

## College of Engineering and Computing

### *Executive Dean and Distinguished*

<i>Professor</i>	<b>Vish Prasad</b>
<i>Dean, School of Computing and Information Sciences</i>	<b>Yi Deng</b>
<i>Associate Dean for Academic Programs</i>	<b>L. David Shen</b>
<i>Associate Dean for Outreach</i>	<b>Gustavo Roig</b>
<i>Associate Dean of Graduate Studies</i>	<b>Jainendra Navlakha</b>
<i>Associate Dean, School of Computing and Information Sciences</i>	<b>Masoud Milani</b>
<i>Acting Director, Corporate and Global Programs</i>	<b>Jainendra Navlakha</b>

The College of Engineering and Computing is committed to educate professionals who can serve industry and the community at large in a wide variety of fields, as well as conduct innovative basic and applied research that meets the technical needs of industry and government, improves the quality of life, and contributes to the economic viability of Florida, the Nation, and the world.

The College of Engineering and Computing consists of one school, the School of Computing and Information Sciences, and six academic departments: Biomedical Engineering, Civil and Environmental Engineering, Construction Management, Electrical and Computer Engineering, Industrial and Systems Engineering, and Mechanical and Materials Engineering. These academic departments offer programs leading to the Bachelor of Science, Master of Science and Doctor of Philosophy degrees.

The College has two institutes and thirteen centers supporting its academic and research programs. The institutes are the Advanced Materials Engineering Research Institute (AMERI) and the Telecommunications and Information Technology Institute (IT2). The centers are the Bioinformatics Research Group (BioRG), Center for Advanced Distributed Systems Engineering, Center for Advanced Technology and Education (CATE), Center for Diversity in Engineering (CDE), Center for Emerging Technology for Advanced Information Processing and High-Confidence Systems, Center for the Study of Matter at Extreme Conditions (CeSMEC), Engineering Manufacturing Center (EMC), Eugenio Pino and Family Global Entrepreneurship Center, Future Aerospace Science and Technology Center (FAST), High Performance Database Research Center and the Lehman Center for Transportation Research (LCTR). Two major university centers, the Applied Research Center (ARC) and International Hurricane Research Center (IHRC), work very closely with the College of Engineering with many joint appointments at the faculty level.

The College has recently created an open-access Motorola Nanofabrication Research Facility to conduct research in nanoelectronics, bio/nanosensors and nanomaterials. In addition, the FIU College of Engineering has developed many collaborations with the industry and hospitals in Florida and across the nation.

The programs of the College are directed towards the practical use of scientific, engineering, and technical principles to meet the objectives of industry, business, government and the public.

The College provides each student with the opportunity to develop a high level of technical skills and to obtain an education, which will prepare him or her for a rewarding career and personal growth.

Underlying the programs of the College is a recognition that the growing impact of technology upon the quality of life is increasing and that the proper application of technology is critical to meeting current and emerging human needs. The College faculty is actively engaged with business, industry and government. Faculty members also participate in a variety of basic and applied research projects in areas such as energy, transportation, solid waste disposal, biotechnology, biomedical devices and instrumentation, computer engineering, artificial intelligence, manufacturing, robotics telecommunications, micro-electronics, nano-electronics, nanotechnology, neuro-sciences/engineering, modeling and simulation, construction engineering, materials, structural systems, virtual prototyping, systems modeling, information technology, environmental sciences and engineering, image processing, engineering education, etc.

### **Doctor of Philosophy**

The College offers Doctor of Philosophy degrees in Biomedical Engineering, Civil Engineering, Computer Science, Industrial and Systems Engineering, Electrical Engineering, Mechanical Engineering, and Materials Science and Engineering.

