New Century, National Academy of Engineering (G. Wayne Clough, 2004)

These studies conclude that *globalization* across many fronts will call upon the new engineers to interact with other citizens of the world, technical and nontechnical, to solve problems that transcend traditional boundaries of nation-states. These problems will not be locally contained in time and space, but will instead be distributed and hidden in the interstices of *complex webs* of interconnection – in commerce, finance, education, health care, infrastructure, transportation, communication, and many other sectors of interacting societies.

Engineering has many definitions. Joseph Bordogna, former Deputy Director of the National Science Foundation, found Fumio Kodama's definition poignant: *"Engineering is the integration of all knowledge to some purpose."* Unlike the specialized characteristic of scientific inquiry, engineers are society's master integrators. They work across different disciplines and fields, make connections for deeper insights to understand the intricacies of the problems and imagine creative solutions; in other words, they are into getting things done. Thus, engineering education is under increasing pressure to move away from specialization to a more comprehensive education that better connects and integrates discoveries and knowledge from multiple fields.

The University of Georgia began focusing on the changing engineering needs and their importance to Georgia and the nation in 1992. Over the years it studied emerging trends influenced by the growing understanding of complex systems and holistic approaches in engineering. UGA Engineering organized university-wide symposia and discussions with national leaders and visited change-making programs such as Olin College in Needham, MA. It began implementing actions to address these changes; some of these precede the first high-profile national report published in 2005 listed above. In 2001, UGA established the Faculty of Engineering with the central objective "to increase opportunity for learning, research and outreach at the confluence of disciplines – preparing students for careers devoted to the integration of discoveries from multiple fields." The three undergraduate degrees proposed by the Faculty of Engineering in 2003 and approved by the Board of Regents in 2005 were designed to move away from classical specializations to a more comprehensive engineering education in a liberal arts environment. The character and content of these proposals addressed the critical conclusions of the aforementioned studies.

Another factor looms in the coming times as well. With the accelerating growth of technical knowledge and need to make connections with other fields of study, it is becoming evident that it is no longer possible to build the content of the four-year undergraduate engineering curriculum that meets the needs of this profession. Today, engineering is one of the very few knowledge-intensive professions that require only the undergraduate degree for professional status. The inadequacies of the undergraduate degree for professional practice are increasingly causing employers to look for Master's or Ph.D. graduates for technical work. Building a baccalaureate through doctoral level continuum of engineering education at UGA is important for meeting the future needs of the state, region and nation and it is critical for the engineering profession.

Graduate degree programs at the Ph.D. level are the backbone of a research university. Graduate students are a critical link to frontier research. Outstanding faculty cannot be recruited without access to outstanding graduate students. The proposed degree will enable the creation of advanced technologies through discoveries of scientific research, particularly in biological and other complex systems where the University of Georgia has nationally prominent programs, and also meet society's future needs for engineers who are integrators, innovators and problem solvers in the complex-interconnected world of globalization. The proposed Ph.D. in Engineering degree is not designated to any specialized engineering discipline or field but open to making new and unique connections with disciplines and fields of study important for future needs. As compared to a Ph.D. in a "named" area of engineering (e.g., Mechanical Engineering or Electrical Engineering), the Ph.D. in Engineering will encourage exploration of new engineering approaches and would not require renaming the degree with the emergence of new engineering fields. The rigor for quality and an open structure for connecting and integrating for solving problems at the interstices of *complex webs* are what this degree will offer. Increasingly there are more nontraditional students who wish to interface multiple disciplines and choose an engineering degree at the graduate level after a degree in science or mathematics. These students bring additional perspectives to the graduate engineering experience. This is a direction by which future engineering knowledge and practice will benefit. It will also provide leaders and scholars needed by the state and national to maintain a leadership position in our highly competitive world.

b. Indicate the student demand for the program in the region served by the institution. What evidence exists of this demand?

The University System of Georgia's (USG) *Strategic Goal Three* is to "Increase the USG's participation in research and economic development to the benefit of a *Global Georgia*." Georgia must increasingly compete not only within fifty states, but also with other countries, create and attract intellectual resources, draw the best talent, and control its own future in a global economy. To achieve this strategic goal Georgia has to increase the number of scientists and engineers in its workforce and, thus, move up from being the 40th state in this category *(The U.S. Council of Competitiveness, 2000)*.

The projection of student demand for the proposed Ph.D. in Engineering requires a study not only of the historic student enrollment in engineering programs in Georgia and the United States (which is projected to increase by 11% between 2006 and 2016), but also the consideration of factors that may affect an increase in engineering enrollments due to new opportunities and new engineering approaches proposed herein.

Currently at the undergraduate-level, the U.S. produces only 8% of engineers globally each year, and only 4.5% of college students major in engineering as compared to 12% in Europe and 40% in Asia. The number of U.S. baccalaureate engineering graduates peaked to 85,000 in 1985 but then dropped by over 24,000 to 61,000 in mid-1990s. It seems to have stabilized at about 74,000 in 2007. This rate of graduation provides a small pool of students for U.S. engineering graduate programs. Such a small number of engineering graduates is grossly inadequate to fill a reasonable percent of even Master's level seats (which peaked at 91,000 students in 2003) with U.S. graduates. As Master's and Ph.D. degrees continue to become requirements for engineering practice, building a strong continuum of undergraduate and graduate engineering education is essential to meeting state and national needs.

In 2006, the U.S. graduated over 39,000 Master's degree engineering students (total enrollment was 83,000) and over 8,300 Ph.D. students (total enrollment was 57,000). Nearly 40% of the engineering Master's degree recipients and 61% of the new engineering Ph.D. degrees were granted to foreign nationals. In 2006, China graduated 8,000 Ph.D. degrees, nearly the same as the U.S. While the change in number of Ph.D. engineering graduates in the U.S. is modest, China is doubling its Ph.D. graduation rate every 5 years.

Addressing the question of student demand passively by only considering past trends, (i.e., number of U.S. engineering graduates and job projections) is not likely to serve the region well in the future and create the desired *Global Georgia.* Charles Vest (President Emeritus of MIT and the current President of NAE) stated that no one can look at today's market for engineers and predict what students will experience in 30 years. Then he puts the question to us: "The world is changing remarkably fast, and leadership in science and engineering will drive it. Where will this leadership come from? China? India? The United States? The choice is ours to make” (*Clark Kerr Lectures*. University of California Press, 2005).

The proposed Ph.D. in Engineering with its focus on future engineering that integrates disciplines will be attractive not only to students with engineering degrees, but also to talented graduates from other disciplines, particularly the graduates of science and mathematics. Engineering knowledge is increasingly driven by the complexity of such fields as biology and ecology as well as by systems science rather than by the current and past reductionism of physics and engineering practice. Future engineering education must also accommodate globalization affecting technology, commerce and politics. Many non-engineering graduates interested in solving problems in these complexities will be attracted to this degree program.

UGA, as one of the nation’s leading research universities with extensive leadership in many areas of science, humanities and arts, and a prime engine of the state’s economic and human development, will provide unique opportunities to students enrolled in the proposed degree program. The heightened interplay between sciences and engineering and research and development at UGA will prepare highly competent next generation engineers ready to lead in the integration of knowledge for revealing and understanding complex problems and creating futuristic technological solutions.

c. Give any additional reasons that make the program desirable (for example, exceptional qualifications of the faculty, special facilities, etc.)

The University of Georgia, the largest and most culturally diverse campus in Georgia with the arts, humanities and all sciences underpinning engineering, uniquely provides opportunity to develop genuine engineering scholars and thinkers capable of integrating diverse perspectives and innovating solutions for problems in commerce, finance, education, health care, infrastructure, transportation, communication, and many other sectors of interacting societies. This degree at UGA will be supported by exceptional faculty and outstanding facilities in sciences and arts and a series of interdisciplinary centers of excellence. For example, distinguished faculty in biological and physical sciences and in applied sciences addressing issues related with energy, health, infectious diseases, environment and bio- and natural-resource systems, and many prominent research centers and laboratories, are most valuable and required resources for the proposed degree.

Recognizing that strong graduate programs are critical to the future of the University, the Provost and the Dean of the Graduate School charged a 28-member Task Force in September 2006 to provide recommendations on three major challenges facing the quality of graduate education in all areas of the academy: Innovation, Interdisciplinarity, and Inclusiveness. The proposed degree, accessible to students from multiple disciplines with open structure to form connections and integration, has a high potential for meeting the three challenges. Students who are graduates of multiple disciplines will naturally build a culture of interdisciplinarity. Because of the comprehensiveness of the University of Georgia, it is positioned to offer this degree like no other institution in the State of Georgia.

d. Include reports of advisory committees and supporting statements of consultants, if available.

Georgia needs more engineers. While Georgia's growth and its stature among states rose in the decade of the 90's in some important categories (for example, 4th in population growth, 8th in venture capital investment, and 8th in start-up companies), it ranked 40th in the nation in percentage of engineers and scientists in its workforce [*The U.S. Council of Competitiveness*, 2000 Report]. The February 2002 report by the Washington Advisory Group [Commissioned by the *University System of Georgia Board of Regents*] notes that Georgia relies on immigration from other states and other countries to fill nearly half of all engineering jobs in the state.

There is also a need to increase the state of Georgia's capacity for engineering education. Another University System of Georgia (USG)-commissioned report on engineering education needs published in 1998 presented data showing that less than two-thirds of the qualified Georgia high school graduates (SAT scores of 1100 to 1600) with an expressed interest in majoring in engineering were enrolled in engineering in USG institutions of higher education. The Georgia Financial Commission recognized the need for Georgia to graduate more engineers when it created, under the HOPE Scholarship Program, a "Scholarship for Engineering Education (SEE)" with the objective "To provide service-cancelable loans to Georgia residents who are engineering students at private accredited engineering universities in Georgia and retain them as engineers in the State." With the increasing need for Master's and Ph.D. degree engineers to enter and succeed in the engineering profession, the adding of capacity to offer graduate degrees is becoming imperative for future engineering.

Since 2001, prominent participants in the UGA organized engineering symposia, numerous invited distinguished guest-lectures (including the immediate past president of NAE and the President of Olin College) and the UGA Engineering Advisory Board composed of nine distinguished leaders from industry, government and academia have commended the UGA Faculty of Engineering as both innovative and farsighted. They have unanimously and strongly recommended the addition of a Ph.D. degree molded in the conceptual framework of the UGA Comprehensive Engineering and the UGA Engineer profile. The proposed degree is molded by these views that also align with the recommendations of the several cited NAE and the University of Michigan Millennium Project reports published since 2005.

e. List all public and private institutions in the state offering similar programs. If no such program exists, so indicate.

No institution in the state offers a Ph.D. in Engineering degree similar to the proposed degree objectives.

Georgia Institute of Technology's Ph.D. degrees in engineering are offered by several disciplinary units with commensurate disciplinary objectives. Its bioengineering program is an interdisciplinary degree available to most of the engineering academic units interfacing aspects of biology in their disciplinary perspectives.

4. PROCEDURE USED TO DEVELOP THE PROGRAM

Describe the process by which the committee developed the proposed program.

This proposal for a new graduate degree is a result of a deliberate process initiated in 1999 in response to the University's Strategic Plan for the First Decade of the 21st Century.

In February 2000, a position paper prepared by Professors Brahm Verma and Dale Threadgill entitled "Comprehensive Engineering at UGA" was submitted to the Vice President for Strategic Planning with the request that Engineering be included as a Strategic Issue in the University's Strategic Plan. The "Comprehensive Engineering at UGA" paper identified Georgia needing more engineers and how the University of Georgia had the responsibility and capacity for developing new approaches for future engineering. It proposed a strategic approach to build engineering in a new way and advance the institution's capacity for meeting not only the shortage of engineers, but also for educating engineers of the future. It demonstrated that Comprehensive Engineering will add new dimensions to the University that will provide advanced technology for research in highly complex systems, including biology and ecology and the ability to rapidly translate scientific discoveries into technology. The University Strategic Planning Advisory Board included Engineering as a new Strategic Institutional Initiative, and it is now a part of the UGA Plan for the first decade of the millennium.

In April 2001, a Symposium, *Towards 2010: Comprehensive Engineering at UGA*, was held to engage UGA faculty from across campus in a daylong effort to identify engineering initiatives of significance and to articulate ways in which Comprehensive Engineering will strengthen a range of UGA programs. More than 100 faculty members from 9 Colleges/Schools participated in the Symposium. Thirteen faculty members highlighted engineering opportunities in research, graduate and undergraduate studies, and outreach. Their perspectives represented the disciplines of physics, chemistry, pharmacy and health sciences, biochemistry and molecular biology, veterinary sciences, computer science, mathematics, ecology, marine sciences, environmental sciences, textile science, food science, business and engineering. They identified the important dimensions in which the University's current programs are unable to grow due to lack of Comprehensive Engineering at UGA and shared experiences on how the University has been handicapped in capitalizing on opportunities for meeting the needs of the state of Georgia. At that time (i.e., in 2001) the UGA faculty identified the following ten engineering program areas as high priority needs and opportunities: bioprocess/biochemical engineering, metabolic engineering, pharmaceutical engineering, nanotechnology, ecological/environmental engineering, information/computer systems engineering, sensors and controls, marine engineering, engineering management and engineering education. A task committee with membership including UGA faculty from diverse but related disciplines was formed for each of these program areas and charged with further developing the needs and opportunities. Another task committee was charged with proposing ideas to create an innovative approach for organizing Comprehensive Engineering at UGA. The concept of a Faculty of Engineering originally proposed in the "Comprehensive Engineering at UGA" document was recommended. The UGA Faculty of Engineering was formally established on October 1, 2001, with Dr. E. Dale Threadgill appointed as its Director.

To gain insight from state and national leaders about building programs in the UGA Faculty of Engineering a second daylong Symposium, *Towards 2010: Faculty of Engineering at UGA*, was organized with invited leaders from industry, business, government agencies and academia participating. The Symposium, held in April 2002, was open to the UGA faculty. More than 100 individuals attended the Symposium. UGA President Michael Adams in his opening remarks explained the needs for engineers in the state of Georgia. He cited the February 2002 report, prepared by a Washington Advisory Group commissioned for the Board of Regents, conclusively stating that Georgia relies on immigration from other states and other countries to fill nearly half of all engineering jobs in the state. President Adams further stated, "UGA has a social and charter responsibility as Georgia's flagship institution to provide innovative services for the economic development of the state. Engineering is a key linchpin in this effort." Dean Kristina Johnson from Duke University (now Provost and Senior Vice President of academic Affairs at Johns Hopkins University) stated that a "modern research university is incomplete and obsolete without comprehensive engineering." Discussions during breakout sessions reinforced the need for engineering in the program areas identified at the 2001 Symposium as well as identified new opportunities with biomedical engineering. At the conclusion of the April 2002 Symposium, the UGA Faculty of Engineering established several task groups and charged them with developing academic programs and other recommendations for meeting the identified engineering needs.

These seminal events began a course for the development of Comprehensive Engineering at UGA. Actions listed below have been key contributors to the process of identifying the need for the proposed degree.

- Since 2002, receiving regular advice and recommendations of the UGA Engineering Council (made up of UGA faculty from multiple disciplines) who study future trends and review progress of Comprehensive Engineering at UGA.
- Since 2003, studies to identify future engineering directions and needs that led to successful undergraduate and graduate degree proposals in BioChemical Engineering and Environmental Engineering built from the "systems and engineering ecology" prospective, and an undergraduate degree in Computer Systems Engineering.
- In 2006, the UGA Think Tank report defined the profile for a UGA Engineer. This recommendation formed the core for UGA engineering program curricula and the basis for the recruitment of faculty and students.
- In 2007, Dr. William Wulf, the Immediate Past President of the National Academy of Engineering (NAE) during his visit to UGA for the inaugural presentation in the Distinguished Engineering Lecture Series commended the UGA's foresighted

approach to engineering and identified the importance of M.S.- and Ph.D.-level degree programs for furthering the vision of Comprehensive Engineering and the University of Georgia's research and educational mission.

- In 2008, the Faculty of Engineering Advisory Board in its inaugural meeting in November made strong and unequivocal recommendation for the need for graduate-level engineering degrees. They also recommended that the degree should be "Engineering" with the flexibility to create new and unique integrations for solving problems of the future.

This proposal is a result of these deliberate efforts. The faculty and student participants in this program will be from all corners of the University. The program will attract outstanding students with engineering and non-engineering degrees. The range of the development of future technology for solving complex problems will exceed the norms of the past. In Georgia, the Georgia Institute of Technology offers numerous discipline-based engineering Ph.D. degrees and a degree in bioengineering which is interdisciplinary with several engineering departments. No institutions in the state offer a Ph.D. in Engineering degree.

The philosophy of engineering on the UGA campus was the guiding framework in preparing this Ph.D. in Engineering program. The proposal was prepared with the support and input of faculty in UGA Engineering and related UGA Colleges/Schools.

5. CURRICULUM

List the entire course of study required and recommended to complete this degree program. Give a sample program of study that might be followed by a representative student. Indicate also the existing courses and any new courses that will be added. Append a course description for existing courses as well as new courses that will be added.

Requirements for the PhD-E degree will include completion of course requirements in compliance with the University of Georgia Graduate School requirements. That is, a student's program of study will include a minimum of 24 semester credit hours, of which 16 credit hours must be courses at the 8000/9000 levels exclusive of research/dissertation hours. To receive the PhD-E degree, each student will be required to pass a qualifying examination and a comprehensive examination, and successfully defend the dissertation.

Each student will have an advisory committee consisting of a major professor and four additional members as per the University guidelines. The committee is responsible for ensuring the quality of the program of study and research. It is the prerogative of each student's advisory committee, in consultation with the student, to plan and supervise all aspects of the doctoral study. The committee will be responsible for preparing the program of study, administering examinations, and assessing quality of the dissertation in accordance with Graduate School requirements and accepted national standards

The program of study of each student will be designed to achieve the objectives of the degree program. The required 9 hours of courses cover core topics: research methods, design methods, computational methods, entrepreneur skills, teaching skills and seminar. The remaining courses are selected to provide fundamental knowledge in the selected areas of sciences for interfacing with engineering, advanced engineering sciences, and enabling mathematical sciences (including statistics and computational methods) to build the foundation for scholarly inquiry in the dissertation research area. Four example programs of study are presented below, each showing a different field of interest in engineering.

EXAMPLE #1
Ph.D. in Engineering
(Students integrating to advance engineering knowledge from molecular biology, electronics and nano-science to create nano-level devices and systems)

Required Courses (8-10 hours)		
ENGR 8910 (new)	Research and Design Methods	3
ENGR 6101, 8102, 8103	Computational Methods Modules	3[1]
ENGG 8XX1, 8XX2	Technology Based Entrepreneurship	1-2
ENGG 8XX1, 8XX2	Effective Engineering Teaching Studio and Practicum in Engineering Teaching	1-2
ENGR 8950	Graduate Seminar	1
Selected Courses (21 hours)		
ENGR 8160	Advanced Fluid Mechanics	3
BCMB 6000	General Biochemistry and Molecular Biology	3
BCMB 8010	Advanced Biochemistry and Molecular Biology I	4
ENGR 8310	MEMS Design	3
ENGG 8XXX	Advanced Nanoelectronics	3
STAT 6310	Statistical Analysis I	3
STAT 8200	Design of Experiments for Research Workers	3
		29-31

EXAMPLE #2
Ph.D. in Engineering
(Students integrating to advance engineering knowledge for developing a fundamental knowledge base that can inform creative pedagogical techniques for educating future engineers)

Required Courses (8-10 hours)		
ENGR 8910 (new)	Research and Design Methods	3
ENGR 6101, 8102, 8103	Computational Methods Modules	3
ENGG 8XX1, 8XX2	Technology Based Entrepreneurship	1-2
ENGG 8XX1, 8XX2	Effective Engineering Teaching Studio and Practicum in Engineering Teaching	1-2
ENGR 8950	Graduate Seminar	1
Selected Courses (21 hours)		
ENGR 8930	Systems Simulation and Optimization	3
ENGG 8XXX	Foundations of Engineering Education Research	3

[1] Each of the three courses is 1 semester hour credit

ENGG 8XXX	Assessment Techniques in Engr Educ Research	3
ENGR 8720	Mathematical Models in Physiology	3
ENGG 8110	Mathematical Biology	3
ERSH 8310	Applied Analysis of Variance Methods in Education	3
EPSY 6800	Foundations of Cognition for Education	3
		29-31

EXAMPLE #3
Ph.D. in Engineering
(Students integrating to build engineering knowledge from complex ecological systems and for advancing sustainable designs. This example assumes that ENGR 8910 and ENGR 6101, 8102 and 8103 were completed at the MS level, thus they are not shown as 'Required'. The equivalent number of hours have been transferred to 'Selected Courses'.)