Areas of study in Biomedical Engineering include:

- Biomechanics, Biomaterials, and Medical Devices
- Bioinstrumentation, and Biomedical Image/Signal Processing
- Drug Delivery and Tissue Engineering
- Medical Physics and Nuclear Medicine
- Bio-nanotechnology and Systems Biology

Areas of study in Civil Engineering include:

- Transportation Engineering
- Environmental Sciences and Engineering
- Structural Engineering
- Geotechnical Engineering
- Construction Engineering and Management

Areas of study in Electrical Engineering include:

- Biomedical Sciences and Engineering
- Micro-Electronics, Nano-Electronics and Photonics
- Computer Engineering
- Systems and Controls
- Electromagnetics and Nanomagnetism
- Power Systems
- Telecommunications and Networking
- Digital Signal and Image Processing

Areas of study in Industrial and Systems Engineering are:

- Enterprise Systems Engineering
- Technology Entrepreneurship
- Information Systems for ISE

Areas of study in Mechanical and Materials Engineering include:

- Thermo/Fluids Sciences
- Biomedical Engineering

- Mechanics of Materials
- Nanostructured Materials
- Ceramics and Electronic Materials
- CAD/CAM
- Manufacturing
- Modeling and Simulation
- Nano Devices

### Master of Science Degree Programs

The College offers Master of Science degrees in:

- Biomedical Engineering
- Civil Engineering
- Computer Engineering
- Computer Science
- Construction Management
- Electrical Engineering
- Engineering Management
- Environmental Engineering
- Environmental and Urban Systems
- Industrial and Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Technology Management
- Telecommunications and Networking

### Corporate and Global Programs

In partnership with national and international corporations and universities, along with Continuing and Professional Studies, the College of Engineering and Computing offers several of its graduate programs off-campus. These programs are offered at the partner's site both in the USA and abroad, particularly Latin America, the Caribbean and China.

Current Global Programs offered include MS in Engineering Management with specializations in Biomedical Technology, Information Systems, and Manufacturing, MS in Computer Engineering, MS in Technology Management, MS in Construction Management, and MS in Telecommunications and Networking.

Students enrolled in these programs are considered regular FIU students; hence, they must meet university admission requirements and are given full access to the university's facilities.

### Distance Learning Education

Florida Engineering Education Delivery Systems (FEEDS) provides graduate engineering courses to place-bound professionals via CD, videotape, ITFS, and web-based asynchronous learning modules.

### Research Centers and Institutes

Research spans from single discipline to multidisciplinary research in the College of Engineering and Computing. Thus, the College, through its research centers and institutes, has established many collaborative and cooperative partnerships with other units in the university as well as with local industry.

The research units involved in these efforts include:

- Advanced Materials Engineering Research Institute (AMERI)
- Applied Research Center (ARC)
- Bioinformatics Research Group (BioRG)
- Center for Advanced Distributed Systems Engineering

- Center for Advanced Technology and Education (CATE)
- Center for Diversity in Engineering (CDE)
- Center for Emerging Technology for Advanced Information Processing and High-Confidence Systems
- Center for the Study of Matter at Extreme Conditions (CeSMEC)
- Distributed Multimedia Information Systems Laboratory
- Engineering Manufacturing Center (EMC)
- Future Aerospace Science and Technology Center (FAST)
- High Performance Database Research Center
- International Hurricane Research Center (IHRC)
- Lehman Center for Transportation Research (LCTR)
- Motorola NanoFabrication Research Facility
- Telecommunications and Information Technology Institute (IT2).

### Academic Support Services

The area of academic support services is responsible for the coordination of academic advising and student services the College of Engineering and Computing. Students are informed of educational opportunities such as scholarships, tuition waivers, and campus resources. It serves as a liaison between the academic departments and the student support services university wide and facilitates the registration process in order to make sure that the students adhere to the College guidelines.

### Admission Requirements

Prospective students seeking a graduate degree in the College must satisfy all university admission requirements as well as the specific program requirements. Each department evaluates candidates for admission to its programs. Prospective students should refer to the appropriate section of the catalog for specific admission requirements and for contact information of the Graduate Programs Directors.

Biomedical Engineering: (305) 348-3019

Dr. Malek Adjouadi

Civil and Environmental Engineering: (305) 348-3821

Dr. Fang Zhao

Construction Management: (305) 348-3172

Dr. Syed Ahmed

Electrical and Computer Engineering: (305) 348-7566

Dr. Hao Zhu

Industrial and Systems Engineering: (305) 348-3491

Dr. Shih-Ming Lee, Engineering Management

Dr. Chin-Sheng Chen, Industrial and Systems Engineering

Mechanical and Materials Engineering: (305) 348-1701

Dr. Arvind Agarwal

School of Computing and Information Sciences

Dr. Xudong He

(305) 348-1831

Telecommunications and Networking: (305) 348-3987

Dr. Nikki Pissinou

### Admitted Student Procedures

A student who has been accepted to a degree program in the College must meet with the Department's Graduate Program Director prior to the enrollment in the first class.

Enrolled students must choose an advisor during their first semester in the program.

Continued contact (at least once per semester) with the advisor is required to review progress and select courses for each succeeding semester.

Courses taken without the required prerequisites and co-requisites, or without the consent of the advisor, will be dropped automatically before the end of the term, resulting in a grade of "DR" or "DF".

Scientific Laboratory Fees are assessed for certain courses where laboratory classes are part of the curriculum. Specific information on scientific laboratory fees may be obtained from the University Financial Services.

### Fellowships, Assistantships, and Scholarships

The College of Engineering and Computing offers a variety of fellowships, assistantships, and scholarships to qualified students. These awards are highly competitive; hence, prospective students are urged to apply and submit all required records and scores as early as possible so they can be considered for these awards.

The amounts of these awards vary depending on the type of the award, but they may provide full tuition and a monthly stipend. Visit: [www.eng.fiu.edu](http://www.eng.fiu.edu) for additional information.

### Policies, Requirements, and Regulations

The University, the University Graduate School, and the College of Engineering and Computing have a set of guidelines to protect the student's rights and to ensure a timely graduation. Students must become familiar with all University, the University Graduate School, and College's graduate procedures. These procedures are described in the University's Student Handbook, this catalog and at <http://gradschool.fiu.edu>.

The programs, policies, requirements and regulations listed in the catalog are continually subject to review to serve the needs of the University's various publics, and to respond to the mandates of the FIU Board of Trustees and the Florida Legislature. Changes may be made without advance notice.

Florida International University and the College adhere to opportunity practices, which conform to all laws against discrimination and are committed to non-discrimination with respect to race, color, creed, age, handicap, sex, marital status, or nationality. Additionally, the University is committed to the principle of taking positive steps necessary to achieve the equalization of educational and employment opportunities.

### College of Engineering Dismissal Policy

A student who has been dismissed from the University for the first time may see the Graduate Program Director to begin the appeal procedure. The Director will determine if the student is eligible to appeal the dismissal or if there is a way to lift the dismissal. If the student is eligible, he or she must make an appointment to see the chairperson or associate chairperson. The student must bring a letter stating when he or she was dismissed the first time and what he or she is going to do to ensure that he or she is not dismissed a second time. If the chairperson determines that the student is worthy of reinstatement, he or she will prepare and sign a memo for the College Dean's consideration stating the conditions for the student to be reinstated. The student may be readmitted on

academic probation upon the approval of the Dean of the University Graduate School. If the student does not meet these conditions, he or she will be dismissed a second and final time from the program. The student must also sign an agreement stating that he or she understands that the department will not allow a second reinstatement if the student is dismissed again.

Any student who is dismissed a second time from FIU will not be readmitted under any circumstances. Only a first dismissal appeal is considered in the College of Engineering and Computing, a second dismissal appeal will not be accepted.

### Department-Specific Information

For additional information refer to your selected department in this catalog, or call the graduate program director of each department. As listed above.