Required Courses (2-4 hours)

ENGG 8XX1, 8XX2	Technology Based Entrepreneurship	1-2
ENGG 8XX1, 8XX2	Effective Engineering Teaching Studio and Practicum in Engineering Teaching	1-2
ENGR 8950	Graduate Seminar	1

Selected Courses (25 hours)

ENGR(ECOL) 8560	Systems and Engineering Ecology	3
ENGR 8160	Advanced Fluid Mechanics	3
ENGR 8170	Advanced Heat Transfer	3
ENVE 8110	Ecological Energetics	3
STAT 8200	Design of Experiments for Research Workers	3
ECOL 8220	Stream Ecology	2
ECOL 8230	Lake Ecology	2
MARS 8510	Modeling Marine Systems	3
STAT 8300	Multivariate Analysis	3
		27-29

EXAMPLE #4
Ph.D. in Engineering
(Students integrating to build engineering knowledge from biology for developing new materials)

Required Courses (8-10 hours)

ENGR 8910 (new)	Research and Design Methods	3
ENGR 6101, 8102, 8103	Computational Methods Modules	3
ENGG 8XX1, 8XX2	Technology Based Entrepreneurship	1-2
ENGG 8XX1, 8XX2	Effective Engineering Teaching Studio and Practicum in Engineering Teaching	1-2
ENGR 8950	Graduate Seminar	1

Selected Courses (24 hours)

ENGR 8XXX	Tissue Engineering for Drug Discovery	3
CBIO 8050-8050L	Techniques in Modern Microscopy	4
ENGR 8180	Advanced Mass Transfer	3
ENGG(CHEM) 4615/6615	Soft Materials	3
ENGR 4740/6740	Biomaterials	3
STAT 8200	Design of Experiments for Research Workers	3

VPHY 8960	Molecular Toxicology	3
BCMB(BINF) 8210	Computational Methods in Bioinformatics	3
		32-34

6. INVENTORY OF FACULTY DIRECTLY INVOLVED

The University of Georgia currently offers M.S. and Ph.D. degrees in five engineering areas. UGA also offers ABET-accredited undergraduate engineering degrees. All required courses in arts and sciences are already available from the UGA Franklin College of Arts and Sciences. Ten engineering faculty members currently offer core engineering science courses. The Faculty of Engineering has more than 60 UGA faculty with engineering degrees that provide a wide range of opportunity for graduate students in this degree program. The need for additional faculty is presented in Section 15.

The faculty who will be directly involved with the proposed degree program are listed below. Additional data on these faculty is provided in Appendix B.

Dr. Mark Haidekker, Faculty of Engineering
Dr. Jenna Jambeck, Faculty of Engineering
Dr. Kyle Johnsen, Faculty of Engineering
Dr. Caner Kazanci, Faculty of Engineering, Mathematics
Dr. William Kisaalita, Faculty of Engineering, Biol. & Agri. Engineering Dept.
Dr. Peter Kner, Faculty of Engineering,
Dr. Ke Li, Faculty of Engineering
Dr. Jason Locklin, Faculty of Engineering, Chemistry
Dr. Sudhagar Mani, Faculty of Engineering, Biol. & Agr. Engineering Dept.
Dr. Leidong Mao, Faculty of Engineering
Dr. Zhengwei Pan, Faculty of Engineering, Physics and Astronomy
Dr. John Schramski, Faculty of Engineering
Dr. Andrew Sornborger, Faculty of Engineering, Mathematics
Dr. William Tollner, Faculty of Engineering, Biol. & Agr. Engineering Dept.
Dr. Joachim Walther, Faculty of Engineering

7. OUTSTANDING PROGRAMS OF THIS NATURE IN OTHER INSTITUTIONS

List three outstanding programs of this nature in the country, giving location and name of official responsible for each program. Indicate features that make these programs stand out.

The University of Georgia's proposed PhD in Engineering degree will provide students freedom to explore in whatever combination of disciplines that are needed and prepare them for the profession and academic inquiry as leading experts in the field. Dartmouth College offers PhD in Engineering with foci in three impact areas: Engineering in Medicine, Energy Technologies, and Complex Systems. Harvard University recently revived its engineering program and formed a School of Engineering and Applied Sciences in the Faculty of Arts and Sciences. It now offers a PhD in Engineering Sciences for keeping the interdisciplinary nature of modern research. Thus, these two programs stand out for the similarity in educational approaches and their contact information is listed below.

Dr. Joseph J. Helble, Dean
Thayer School of Engineering at Dartmouth College

Dr. Cherry A. Murray
Dean, Harvard School of Engineering and Applied Sciences

However, whereas the University of Georgia is a state-supported, land-grant university, both Dartmouth College and Harvard University are private institutions without the land-grant mission.

Three land-grant universities that are highly motivated for incorporating interdisciplinarity in their graduate-level engineering degrees and exhibit several features proposed in this PhD in Engineering proposal are the University of Florida, Purdue University and University of California at Davis. Contact information for these institutions is listed below:

Dr. Cammy Abernathy, Dean
College of Engineering, University of Florida

Dr. Leah H. Jamieson, Dean
College of Engineering, Purdue University

Dr. Bruce White, Dean
University of California, Davis

8. INVENTORY OF PERTINENT LIBRARY RESOURCES

Indicate in number of volumes and periodicals, available library resources (including basic reference, bibliographic, and monographic works as well as major journal and serial sets) which are pertinent to the proposed program. What additional library support must be added to support the program?

The University of Georgia Library has several campus units. It has a comprehensive collection in arts, sciences and professional subjects and has an archival section that holds special historical documents. The Library has been a member of the Association of Research Libraries, a nonprofit organization of 122 of the largest research libraries in the U. S. and Canada, since 1967. In 2000, UGA was ranked 35th in the total number of volumes and 9th in total number of current serials owned.

The UGA Library is the largest in the state with over 3.8 million volumes. On-line access to full text journals and serials is available both through a consortium of UGA, Emory, Georgia Tech, Georgia State and Medical College of Georgia, and directly to the University of Georgia libraries. In addition, UGA is a leader nationally in offering electronic access to a wide range of electronic resources, including journal articles in full text. The statewide GALILEO system provides electronic access to hundreds of databases, including Chemical Abstracts, Engineering Index, Bioengineering Abstracts, Current Contents, etc. The University subscribes electronically to over 1000 Elsevier titles and to all titles published by Academic Press, Marcel Dekker, Spring Verlag, and Wiley Interscience.

The University Libraries have excellent print and electronic resources, particularly in chemistry, biological sciences, physics, mathematics and computer sciences, ecology and environmental sciences, agricultural sciences and earth sciences. The University of Georgia Science Library would provide the primary resource and support for the proposed program. Some relevant Science Library inventory and operational information is listed below.

a) Total volumes - 750,000 and its catalog is available over the Internet.
b) Volumes pertaining to the engineering and technology – nearly 100,000 and materials accessible via the Internet.

Generally, basic texts and references are available; however, some expansion will be needed as described in the following section.

State of Faculty Instructional Support and Additional Support Needs

State of collections in engineering sciences for the proposed degree programs is as follows:

• Reference Collection	Adequate, but update will be required
• General Book Collection	Additional books on engineering will be needed
• Periodicals, current	Additional engineering periodicals will be needed
• Serials	Adequate
• Documents	Adequate

Projection

The Science Library has made steady progress in upgrading technical holdings. With modest designated funding increases, the library should provide good support for the proposed program. Ongoing improvement in the Science Library holdings will complement the engineering resources.

Additional Information on Library Resources

The Science Library provides reference help, interlibrary loan, circulation and collection development. It has 26 full-time staff including 8 librarians. It has about 750 seating capacity and is open 99.5 hours per week.

The University of Georgia Libraries' fiscal year Total Expenditures show a steady growth.

FY-02	$21,545,504
FY-03	21,010,793
FY-04	21,544,004
FY-05	22,679,865
FY-06	23,014,039
FY-07	23,703,488
FY-08	24,451,142

Georgia Institute of Technology library would also be available to supplement the University’s resources in engineering.

9. FACILITIES

Describe the facilities available for the program. What new facilities and equipment are required?

The University of Georgia has extensive facilities available for the proposed degree program. The following is a selective list most related to the proposed program that gives the range and quality of facilities available for both undergraduate and graduate education.

A. Athens Campus

Instruction Labs:

Applied Machine Vision Laboratory: The Applied Machine Vision laboratory supports a course designed to provide students with experience in machine vision systems.

Bio-Photonics Laboratory is involved in optical sensing and optical imaging using the visible light spectrum. This includes fluorescent spectroscopy (some instruments are custom-designed to accommodate mechano-sensitive fluorescent molecular rotors), fluorescent imaging, fluorescent microscopy, laser-induced fluorescence. In addition, the lab has the capability of optical coherence tomography and a custom scattered-light confocal scanner exists. There are plans to add X-ray imaging and computed tomography with a custom-built instrument.

Electronics and Electrical Laboratory houses comprehensive facilities for teaching basic and advanced courses in electrical and electronic systems.

Engineering Design Studio provides dedicated computer facilities for rapid prototyping and CNC machining. Undergraduates enrolled in the sophomore-level Design Methodology course and the senior-level Engineering Project course are required to design, prototype and analyze a new product that meets a real-world need. Projects in these courses are typically sponsored by industry and are used by the companies to solve current problems.

Engineering a Sustainable Environment: The laboratory is located at Whitehall Bioconversion Center and is used in courses which focus on environmental monitoring, modeling and process design, solid waste management, hazardous waste management and concepts of risk assessment.

Fluid Mechanics Laboratory houses comprehensive facilities for teaching basic and advanced courses in electrical and electronic systems.

General Computing Undergraduate Study Lab occupies approximately 1228 ft2 and is designed to provide general-purpose computing for undergraduates. This Study Lab is accessible to students for 90 hours per week.

Industrial Controls Laboratory is a teaching laboratory which exposes students to motor controllers and programmable logic controllers that are used in industrial control environments.

Instructional Computer Laboratory supports courses that require programming and specialty software applications for Active Learning. This lab can be used for long-distance learning and on-line learning courses.

Materials Testing Laboratory: The laboratory is equipped to perform: 1) testing of engineering materials and biological materials, 2) properties of soils and granular materials, 3) load cell testing and calibration and photoelastic testing. This laboratory is equipped with equipment for measuring static and dynamics strains.

Micro-mechatronics Laboratory has 18 "Intellibrain" controller systems equipped with color vision systems, servo motors with wheel encoders, NIR and SONAR range sensors which can be used for various autonomous mechatronics projects.

Robotics Laboratory: This laboratory is design to support hands-on practice of robotics and mechatonics processes. This lab allows for the construction, programming and testing of multi-wheeled and multi-legged robots equipped with servo motors and sensors.

Smallholder Technology Laboratory focuses on research and development of products or processes to improve productivity among low income workers in developing countries. Research is done with undergraduate students through international capstone summer research experiences.

Spatial Data Collection: This laboratory provides fundamental capabilities for students to collect baseline data in collection, mapping and analysis of line-of-sight spatial data.

Undergraduate Teaching Laboratories include two laboratory/classroom areas which are dedicated to classroom labs. One laboratory is a dry lab and the other is a wet lab which contains hookups for gas, air, water and vacuum.

Research Labs:

Algae Laboratory is dedicated to the growth of algae, including harvesting and conversion technologies at the bench and pilot scales.

Alternative Fuels and Solvents Laboratory allows engineers to investigate the effects of different biological fuel mixtures on engine performance and reliability.

Analytical Laboratory houses chromatography equipment for the chemical analysis of various materials.

Applied Electrostatics Laboratory contains specialized high-voltage and low-current instrumentation facilitating the research and development of electrostatics processes for beneficial agricultural and biological applications.

Applied Machine Vision Laboratory is equipped with fiber-optic spectrometers, video imaging equipment, light sources and computer-controlled X-Y translation stages for sample presentation, allowing VIS/NIR spectrometry, spectral imaging and basic/high speed image acquisition and processing capabilities. Equipment in this lab is accessible to students via the Web.

Bioassessment Laboratory: Identification and characterization of benthic macroinvertebrates to support the watershed assessment research program. This laboratory is equipped with superb sampling equipment, D-frame and kick nets, and high resolution light microscopes.

Biochemical Laboratory includes facilities for the maintenance of aerobic and anaerobic microorganisms, and for enzyme analysis.

Bioconversion Laboratory is equipped to monitor air quality, develop processing technology for solid waste conversion to composts, and evaluate the quality and safety characteristics of compost.

The Bio-expression and Fermentation Facility is housed within the Department of Biochemistry and is a molecular biology, protein and biomass production core facility.

Biomass Processing Laboratory includes preprocessing technologies such as pelletization, torrefaction, pyrolysis, solvent extraction, and hydrolysis, and includes conversion technologies such as pyrolysis, liquefaction, gasification, catalytic conversion, fermentation, and transesterficiation. A novel aspect of carbon cycling using bichar (a co-product of pyrolysis) is being studied as a soil carbon sequestration method that simultaneously provides significant agronomic benefits.

Biomechanics/Gait Analysis Laboratory is designed to analyze motion of bodies and evaluate tissue mechanics.

Bio-Photonics Laboratory is involved in optical sensing and optical imaging using the visible light spectrum.

Biorefining Research and Education Center (BREC) hosts a pilot thermochemical biorefinery. The pilot scale refinery system converts peanut hulls to hydrogen (or other fuels) and produces a carbon char co-product, biochar. This byproduct in itself holds tremendous potential for carbon sequestration and soil amendments, which are currently being researched.

Cellular Bio-Engineering Laboratory is equipped for a study of enzyme and cell-based sensing. Current focus is on research towards use of nano/micro structures to facilitate the implementation of three-dimensional cultures in drug discovery programs.

Clean Room consists of a 500-square-foot microfabrication space equipped with fume hood, DI water, gases, vacuum, exhaust system, air filtration system and chemical storage. The major equipment inside clean room are one MJB3 mask aligner, one bench top chemical spinner and one bench top hot plate. It is designed to carry out fabrication processes for engineering and biomedical research.

Fermentation Laboratory is equipped for the growth of microorganisms and for the design of processes to optimize their use.

Functional Nanomaterials Synthesis and Characterization Laboratory is equipped with six well-controlled tube furnace synthesis systems, a field-emission gun scanning electron microscope attached with an energy-dispersive x-ray spectrometer, a spectrofluorometer, a UV-vis spectrometer and a variety of other nanomaterials synthesis equipment.

Geographic Information Systems (GIS) Laboratory: This laboratory contains workstations and PC's, color plotters/printers/ high-quality scanners and a Calcomp digitizer to analyze spatial data. SPANS, Arc/Info, ArcView and ERDAS software packages are used in many applications to environmental engineering.

Materials Testing Laboratory is equipped for investigating the mechanical properties of both physical and biological materials undergoing static and dynamic loading.

MEMS Test and Characterization Laboratory (RBS) is designed to carry out the research work for microelectromechanical systems (MEMS) device fabrication, testing and characterization.

Microcontroller Laboratory houses stations for data acquisition, analog and digital signal applications and machine control.

Microscopy Laboratory is equipped with an Olympus IX71 inverted microscope and a variety of lasers, optics, and electro-optic components for research and development of advanced microscopy techniques.

Molecular Nano-bioengineering / Molecular Nano-bioelectronics Laboratory houses equipment to investigate organic molecules, especially biological systems on the single molecular level.

Office of the State Climatologist: Extensive weather and climate impact data and computer models are available for design to meet Georgia's environmental conditions.

Optical Microscopy Laboratory: This laboratory is being developed to enable research into novel techniques for the advancement of optical microscopy and imaging.

Polymer Science and Engineering Laboratory (RBS) includes 1500 square feet of laboratories used to synthesize and characterize polymeric materials.

Processing Systems and Unit Operations Laboratory: This laboratory focuses on process and material properties measurements and physical and biological process studies for optimizing energy and environmental pollution abatement.

Research Shop: All basic metal and wood working equipment are available.

Tissue Biomechanics Laboratory is designed for activities in analyzing the loading behavior of soft and hard animal tissues as well as plant materials.

Virtual Experiences Laboratory is equipped for research on the use and development of virtual, mixed, and augmented reality experiences.

Water Quality Analysis Laboratory / Watershed Center houses labs for analyzing physical, chemical, and biological characteristics of water samples.

Watershed Assessment: Extensive research programs combining bioassessments, physical habitat assessments, water quality analysis and hydrologic modeling. This laboratory offers workstations and PC's for use in GIS analysis and computer modeling.

B. Griffin Campus – Research Labs

Georgia Automated Weather Station Network and Agrometeorology Laboratory
Statewide Automated Environmental Monitoring Network (AEMN), consisting of over 58 automated weather stations that collect weather and other environmental variables on a

continuous basis (http://www.georgiaweather.net/). An instrument laboratory allows for evaluation and calibration of sensors, data loggers, and other environmental equipment.

Crop Modeling Laboratory
Hardware and software for the development and application of crop simulation models, decision support systems, and Geographic Information Systems (http://www.icasa.net/index.html).

Envirotron
Multi-disciplinary environmental control facility to study the interaction of environmental factors, including temperature, humidity, radiation, soil moisture, CO_2, O_3, and other trace gases, on plant growth and development. The facility currently includes nine large indoor growth chambers, eight greenhouses, and three movable controlled-environment sunlit growth chambers, and four rainout shelters.

Electronics Laboratory
Facilities and electronics equipment such as oscilloscopes, multimeters, and Labview software provide capabilities for developing sensors, instrumentation, data acquisition systems, and electronic devices needed for research, extension, and instruction programs.

Food Engineering and Packaging Laboratory
Facilities and electronics equipment such as oscilloscopes, multimeters, and Labview software provide capabilities for developing sensors, instrumentation, data acquisition systems, and electronic devices needed for research, extension, and instruction programs.

Postharvest Systems Laboratory
A pilot plant includes equipment for simulating commercial unit operations for fresh fruits and vegetables including: TEW packing line (wash, dry, inspect visually, wax and size), three walk-in coolers with four chambers in each with independent RH control, vibration table (transport simulation), two Kyser-Werner retail display cases and a home kitchen.

C. Tifton Campus – Research Labs

Water Quality Laboratory
Approximately 3,000 square feet of sample preparation and analysis space with modern instrumentation with NESPAL (http://nespal.cpes.peachnet.edu).

Flexible Laboratory Spaces
Available spaces can accommodate a wide variety of uses. These range in size and characteristics from 400 square feet of clean and conditioned space to 3,000 square feet enclosed, heated, high-clearance space or 2,000 square feet of covered exterior space.

10. ADMINISTRATION

Describe how the proposed program will be administered within the structure of the institution.

The program will be based in the Institute of The Faculty of Engineering. The Faculty of Engineering is a stand-alone academic unit which has a budget provided directly by the Provost. The overall responsibility will reside with the Director of the Faculty of Engineering who reports directly to the Provost. The Director will be the administrative officer of the program and will be responsible for budgetary and related business matters.

The Graduate Coordinator of the Faculty of Engineering will coordinate all academic aspects of this graduate degree program. Applications for admission will include academic records and evidence of earned B.S. degree in engineering or related sciences, GRE test scores, letters of recommendation and statement of purpose. The Graduate Committee will review all applications, and based on its recommendation, the Graduate Coordinator will recommend admission to the Graduate School Dean. The policies and procedures of the University of Georgia Graduate School will govern the administration of the program and the Dean of the Graduate School will certify the compliance by individual students with regard to the requirements for admission and graduation. The Graduate Coordinator will serve as the Chair of the Faculty of Engineering Graduate Committee. This committee will meet quarterly and each member will serve a three-year term and may be reappointed for no more than one consecutive three-year term. The general responsibility of the Graduate Committee will be to oversee all graduate degree programs to recommend guidelines and procedures for enhancing the quality of the programs. The Graduate Committee will be responsible for the following items and will make its recommendations to the Director of the Faculty of Engineering:

a. Guidelines for recruitment, admission and retention/dismissal.
b. Guidelines for assistantships
c. Guidelines for remedial programs to strengthen the background of students in complementary science(s).
d. Guidelines for uniformity of credits for courses.
e. Guidelines for M.S. thesis and Ph.D. dissertation research proposals.
f. Guidelines for all graduate degree examinations.
g. Guidelines for appointment of graduate advisory committees.
h. New instructional needs and course proposals.
i. Development of collaborative relationships with government research units and industry.
j. Guidelines on other matters ensuring continued program enhancement.