### Other Important Contact Information

Website:	<a href="http://www.eng.fiu.edu">http://www.eng.fiu.edu</a>	
Admissions:	<a href="http://gradschool.fiu.edu">http://gradschool.fiu.edu</a>	(305) 348-7442
College of Engineering and Computing- Graduate Admissions		(305) 348-3526
Campus Resources		(305) 348-2973
Career Services		(305) 348-1281
Financial Aid		(305) 348-2489
University Graduate School		(305) 348-2455
International Students and Scholars Services		(305) 348-2421
Registrar's Office		(305) 348-2320
Scholarships		(305) 348-3526
Tuition Waivers		(305) 348-3526

## Research, Development and Training Centers

### Advanced Materials Engineering Research Institute (AMERI)

**W. Kinzy Jones**, *Director and Professor, Mechanical and Materials Engineering*

The Advanced Materials Engineering Research Institute provides an open access equipment infrastructure to support materials research and engineering over a broad range of technology and capabilities. The Institute provides analytical instrumentation, materials characterization, and process development laboratories to support faculty and industry in the development and characterization of new materials over the continuum from the nanoscale to bulk materials.

The Analytical Instrumentation Laboratory contains a field emission scanning electron microscope (FESEM), a 200 keV Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), X-ray diffraction, thermal (DSC, TGA, DMA, dilatometer flush diffusion, and mechanical testing (uniaxial/biaxial Instron, creep). Process Development laboratories for ceramic processing (sol-gel, tape casting, milling), polymer processing, metal processing, and arc melting, thermal processing (air, vacuum, hydrogen, controlled atmosphere furnaces) are available to support faculty and student researchers.

The Institute consists of the Center for Nanofabrication and Devices, which is supported by a class 100 clean room and nanofabrication capabilities including e-beam lithography and optical photolithography. Fabrication of nano/micro electromechanical systems (N/MENS) can be

accomplished by a combination of nanolithography, focused ion beam (FIB), micro machining, reactive ion etching, and thin film deposition by a variety of techniques (e-beam, sputtering, filament evaporation, cvd).

In addition to supporting research within the graduate program in materials science within the Department of Mechanical and Materials Engineering, the Institute supports faculty across all departments (physics, chemistry, geology, biology, electrical and computer engineering and biomedical engineering) in materials based research.

### Research and Support Staff

**W. Kinzy Jones**, *Director and Professor, Mechanical and Materials Engineering*

**Arvind Agarwal**, *Assistant Professor, Mechanical and Materials Engineering*

**Wonbong Choi**, *Associate Professor, Mechanical and Materials Engineering*

**Eric Crumpler**, *Assistant Professor, Biomedical Engineering*

**Sakhrat Khizroev**, *Associate Professor, Electrical and Computer Engineering*

**Norman Munroe**, *Director, Applied Research Center and Associate Professor, Mechanical and Materials Engineering*

**Roberto Panepucci**, *Assistant Professor, Electrical and Computer Engineering*

**Surendra Saxena**, *Professor, Mechanical and Materials Engineering*

**Yuriy Vlasov**, *Assistant Professor, Electrical and Computer Engineering*

**Kuang-Hsi Wu**, *Professor, Mechanical and Materials Engineering*

**Yesim Darici**, *Associate Professor, Physics*

**Sukky Jun**, *Assistant Professor, Mechanical and Materials Engineering*

**Watson Lees**, *Associate Professor, Chemistry*

**Kevin O'Shea**, *Associate Professor, Chemistry*

**Yanqing Liu**, *Research Engineer*

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### Applied Research Center (ARC)

**Fernando Miralles-Wilhelm**, *Director of Research*

**Rob Rose**, *Associate Director for Waste Management*

**Dave Roelant**, *Associate Director for Defense Technologies*

**Walter Tang**, *Associate Director for Water*

**Norman Munroe**, *Associate Director for Energy*

**George Philippidis**, *Associate Director of Research Development*

**Richard Burton**, *Senior Program Manager*

ARC is an applied research and development (R&D) and technology deployment center that attracts funding not only for advancing academic research but also for supplying technical services. ARC's mission is to research, develop, and disseminate technologies and information for solving waste, defense, water, environmental and energy issues throughout the Western Hemisphere. To fulfill its mission, ARC conducts research that creates new knowledge and understanding of challenging scientific and engineering problems and develops innovative solutions to complex real-world issues. Furthermore, ARC acts as a bridge among government, business and academia for the transfer and utilization of knowledge and technologies that

promote economic benefit, national security and sustainable development.