The Director of the Faculty of Engineering, in consultation with the Engineering Council, will act on the recommendations of the Graduate Committee.

11. ASSESSMENT

Indicate the measures that will be taken to assess the effectiveness of the program and the learning outcomes of students enrolled.

The effectiveness of the proposed degree will be assessed by the following methods:

A. Graduates of the program

The performance of graduates of this degree program will be monitored by collecting information on:

i. Employment opportunities

Number of offers received

Geographic distribution of offers
Distribution of industries offering employment
Type of position obtained
Starting salary
Unemployment
Underemployment
Advancements in position and salary after five years

ii. Additional Graduate Studies

Graduate school enrollment
Nature of graduate programs enrolled
Professional school enrollment (e.g. M.D.)

iii. Other

Graduates starting new companies
Consulting areas

B. Recruitment and Enrollment

The success of this program will be assessed by the impact on recruitment and enrollment:

i. Number and quality of applicants

GRE scores
Geographic distribution of applicants
Undergraduate grade point average
Distribution of disciplines represented in applicants

ii. Number and quality of applicants from underrepresented groups

C. Performance of Enrolled Students

The performance of students in this program will be assessed by:

i. Overall grade point average
ii. Grades in non-engineering courses (Sciences, Mathematics)
iii. Percent completing degree and time to completion
iv. Scholarships and fellowships awarded
v. Publications in journals
vi. Other recognized tests (e.g., MCAT, GRE)
vii. Scholarly presentations

D. Impact of Enrolled Students

The impact of students enrolled in this program will be assessed by:

i. Departmental, College, Institute and University awards provided to enrolled students
ii. Activities of enrolled students in professional societies
iii. Activities of enrolled students in student organizations
iv. Patent applications of enrolled students

E. Regional and National Standing of the Program

The regional and national standing of the program will be assessed by:

i. Faculty/students invited to consult with other universities
ii. Faculty/students retained as consultants by pharmaceutical and biobased industries
iii. National demand for graduates, assessed from data shared among engineering deans and from the number of faculty and industry positions advertised
iv. Regional and national awards to faculty and students
v. Regional and national media descriptions

12. ACCREDITATION

Identify accrediting agencies and, where applicable, show how the program meets the criteria of these agencies.

The accrediting agency for professional engineering degree programs in the United States is ABET. ABET allows an institution to seek accreditation for a program at only one degree level – B.S., M.S. or Ph.D. The University of Georgia only seeks accreditation for undergraduate engineering degree programs which is the guideline used by most universities for engineering degree programs. Thus, accreditation for this degree program will not be sought.

13. AFFIRMATIVE ACTION IMPACT

Indicate what impact the implementation of the proposed program will have on the institution's desegregation and affirmative action programs.

The degree program will be open to all qualified persons and shall not discriminate on the basis of race, color, religion, national origin, sex, age, or physical disability. The engineering program at the University of Georgia has focused effort in recruiting students and faculty from under-represented groups and is a charter member of the Southeastern Consortium for Minorities in Engineering (SECME). In addition to continued active participation in SECME, engineering recruiting activities include participation in identifying students in the under-represented populations through letters, personal contacts and visitations. The University has agreements with several HBCU's and the proposed engineering program in Biochemical Engineering is expected to enhance the effectiveness of these agreements, especially with institutions having established colleges of engineering. The graduate degree program will also foster research collaborations that provide opportunities for graduate student and faculty exchange. It is anticipated that strong biological emphasis in the engineering program will be appealing to students from a broad spectrum of engineering and biological interests. It is expected that this program will enhance minority recruitment and will contribute to the University's goal of increasing enrollment from the under-represented groups.

14. DEGREE INSCRIPTION

Indicate the degree inscription that will be placed on the student's diploma upon completion of this program of study.

Doctor of Philosophy with major in Engineering

15. FISCAL AND ENROLLMENT IMPACT AND ESTIMATED BUDGET

On this form please indicate the expected EFT and headcount student enrollment, estimated expenditures, and projected revenues for the first three years of the program. Include both the reallocation of existing resources and anticipated or requested new resources. Second and third year estimates should be in constant dollars – do not allow for inflationary adjustments or anticipated pay increases. Include a budget narrative that explains significant line items and discusses specific reallocations envisioned.

	FY12 First Year	FY13 Second Year	FY14 Third Year
I. ENROLLMENT PROJECTIONS (indicate basis for projections in narrative)			
A. Student majors			
1. Shifted from other programs	2	2	2
2. New to institution	3	11	23
Total Majors	5	13	25
B. Course sections satisfying program requirements.			
1. Previously existing	12	12	12
2. New	2	5	8
Total Program Course Sections	14	17	20
C. Credit Hours generated by those courses			
1. Existing enrollments	288	288	288
2. New enrollments	48	150	288
Total Credit Hours	336	338	568
D. Degrees awarded	0 (yr 2)	2 (yr 3)	4 (yr 4)

II. COSTS	EFT	Dollars	EFT	Dollars	EFT	Dollars
A. Personnel–reassigned or existing positions						
1. Faculty	0.5	40,000	1.0	80,000	2.0	160,000
2. Part-time Fac.	0	0	0	0	0	0
3. Grad. Assist.	1.0	30,000	1.5	45,000	2.5	75,000
4. Administrators	0.10	10,000	0.10	10,000	0.10	10,000
5. Support staff	0.3	7,500	0.5	12,500	1.3	32,500
6. Fringe benefits		19,125		33,625		66,125
7. Other personnel costs		0		0		0
Total Existing Personnel Costs		106,625		181,125		343,625
B. Personnel–new positions						
1. Faculty	0	0	0	0	0	0
2. Part-time Fac.	0	0	0	0	0	0
3. Grad. Assist.	0	0	0	0	0	0
4. Administrators	0	0	0	0	0	0
5. Support staff	0	0	0	0	0	0
6. Fringe benefits	0	0	0	0	0	0
7. Other personnel costs						

	FIRST YEAR	SECOND YEAR	THIRD YEAR
Total New Personnel Costs	0	0	0
C. Start-up Costs (one-time expenses)			
1. Library/learning resources	2,000	4,000	5,000
2. Equipment	280,000	380,000	350,000
3. Other (__________)	0	0	0
D. Physical Facilities: construction or major renovation	65,000	66,000	48,000
TOTAL ONE-TIME COSTS	347,000	450,000	403,000
E. Operating Costs (recurring costs–base budget)			
1. Supplies/Expenses	3,000	6,000	8,000
2. Travel	500	1,000	1,000
3. Equipment	6,000	12,000	19,000
4. Library/learning resources	500	1,000	2,000
5. Other (__________)	0	0	0
TOTAL RECURRING COSTS	10,000	20,000	30,000
GRAND TOTAL COSTS	463,625	651,125	776,625
III. REVENUE SOURCES			
A. Source of Funds			
1. Reallocation of existing funds (see budget narrative)	412,553	392,525	360,193
2. New student workload	xxxxxxxxxx	xxxxxxxxxxx	
3. New tuition	51,072	159,600	306,432
4. Federal funds	0	100,000	110,000
5. Other grants	0	0	0
6. Student fees	0	0	0
7. Other (__________)	0	0	0
Subtotal	60,947	269,475	306,432
New state allocation requested	0	0	0
GRAND TOTAL REVENUES	463,625	651,125	776,625
B. Nature of funds			
1. Base budget	116,625	201,125	373,625
2. One-time funds	347,000	450,000	403,000
GRAND TOTAL REVENUES	463,625	651,125	776,625

Budget Narrative

In November 2010, the Board of Regents approved the University of Georgia proposals for BS degrees in civil, electrical and electronics, and mechanical engineering and their associated budgets. The resources allocated for those three BS degree programs also provide the faculty, staff and other resources required to implement this PhD in Engineering degree program. Thus, no new resources are needed for this degree program.

The above budget is required for implementation of the Ph.D. in Engineering degree program. A similar budget is presented in the companion M.S. in Engineering degree program proposal. Upon the approval and funding of the Ph.D. in Engineering proposal, the resources requested above will also fulfill the budgetary requirements for implementation of the companion M.S. in Engineering degree program.

APPENDIX A

Graduate Course Descriptions

for the

Ph.D. Degree with Major in Engineering

Course Descriptions for Existing Engineering Courses:

ENGR 6910. Research Methods. The philosophy of engineering research, research methodology, review of the departmental research programs, and writing and presenting thesis and dissertation proposals and grant proposals.

ENGR 6101. Computational Mathematics for Engineers: Fundamentals. The use of computational applied mathematics techniques to develop models to evaluate data and make predictions of relevance to engineering. Numerical differentiation and integration, Taylor series, numerical solutions of ordinary differential equations and programming techniques are examined in the context of engineering applications.

ENGR 8102. Computational Engineering: Elliptic Differential Equations. The formulation, analysis, and methods of solution of elliptic differential equations in engineering problems.

ENGR 8103. Computational Engineering: Parabolic Differential Equations. The formulation, analysis, and methods of solution of parabolic differential equations in engineering problems.

ENGR 8950. Graduate Seminar. Presentations/discussions related to engineering research, teaching, design, and service presented by students, faculty, and industry leaders.

ENGR 8160. Advanced Fluid Mechanics. A mathematical treatment of fluid mechanics using tensors with emphasis on viscosity, momentum balance in laminar flow, equations of change, velocity distribution in laminar and turbulent flow, interphase transport, macroscopic balance, and polymeric liquids. Analytical and numeric methods for solving fluid mechanic problems will be used.

ENGR 8170. Advanced Heat Transfer. Conduction, convection, and radiation heat transfer will be covered from an analytical and applications viewpoint. Computer tools for solving heat transfer problems will be emphasized. Projects will involve the analyses of a research-related or design-related heat transfer problem involving at least two of the three heat transfer modalities.

ENGR 8180. Advanced Mass Transfer. Basic laws of mass transport will be derived. Advanced mass transport will focus on molar flux, Fick's law, binary diffusion, two phase transfer, convective mass transfer, mass transfer coefficients, and mass transfer with chemical reaction. A project will be assigned requiring numerical solution of governing mass transport equations.

ENGR 4350/6350. Introduction to Finite Element Analysis. Fundamental finite element theory for the solution of engineering problems. Geometrical modelling techniques, element selection, and tests for accuracy. Emphasis on problems in structural mechanics and elasticity.

ENGR 4510/6510. Biochemical Engineering. Design and analysis of enzymatic and microbial biological reaction systems.

ENGR 4520/6520. Design of Biochemical Separations Processes. Unit operations used for biological processing including filtration, centrifugation, cell disruption, isolation, purification, and polishing.

ENGR 6530. Monitoring and Control of Biological Processes. Concepts of biological process controls; modern control techniques and optimization of batch, fed-batch and continuous bioreactors, and other biological systems.

ENGR 4230/6230. Sensors and Transducers. Fundamentals of the sensing process, transducers and their environments and the measurement problem. Transducer types and modeling. Displacement, motion, pressure, fluid-flow, temperature measurements.

ENGR 4250/6250. Advanced Microcontrollers. Using the MC68HCII to solve practical engineering monitoring and control problems. A project-oriented course.
CSCI(ENGR) 8940. Computational Intelligence. Programs that solve complex problems in a particular domain, typically independent of knowledge used to direct the search for an optimal solution. Approaches include simulated annealing, genetic algorithms, neural networks.
ENGR 6410. Open Channel Hydraulics and Sediment Transport. Fundamental mass, energy, and momentum transport relations in water flows open to the atmosphere. Channel design and measurement of flows in natural channel. Sediment transport relations are introduced.
ENGR 4440/6440. Environmental Engineering Unit Operations. Engineering science and design related to treatment of drinking water and wastewater as well as the treatment and ultimate disposal of the sludges created during water treatment.
ENGR 4450/6450. Environmental Engineering Remediation Design. Engineering science and design related to environmental modeling, solid waste management, and hazardous waste management. Concepts of risk assessment will also be introduced.
ENGR 8580. Compost Facility Engineering. Factors impacting the design and operation of large scale composting facilities.
ENGR 8310. MEMS Design. Exploration of the world of microelectromechanical systems (MEMS) through awareness of material properties, microfabrication technologies, structural behavior, sensing techniques, actuation schemes, fluid behavior, electronic circuits, and feedback systems. Lectures will be augmented with homework assignments and design projects.
ENGR 8930. System Simulation and Optimization. A continuation of Introductory System Modeling. More advanced topics in this course are presented: combined discrete/continuous models, system parameter estimation, system optimization (discrete/continuous, unconstrained/constrained). Emphases will be on appropriate applications rather than mathematical optimization theories, with the goal of process analysis and improvement.
ENGR 8720. Mathematical Models in Physiology. Review non-linear system analysis. Review molecular transport and ion channels. Excitability: Hodgkin-Huxley and FitzHugh-Nagumo models. One- and two-dimensional non-linear partial differential equations. Wave fronts and pattern formation. Further topics from calcium oscillations and intercellular communication. Passive electrical flow in neurons. Spiral calcium waves. Wave propagation on the heart.
ENGR(ECOL) 8560. Systems and Engineering Ecology. A focused study of the mathematical theory of environment, termed Environ Theory, and the analytical methodology emerging from it.
ENGR 4740/6740. Biomaterials. Biomaterials and groundwork for topics such as mechanical, chemical, and thermal properties of replacement materials and tissues. Implantation of materials in the body is studied for the biological point of view.
ENGG 8110. Mathematical Biology. Focus on mathematical topics used to model biological systems, and the corresponding biological applications. Problems related to population biology, biochemical pathways, enzymatic reactions, gene regulation, and systems biology will be discussed.
ENVE 8110. Ecological Energetics. Ecological thermodynamics analyses as applied to ecosystems. First law energy balances and second law entropy generation analyses of ecosystem scale problems will be covered through conventional thermodynamic approaches, a new Lagrangian-based analyses approach, and the Odum Energy approach to thermodynamics.
ENGG(CHEM) 4615/6615. Soft Materials. Introduction to soft condensed matter, including the general aspects of chemistry, physical properties, structure and dynamics, and

applications of soft materials (including polymers, colloids, liquid crystals, amphiphiles, gels, and biomaterials). Emphasis is placed on the molecular forces related to self-assembly.

Course Descriptions for Existing Courses in Other Departments:

ADSC 6110-6110L. Experimental Methods in Animal Biotechnology. Laboratory methods in molecular biology stressing recombinant DNA techniques. Experiments will include recombination, cloning, restriction analysis techniques, and optional experiments chosen by students.
BCMB 6000. General Biochemistry and Molecular Biology. Beginning intensive one-semester graduate-level course in biochemistry and molecular biology covering the structure and function of biological molecules, enzymology, metabolism, bioenergetics, and recombinant DNA technology.
BCMB 8010. Advanced Biochemistry and Molecular Biology I. Advanced biochemistry and molecular biology stressing thermodynamic principles in biochemistry, structural biology, enzymology, and aspects of metabolism and bioenergetics.
STAT 8200. Design of Experiments for Research Workers. Methods for constructing and analyzing designed experiments are considered. Concepts of experimental unit, randomization, blocking, replication, and orthogonal contrasts are introduced. Designs include completely randomized design, randomized complete block design, Latin squares design, split-plot design, repeated measures design, and factorial and fractional factorial designs.
CSCI 8060. Advanced Software Engineering. Analysis of advanced methods in software engineering. Emphasis is placed on formal specification methods, advanced software testing, software reuse, distributed software design, and communication protocol specification. Studies include advanced software development tools and systems.
CSCI 8470. Advanced Algorithms. Further study of fundamental algorithms. Topics covered include advanced data structures, graph algorithms, string algorithms, geometric algorithms, parallel algorithms, and approximation algorithms for NP-complete problems.
CSCI 4810/6810. Computer Graphics. Principles of two-dimensional and three-dimensional interactive raster graphics. Principles of scan conversion algorithms for two-dimensional and three-dimensional graphics primitives; data structures and modeling techniques for raster graphics; interaction, visual realism, animation and user interface design; ray tracing, illumination, shading, data storage/retrieval, software engineering and parallel computing for graphics.
STAT 6310. Statistical Analysis I. Basic statistical analysis for students in quantitative disciplines other than statistics. Topics include principles of sampling and descriptive statistics, elementary probability and probability distributions, discrete and continuous random variables, normal distribution, sampling distributions, statistical inference for one and two samples, simple linear regression, basic nonparametrics, and chi-squared tests.
ECON 4400/6400. Economics of Public and Regulated Enterprises. The economic analysis of regulated and nationalized industries and organizations, with emphasis on the regulation of electric, natural gas, and telecommunications enterprises. Methods and implications of privatization of traditionally "public" enterprises are also considered.
ERSH 8310. Applied Analysis of Variance Methods in Education. Experimental design and the analysis of data from experiments, including orthogonal analysis of variance for single and multifactor designs, randomized block, repeated measures, and mixed models. Computer applications and the reporting results using APA style.
EPSY 6800. Foundations of Cognition for Education. Cognitive psychology as applied to education. Cognitive theories, models, and processes are applied to the teaching and learning of school skills and content areas. Processes such as attention, critical thinking,

concept formation, language, memory, and problem solving are examined. Cognitive psychology principles are used to examine and refine instructional methods.
BIOS(STAT) 8220. Clinical Trials. Drug development and NDA approval procedures; randomization; blindness; phase I-IV clinical trials; multicenter trials; bioequivalency; sample size determination; design and analysis; cross-over design; repeated measurements design; survival analysis; meta analysis.
ECOL 8220. Stream Ecology. Current topics and literature from the standpoints of objectives, experimental design, data analyses, results, assessment of results, and significance to general stream ecology.
ECOL 8230. Lake Ecology. Current topics and literature in the ecology of lakes, ponds, reservoirs, and wetlands.
CBIO 8050-8050L. Techniques in Modern Microscopy. Modern microscopical techniques: brightfield, phase, DIC, fluorescence, confocal, scanning tunneling, and scanning and transmission electron microscopy. Related techniques: X-ray microanalysis photomicrography, and image analysis and processing.
STAT 8200. Design of Experiments for Research Workers. Methods for constructing and analyzing designed experiments are considered. Concepts of experimental unit, randomization, blocking, replication, and orthogonal contrasts are introduced. Designs include completely randomized design, randomized complete block design, Latin squares design, split-plot design, repeated measures design, and factorial and fractional factorial designs.
VPHY 8960. Molecular Toxicology. Molecular mechanisms of toxicities.
BCMB(BINF) 8210. Computational Methods in Bioinformatics. Computational methods, including development and implementation of computer codes, used to solve biological problems; development and solution of statistical and mathematical biological models. Topics include bio-sequence comparison and analysis, functional site prediction, structure prediction and analysis, and biological data analysis.

Course Descriptions for New Courses

ENGR 8910 Design and Research Methods (3-hr). Modify the current Research Methods course ENGR 6910 by adding a module for teaching design methodology with a short-term design project.

ENGG 8XX1/2 Technology Based Entrepreneurship (2-hr). The course provides a broad practice-based experience in the process of creating new products. It starts with the idea generation process and ends with plans for the commercialization of new products. The pedagogical objectives are to shape student abilities to think about technology-based business creation, evaluation of situations from a strategic perspective, and reaching strategic decisions. Accomplishing these objectives entails introducing students to how an enterprise must deal with all complexities and constraints of the environment in which it operates, why none of these can be assumed away or ignored, and how situation factors impact strategic decisions. Topics covered include but are not limited to: starting, financing, and managing a technology-based business as well as management of existing enterprises; market analysis; product design specification; proposal preparation; strategic management; manufacturing facilities design; and business plan.

ENGG 8XX1 Effective Engineering Teaching Studio (1-2 -hr). In this studio, students will develop effective teaching strategies of active and cooperative learning, course planning, assessment of student learning, student learning styles, and strategies for becoming a good educator while still meeting other requirements of a graduate student or new faculty member. Students will be required to keep an online teaching portfolio

(including written reflections with at least one new reference per week from a journal article), observe courses, and teach a portion of a course to peers. Students in the Practicum in Engineering Education Teaching course will meet during the same time period, which will provide opportunities for peer mentoring among students.
Contact time: 3 hours per week

ENGG 8XX2 Practicum in Engineering Teaching (1-hr). In this studio, students will attend weekly studio sessions for one and a half hours to reflect on their teaching experiences and will be required to have a separate teaching assistantship (TA) position. Students will be required to design and teach at least three classes throughout the semester for their TA position. This will provide opportunities for students to learn from prior experience and integrate new concepts learned into their teaching. Students will continue their online teaching portfolios which will include weekly written reflections documenting progress towards becoming an effective engineering educator.

ENGG 8XXX Advanced Nanoelectronics (3-hr). This course will cover the following: (1) Classic and current research and theories about electronic transport in nanoscale structures; (2) Major experimental approaches used to measure the electronic, optical, and mechanical properties of nanostructures; (3) Differences in electronic transport behaviors when structure size shrinks to nanoscale; and (4) Quantum transport. The course will also cover methods to search and read scientific papers and design research projects to address important problems in nanoelectronics.

ENGG 8XXX Tissue Engineering for Drug Discovery (3-hr.). Advances in cell-surface interactions for physiologically relevant three-dimensional cell-based sensors and microtissue formation in vitro and signal readout technologies. Emphasis is on applications in drug discovery and pre-clinical development.

APPENDIX B

Scholarship, Publications and Professional Activities

of the Faculty Directly Involved

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a. Name, rank, academic discipline, institutions attended, degrees earned

Mark A. Haidekker
Associate Professor, Faculty of Engineering

Postdoctoral (1999-2002), University of California, San Diego: Biomegineering
Ph.D. 1998 University of Bremen (Germany): Computer Science
Diploma[1] 1990 University of Hannover (Germany): Electrical Engineering

[1] The German university diploma is a 5-year professional degree that culminates in a research-based thesis and is generally considered equivalent to the M.Sc. degree

b. Current workload for typical semester, including specific courses actually taught

ENGG 4620/6620 Biomedical Imaging

Fall 2007 (as ENGR4980/8980), 2008 (as ENGR4620/6620), 2009

ENGR 4220/6220 Feedback Controls

Spring 2008, 2009

ENGR 8980 Advanced Topics

Summer 2008
Fall 2008

c. Scholarship and publication record for past five years

Haidekker MA. Advanced Biomedical Image Analysis (monograph). John Wiley & Sons, planned publication 2010

Haidekker MA, Nipper M, Mustafic A, Lichlyter D, Dakanali M, Theodorakis EA. Dyes with segmental mobility (molecular rotors). In: Demchenko A. Advanced fluorescence reporters in chemistry and biology I: Design. Springer series on fluorescence (Wolfbeis OS, Series Editor). Springer Verlag, planned publication 2010

LaCroix JT, Haidekker MA. Quantifying light scattering with single-mode fiber-optic confocal microscopy BMC Medical Imaging (in press)

Yang X, Sheng W, Haidekker MA, Sun GY, Lee C-M.. Secretory phospholipase A_2 Type III enhances α-secretase-dependent amyloid precursor protein processing through alterations in membrane fluidity. Journal of Lipid Research (in press)

Lichlyter D, Haidekker MA. Immobilization Techniques for Molecular Rotors -- Towards a Solid-State viscosity sensor platform. Sensors and Actuators B (Chemical) 2009; 139: 648-656.

Zhu D, Hu C, Sheng W, Tan KS, Haidekker MA, Sun AY, Sun GY, Lee C-M.NADPH oxidase-mediated reactive oxygen species alter astrocyte membrane molecular order via phospholipase A_2 . Biochem J 2009; 421 : 201-210.

LaCroix JT, Xia J, Haidekker MA.A Fully Automated Approach to Quantitatively Determine Thickness of Tissue-Engineered Cell Sheets. Annals of Biomedical Engineering 2009; 37: 1348-1357.

Huang H-M, Xia J, Haidekker MA. Fast Optical Transillumination Tomography with Large-Size Projection Acquisition . Annals of Biomedical Engineering 2008; 36: 1699-1707.

Nipper ME, Majd S, Mayer, M, Lee JCM, Theodorakis EA, Haidekker MA. Characterization of changes in the viscosity of lipid membranes with the molecular rotor FCVJ. Biochim Biophys Acta (Biomembranes) 2008; 1778: 1148-1153.

Zhu D, Haidekker MA, Lee JS, Won YY, Lee J-CM. Application of molecular rotors to the determination of the molecular weight dependence of viscosity in polymer melts. Maccromolecules 2007; 40: 7730-7732.

Blake ES, Haidekker MA, Viator JA, Hdeib MM, Lorenzen CL.Using ultrasonic methods to determine cooking degree of doneness in beef steaks. Journal of Muscle Foods 2008; 19: 111-124.

Haidekker MA, Theodorakis EA.Molecular rotors--fluorescent biosensors for viscosity and flow. OBC 2007; 5: 1669-1678.

Fischer D, Theodorakis EA, Haidekker MA. Synthesis and use of an in-solution ratiometric fluorescent viscosity sensor. Nature Protocols 2007; 2: 227-236.

Haidekker MA, Lichlyter D, Ben Johny M, Grimes CA. Probing Polymerization Dynamics with Fluorescent Molecular Rotors and Magnetoelastic Sensors. Sensor Letters 2006; 4: 257-261.

Haidekker MA, Akers WJ, Fischer D, Theodorakis EA. Optical Fiber-Based Fluorescent Viscosity Sensor. Optics Letters 2006; 31(17): 2529-2531.

Haidekker MA, Boettcher LW, Suter JD, Rone R, Grant SA . Influence of gold nanoparticles on collagen fibril morphology quantified using transmission electron microscopy and image analysis. BMC Medical Imaging 2006; 6: 4.

Haidekker MA, Brady TP, Lichlyter D, Theodorakis EA. A Ratiometric Fluorescent Viscosity Sensor. JACS 2006; 128: 398-399.

Haidekker MA, Bidesi A, Radmer S, Andresen R. Texturpaprameter zur Bestimmung osteoporotisch bedingter Strukturveränderungen im CT-Bild der Wirbelkörperspongiosa - eine Vergleichsstudie [Texture parameters to quantify osteoporosis-related structural changes in CT images of the vertebral spongiosa - a comparative study]. Osteologie 2006; 15: 120-130 (article in German).

Benson JD, Haidekker MA, Benson CM, Critser JK. Mercury free operation of the coulter counter multisizer II sampling stand. Cryobiology 2005; 51: 344-347.

White CR, Stevens H, Haidekker MA, Frangos, JA. Temporal gradients in shear, but not spatial gradients, stimulate ERK1/2 activation in human endothelial cells. Am J Physiol Heart Circ Physiol 2005;289:H2350-5.

Akers WJ, Cupps JM, Haidekker MA. Interaction of fluorescent molecular rotors with blood plasma proteins. Biorheology 2005;42(5):335-44.

Haidekker MA, Brady TP, Lichlyter D, Theodorakis, EA. Effects of solvent polarity and solvent viscosity on the fluorescent properties of molecular rotors and related probes.
Bioorganic Chemistry 2005; 33; 415-425.

Milich K, Akers WA, Haidekker MA . A ratiometric fluorophotometer for fluorescence-based viscosity measurement with molecular rotors. Sensor Letters 2005; 3: 237-243.

Haidekker MA. Optical Transillumination Tomography with tolerance against refraction mismatch. Computer Programs and Methods in Biomedicine 2005; 80: 225-235.

Yao G, Haidekker MA. Transillumination optical tomography of tissue-engineered blood vessels: A Monte Carlo simulation. Applied Optics 2005; 44: 4265-4271.

Akers W, Haidekker MA. Precision Assessment of Biofluid Viscosity Measurements Using Molecular Rotors. Journal of Biomechanical Engineering 2005; 127: 450-454.

Haidekker MA, Akers W, Lichlyter D, Brady TP, Theodorakis EA. Sensing of Flow and Shear Stress Using Fluorescent Molecular Rotors. Sensor Letters 2005; 3: 42-48.

Gladish JC, Yao G, L'Heureux N, Haidekker MA. Optical Transillumination Tomography for Imaging of Tissue-Engineered Blood Vessels. Annals of Biomedical Engineering 2005; 33(3): 323-327

Haidekker MA . A Hands-on Model-computed Tomography Scanner for Teaching Biomedical Imaging Principles. Int J Engng Ed 2005; 21(2): 327-334

Huang H-M, Haidekker MA. Rapid Broad-Beam Acquisition of 3D Objects with Laser-Optical Transillumination Tomography. Proceedings of the 2008 Annual Conference of the Institute of Biological Enigneering.
http://openwetware.org/wiki/IBE:_Biology-Inspired_Imaging_and_Optical_Sensing_2008

Nipper ME, Haidekker MA. A Ratiometric Molecular Rotor for Measuring Membrane Viscosity. Proceedings of the 2008 Annual Conference of the Institute of Biological Enigneering. http://openwetware.org/wiki/IBE:_Biology-Inspired_Sensors_2008

Lichlyter D, Haidekker MA. Comparison of Three Aminosilanes for Immobilization of Molecular Rotors for Fluid Viscosity Measurements. Proceedings of the 2008 Annual Conference of the Institute of Biological Enigneering.
http://openwetware.org/wiki/IBE:_Biology-Inspired_Sensors_2008

Haviv S, Haidekker MA. A Tunable Picosecond Lifetime Reference. Proceedings of the 2008 Annual Conference of the Institute of Biological Enigneering.
http://openwetware.org/wiki/IBE:_Biology-Inspired_Sensors_2008

LaCroix JT, Haidekker MA. Quantitative Measurement of Tissue-Engineered Sheets using Reflectance Confocal Microscopy. Proceedings of the 2008 Conference of the Biomedical Engineering Society, St. Louis, MO.

Haviv, S., Haidekker, M.A. Determining Biofluid Viscsoity using Fluorescent Lifetime Dynamics of Molecular Rotors. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March 2007.
Haidekker, M.A., Sebastian, A., Huang, H.-M. Visualizing flow patterns with fluorescent molecular rotors. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March 2007.
LaCroix,J., Haidekker, M.A. Fast confocal scattering-imaging for sheet-based tissue
engineering. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March 2007.
Nipper, M., Haidekker, M.A. Characterizing Changes in DLPC Membrane Viscosity with the Molecular Rotor FCVJ. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March 2007.
J.T. LaCroix, M.A. Haidekker. Prototype confocal scanner for tissue-engineered blood vessels. University of Missouri Life Sciences Week, April 2007. First Prize, poster competition.
S. Haviv, M.A. Haidekker. Determining Biofluid Viscsoity using Fluorescent Lifetime Dynamics of Molecular Rotors. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March/April 2007.
M.A. Haidekker, A. Sebastian, H.M. Huang. Visualizing flow patterns with fluorescent molecular rotors. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March/April 2007.
J.T. LaCroix, M.A. Haidekker. Fast confocal scattering-imaging for sheet-based tissue engineering. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March/April 2007.
M. Nipper, M.A. Haidekker. Characterizing Changes in DLPC Membrane Viscosity with the Molecular Rotor FCVJ. Proceedings of the Annual Meeting of the Institute of Biological Engineering, St. Louis, MO, March/April 2007.
L.W. Boettcher, A. Viehmann, M.A. Haidekker and S.A. Grant, Production of a Type 1 Collagen Crosslinked Matrix Using Functionalized Gold Nanoparticles to Provide Improved Biocompatibility to Implantable Biosensors. Proceedings of the Annual Meeting of the Institute of Biological Engineering, Tucson, AZ, March 2006.
M.A. Haidekker, S.A. Grant, L.W. Boettcher, J.D. Suter, R.Rone, A. Viehmann, Quantification of Collagen Fibril Morphology in the Presence of Gold Nanoparticles. Proceedings of the Annual Meeting of the Institute of Biological Engineering, Tucson, AZ, March 2006.
J.T. LaCroix, M.A. Haidekker, Confocal Scanner for Quality Control of Tissue-Engineered Sheets. Proceedings of the Annual Meeting of the Institute of Biological Engineering, Tucson, AZ, March 2006.
M. Ben Johny, C.A. Grimes, M.A. Haidekker, Comparing Fluorescent Molecular Rotors and Magnetoelastic Sensors to Probe Polymerization Dynamics. Proceedings of the Annual Meeting of the Institute of Biological Engineering, Tucson, AZ, March 2006.
D. Lichlyter, M.A. Haidekker, Examination of the Behavior of Viscosity-Sensitive Molecular Rotors in Shear Thinning Fluids. Proceedings of the Annual Meeting of the Institute of Biological Engineering, Tucson, AZ, March 2006.
W. Akers, J. Cupps, M.A. Haidekker. Interaction of fluorescent molecular rotors with blood plasma proteins. Proceedings of the Annual Fall Meeting of the Biomedical Engineering Society, Baltimore, MD, September/October 2005.
K. Milich, M.A. Haidekker. A Ratiometric Fluorophotometer for Reduced Sensitivity Against Solvent Artifacts. Proceedings of the Annual Fall Meeting of the Biomedical Engineering Society, Baltimore, MD, September/October 2005.

M.A. Haidekker, J.C. Gladish. A Volumetric Optical Tomography Scanner for Tissue-Engineered Blood Vessels. Proceedings of the Annual Fall Meeting of the Biomedical Engineering Society, Baltimore, MD, September/October 2005.
M.A. Haidekker. Reducing Refraction Mismatch Artefacts in Optical Transillumination Tomography. Proceedings of the Annual Fall Meeting of the Biomedical Engineering Society, Baltimore, MD, September/October 2005.
M.A. Haidekker, T. Brady, D. Lichlyter, E. Theodorakis. Behavior of Some Twisted Intramolecular Charge Transfer Complexes in Polar and Viscous Solvents. Proceedings of the Annual Fall Meeting of the Biomedical Engineering Society, Baltimore, MD, September/October 2005.
D. Zhu, M.A. Haidekker, G. Sun, J. Lee. Oxidative Stress Alters Membrane Microdomains in Glial Cells. University of Missouri Life Sciences Week, April 2005.
D. Lichlyter, M.A. Haidekker. Characterization of twisted intramolecular charge transfer complexes in polar and nonpolar solvents. University of Missouri Life Sciences Week, April 2005.
W. Akers, M.A.Haidekker, Fiber-optic biofluid viscosity sensor based on fluorescent molecular rotors. University of Missouri Life Sciences Week, April 2005.
K. Milich, M.A. Haidekker. A Prototype Spectrometer to Monitor Fluorescence and Absorbance Simultaneously. University of Missouri Life Sciences Week, April 2005.

d. Professional activity

American Society for Engineering Education (institutional membership)
Biomedical Engineering Society
Institute for Biological Engineering
Sigma Xi, the Research Honors Society

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Jenna R. Jambeck
Assistant Professor, Faculty of Engineering

Ph.D.	2004	University of Florida, Environmental Engineering Sciences
M.S.	1998	University of Florida, Environmental Engineering Sciences
B.S.	1996	University of Florida, Environmental Engineering Sciences

b. Current workload for typical semester, including specific courses actually taught

ENVE 2320 Environmental Engineering Urban Systems
Fall 2009, 2010

ENVE 3510 Statistics, Modeling and Uncertainty

Spring 2010

ENVE 4530 Energy and Environmental Policy Analysis
Fall 2010

c. Scholarship and publication record for past five years

Jambeck, J., Townsend, T., Solo-Gabriele, H., (2008), "Landfill Disposal of CCA-treated Wood with Construction and Demolition (C&D) Debris: Arsenic, Chromium and Copper Concentrations in Leachate," Environmental Science and Technology, 42 (15), p. 5740–5745.

Jambeck, J., Weitz, K., Townsend, T., Solo-Gabriele, H., (2007). "CCA-treated Wood Disposed in Landfills and Life-cycle Trade-Offs With Waste-to-Energy and MSW Landfill Disposal in the U.S.," Waste Management, Volume 27, Issue 8, 2007, Pages S21-S28.

Thorneloe, S., Weitz, K., Jambeck, J., (2007). "Application of the U.S. Decision Support Tool for Materials and Waste Management," Waste Management, 27 (2007) 1006–1020.

Jambeck, J. and Andino, J., (2007). Classroom Activity, "Garbage Juice: Waste Management and Leachate Generation," Journal of Chemical Education, Vol. 84, No. 2, p. 240A-B.

Jambeck, J., Townsend, T., Solo-Gabriele, H., (2006) "Leaching of Chromated Copper Arsenate (CCA)-treated Wood in a Simulated Monofill and Potential Impacts to Landfill Leachate," Journal of Hazardous Materials, A135 (2006) 21–31.

Khan, B., Jambeck, J., Solo-Gabriele, H., Townsend, T., Cai, Y., (2006) "Release of Arsenic to the Environment from CCA-Treated Wood: Part II – Leaching and Speciation during Disposal," Environmental Science and Technology, 40(3); 994-999.

Clark, C., Jambeck, J., Townsend, T. (2006) "A Review of Construction and Demolition Debris Regulations in the US," Critical Reviews in Environmental Science and Technology, 36:141-186.

Townsend, T., Tolaymat, T., Leo, K., Jambeck, J. (2004). "Heavy Metals in Recovered Fines from Construction and Demolition Debris Recycling Facilities in Florida," Science of the Total Environment, Vol. 332, Issues 1-3, p. 1-11.

Solo-Gabriele, H., Townsend, T., Hahn, D., Moskal, T., Hosein, N., Jambeck, J., Jacobi, G, (2004)."Evaluation of XRF and LIBS Technologies for On-line Sorting of CCA-Treated Wood Waste," Waste Management, Vol. 24, No. 4, p. 413-424.

Jambeck, J., Dubey, B., Townsend, T., Solo-Gabriele, H. (2006). "Disposal of Preservative Treated Wood in Landfills," In Environmental Impacts of Preservative Treated Wood, Ed. Townsend, T. and Solo-Gabriele, H., CRC Press, Boca Raton, FL.

Damiano, L., Jambeck, J., (2008), "Electricity Production from the Management of Leachate with Microbial Fuel Cells," Global Waste Management Symposium, Accepted for Oral Presentation, September 2008.

Johnson, T., Jambeck, J., Loaiza, K.M., (2008), "Case Study of Elk River Landfill: Isolated Hydrogen Sulfide Emissions and Materials/Conditions for Attenuation and Treatment," Global Waste Management Symposium, Accepted for Oral Presentation, September 2008.

Jambeck, J., Damiano, L., Magdol, Z., Merten, A., Kennedy, J. (2007), "A Systematic Approach to Marine Debris Reduction Efforts and Education in New Hampshire," Oceans 2007 IEEE/MTS, Vancouver, BC, October 1-4.

Jambeck, J., Townsend, T., Solo-Gabriele, H. (2006), "A Prediction of Arsenic Groundwater Concentrations Influenced by Construction and Demolition Debris Landfills in Florida Containing CCA-Treated Wood," International Research Group on Wood Preservation (IRG) 37th Annual Conference, Tromso, Norway, June 18-22.

Jambeck, J., Weitz, K., Townsend, T., Solo-Gabriele, H. (2005), "CCA-treated Wood Disposed in Landfills and Life-cycle Trade-Offs With Waste-to-Energy and MSW Landfill Disposal in Florida," International Research Group on Wood Preservation (IRG) 36th Annual Conference, Bangalore, India, April 24-28.

Jambeck, J., Townsend. T., Solo-Gabriele, H., (2004), "Leachate Quality from Simulated Landfills Containing CCA-Treated Wood," Environmental Impacts of Preservative-Treated Wood Conference, sponsored by the Florida Interdisciplinary Center for Environmentally Sound Solutions (FICESS), Orlando, FL, February 8-11.

Jambeck, J., Damiano, L., (2009), "Microbial Fuel Cells in Landfill Applications," Environmental Research and Education Foundation, Final Report August, 2009.

Jambeck, J., Merten, A., Damiano, L., Magdol, Z., (2008), "An Integrated PDA-GPS Protocol for Marine Debris and Oil Spill Cleanup, Mitigation and Decision-making," Final Report to NOAA, January 2008.

Greenwood, S., Jambeck, J., (2007), "An Environmental Characterization of Unbound Mined Residuals from the Tri State Mining District," Project 40 Report, Recycled Materials Resource Center, August, 2007.

Jambeck, J, Bryan, K, Dalbavie, O., Fuller, A., (2006), "An Investigation of Recycled Materials to Attenuate Hydrogen Sulfide from the Beneficial use of Construction and Demolition (C&D) Waste Fines/Residuals at a Landfill," A Supplemental Environmental Project (SEP) prepared for Waste Management of Massachusetts to MA DEP, December, 29, 2006.