**Waste Management** – ARC provides a full spectrum of waste management research capabilities and services with experience supporting waste management and pollution prevention activities for numerous federal agencies and private contractors. The Center's waste processing research program develops innovative, cost-effective technologies to help clients protect the environment from chemical pollutants generated as nuclear, industrial and agricultural waste. A significant portion of ARC's R&D activities focus on the safe and efficient remediation and deactivation of nuclear facilities; the characterization, management, and reduction of radioactive and hazardous waste; and the development and acquisition of environmental information technologies and systems. These technology development activities support U.S. Department of Energy-Environmental Management (DOE-EM) programs in various areas, such as: applied instrumentation and monitoring development; alternatives to nuclear waste management and disposition; attenuation of soil and groundwater contamination; environmental risk assessment and regulatory compliance research; as well as engineering studies for contaminated soil removal. Furthermore, these technology development activities are of significant interest to domestic and international commercial interests.

**Fossil and Renewable Energy** - The Country's new energy policy emphasizes the importance of combining cleaner use of fossil fuels with the development of alternative energy and the adoption of energy efficiency techniques. As a result, there is great demand for R&D covering the full spectrum of energy resources from natural gas to hydrogen utilization to fuel cell systems. Capitalizing on the national emphasis on clean and renewable energy, ARC has enhanced its research and technology development activities in various energy fields and has created an affiliate center, the Center for Energy and Technology of the Americas (CETA). ARC is developing technologies for clean and high-efficiency combustion systems that reduce air emissions, hydrogen production, purification, storage, cost-competitive high temperature PEM fuel cells and intermediate temperature solid oxide fuel cells serving as distributed energy systems, biomass thermochemical conversion, and energy-efficient and environmentally friendly heating and cooling systems.

Reliable and adequately priced energy supplies are some of the most important building blocks for economic growth, job creation and hemispheric security. Most scenarios for world, and regional, energy demand predict strong increases in the coming decades and will likely be met, if no measures or policies are put in place, by increased oil and gas production from countries in the Persian Gulf and the former Soviet Union. This reliance on supplies from the Middle East amplifies the political and economic risks the world faces today.

Fortunately, there is great potential for increased energy supplies from the Western Hemisphere that could help mitigate these risks. However, many hurdles must first be overcome such as inadequate regulatory and tax frameworks, rights of way and permitting, access to capital markets, environmental, political and social issues and the obvious, and very relevant, technological challenges. It is

the goal of ARC and CETA to solve these challenges through its research and development initiatives.

**Environmental Remediation** – At ARC, our commitment to the environment spans a breadth of concerns, from soil and groundwater cleanup to the treatment and disposition of hazardous wastes, to the decontamination and decommissioning of surplus nuclear and industrial facilities. We have performed over 200 projects worth over \$70M in the environmental arena.

The environmental program at ARC offers a full suite of environmental R&D and engineering support services covering the entire gamut, from fate and transport of contaminants in soil and groundwater to innovative engineering and technology development and assessment. ARC scientists and engineers have proven expertise in soil and water analysis; radioactive, hazardous, transuranic, high-level, and mixed waste treatment and disposal; decontamination of facilities; sensors and monitoring systems; and robotics. Our activities include: Contaminant fate and transport; assessment, remedial design and implementation; brownfields redevelopment; and long-term monitoring and stewardship.