Townsend, T., Jambeck, J., Jang, Y., Plaza, C., Xu, Q., Clark, C. (2005), "C&D Waste Landfills in Florida: Assessment of True Impact and Exploration of Innovative Control Techniques," Florida Center for Solid and Hazardous Waste Management, Gainesville, FL.

Jambeck, J., (2004), "The disposal of CCA-Treated Wood in Simulated Landfills: Potential Impacts," PhD Dissertation, University of Florida.

d. Professional activity

Solid Waste Association of North America

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

caner Kazanci
Asst. Professor, Department of Mathematics
Member, Faculty of Engineering

Ph.D.	2005	Carnegie Mellon University, Mathematical Sciences
M.S.	2000	Carnegie Mellon University, Mathematical Sciences
B.S.	1999	Bilkent University, Department of Mathematics

b. Current workload for typical semester, including specific courses actually taught

MATH 2200 Calculus I
Fall 2005

MATH 2700 Differential Equations
Spring 2008

MATH 4500/6500 Numerical Analysis I
Fall 2006

MATH 4510/6510 Numerical Analysis II
Spring 2007

MATH 4700 Qualitative Differential Equations
Fall 2009

ENGR 6101 Computational Engineering: Introduction
Fall 2008, 2009

ENGR 8102 Computational Engineering: Elliptic Partial Differential Equations
Fall 2006, 2007, 2008, 2009

ENGR 8103 Computational Engineering: Parabolic Partial Differential Equations
Fall 2005, 2006, 2007, 2008, 2009

ENGG 8110 Mathematical and Computational Biology
Spring 2006, 2008, 2009

MATH 8850 VIGRE Research Group
Fall 2008, 2009
Spring 2008

c. Scholarship and publication record for past five years

Control System Approaches to Ecological Systems Analysis: Invariants and Frequency Response. E.W. Tollner, C. Kazanci, J.R. Schramski and B.C. Patten. Ecological Modeling. doi:10.1016/j.ecolmodel.2009.08.002 (In press).

Dynamic environ analysis of compartmental systems: a computational approach, J. Shevtsov, C. Kazanci, B. C. Patten. Ecological Modeling. doi:10.1016/j.ecolmodel.2009.07.022 (In press).

The Reynolds Transport Theorem: Application to Ecological Compartment Modeling and Case Study of Ecosystem Energetics, J.R. Schramski, B.C. Patten, C. Kazanci, D.K. Gattie, N.N. Kellam. Ecological Modeling. doi:10.1016/j.ecolmodel.2009.08.009 (In press).

Throughflow analysis: a stochastic approach, L. Matamba, C. Kazanci, J.R. Schramski, M. Blessing, P. Alexander, B.C. Patten. Ecological Modeling. doi:10.1016/j.ecolmodel.2009.07.001 (In press).

Cycling in ecosystems: An individual based approach, C. Kazanci, L. Matamba, E.W. Tollner. Ecological Modeling. doi:10.1016/j.ecolmodel.2008.09.013 (In press).

Implications of Network Particle Tracking (NPT) for Ecological Model Interpretation, E.W. Tollner, C. Kazanci, J.R. Schramski and B. Patten. Ecological Modeling. 220:1904-1912, 2009.

Can consumer stoichiometric regulation control nutrient spiraling in streams?, G. Small, A. Helton, C. Kazanci. Journal of the North American Benthological Society. 28(4):747-765, 2009.

EcoNet, A new software for ecological model simulation and network analysis, C. Kazanci, Ecological Modeling. 208:3-8, 2007.

Defining an ecological thermodynamics using discrete simulation approaches, E. W. Tollner and C. Kazanci, Ecological Modeling. 208:68-79, 2007.

Network Particle Tracking (NPT) for ecosystem thermodynamics and risk analysis, E. W. Tollner, J. Schramski and C. Kazanci, Proc. ASEE Annual Conf. pp 2020, 2009. (awarded best paper)

An Evolving Course in Ecological Thermodynamics, E. W. Tollner and C. Kazanci, Proc. ASEE Annual Conf. pp 1345, 2007.

A network model of distributed and centralized systems of students, N. Kellam, D. Gattie, C. Kazanci, Proc. FIE, pp F4G3-F4G8, 2007.

Ecological Thermodynamics and the possibility of new thermodynamic indicators, E. W. Tollner and C. Kazanci, Proc. ASEE Annual Conf. pp 112, 2006.

Chapter 18: Network calculations II: a user's manual for EcoNet, in "Handbook of Ecological Modeling and Informatics", Edited by S.E. Jorgensen, T-S Chon, F. Recknagel. WIT press, 2009.

d. Professional activity

SMB, Society of Mathematical Biology
SIAM, Society of Industrial and Applied Mathematics
ISEM, International Society for Ecological Modeling

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

William S. Kisaalita
Professor, Department of Biological & Agricultural Engineering
Member, Faculty of Engineering

Ph.D.	1987	University of British Columbia, Chemical Engineering
M.A.S.	1982	University of British Columbia, Bioresource Engineering
B.S.	1978	Makerere University, Mechanical Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 8980 Tissue Engineering for Drug Discovery
Fall 2007, 2009

ENGR 8950 Graduate Seminar
Fall 2005, 2006, 2007, 2008, 2009

ENGR 4920 Engineering Design Project
Spring 1992 - 2008

ENGR 3720 Engineering Physiology
Fall 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009

c. Scholarship and publication record for past five years

Wang, L.; Wu, Z.-Z.; Xu, B.-Q.; Zhao, Y.-P. SU-8 microstructure for three-dimensional biosensing. *Sensors and Actuators B* 140:349-355 (2009).

Yoder, M.F.; Kisaalita, W.S. Leaching behavior of fluorescent pyoverdin immobilized in sol-gel glass. *Open Biotechnology Journal* 2:157-166 (2008).

Lai, Y.; Wang, L.; Cheng, K.; Kisaalita, W.S. Taking cell culture in drug discovery to the third dimension - A patent review. *Recent Patents on Biomedical Engineering* 1(2):103-116 (2008).

Cheng, K.; Lai, Y.; Kisaalita, W.S. Three-dimensional polymer scaffolds for high throughput cell-based assay systems. *Biomaterials* 29:2802-2812 (2008)

Bariho, D.; Kisaalita, W.S.; Kasisira, L. Solar Energy zeolite regeneration for a milk cooler. *Journal of Agricultural Machinery Sciences* 14(2):265-268 (2008).

Muyanja, A.; Kawongolo, J.B.; Kisaalita, W.S. A simple milk churner for ghee-making. *Agricultural Mechanization in Asia, Africa abd Latin America (Accepted).*

Shealy, M.; Jones, P.; Neu, M.J.; Dunn, J.; Kisaalita, W.S. Argan nutcracker for southwestern Moroccan women. *Agricultural Mechanization in Asia, Africa and Latin America (Accepted).*

Kisaalita, W.S.; Bibens, B.; Kinsey, V.R.; Lane, E.; Young, P. Avian hatchery solar incubator for smallholder poultry farmers from the Sudano-Sahelian Belt. Submitted to *Agric. Mech. Asia Africa & Latin America (Accepted).*

Chen, K.; Lai, Y.; Kisaalita, W.S. Three-dimensional polymer scaffolds for high throughput cell-based assay systems. *Biomaterials* 29:2802-2812 (2008).

Kisaalita, W.S. Sentongo-Kibalama, J. Delivery of Urban transport in developing countries: the case for the motorcycle taxi service (*boda-boda*) operators of Kampala. *Development Southern Africa* 24(2):345-357 (2007).

Wu, Z.-Z.; Zhao, Y.-P.; Kisaalita, W.S. Interfacing SH-SY5Y human neuroblastoma cells with SU-8 microstructures. *Colloids and Surfaces B: Biointerfaces* 52:14-21 (2006)

Wu, Z.-Z.; Zhao, Y.-P.; Kisaalita, W.S. A packed Cytodex microbead array for 3-D cell-based biosensing. *Biosensors and Bioelectronics* 22:685-693 (2006)

Kisaalita, W.S.; Tippie, A.; Faircloth, W.; Franklin, J.; Boyer, B. Comparative analysis of alternative renewable energy sources for small milk cooling plants of Southwestern Uganda. *Agricultural Mechanization in Asia, Africa and Latin America* 37(4):69-75 (2006)

Kisaalita, W.S. Experiential technical education in developing counties: practical training in Uganda’s agricultural engineering curriculum. *Agricultural Mechanization in Asia, Africa and Latin America* 37(3):71-78 (2006)

Zhao, Y.-P.; Li, S.-H.; Chaney, S.B.; Shanmukh, S.; Fan, J.-G.; Druhy, R.A.; Kisaalita, W.S. Designing nanostructures for sensor applications. *J. of Electronic Materials* 35(5) (2006)

Yoder MF, Kisaalita WS. Fluorescence of pyoverdin in response to iron and other common well water metals. *J. of Environmental Science and Health Part* A 41:1-2, 2006

Desai A, Kisaalita WS, Keith C, Wu ZZ. Human neuroblastoma (SH-SY5Y) cell culture and differentiation in 3-D collagen hydrogels for cell-based biosensing. *Biosensors and Bioelectronics* 21(8):1483-1492, 2005

Diramio JA, Kisaalita WS, Majetich GF, Shimkus JM. Poly(ethylene glycol) methacrylate/dimethacrylate hydrogels for controlled release of hydrophobic drugs. *Biotechnology Progress*. 21(4):1281-8, 2005.

Halper J, Griffin A, Hu W, Jung C, Zhang J, Pan H, Kisaalita WS, Foutz TL, Frazier KS. In vitro culture decreases the expression of TGF(beta), Hsp47 and type I procollagen and increases the expression of CTGF in avian tendon explants. *J. of Musculoskeletal and Neuronal Interactions.* 5(1):53-63, 2005.

d. Professional activity

American Society for Engineering Education
American Chemical Society
American Association for Advancement of Science
Society for Biomolecular Sciences
American Society for Agricultural and Biological Engineering

e. Expected responsibilities in this program

Teach graduate level courses
Serve as major professor for M.S. and Ph.D. students
Serve on advisory committees for M.S. and Ph.D. students

_ a. Name, rank, academic discipline, institutions attended, degrees earned

Peter Kner
Assistant Professor, Department of Biological & Agricultural Engineering
Member, Faculty of Engineering

Ph.D.	1998	University of California, Berkeley, Physics
B.S.	1991	Massachusetts Institute of Technology, Physics
B.S.	1991	Massachusetts Institute of Technology, Electrical Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 4230 Sensors and Transducers

Fall 2009 (1 sections)

ENGR 1140 Computational Engineering Methods

Spring 2010 (1 section)

c. Scholarship and publication record for past five years

P. Kner, J. W. Sedat, D. A. Agard, and Z. Kam, High-resolution wide-field microscopy with adaptive optics for spherical aberration correction and motionless focusing, *J. Microscopy*, DOI 10.1111/j. 1365-2818.2009.03315.x, published online September 16 (2009)

P. Kner, B. B. Chhun, E. R. Griffis, L. Winoto, and M. G. L. Gustafsson, Super-Resolution Video Microscopy of Live Cells by Structured Illumination, *Nature Methods* 6, pp. 339-342 (2009)

O. Azucena, J. Kubby, J. Crest, J. Cao, W. Sullivan, P. Kner, D. Gavel, D. Dillon, and S. Olivier, Implementation of a Shack-Hartmann wavefront sensor for the measurement of embryo-induced aberrations using fluorescent microscopy, *SPIE Photonics West*, San Jose, CA, January, 2009

P. Kner, B. B. Chhun, E. R. Griffis, L. Winoto, L. Shao, and M. G. L. Gustafsson, Live TIRF microscopy at 100nm resolution through structured illumination, *SPIE Photonics West*, San Jose, CA, January 2009

L. Schermelleh, P. M. Carlton, S. Haase, L. Shao, L. Winoto, P. Kner, B. Burke, M. C. Cardozo, D. A. Agard, M. G. Gustafsson, H. Leonhardt, and J. W. Sedat, Subdiffraction multicolor imaging of the nuclear periphery with 3D structured illumination microscopy, *Science* 320, pp. 1332-1336 (2008)

P. Kner, J. W. Sedat, D. A. Agard, and Z. Kam, Enabling High-Resolution Imaging Deep in Live Tissue with Adaptive Optics, *Joint CBST and PicoQuant Workshop on Single Molecule Measurements*, Sacramento, CA, January, 2008

Z. Kam, P. Kner, D. A. Agard, and J. W. Sedat, Application of Adaptive Optics to Live Imaging, *J. Microscopy* 226, pp. 33-42 (2007)

P. Kner, Recent Advances in Microscopy at UCSF, *European Light Microscopy Initiative*, York, England, April, 2007

Z. Kam, P. Kner, D. A. Agard, and J. W. Sedat, U.S. Patent Application 20070268592: Method and System of Correcting Optical Aberrations, Including Widefield Imaging Applications. (2006)

D. Sun, W. Fan, P. Kner, J. Boucart, T. Kageyama, Z. Dongxu, R. Pathak, R. F. Nabiev, W. Yuen, Long wavelength tunable VCSELs with optimized MEMS bridge tuning structure, *IEEE Photon. Technol. Lett.* 16, p. 714 (2004)

P. Floyd, P. Kner, and D. Sun, U.S. Patent Application 20080259971: Method for improving high frequency operation of a vertical cavity surface emitting laser (VCSEL) with monolithically integrated bridge arm. (2004)

d. Professional activity

SPIE (Society of Photonics Engineers)
IEEE (Institute of Electrical Engineers)

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Kyle J. Johnsen
Asst. Professor, Faculty of Engineering

Ph.D.	2008, University of Florida, Computer Engineering
B.S.	2003, University of Florida, Computer Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 1140 Computational Engineering Methods

Spring	2009
Fall	2009 (2 sections)
Spring	2010

ENGR 4920 Senior Design

Spring 2009 (The Data Analyzing Wireless Glove)

CSCI 6930 Virtual Reality

Spring 2010

c. Scholarship and publication record for past five years

A Kotranza, K Johnsen, J Cendan, B Miller, DS Lind, and B Lok (2009), Virtual Multi-Tools for Hand and Tool-Based Interaction with Life-Size Virtual Human Agents. Proceedings of IEEE Symposium on 3D User Interfaces, 2009

B. Rossen, K. Johnsen, A. Deladisma, D. S. Lind, and B. Lok Virtual Humans Elicit Skin-Tone Bias Consistent with Real-World Skin-Tone Biases. Proceedings of Intelligent Virtual Agents, 2008

Johnsen, Kyle, Benjamin Lok (2008). "An Evaluation of Immersive Displays for Virtual Human Experiences" Proceedings of IEEE Virtual Reality 2008.

Deladisma, Adeline, Marc Cohen, Amy Stevens, Peggy Wagner, Benjamin Lok, Thomas Bernard, Christopher Oxendine, Lori Schumacher, Kyle Johnsen, Robert Dickerson, Andrew Raij, Rebecca Wells, Margaret Duerson, J. Garrett Harper, D. Scott Lind (2007). "Do Medical Students Respond Empathetically to a Virtual Patient?" American Journal of Surgery. 193(6): 756-760.

Johnsen, Kyle, Andrew Raij, Amy Stevens, D. Scott Lind, Benjamin Lok (2007). "The Validity of a Virtual Human Experience for Interpersonal Skills Education" Proceedings of ACM SIGCHI 2007.

Raij, Andrew, Kyle Johnsen, Robert Dickerson, Benjamin Lok, Marc Cohen, Amy Stevens, Thomas Bernard, Christopher Oxendine, Peggy Wagner, D. Scott Lind (2006). "Comparing Interpersonal Interactions with a Virtual Human to those with a Real Human" IEEE Transactions on Visualization and Computer Graphics. 13(3): 443-457.

Raij, Andrew, Kyle Johnsen, Robert Dickerson, Benjamin Lok, Marc Cohen, Amy Stevens, Thomas Bernard, Christopher Oxendine, Peggy Wagner, D. Scott Lind

(2006). “Interpersonal Scenarios: Virtual ≈ Real?” Proceedings of IEEE Virtual Reality 2006

Dickerson, Robert, Kyle Johnsen, Andrew Raij, Benjamin Lok, Thomas Bernard, Amy Stevens, D. Scott Lind (2006). "Virtual Patients: Assessment of Synthesized Versus Recorded Speech," Proceedings of Medicine Meets Virtual Reality 14, 114-119.

Bernard, Thomas, Amy Stevens, Peggy Wagner, Nicole Bernard, Lori Shumacher, Kyle Johnsen, Robert Dickerson, Andrew Raij, Benjamin Lok, Margaret Duerson, Marc Cohen, D. Scott Lind (2006). “A Multi-Institutional Pilot Study to Evaluate the Use of Virtual Patients to Teach Health Professions Students History-Taking and Communication Skills” Proceedings of the Society of Medical Simulation Meeting.

Lok, Benjamin, Rick Ferdig, Andrew Raij, Kyle Johnsen, Robert Dickerson, Jade Coutts, Amy Stevens, D. Scott Lind (2006). “Applying Virtual Reality in Medical Communication Education: Current Findings and Potential Teaching and Learning Benefits of Immersive Virtual Patients” To Journal of Virtual Reality. 10(3):185-195

Johnsen, Kyle, Robert Dickerson, Andrew Raij, Benjamin Lok, Jonathan Jackson, Min Shin, Jonathan Hernandez, Amy Stevens, Scott Lind (2005). “Evolving an Immersive Medical Communication Skills Trainer,” Journal on Presence: Teleoperators and Virtual Environments. 15(1):33-46.

Stevens, Amy, Jonathan Hernandez, Kyle Johnsen, Robert Dickerson, Andrew Raij, Jonathan Jackson, Min Shin, Juan Cendan, Margaret Duerson, Benjamin Lok, D. Scott Lind (2005). “The Use of Virtual Patients to Teach Medical Students Communication Skills” American Journal of Surgery. 191(6):806-811.

Dickerson, Robert, Kyle Johnsen, Andrew Raij, Benjamin Lok, Jonathan Hernandez, Amy Stevens, and D. Scott Lind (2005). “Evaluating a Script-Based Approach to Simulating Patient-Doctor Interaction” Proceedings of SCS 2005 International Conference on Human-Computer Interface Advances for Modeling and Simulating (SIMCHI ’05), 79-84.

Johnsen, Kyle, Robert Dickerson, Andrew Raij, Benjamin Lok, Jonathan Jackson, Min Shin, Jonathan Hernandez, Amy Stevens, Scott Lind (2005). “Experiences in Using Immersive Virtual Characters to Educate Medical Communication Skills” Proceedings of IEEE Virtual Reality 2005.

d. Professional activity

Member
- IEEE
- ACM

Program Committee
- IEEE Virtual Reality 2010
- ACM Virtual Reality Software and Technology 2009
- International Symposium on Mixed and Augmented Reality 2009

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses

Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Ke Li
Assistant Professor, Faculty of Engineering

Ph.D. 2003 Michigan Technological University, Environmental Engineering
M.S. 1998 Chinese Academy of Sciences, Environmental Chemistry
B.S. 1995 Tsinghua University, Environmental Engineering

b. Current workload for typical semester, including specific courses actually taught

ENVE 4550 Environmental Life Cycle Analysis
Spring 2010

ENVE 4620 Sustainable Design in Urban Systems

Fall 2010

c. Scholarship and publication record for past five years

E. Lyons, P. Zhang, T. Benn, F. Sharif, K. Li, J. Crittenden, M. Costanza, Y.S.Chen, 2009, Life Cycle Assessment of Three Water Supply Systems: Importation, Reclamation and Desalination, *Water Science and Technology*.

S.Palaniappan, H. Bashford, K. Li, A. Fafitis, Leger Stecker, 2009 Carbon Emissions based on Transportation in Post-Tensioned Slab Foundation Construction: A Production Home Building Case Study in the Greater Phoenix Arizona Area, International *Journal of Construction Education and Research*.

Kahhat, R., J. Crittenden, E. Fonseca, K. Li, A. Sawhney, P. Zhang, 2009, Environmental Impacts over the Life Cycle of Residential Buildings Using Different Exterior Wall Systems, *ASCE Journal of Infrastructure Systems*.

Li, K., J. Crittenden, 2009 Computerized Pathway Elucidation for Hydroxyl Radical Induced Chain Reaction Mechanisms in Aqueous Phase Advanced Oxidation Processes, *Environmental Science and Technology*.

Schramski JR, Gattie DK, Rutz ZJ, Li K, Jambeck JR, Rabe, RJ. 2009. Modeling a Trophically Balanced Thermodynamic Economy: Considerations of Energy Networks in a Fossil Energy Free Economic and Corresponding Ecological System. Poster Presentation, *International Society of Ecological Modellers Conference. Quebec City, Canada, Oct. 3-7*.

Ke Li; P. Zhang; J. C. Crittenden; R. Kahhat; Y. Choi; D. Gerrity; H. Fernando; S. Guhathakurta; A. Sawhney; P. Torrens, 2009 Regional Futures 2100 (RF2100): A holistic framework for evaluating urban sustainability, in *Visualizing sustainable planning models*, Springer, Heidelberg.

Guhathakurta, S. Y. Kobayashi, M. Patel, J. Holston, T. Lant, J. Crittenden, K. Li, and K. Date, 2009 Digital Phoenix Project: A Multidimensional journey through time, in *Visualizing sustainable planning*, Springer, Heidelberg.

Melissa R. McHale, Nancy B. Grimm, Lawrence A. Baker, Brenda A. Koerner, Ke Li, and Sharon J. Hall, 2009 Impacts of urbanization on regional and global carbon cycling: a complete carbon budget of Phoenix metropolitan region as a case study, *the 94th ESA Annual Meeting, Albuquerque, New Mexico, Aug 2-7*.

Ke Li, Subhro Guhathakurta, Ying Cao, 2009 Understand Urban Complexity Through Integrated Simulation Framework, *11th International Conference on Computers in Urban Planning and Urban Management (CUPUM), Hongkong, June 16-18*.

Sivakumar Palaniappan, Howard Bashford, Apostolos Fafitis and Ke Li, 2009 Carbon Emissions based on Ready-mix Concrete Transportation: A Production Home Building Case Study in the Greater Phoenix Arizona Area. *Association of School of Construction's the 45th Annual International Conference, Florida*. (conference proceeding online at http://ascpro.ascweb.org/chair/paper/CPRT87002009.pdf)

Ke Li, John Crittenden, 2009 Understanding and Engineering the Complexity of Urban Systems, Decision Analysis: *Supporting Environmental Decision Makers Workshop, Cincinnati, OH, March 31*.

Li, K., D. R. Hokanson, J. C. Crittenden, R. R. Trussell, Daisuke Minakata, 2008 Evaluating UV/H_2O_2 Processes for Methyl *tert*-Butyl Ether and tertiary Butyl Alcohol Removal: Effect of retreatment Options and Light Sources, *Water Research*.

Crittenden, J.C.; Minakata, D.; Li, K.; Westerhoff, P. 2008 Overview of Advanced Oxidation Processes (AOPs): Understanding and Improving Process Performance. Potable Reuse for Water Supply Sustainability, *Critical Today –Essential Tomorrow-. Long Beach, California, November 16-19*.

Ke Li, Understanding Urban Construction Practice, invited talk, 2008 *Joint Annual Meeting and Exposition of the Geological Society of America, Soil Science Society of America, American Society of Agronomy, Crop Science Society of America, Gulf Coast Association of Geological Societies, Houston, Texas, October 5-9*.

Daisuke, M., K. Li, J. Crittenden, P. Westerhoff, 2008 Development of Group Contribution Method (GCM) for Hydroxyl Radical (HO•) Reaction Rate Constants in the aqueous phase, *the 14th International Conference on Advanced Oxidation Technologies in San Diego, CA, Sept. 22*.

Crittenden, J.C.; Li, K.; Minakata, D.; Westerhoff, P.; Hokanson, D.; Trussell, R.; Jeong, H. 2008 Understanding and improving process performance of advanced oxidation processes (AOPs). *The Croucher Foundation Advanced Study Institute (ASI), The Hong Kong University of Science and Technolog, HongKong, June 23-27*.

Li, K., E. Fonseca, F. Sharif, S. Palaniappan, J. Crittenden, 2008 Community Design towards Sustainability, *Ecocity World Summit 2008,San Francisco, April 21-26*.

Sharif, F., K. Li, J. Crittenden, P. Zhang, 2008 A Comparative Study on Several Energy Saving Measures for Residential Buildings, Ecocity World Summit 2008,*San Francisco, April 21-26*.

Li, K., P. Zhang, J. Crittenden, S. Guhathakurta, Y. Chen, H. Fernando, A. Sawhney, P. McCartney, N. Grimm, H. Joshi, G. Konjevod, Y. Choi, E. Fonseca, B. Allenby, D. Gerrity, R. Kahhat, P. Torrens, 2007 Development of a Framework for Quantifying the Environmental Impacts of Urban Development and Construction Practices, *Environmental Science and Technology*.

Li, K., M. I. Stefan, J.C. Crittenden, 2007 Trichloroethylene Degradation by UV/H_2O_2 Advanced Oxidation Process: Product Study and Kinetic Modeling, *Environmental Science and Technology*.

John C. Crittenden, P. Zhang, E. Lyons, K. Li, F. Sharif, T. Benn, P. Westerhoff, D. Minakata, 2007 *EPRI Workshop to assess research opportunities for water use efficiency technologies, Palo Alto, CA, November 14-15*.

Minakata, D.; Crittenden, J.C.; Li, K. 2007 Evaluation and design Advanced Oxidation Processes (AOPs). 1. UV/H_2O_2 processes for methyl *tert*-butyl ether (M*t*BE) and tertiary butyl alcohol (*t*BA) removal from drinking water source: effect of pretreatment options and light source. 2. Mitigation of bromate during ozonation –kinetic study -. *Water Quality Technology Conference Workshops Sun 5 Advanced Oxidation Technologies in Water. Nov. 4th, Charlotte, NC*.

Guhathakurta, S., Y. Konaysh, M. Patel, J. Holston, T. Lant, K. Li, G. Konjevod, K. Date, 2007 Digital Phoenix: A Multidimensional Journey Through Time, in CUPUM, Ed: Antonio Nelson Rodrigues da Silva, Lea Cristina Lucas de Souza, *10th international Conference on Computers in Urban Planning and Urban Management, Iguassu Falls, PR, Brazil, July 11-13*.

J. Crittenden, K. Li, 2007 Development of a Metamodel for Informing More Sustainable Urban Development: Preliminary Results, *at ISIE Conference, Toronto, June 17-20*.

Ke Li, D. Minakata, J. C. Crittenden, P. Westerhoff, 2007 Computer-Aided Pathway Generation for Aqueous Phase Advanced Oxidation Processes, *American Chemical Society 233rd National Meeting & Exposition, Chicago, IL USA, March 25-29*.

J. Crittenden, E. Lyons, P. Zhang, M. Costanza, K. Li, 2007 Life Cycle Assessment of Two Water Supply Systems: Importation vs. Reclamation, *First Western Forum on Energy & Water Sustainability, March 22-23*.

Li, K., P. Zhang, J. Crittenden, S. Guhathakurta, Y. Chen, H. Fernando, A. Sawhney, P. McCartney, N. Grimm, H. Joshi, G. Konjevod, Y. Choi, E. Fonseca, B. Allenby, D. Gerrity, R. Kahhat, P. Torrens, 2007 Development of a Metamodel for More Informed Sustainable Urban Development: Preliminary Results, *American Association for the Advancement of Science Annual Meeting, San Fransisco, CA, February 19*.

Joshi, H., S. Guhathakurta, G. Konjevod, J. Crittenden, K. Li, 2006 Simulating the Effect of Light Rail on Urban Growth in Phoenix: An application of the UrbanSim Model Environment, *Journal of Urban Technology*.

Li, K., M. I. Stefan, J. C. Crittenden, 2004 UV Photolysis of Trichloroethylene (TCE): Product Study and Kinetic Modeling, *Environmental Science and Technology*.

Joshi, H., S. Guhathakurta, G. Konjevod, J. Crittenden, K. Li, 2006 Simulating impact of light rail on urban growth in Phoenix: an application of urbansim modeling environment, *Proceedings of the 2006 international conference on Digital government research, San Diego, California*.

Ke Li, 2005, Participated in chapter writing and reviewing "Water Treatment: Principles and Design" Second Edition, Ed. Crittenden, J.C., R. Trussell, D.W. Hand, Kerry Howe and G. Tchobanoglous, 1984 pages, John Wiley, NY.

Li, K., J. Crittenden, 2005 Advance of Advanced Oxidation Processes Modeling, *The Eco-Environmental Sciences of Chinese Academy of Sciences, Beijing, China, Oct. 31*.

Li, K., S. Guhathakurta, J. Crittenden, A. Sawhney, H. Fernando, N. Grimm, G. Konjevod, P. McCartney, B. Allenby, J. Si, H. Joshi, D. Gerrity, Y. Choi, S. Winter, Y. Chen, 2005 Informed Decision Making towards a More Sustainable Urban Development in the Great Phoenix Area, *2005 AEESP Research and Education Conference, July 23-27*.

Li, K., D. Gerrity, S. Guhathakurta, J. Crittenden, A. Sawhney, H. Fernando, P. McCartney, N. Grimm, H. Joshi, G. Konjevod, Y. Choi, S. Winter, Y. Chen, B. Allenby, 2005, Informed Decision Making towards a More Sustainable Urban Development, *International Society of Industrial Ecology 2005 Conference, Stockholm, Sweden, June 12-15*.

Guhathakurta, S., H. Joshi, G. Konjevod, K. Li, 2005 Simulating Impact of Light Rail on Urban Growth in Phoenix: An Application of UrbanSim Modeling Environment, *the Computers Use in Planning and Management Conference, June, London, U.K.*

Li, K. 2004 UV/H_2O_2 Process From Design Aid to Mechanism Study, *invited Pre-conference Workshop of the Tenth International Conference on Advanced Oxidation Technologies for Water and Air Remediation, Oct. 24-28, San Diego, CA*.

Li, K., J. C. Crittenden, 2004 Computer-Generated chemical reaction Pathways for Aqueous Phase Advanced Oxidation Processes, *The Tenth International Conference on Advanced Oxidation Technologies for Water and Air Remediation, Oct. 24-28, San Diego, CA*.

d. Professional activity

American Environmental Engineering and Science Professors
American Chemical Society
Water Environment Federation
American Water Works Association

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

---

_ a. Name, rank, academic discipline, institutions attended, degrees earned

Jason Locklin
Assistant Professor, Department of Chemistry and Faculty of Engineering

Ph.D. 2004 University of Houston, Chemistry
B.S. 1999 Millsaps College, Chemistry

b. Current workload for typical semester, including specific courses actually taught

ENGG 4165/6615; CHEM 4615/6615 Soft Materials
Fall 2007, 2008, 2009

CHEM 8390 Principles of Polymerization
Spring 2008

CHEM 2212 Organic Chemistry II
Spring 2009, 2010

c. Scholarship and publication record for past three years

Orski, S.V., Fries, K.H., Sheppard, G.R., J. Locklin. 2009. High Density Scaffolding of Functional Polymer Brushes: Surface Initiated Atom Transfer Radical Polymerization of Active Esters. *Langmuir, ASAP*.

Ito, Y., Virkar, A.A., Mannsfeld, S.C.B., Oh, J.H., Toney, M., J. Locklin, Bao, Z. 2009. Crystalline Ultra Smooth Self-Assembled Monolayers of Alkanesilanes for Organic Field Effect Transistors. *J. Am. Chem. Soc.*, *131*, 9396-9404.

Sontag, S. K., Marshall, N., J. Locklin. 2009. Formation of Conjugated Polymer Brushes by Surface-Initiated Catalyst-Transfer Polycondensation. *Chem. Comm.*, 3354-3356.

Fries, K., Samanta, S., Orski, S., J. Locklin. 2008. Reversible Colorimetric Ion Sensors Based on Surface-Initiated Polymerization of Photochromic Polymers. *Chem. Comm.*, 6288.

Samanta, S., J. Locklin. 2008. Formation of Photochromic Spiropyran Polymer Brushes via Surface-Initiated, Ring-Opening Metathesis Polymerization:

Reversible Photocontrol of Wetting Behavior and Solvent Dependent Morphology Changes. *Langmuir*, *24*, 9558-9565.

Roberts, M.E., Mannsfeld, S.C.B., Queraltó, N., Reese, C., J. Locklin, Knoll, W., Bao, Z. 2008. Water-stable organic transistors and their application in chemical and biological sensors. *Proc. Natl. Acad. Sci. USA*, *105*, 12134-12139.

Virkar, A., Ling, M.-M., J. Locklin, Bao, Z. 2008. Oligothiophene based organic semiconductors with cross-linkable benzophenone moieties. *Synthetic Metals*, 2008, *158*, 958-963.

Becerril, H.A., Roberts, M.E., Liu, Z., J. Locklin, Bao, Z. 2008. High-Performance Organic Thin Film Transistors through Solution Sheared Deposition of Small Molecule Organic Semiconductors. *Adv. Mater.*, *20*, 2588-2594.

Haley, J., Li, X., Marshall, N., J. Locklin, Geng, Y. 2008. DNA Packaging via Combinative Self-Assembly. *Mol. BioSyst.*, *4*, 515-517.

Jiang, G., Baba, A., Ikarashi, H., Xu, R., J. Locklin, Kashif, K. R., Shinbo, K., Kato, K., Kaneko, F., Advincula, R. 2007. Signal Enhancement and Tuning of Surface Plasmon Resonance in Au Nanoparticle/Polyelectrolyte Ultrathin Films. *J. Phys. Chem. C. 111*, 18687-18694

Shin, T. J., Yang, H., Ling, M., J. Locklin, Yang, L., Lee, B., Roberts, M. E., Mallik, A. B., Bao, Z. 2007. Tunable Thin-Film Crystalline Structures and Field-Effect Mobility of Oligofluorene–Thiophene Derivatives. *Chem. Mater. 9*, 5882-5889.

Liu, S., Briseno, A.L., Mannsfeld, S.C.B., You, W., J. Locklin, Lee, H.W., Xia, Y., Bao, Z. 2007. Selective crystallization of organic semiconductors on patterned templates of carbon nanotubes. *Adv. Funct. Mater.* 17, 2891-2896.

Liu, S., Wang, W.M., Mannsfeld, S.C.B., J. Locklin, Erk, P., Gomez, M., Richter, F., Bao, Z. 2007. Solution-assisted assembly of organic semiconducting single crystals on surfaces with patterned wettability. *Langmuir*, *23*, 7428-7432.

Fujiwara, T., J. Locklin, Bao, Z. 2007. Solution-deposited liquid crystalline semiconductors on a photo-alignment layer for organic thin film transistors. *Appl. Phys. Lett.*, *90*, 232108.

Mannsfeld, S.C.B., J. Locklin, Reese, C., Roberts, M., Lovinger, A.J., Bao, Z. 2007. Probing the Anisotropic Field Effect Mobility of Solution-Deposited Dihexyl-α-Quarterthiophene Single Crystals, *Adv. Funct. Mater. 17*, 1617-1622.

Ling, M.-M., Erk, P., Gomez, M., Koenemann, M., J. Locklin, Bao, Z. 2007. Air-stable n-channel Organic Semiconductors Base on Perylene Diimide Derivatives without Strong Electron Withdrawing Groups. *Adv. Mater.*, *19*, 1123-1127.

Sung, A., Ling, M. M., Tang, M. L., Bao, Z., J. Locklin. 2007. Correlating Molecular Structure to Field-Effect Mobility: The Investigation of Side-Chain Functionality in Phenylene-Thiophene Oligomers and Their Application in Field Effect Transistors. *Chem. Mater*. *19*, 2342-2351.

Tang, M. L.; Roberts, M. E.; Locklin, J. J.; Ling, M. M.; Meng, H.; Bao, Z. "Structure Property Relationships: Asymmetric Oligofluorene-Thiophene Molecules for Organic TFTs. *Chem. Mater.*, 2006, 18, 6250-6257. *This article was featured on the cover.*

Liu, S.; Tok, J.B.H.; Locklin, J.; Bao, Z. 2006. Assembly and Alignment of Metallic Nanorods on Surfaces with Patterned Wettability. *Small, 2,* 1448-1453.

J. Locklin, Ling, M.-M., Sung, A., Roberts, M.E., Bao, Z. 2006. High Performance Organic Semiconductors Based on Fluorene-phenylene Oligomers with High Ionization Potentials. *Adv. Mater. 18*, 2989-2992.
J. Locklin, Bao, Z. 2006. "Effect of Morphology on Organic Thin Film Transistor Sensors" *Anal. Bioanal. Chem.* 384(2), 336-42.

Baba, A., J. Locklin, Xu, R., Advincula, R. 2006. Nanopatterning and Nanocharge Writing in Layer-by-Layer Quinquethiophene/Phthalocyanine Ultrathin Films. *J. Phys. Chem. B.,* 110(1); 42-45.

J. Locklin, Roberts, M.E., Mannsfeld, S.C.B., Bao, Z. 2006. Optimizing the Thin Film Morphology of Organic Field-Effect Transistors: The Influence of Molecular Structure and Vacuum Deposition Parameters on Device Performance. *Journal of Macromolecular Science: Polymer Reviews. 46*, 79.

Millan, M., J. Locklin, Fulghum, T., Baba, A., Advincula, R. 2005. Polymer Thin Film Photodegradation and Photochemical Crosslinking: FT-IR Imaging, Evanescent Waveguide Spectroscopy, and QCM Investigations" *Polymer*, 46(15), 5556-5568.

J. Locklin, Li, D., Mannsfeld, S.C.B., Borken, E.-J., Meng, H., Advincula, R., Bao, Z. 2005. Organic Thin Film Transistors Based on Cyclohexyl-Substituted Organic Semiconductors. *Chem. Mater.* 17(13), 3366-3374.

Deng, S., J. Locklin, Patton, D., Baba, A., Advincula, R. 2005. Thiophene Dendron Jacketed Poly(amidoamine) Dendrimers: Nanoparticle Synthesis and Adsorption on Graphite. *J. Am. Chem. Soc.* 127(6), 1744-1751.

d. Professional activity

American Chemical Society
Materials Research Society
The Fiber Society

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Sudhagar Mani
Asst. Professor, Biochemical Engineering Program, Faculty of Engineering
Asst. Professor, Department of Biological & Agricultural Engineering

Ph.D. 2005 University of British Columbia, Chemical Engineering
M.S. 2000 Indian Institute of Technology (IIT) Kharagpur – Food Engineering
B.E. 1998 Tamil Nadu Agricultural University, Agricultural Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 3140 Engineering Thermodynamics
Fall 2007, 2008, 2009
Spring 2007, 2008, 2009

ENGR 3540 Physical Unit Operations
Spring 2008, 2009

ENGR 8520 Biomass Feedstock Engineering
Spring 2008, 2009

ENGR 8980 Process Modeling & Heterogeneous Catalysis
Spring 2009

c. Scholarship and publication record for past five years

1. Phanphanich, M & **S. Mani.** 2009. Thin layer drying kinetics of forest residues. Bioresources (accepted)
2. **Mani, S.**, S. Sokhansanj, S. Tagore, A. F. Turhollow. 2009. Techno-economic analysis of using stover to supply heat and power to a corn ethanol plant. Part 2: Heat and power generation costs. Biomass and Bioenergy (accepted)
3. Sokhansanj, S., **S. Mani**, S. Tagore, A. F. Turhollow. 2009. Techno-economic analysis of using stover to supply heat and power to a corn ethanol plant. Part 1: Feedstock supply logistics and costs. Biomass and Bioenergy (in press)
4. **Mani, S**., J. Kaster, KC, Das, R. Adolphson. 2009. Development of biomass torrefaction technology to produce biocoal for electricity production. FY2009 Final Project Report – Phase I, TIP- Forest Resources & Products Research Project, Atlanta, GA.
5. Sokhansanj, S., **S. Mani**, A. F. Turhollow, A. Kumar. 2009. Large scale production, collection, and supply of switchgrass (*Panicum virgatum L.*) - Visioning a mature technology. Biofuels, Bioproducts & Biorefining 3:124-141.
6. Singh K., E. W. Tollner, **S. Mani**, L. M. Risse, K. C. Das & J. Worley. 2009. Pelleting of poultry litter fractions with pyrolyzed oil as a binder. Transactions of the ASABE. 52(3): 949-956
7. Sokhansanj, S., A. F. Turhollow, J. Stephen, M. Stumburg, Jim Fenton, **S. Mani**. 2008. Analysis of five simulated straw harvest scenarios. Canadian Biosystems Engineering. 50: 2.27-2.35.
8. Zaini, P., S. Sokhansanj, X. Bi,C. J. Lim, **S. Mani**, S. Melin, J. Kadla. 2008. Density of pellets made from lodge pole pine infested with mountain pine beetle. Canadian Biosystems Engineering, 50: 3.47 – 3.55.