**Water Engineering** – ARC provides unique capabilities in treatment, remediation, bioremediation, contaminant characterization, desalination and restoration. Secure and affordable water supplies are the building blocks for economic growth and competitiveness. The Applied Research Center has expertise, instrumentation, dedicated laboratories and pilot-scale facilities to tackle multidisciplinary problems in water treatment and purification processes, energy-efficient water cleanup, as well as surface water and groundwater pollution characterization. ARC conducts soil and water R&D for a variety of clients in the public and private sectors. Recent projects have focused on cutting-edge methods of employing natural processes to remove contamination from soil and water, automated sampling and remote monitoring systems for soil and groundwater, and information management to support informed decision making related to soil and water remediation technologies.

Through research supported by the U.S. Army, ARC is developing, fabricating and demonstrating mobile water purification systems in Latin America. Projects like this will assist the U.S. Army and other militaries in the Western Hemisphere in solving common problems related to the environment, energy and infrastructure. ARC is working on ways to provide safe drinking water, sanitation and water quality control in disaster areas.

**Defense Technology** – Researchers at the Applied Research Center have conducted research on many defense science and technology projects in the past decade. During the past three years, the Center has conducted research on twelve projects with an overall value of more than \$4M.

Clients such as the U.S. Air Force Office of Scientific Research (AFOSR), the Air Force Research Laboratory (AFRL), the Army Research Office (ARO), the Missile Defense Agency (MDA), Defense Advanced Research Projects Agency (DARPA), and the National Reconnaissance Office (NRO) have partnered with the Center on research. This research includes: integration of sensing and imaging systems into autonomous monitoring technologies, such as remote ground stations and unmanned aerial vehicles (UAVs) and unmanned

ground vehicles (UGVs); Computational Fluid Dynamics analyses and experimental research for microchannel nozzle flow for space vehicle thrusters, hypersonic flow for Scramjets, model verification of ice formation on wings, and microchannel cooling of electronic components; experimental and theoretical research on absorption of infrared laser radiation by animal tissue as a surrogate for human tissue; and numerical simulation of microbubble drag reduction for applications in naval ships and submarines.

ARC's capabilities in Defense Technology include: detection of radiological and chemical contaminants, remote monitoring, automated sampling, sensor testing and integration, imaging and sensor data collection and analysis, as well as modeling, simulation and visualization.

**Doing Business with the Applied Research Center** - ARC's employees are drawn from a wide segment of the commercial, government, and academic arenas to collectively utilize their combined experience and expertise to support the needs of ARC's clients. The Applied Research Center's operating philosophy recognizes and accommodates the critical performance characteristics of government and commercial activities, while exercising the benefit of its cost structure in a way that serves both client interests and those of the University and its students. The staff at ARC is fully engaged in the project and program activities assigned, as well as in mentoring students through internships that expose them to real-world experiences in their chosen fields.

The critical difference in the Applied Research Center's structure is the administrative processes and structures that have been put in place to serve its clients. The Center has executed work for federal agencies, state and local governments, and commercial entities, in large part through task-based contracts. For instance, in working with the U.S. Department of Defense, the Center has acted as both the prime contractor and as a sub-contractor/consultant for commercial partners, serving to streamline the process.

For more information on FIU's Applied Research Center, please visit [www.arc.fiu.edu](http://www.arc.fiu.edu).

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## Bioinformatics Research Center (BioRG)

**Giri Narasimhan**, *Director and Professor, School of Computing and Information Sciences*

The mission of this research group is to work on problems from the fields of Bioinformatics and Biotechnology. The group's research projects includes Pattern Discovery in sequences and structures, micro-array data analysis, primer design, probe design, phylogenetic analysis, image processing, image analysis, and more. The group builds on tools and techniques from Algorithms, Data Mining, Computational Statistics, Neural Networks, and Image Processing.