9. Lam, P.S., S. Sokhansanj, X. Bi, C.J. Lim, J. Naimi, M. Hoque, **S. Mani**, A. R. Womac, X. P. Ye, S. Narayan. 2008. Bulk density of wet and dry wheat straw and switchgrass particles. Applied Engineering in Agriculture 24(3): 351-358
10. Singh K., E. W. Tollner, **S. Mani**, L. M. Risse, K. C. Das & J. Worley. 2008. Transforming solid wastes into high quality bioenergy products: Entropy Analysis. Proceedings of the ASME 16th Annual North American Waste to Energy Conference, ASME Press, New York.
11. Singh K., E. W. Tollner, **S. Mani**, L. M. Risse, K. C. Das & J. Worley. 2008. Emergy synthesis of a pyrolysis process. Proceedings of the 5th biennial emergy conference, Center for Environmental Policy, University of Florida Press, FL, USA.
12. **Mani, S.,** S. Jaya, R. Vadivambal. 2007. Optimization of solvent extraction of moringa seed kernel oil using response surface methodology. Food and Bioproducts Processing, 85(C4): 328-335.
13. **Mani, S** and S. Sokhansanj. 2007. Rotary Drum Drying. In: Food Drying: Science and Technology (ed. Hui, et al.) Destech Publications Inc., Pennsylvania, U. S. A.
14. **Mani, S.,** S. Sokhansanj, X. Bi and A. Turhollow. 2006. Economics of producing fuel pellets from biomass. Applied Engineering in Agriculture, 22(3):1-6.
15. **Mani, S**., L. G. Tabil and S. Sokhansanj. 2006. Effects of compressive force, particle size and moisture content on mechanical properties of biomass pellets. Biomass and Bioenergy, 30(7): 648-654.
16. **Mani, S**., L. G. Tabil and S. Sokhansanj. 2006. Specific energy requirement for compacting corn stover. Bioresource Technology, 97(12):1420-1426
17. **Mani, S**., L. G. Tabil, and S. Sokhansanj. 2006. Relaxation characteristics of pelletized wheat and barley straws, corn stover and switchgrass grinds. In: Science in Thermal and Chemical Biomass Conversion, A. V. Bridgewater and D. G. B. Bobcock (Eds.), Vol. 1, pp. 340-350, Newbury Perks, UK: CPL Press.
18. Sokhansanj, S., **S. Mani,** S. Stumborg, R. Samson and J. Fenton. 2006. Production and distribution of cereal straw on the Canadian prairies. Canadian Biosystems Engineering, 48: 3.39-3.46.
19. Sokhansanj, S and **S. Mani**. 2006. Modeling of biomass supply logistics. In: Science in Thermal and Chemical Biomass Conversion, A. V. Bridgewater and D. G. B. Bobcock (Eds.), Vol. 1, pp. 387-403, Newbury Perks, UK: CPL Press.
20. Jaya, S., H. Das and **S. Mani.** 2006. Optimization of maltodextrin and tri calcium phosphate for producing vacuum dried mango powder. International Journal of Food Properties 9(1):1-12.
21. Samson, R., **S. Mani**, R. Boddey, S. Sokhansanj, D. Quesada, S. Urquiaga, V. Reis, C.H. Lem and C. Carpio. 2005. The potential of C4 perennial grasses for developing a global bio-heat industry. Critical Reviews in Plant Science, 24(5-6):461-495.

d. Professional activity

American Society of Agricultural & Biological Engineering (ASABE)
  (1) Chair, Georgia Section of ASABE (2009-2010)
  (2) Vice Chair, FPE 709 Technical Committee
  (3) Member, T-11 Energy Committee
  (4) Sub-task chair – Solid Fuels Standards development
American Institute of Chemical Engineers (AIChE)
Society for Industrial Microbiology (SIM)
Institute for Biological Engineers (IBE)

International Standards Organization (ISO)
(1) Task leader for working group 4 & 5 – Solid Biofuels Standard.

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on engineering graduate committees, serve in the Engineering Graduate Students Selection Committee and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Leidong Mao
Asst. Professor, Faculty of Engineering

Ph.D. 2008 Yale University, Electrical Engineering
B.S. 2001 Fudan University, Materials Science

b. Current workload for typical semester, including specific courses actually taught

CSEE 2220 FUNDAMENTALS OF LOGIC DESIGN
Fall 2008, 2009

ENGR 8310 MEMS DESIGN
Spring 2009

FRES 1020 FRESHMAN SEMINAR
Fall 2009

c. Scholarship and publication record for past five years

Fischer, B., Mao, L., Gungormus, M., Tamerler, C., Sarikaya, M., Koser, H., 2008, Ferro-microfluidic Device for Pathogen Detection, *Proc. of 3rd Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems*, Sanya, Hainan Island, China.

Fischer, B., Mao, L., Gungormus, M., Tamerler, C., Sarikaya, M., Koser, H., 2007, Engineered Biomedical Ferrofluids, *Proc. of 2007 Materials Research Society (MRS) Fall Meeting*, Boston, Massachusetts, USA.

Mao, L., Koser, H., 2007, Overcoming the Diffusion Barrier: Ultra-fast Micro-scale Mixing via Ferrofluids, *TRANSDUCERS &EUROSENSORS' 07, Proc. of 14th International Conference on Solid-State Sensors, Actuators and Microsystems*, Lyon, France.

Mao, L., Koser, H., 2006, Towards Ferrofluidics For μ-TAS and Lab On-A-Chip Applications, *Nanotechnology*, vol. 17, p. S34-S47.

Mao, L., Koser, H., 2005, An Integrated, High Flow Rate MEMS Ferrofluid Pump, *Proc. of 9th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS)*, Boston, Massachusetts, USA.

Mao, L., Koser, H., 2005, An Integrated MEMS Ferrofluid Pump Using Insulated Metal Substrate, *Proc. of 31st Annual Conference of the IEEE Industrial Electronics Society (PCB MEMS Technology Special Session)*, Raleigh, North Carolina, USA.

Mao, L., Koser, H., 2005, Ferrohydrodynamic Pumping In Spatially Traveling Sinusoidally Time-Varying Magnetic Fields, *J. of Magnetism and Magnetic Materials*, vol. 289, pp. 199-202.
Mao, L., Koser, H., 2004, Modeling Ferrofluids in Spatially-Traveling Sinusoidally Time-Varying Magnetic Fields, *Proc. 3rd International Conference on Computational Modeling and Simulation of Materials (CIMTEC)*, Sicily, Italy.

Mao, L., Koser, H., 2004, Ferrohydrodynamic Pumping In Spatially-Traveling Sinusoidally Time-Varying Magnetic Fields, *Proc. of 10th International Conference on Magnetic Fluids*, Sao Paulo, Brazil.

d. Professional activity

Institute of Electrical and Electronics Engineers
American Society for Mechanical Engineers
American Chemical Society

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

---

a. Name, rank, academic discipline, institutions attended, degrees earned

Zhengwei Pan
Asst. Professor, Faculty of Engineering & Department of Physics and Astronomy

Ph.D.	1997	Northwestern Polytechnic University, China, Mater. Sci. & Eng.
M.S.	1993	Shandong University of Technology, China, Mater. Sci. & Eng.
B.S.	1990	Shandong University of Technology, China, Mater. Sci. & Eng.

b. Current workload for typical semester, including specific courses actually taught

ENGR 4740/6740 Biomaterials
Fall 2009

ENGR 8980 Nanomaterials Characterization
Spring 2008

PHYS 4800/6800
Fall 2007, 2009

PHYS 1111 Introductory Physics (Mechanics)
Spring 2009

c. Scholarship and publication record for past five years

Z.J. Gu, M.P. Paranthaman, J. Xu & Z.W. Pan, "Aligned Zinc Oxide Nanorod Arrays Grown Directly on Zinc Foils and Zinc Microspheres by a Low-Temperature Oxidization Method", *ACS Nano* 2, 273-278 (2009).

Z.W. Pan, J.D. Budai, Z.R. Dai, W.J. Liu, M P. Paranthaman & S. Dai," Zinc Oxide Microtowers by Vapor Phase Homoepitaxial Regrowth", *Adv. Mater.* 21, 890-896 (2009). (Cover Art)

Z.J. Gu, M. P. Paranthaman & Z.W. Pan, "Vapor-Phase Synthesis of Gallium Phosphide Nanowires", *Crystal Growth & Design* 9, 525-527 (2009).

Z.J. Gu, F. Liu, J. Y. Howe, M. P. Paranthaman & Z.W. Pan, "Three-Dimensional Germanium Oxide Nanowire Networks", *Crystal Growth & Design* 9, 35-39 (2009).

A. Prasad, S. Mensah, Z.W. Pan, and Y.K. Yap, "Alternative nanostructured sensors: nanowires, nanobelts, and novel nanostructures", in the book "*Sensors Based on Nanostructured Materials*", edited by F.J. Arregui, Springer Science (2008).

J.D. Budai, W. Liu, J.Z. Tischler, Z.W. Pan, D.P. Norton, B.C. Larson, W. Yang & G.E. Ice, "Polychromatic X-ray micro- and nanodiffraction for spatially-resolved structural studies," *Thin Solid Films* 516, 8013-8021 (2008).

J. Xu, R. Ott, A.S. Sabau, Z.W. Pan, F.X. Xiu, J.L. Liu, J.M. Erie & D.P. Norton, "Generation of nitrogen acceptors in ZnO using pulse thermal processing", *Appl. Phys. Lett.* 92, 151112 (2008).
H.G. Zhu, Z. Ma, J.C. Clark, Z.W. Pan, S.H. Overbury, & S. Dai. "Low-temperature CO oxidation on Au/fumed SiO2-based catalysts prepared from Au(en)(2)Cl-3 precursor", *Applied Catalysis A-General* 326, 89-99 (2007).

K. Xiao, J. Tao, Z.W. Pan, A.A. Puretzky, I.N. Ivanov, Z.Q. Liu, S.J. Pennycook & D.B. Geohegan, "Plastic nonvolatile memory devices based on organic single crystal nanowires", *Angew. Chem. Int. Ed. Engl.* 46, 2650-2654 (2007).

I. Ivanov, A. Puretzky, G. Eres, H. Wang, Z.W. Pan, H.T. Cui, R.Y. Jin, J. Howe & D.B. Geohegan, "Fast and highly anisotropic thermal transport through vertically aligned carbon nanotube array", *Appl. Phys. Lett.* 89, 223110 (2006).

M. Monteverde, G. Garbarino, M. Nunez-Requeiro, J. Souletie, C. Acha, X. Jiang, L. Lu, Z.W. Pan, S.S. Xie & R. Egger, "Tomonaga-luttinger liquid and coulomb blockade in multiwall carbon nanotubes under pressure", *Phys. Rev. lett.* 97, 176401 (2006).

H.G. Zhu, J.F. Huang, Z.W. Pan & S. Dai, "Ionothermal synthesis of hierarchical ZnO nanostructures from ionic liquid precursors", *Chem Mater.* 18, 4473-4477

(2006).

W.F. Yan, S. Brown, Z.W. Pan, S.M. Mahurin, S.H. Overbury & S. Dai, "Ultra-Stable Au Nanocatalyst Supported by Nanosized Non-Oxide Substrate", *Angew. Chem. Int. Ed. Engl.* 45, 3614 (2006).

J.S. Wang, V.K. Kayastha, Y.K. Yap, Z.Y. Fan, J.G. Lu, Z.W. Pan, I.N. Ivanov, A.A. Puretzky and D.B. Geohegan, "Low temperature growth of boron nitride nanotubes on substrates", *Nano Lett.* 5, 2528-2532 (2005).

J. Menda, B. Ulmen, L.K. Vanga, V.K. Kayastha, Y.K. Yap, Z.W. Pan, I.N. Ivanov, A.A. Puretzky & D.B. Geohegan, "Structural control of vertically aligned multiwalled carbon nanotubes by radio-frequency plasmas", *Appl. Phys. Lett.* 87, 173106 (2005).

Z.W. Pan, S. Dai & D.H. Lowndes, "Gallium-catalyzed silicon oxide nanowire growth", *Tsinghua Sci. Technol.* 10, 277-287 (2005) (invited article).

W.F. Yan, S.M. Mahurin, Z.W. Pan, S.H. Overbury & S. Dai, "Ultra-stable Au nanocatalysts supported on surface-modified TiO2 nanocrystals", *J. Am. Chem. Soc.* 127, 10480-10481 (2005).

H.G. Zhu, Z.W. Pan, E.W. Hagaman, C.D. Liang, S.H. Overbury & S. Dai, "Facile one-pot synthesis of gold nanoparticles stabilized with bifunctional amino/siloxy liands", *J. Colloid Interface Sci.* 287, 360-365 (2005).

V.K. Kayastha, Y.K. Yap, Z.W. Pan, I.N. Ivanov, A.A. Puretzky & D.B. Geohegan, "High-density vertically aligned multiwalled carbon nanotubes with tubular structures", *Appl. Phys. Lett.* 86, 253105 (2005).

Z.W. Pan, S.M. Mahurin, S. Dai & D.H. Lowndes, "Nanowire array gratings with ZnO combs", *Nano Letters* 5, 723-727 (2005).

Z.W. Pan, S. Dai & D.H. Lowndes, "Straight single-crystalline germanium nanowires and their patterns grown on sol-gel prepared gold/silica substrates", *Solid State Commu.* 134, 251-255 (2005).

Z.W. Pan, S. Dai, C.M. Rouleau & D.H. Lowndes, "Germanium-catalyzed growth of zinc oxide nanowires: a semiconductor catalyst for nanowire synthesis", *Angew. Chem. Int. Ed. Engl.* 44, 274-278 (2005).

H.G. Zhu, Z.W. Pan, B. Chen, B.H. Lee, S.M. Mahurin, S.H. Overbury & S. Dai, "Synthesis of the ordered mixed titania and silica mesostructured monolith for gold catalysts", *J. Phys. Chem. B.* 108, 20038-20044 (2004).

Z.J. Li, Z.W. Pan & S. Dai, "Nitrogen adsorption characterization of aligned multiwalled carbon nanotubes and their acid modification", *J. Colloid Interface Sci.* 277, 35-42 (2004).

F. Zhou, L. Lu, D.L. Zhang, Z.W. Pan & S.S. Xie, "Linear conductance of multiwalled carbon nanotubes at high temperature", *Solid State Commu.* 129, 407-410 (2004).

E. Comini, V. Guidi, C. Martinelli, Z.W. Pan, G. Sberveglieri & Z.L. Wang, "Electrical properties of tin oxide two-dimensional nanostructures", *J. Phys. Chem. B* 108, 1882-1887 (2004).

d. Professional activity

Materials Research Society
American Chemical Society
TMS

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

---

a. Name, rank, academic discipline, institutions attended, degrees earned

John R. Schramski
Asst. Professor, Environmental Engineering, Faculty of Engineering

Ph.D.	2006	University of Georgia, Ecology
M.S.	1993	University of Cincinnati, Mechanical Engineering
B.S.	1989	University of Florida, Mechanical Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 3160 Fluid Mechanics
Fall 1999
Spring 1999
Fall 2000

ENGR 4300 Mechanical Systems II
Spring 2008

ENVE 3210 Energy I
Fall 2009
Fall2010 (scheduled)

ENVE 3220 Energy II
Spring 2010 (scheduled)

ENVE 4230 Ecosystem Energetics
Fall 2010 (scheduled)

c. Scholarship and publication record for past five years

Luper, D, Schramski, JR, Kazanci, C, and Arabnia, HR. 2009. Using Time Series and Pattern Recognition Analysis to Find Repetition and Homogeneity Buried in Complex Ecosystems. *International Society of Ecological Modellers Conference*. Quebec, Canada, Oct. 3-7, 2009.

Schramski, JR, Gattie, DK, Jambeck, J, Rutz, Z, and Rabe, J. 2009. Modeling a Trophically Balanced Thermodynamic Economy: Considerations of Energy Networks in a Fossil Energy Free Economic and Corresponding Ecological System. Poster Presentation, *International Society of Ecological Modellers Conference*. Quebec, Canada, Oct. 3-7, 2009.

Schramski, JR, Tollner, EW, Gattie, DK, Patten, BC, Jambeck, J. 2009 Conservation Laws: Interdisciplinary Modeling Lessons in Engineering and Ecological Compartment Analysis Using First Principles and a Case Study of Ecosystem Energetics. *International Society of Ecological Modellers Conference*. Quebec, Canada, Oct. 3-7, 2009.

Kazanci, C, Ma, Q, Tollner, EW, Matamba, L., Schramski, JR, Patten, BC. 2009. Dynamic Network Analysis: Throughfow, Storage, Cycling and Indirect Effects. *International Society of Ecological Modellers Conference*. Quebec, Canada, Oct. 3-7, 2009.

Tollner, EW, Schramski, JR, Kazanci, C, and Patten, B 2009. Implications of Network Particle Tracking (NPT) for Ecological Model Interpretation. *Ecological Modeling* 220(16):1904-1912.

Matamba, L, Kazanci, C, Schramski, JR, Alexander, P, Blessing, M, and Patten, BC, Throughflow Analysis: A Stochastic Approach. *Ecological Modelling*, (2009), doi:10.1016/j.ecolmodel.2009.07.001.

Schramski JR, Patten BC, Kazanci C, Gattie DK, and Kellam NN, The Reynolds transport theorem: Application to ecological compartment modeling and case study of ecosystem energetics. *Ecological Modelling* (2009), doi:10.1016/j.ecolmodel.2009.08.009.

Tollner, EW, Kazanci, C, Schramski JR, and Patten BC, Controls Systems Approaches to Ecological Systems Analyses – Invariants and Frequency Response. *Ecological Modelling*, (2009), doi:10.1016/j.ecolmodel.2009.08.002April 2009.

Luper, D, Schramski, JR, Kazanci, C, and Arabnia, H. 2009. Repetition and Homogeneity Buried in Complex Ecosystems: Using Pattern Recognition in Ecological Network Analysis. *Computational and Applied Mathematics & Applications in Science and Engineering Conference.* Athens, GA, August 3-5, 2009.

Tollner, EW, Schramski, JR, Kazanci, C, and Patten, BC. 2009. Control System Approaches to Ecological Systems Analysis. *Computational and Applied Mathematics & Applications in Science and Engineering Conference.* Athens, GA, August 3-5, 2009.

Tollner, EW, Kazanci, C, and Schramski JR, Network Particle Tacking (NPT) for Ecosystem Thermodynamics and Risk Analysis. *American Society of Engineering Education Conference*, Austin Texas, June 14-17, 2009. Won first place in Biological Engineering Section which included a $250 award stipend.

Schramski, JR, Tilley DR, and Carter TL. 2009. Comparative Embodied Energy Analysis to Assess Green Roof Sustainability. *International Greening Rooftops for Sustainable Communities Conference*, Atlanta, GA, June 4-7, 2009.

Schramski JR, Tilley DR, Carter TL, Rustagi, N. 2008. Data collection, assumptions, and synthesis for comparative embodied energy analysis for green engineering. *International Society for the Advancement of Emergy Research (ISAER.org).* Gainesville, FL, January 31 – February 2, 2008.

Rustagi N, Tilley DR, Schramski JR. 2008. Emergy analysis of living green roofs. *International Society for the Advancement of Emergy Research (ISAER.org).* Gainesville, FL, January 31 – February 2, 2008.

Bata SA, Borrett SR, Patten BC, Whipple SJ, Schramski JR, Gattie DK. 2007. Equivalence of throughflow- and storage-based environs, *Ecological Modelling, 206(3-4):400-406.*

Gattie DK, Schramski JR. 2007. Environs, ascendency, exergy and emergy: System-level properties for ecosystem analysis and the need for synthesis in ecological engineering. *AEES Annual Conference*. Manhattan, KS, May 23-25, 2007.

Whipple SJ, Borrett SR, Patten BC, Gattie DK, Schramski JR, Bata SA. 2007. Indirect effects and distributed control in ecosystems: Comparative network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Time series analysis. *Ecological Modelling, 206(1-2):1-17*.

Schramski JR, Gattie DK, Patten BC, Bata SA, Whipple SJ, Borrett SR, Fath BD. 2007. Indirect effects and distributed control in ecosystems: Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Time series analysis. *Ecological Modelling, 206(1-2):18-30*.

Gattie DK, Schramski JR, Bata SA. 2006. Analysis of microdynamic environ flows in an ecological network. *Ecological Engineering, 28(3):187-204.*

Schramski JR, Gattie DK, Patten BC, Borrett SR, Fath BD, Thomas CR, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Steady-state analysis. *Ecological Modelling, 194(1-3):189-201*.

Gattie, DK, Schramski JR, Borrett SR, Patten BC, Bata SA, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Steady-state analysis. *Ecological Modelling, 194(1-3):162-177*.

Gattie DK, Schramski JR, Bata SA. 2005. Ecological Network Analysis: An analytical methodology for mathematically deriving holistic ecosystem properties. *ASAE International Meeting*. Orlando, FL, July 17-20, 2005.

Gattie DK, Schramski JR, Bata SA. 2005. Analysis of microdynamic environ flows in an ecological network. *AEES Annual Meeting*. Columbus, OH, May 18-20, 2005.

Gattie DK, Schramski JR, Bata SA. 2005. Holistic analysis of ecosystem properties and complexity. *IBE Annual Meeting*. Athens, GA, Mar. 4-6, 2005.

Schramski JR, Gattie DK, Patten BC, Borrett SR, Fath BD, Thomas CR, Whipple SJ. 2004. Indirect effects and distributed control in ecosystems: Network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Steady-state analysis. *European Conference on Ecological Modelling*. Bled, Slovenia, Sept. 29-Oct. 1, 2004.

Schramski JR, Gattie DK, Patten BC, Borrett, SR, Bata SA, Fath BD, Whipple SJ. 2004. Indirect effects and distributed control in ecosystems: Distributed Control in the Environ Networks of a Seven-Compartment Model of Nitrogen Flow in the Neuse River Estuary, USA — Time series analysis. *European Conference on Ecological Modelling*. Bled, Slovenia, Sept. 29-Oct. 1, 2004.

Borrett SR, Gattie DK, Patten BC, Whipple SJ, Schramski JR, Bata S. 2004. Throughflow decomposition and indicators of ecosystem complexity in Network Environ Analysis. *Ecosystem Complexity Workshop*. Bled, Slovenia, Sept. 25-26, 2004.

Gattie DK, Schramski JR, Borrett SR, Patten BC, Whipple SJ. 2004. Network (output) environ analysis of a nitrogen flow model. *First Annual UGA Engineering Conference*. Athens, GA, Oct. 28, 2004.

Patten BC, Gattie DK, Whipple SJ, Schramski JR, Borrett SR, Turk HJ, Fath BD. 2004. Environs and network environ analysis: introduction and overview. *European Conference on Ecological Modelling*. Bled, Slovenia, Sept. 28-Oct. 1, 2004.

Gattie DK, Schramski JR, Borrett SR, Patten BC, Turk HJ. 2004. Network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA: Steady-state analysis. *European Conference on Ecological Modelling*. Bled, Slovenia, Sept. 28-Oct. 1, 2004.

Gattie DK, Schramski JR, Borrett SR, Patten BC, Turk HJ, Whipple SJ. 2004. Analysis of ecosystem as a network of environments. *AEES*. Fayetteville, AR, 2004.

d. Professional activity

International Society of Ecological Modellers
Georgia Professional Engineer, License #021404

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Andrew T. Sornborger
Assoc. Professor, Faculty of Engineering, Department of Mathematics

Ph.D. 1995 Brown University, Physics
B.S. 1985 Dartmouth College, Computational Linguistics

b. Current workload for typical semester, including specific courses actually taught

MATH2250 Calculus for Engineers and Scientists, Part I
Fall 2004, 2008
MATH2260 Calculus for Engineers and Scientists, Part II
Spring 2005, 2006
MATH2700 Ordinary Differential Equations
Spring2004, 2009
MATH3500 Linear Algebra
Spring 2008
MATH4700/6700 Qualitative Differential Equations
Fall 2006
MATH4500/6500 Numerical Analysis
Spring 2007
MATH4780/6780 Mathematical Biology
Spring 2007
MATH4900 Transforms, Topics in Mathematics
Fall 2009
MATH8850 VIGRE Cardiac Physiology Group
Fall 2004, 2005
Spring 2004, 2005

ENGR4980 Undergraduate Independent Study
Fall 2005 Blake Windsor, Mouse Brain Imaging
Fall 2005 Amit Salkar, Mouse Brain Imaging
ENGR6930 Experimental Methods for Engineers
Spring 2004, 2006
ENGR8980 Special Topics in Engineering, Mathematical Physiology
Spring 2005
ENGR8980 Graduate Independent Study
Fall 2005 Prince Odame, Multivariate Imaging Data Analysis
Fall 2008 Judith Navick, Multivariate Statistical Analysis

c. Scholarship and publication record for past five years (reverse chronological order)

Tao, L. and A. Sornborger, 2009. Dimensionally-reduced visual cortical network model predicts network response and connects system- and cellular-level descriptions. *J. Comput. Neurosci.* online: DOI 10.1007/s10827-009-0189-8.

Sornborger, A., J. Broder, A. Majumder, G. Srinivasamoorthy, E. Porter, S.S. Reagin, C.H. Keith and J.D. Lauderdale, 2008. Estimating weak ratiometric signals in imaging data. II. Meta-analysis with multiple, dual-channel datasets. *J.*

Opt. Soc. Am. A 25:2185-2194. Selected for inclusion in *Virtual J. Biomed. Opt.* 3, *Virtual J. Biophys. Res.* 16.

Xu, J., Sornborger, A., Lee, J.K. and Shen, P., 2008. Drosophila TRPA channel modulates sugar-stimulated neural excitation, avoidance and social response. *Nat. Neurosci.* 11:676-682.

Sornborger, A. and M. Adams, 2008. The evolution of fidelity in sensory systems. *J. Theor. Biol.* 253:142-150.

Broder, J., A. Majumder, E. Porter, G. Srinivasamoorthy, C.H. Keith, J. Lauderdale and A. Sornborger, 2007. Estimating weak ratiometric signals in imaging data. I. Dual-channel data. *J. Opt. Soc. Am. A* 24:2921-2931.

Sornborger, A., 2007. Higher-order operator splitting methods for deterministic parabolic equations. *Int. J. Comp. Math.* 84:887-893.

Fan, X., A. Majumder, S.S. Reagin, E. Porter, A. Sornborger, C.H. Keith and J.D. Lauderdale, 2007. New statistical methods enhance imaging of cameleon FRET in cultured zebrafish spinal neurons. *J. Biomed. Opt.* 12:034017. Selected for inclusion in *Virtual J. Biol. Phys. Res.* 13.

Adams, M. and A. Sornborger, 2007. Analysis of a certain class of replicator equations. *J. Math. Biol.* 54:357-384.

Wireman, J., M. Lowe, A. Spiro, Y.Z. Zhang, A. Sornborger, and A.O. Summers, 2005. Quantitative, longitudinal profiling of the primate fecal microbiota with flow cytometry microarrays. *Environmental Microbiology* 00915:1462-2920.

Sornborger, A., T. Yokoo, A. Delorme, C. Sailstad and L. Sirovich, 2005. Extraction of average and differential dynamical responses in stimulus-locked experimental data. *J. Neurosci. Meth.* 141:223-229.

Sornborger, A., A. Cleland and M. Geller., 2004. Superconducting phase qubit coupled to a nanomechanical resonator: beyond the rotating-wave approximation. *Phys. Rev. A* 70:052315. Selected for inclusion in *Virtual J. of Quant. Info.* 4.

d. Professional activity

Society for Neuroscience
Society of Industrial and Applied Mathematicians
American Mathematical Society

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students

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a. Name, rank, academic discipline, institutions attended, degrees earned

Ernest W. Tollner
Professor, Department of Biological & Agricultural Engineering
Member, Faculty of Engineering

Ph.D. 1980 Auburn University, Bio Systems Engineering
MSAE 1974 University of Kentucky, Agricultural Engineering
BSAE 1972 University of Kentucky, Agricultural Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 3420 Soil Mechanics

Every Spring

ENGR 3440 Water Management
Every Spring

ENGR 4210/6210 Linear Systems

Every Fall

ENGR 4920 Senior Design
Spring 2001-Present

ECOL 8710 Environmental Law Practicum
Spring 2008

ENGR 8750 Advanced Heat Transfer
Spring 2008, 2009

c. Scholarship and publication record for past five years

Carter, T., C.R. Jackson, A. Rosemond, C. Pringle, D. Radcliffe, E.W. Tollner, J. Maerz, D. Leigh and A. Trice. 2009. Beyond the urban gradient: barriers and opportunities for timely studies of urbanization effects on aquatic ecosystems. J. N. Am. Benthol. Soc. (IN PRESS).

Li, C., R. Gitaitis, E. W. Tollner, P. Sumner and D. MacLean. 2009. Onion sour skin detection using a gas sensor array and support vector machine. Sensing and Instrumentation for Food Quality and Safety (IN PRESS).

Tekeste, M.Z., E.W. Tollner, R.L. Raper, T.R. Way and C.E. Johnson. 2009. Non-linear finite element analysis of cone penetration in layered sandy loam soil – Considering precompression stress state. *Journal of Terramechanics*. 46(5):229-239.

Tollner, E.W., Kazanci, C., J. Schramski and B.Patten. 2009. Implications of Network Particle Tracking (NPT) for Ecological Model Interpretation. *Ecological Modeling* 220(16):1904-1912.

Tollner, E.W., Kazanci, C., J. Schramski and B.Patten. 2009. Control System Approaches to Ecological Systems Analysis: Invariants and Frequency Response. *Ecological Modeling* (IN PRESS).

Kazanci, C. L. Matamha, E.W. Tollner. 2008. Cycling in ecosystems: An individual based approach. *Ecological Modeling* (In Press).

Mosqueda, M., E W Tollner, R W mcclendon, G. Boyhan and C. Li. 2008. Simulating onion packinghouse product flow for performance evaluation and education, *Bioresource Engineering* 102(2):135-142.

Tollner, E.W., D. Meyer, S. Triminio-Meyer[2] and J. J. Molnar. 2008. Spreadsheet tool for computing levee pond excavation costs for developing countries. *Aquacultural Engineering* 39(2-3):122-126.

Ssegane, H., E W Tollner and S. Mccutcheon. 2008. Estimation of micro-watershed topographic parameters using earth observatory tools. *Applied Engineering in Agriculture*, 24(6):763-766.

Hilten, R. H., T. M. Lawrence, and E. W. Tollner .2008. Modeling stormwater runoff from green roofs with HYDRUS-1D. *Journal of Hydrology*, 358(3-4):288-293.

Bhandarkar, S.M., X. Luo, R.F. Daniels and E.W. Tollner. 2008. Automated planning and optimization of lumber production using machine vision and computer tomography. *Transactions on Automation Science and Engineering* 5:1-18.

K.C. Das, P.A. Annis, E.W. Tollner and S. Dudka .2006. Technical and economic aspects of utilizing fibrous wool composts in horticulture. Journal of Applied Horticulture, 8(2): 165-169. (not notified until 2007).

Bhandarkar SA, Chowdhury AS, Tang Y, and E W Tollner. 2007. Computer vision guided virtual craniofacial reconstruction . Computerized Medical Imaging and Graphics 31 (6): 418-427.

Meyer, S., J. Molnar, D. Meyer. and E. Tollner. 2007. Tilapia fingerling production in Honduras. Journal of Applied Aquaculture 19 (2): 1-27.

Tollner, E.W. and C. Kazanci. 2007. Defining an ecological thermodynamics using discrete simulation approaches Ecological modeling 208(1): 68-79**.**

Tekeste, M.Z., R.L.Raper and E.W. Tollner, T.R. Way. 2007. Finite element analysis of cone penetration in soil for prediction of hardpan location. Trans. ASABE 50(1): 23-31.

Birkett, C., E.W. Tollner and D. Gattie. 2007. Total Suspended Solids and Hydraulic Regime effects on periphyton growth in a laboratory flume. Transactions of the ASABE 50 (3): 1095-1104.

Tollner, E.W., S.E. Prussia and W. Florkowski. 2006. Modeling Product Flow Through a Generic Postharvest Distribution System. Journal of Food Distribution Research. 37(2):23-34.

Bhandarkar SM, Luo XZ, Daniels R, and E.W. Tollner. 2006. A novel feature-based tracking approach to the detection, localization, and 3-D reconstruction of internal defects in hardwood logs using computer tomography. Pattern Analysis and Applications 9 (2-3): 155-175.

Tollner, E.W. and T.C. Rasmussen. 2005. Simulated moving bed forms effects on real-time in-stream sediment concentration measurement with densitometry. Jour. of Hydraulic Engineering. 131(12):1141-1144.

Pablo R. Martinez, Joseph Molnar, Elizabeth Trejos, Daniel Meyer, Suyapa Triminio Meyer & William Tollner . 2005. Cluster Membership as a Competitive Advantage in Aquacultural Development: Case Study of Tilapia Producers in Olancho, Honduras. Journal of Aquacultural Economics 8(5-6): 281-294.

Bhandarkar SM, X.Z. Luo, R. Daniels and E.W. Tollner. 2005. Detection of cracks in computer tomography images of logs. Pattern Recognition Letters 26 (14): 2282-2294.

Gattie D.K., E.W. Tollner, T.L. Foutz. 2005. Network environ analysis: A mathematical basis for describing indirect effects in ecosystems. *Trans ASAE, Vol. 48(4):1645-1652.*

Tollner, E.W., R. Gitiatus, K. Seebold and B. Maw. 2005. Experiences with an onion inspection machine. Applied Engineering in Agriculture 21 (5): 907-912.

Tollner, E.W. and K.C. Das. 2004. Predicting Runoff from a Yard Waste Windrow Composting Pad. Transactions of the ASAE Vol. 47(6): 1953-1961.

van Donk, SJ; Tollner, EW; Steiner, JL, Soil temperature under a dormant bermudagrass mulch: Simulation and measurement. Transactions of the ASAE, 47 (1): 91-98 JAN-FEB 2004.

Ezeike, GOI; Hung, YC; Tollner, EW 2004. Laser-based positioning and drilling system for placing a temperature sensor into a food sample Appl Eng Agric, 20 (3): 329-334 May 2004.

Tollner, EW. 2004. Efficacy and economics of placing X-ray machines in an onion packinghouse Rec Res Dev Crop Sci, 1: 55-69 Part 1

Tollner, E.W., D. Meyer, S. Triminio-Meyer, B. Verma, G. Pilz and J.J. Molnar. 2004. Spreadsheet tools for developing surface water supplies for freshwater fish in developing countries. Jour. Of Aquacultural Engineering 31(1-2):31-49.

d. Professional activity

American Society for Engineering Education
American Society of Agric. and Biol. Engineers
- Publication director
  - Co-chair of International Water Quality Conference (Chile, 2009, Costa Rica, 2010).

Contributor to the Fundamentals of Engineering Exam development
Contributor to the Agricultural PE exam development

Operating Engineer, UGA BAE-Physical Plant Composting yard

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students
Currently serving as FE Graduate Coordinator

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a. Name, rank, academic discipline, institutions attended, degrees earned

Joachim Walther
Asst. Professor, Faculty of Engineering

Ph.D.	2008	University of Queensland (Australia), Engineering Education
Dipl.-Ing.	1998	University of Darmstadt (Germany), Mechanical Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 1010 Synthesis and Design Studio

Fall 2009

ENGR 1020 Synthesis and Design Studio

Spring 2010

ENGR 2010 Synthesis and Design Studio

Spring 2010

c. Scholarship and publication record for past five years

Jaensch, J., Birkhofer, H., & Walther, J. (2005, August). *The development of design methods and expertise.* Paper presented at the International Conference on Engineering Design ICED 2005, Melbourne, Australia.

Kellam, N., & Walther, J. (2009, June 14 - 17). *Complex Systems: What Are They and Why Should We Care?* Paper presented at the 2009 American Society for Engineering Education Annual Conference, Austin, TX.

Mann, L., Walther, J., & Radcliffe, D. (2005, 26. - 29. Sept.). *Sustainable design practitioners: Why they must be at the centre of discussions on sustainable design education?* Paper presented at the 4th Global Colloquium on Engineering Education GCEE 2005, Sydney, Australia.

Robertson, B. F., Walther, J., & Radcliffe, D. F. (2007). Creativity and the Use of CAD Tools: Lessons for Engineering Design Education From Industry. *Journal of Mechanical Design, 129*(7), 753-760.

Sochacka, N., Walther, J., Kavanagh, L., & Jolly, L. (2009, July 20 - 23). *Confronting the methodological challenges of engineering practice research: A three-tiered model of reflexivity.* Paper presented at the Research on Engineering Education Symposium (REES), Cairns, Australia.

Walther, J. (2008). *A complex systems approach to engineering competence.* University of Queensland, Brisbane.

Walther, J., Boonchai, C., & Radcliffe, D. (2008). *A holistic view on the development of engineering students' flexible and creative problem solving.* Paper presented at the SEFI 36th Annual Conference, Aalborg, Denmark.

Walther, J., Boonchai, C., & Radcliffe, D. F. (2008). *Understanding fundamental assumptions underlying educational research through the lens of a cultural 'Verfremdungseffekt'.* Paper presented at the Research on Engineering Education Symposium (REES), Davos, Switzerland.

Walther, J., Kellam, N., Radcliffe, D., & Boonchai, C. (2009). *Integrating students' learning experiences through deliberate reflective practice*. Paper presented at the 39th ASEE/IEEE Frontiers in Education Conference.

Walther, J., Kellam, N., & Radcliffe, D. F. (2009, July 20 - 23). *Influences of cohort effects on engineering students' competence formation.* Paper presented at the Research on Engineering Education Symposium (REES), Cairns, Australia.

Walther, J., Mann, L., & Radcliffe, D. (2005, 26. - 29. Sept.). *Global engineering education: Australia and the bologna process.* Paper presented at the 4th Global Colloquium on Engineering Education GCEE 2005, Sydney, Australia.

Walther, J., & Radcliffe, D. (2006a, 10th – 13th December). *Accidental Competencies: Is engineering education simply a complex system?* Paper presented at the 17th Annual Conference of the Australasian Association for Engineering Education, Auckland, New Zealand.

Walther, J., & Radcliffe, D. (2006b). Challenging the Paradigm of Outcomes-Based Education: Accidental Competency Acquisition in Engineering Education, *Effective Teaching and Learning Conference*. Brisbane, Australia.

Walther, J., & Radcliffe, D. (2006c). *Engineering education: Targeted learning outcomes or Accidental Competencies?* Paper presented at the 2006 American Society for Engineering Education Annual Conference, Chicago.

Walther, J., & Radcliffe, D. (2006d, 10th – 13th December). *A multi-scale systems model of engineering competence - a way to overcome the competence dilemma in engineering education?* Paper presented at the 17th Annual Conference of the Australasian Association for Engineering Education, Auckland, New Zealand.

Walther, J., & Radcliffe, D. (2007a). *Accidental Competency Formation: An Investigation of Behavioral Learning in Engineering Education.* Paper presented at the 2007 American Society for Engineering Education Annual Conference, Hawaii.

Walther, J., & Radcliffe, D. (2007b). *Analysis of the use of an Accidental Competency discourse as a reflexive tool for professional placement students.* Paper presented at the Frontiers in Education Conference, Milwaukee, Wisconsin.

Walther, J., & Radcliffe, D. (2007c). The Competence Dilemma in Engineering Education: Moving beyond simple Graduate Attribute mapping. *Australasian Journal of Engineering Education, 13*(1).

Walther, J., & Radcliffe, D. (2008, June 22 - 25). *Approaching questions of research quality in an interpretive investigation of engineering students' competence formation.* Paper presented at the 2008 American Society for Engineering Education Annual Conference, Pittsburgh, PA.

Walther, J., & Radcliffe, D. (2008 (withdrawn), February 3-5). *An analysis of educational research methods from a complex systems perspective.* Paper presented at the Complexity Science and Educational Research Conference, Athen, GA.

Walther, J., Robertson, B., & Radcliffe, D. (2007). *Avoiding the potential negative influence of CAD tools on the formation on students' creativity.* Paper presented at the 8th Annual Conference of the Australasian Association for Engineering Education, Melbourne, Australia.

d. Professional activity

American Society for Engineering Education

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students