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## Center for Advanced Distributed Systems Engineering

**Xudong He**, *Director and Professor, School of Computing and Information Sciences*

Another of our research efforts is the Center for Advanced Distributed System Engineering (CADSE). Its mission is to establish a streamlined research, technology exploration and advanced training program in the field of distributed and Internet-based computing. The Center's R&D cover

both theoretical and practical aspects of distributed software engineering, i.e. using engineering methods and technologies to tackle development problems of complex, reliable, and/or real-time distributed systems.

## Center for Advanced Technology and Education (CATE)

**Malek Adjouadi**, *Director and Associate Professor, Joint Appointment with Biomedical Engineering and Electrical and Computer Engineering*

The vision of the NSF-CATE center at FIU is to foster a cross-disciplinary research and educational program as a catalyst for our undergraduates and graduates alike to develop their creative thinking by bringing in synergy the fields of applied information (signal and image) processing, neuroscience and assistive technology research. The CATE center focuses on new methodologies that (1) will enhance analysis and interpretation of signals and images in real-world applications; (2) will meet the impending needs in neuroscience as we elicit both the functional mapping of the brain, and the causality of key brain disorders; and (3) will result in new Human-Computer Interface (HCI) prototypes that address effectively the issue of *Universal Accessibility*, focusing on visual impairment and motor disability. Experimental results, as observed through clinical means or through system design evaluations and feasibility studies serve as means to redefine or re-evaluate our theoretical premises. The strong collaboration we have secured with our industry partners generates joint programs, student internships, clinical rotations, joint faculty appointments, shared use of modern equipment and infrastructure. The overall mission of the CATE Center is thus to create a unified infrastructure to synergize imaging/signal processing research, while fostering an environment that supports cross-disciplinary initiatives in order to produce new scientific specialties relying on combinations of specific technologies, medicine, and computation. This environment as set is apt to ensure the anticipated success in meeting our students' educational needs and research goals all the way to the Ph.D. level.

### Research Areas

- Image and Signal Processing and Computer Vision
- Real-Time Assistive Systems and Human-Computer Interfaces
- Neuroscience: - EEG Brain Research – Functional Brain Mapping and Neurorehabilitation
- Biomedical Applications in Flow Cytometry and Confocal Microscopy
- Robotics for Motion Planning and Automated Guidance
- Parallel and Distributed Processing

### Sponsors

- National Science Foundation (NSF)
- Office of Naval Research (ONR)
- Miami Children's Hospital
- Beckman-Coulter Inc.

### Faculty

**Malek Adjouadi**, *Director and Associate Professor, Joint Appointment with Biomedical Engineering and Electrical and Computer Engineering*

**Armando Barreto**, *Director of the Digital Signal Processing Laboratory and Associate Professor, Joint Appointment with Biomedical Engineering and Electrical and Computer Engineering*

**Ana Pasztor**, *Professor, School of Computer Science*  
**liker Yaylali**, *Courtesy Assistant Professor, Biomedical Engineering*

**Gustavo Roig**, *Director, Center for Diversity in Engineering*

**Bob Coatie**, *Director of FIU Office of Multicultural Services*

### Research Partners

**Prasanna Jayakar**, *Director, Neuroscience Center, Miami Children's Hospital*

**Arthur Karshmer**, *Professor and Chair, Information Technology, University of South Florida*

**Gualberto Cremades**, *Assistant Professor at Barry University*

**Rafael Delgado**, *Executive Vice President and Director of Software Systems, Intelligent Hearing Systems, Miami*

**Julie Jacko**, *Director, Laboratory for Human-Computer Interaction, Georgia Tech University*

**Gustavo Rey**, *Neuropsychologist, Miami Childrens Hospital*

### Coordinator, Student Recruitment

**Stephanie Strange**, *College of Engineering and Computing, Assistant Director of Recruitment and Retention*

### Research and Support Staff

**Melvin Ayala**, *Manager, CATE Center*

**Ana Guzman**, *Assistant Manager, CATE Center*

**Javier Delgado**, *Distributed System Manager*

**Christy Bedia and Mouncef Lahlou**, *Webmasters*

### Doctoral Students:

Mildred Zabawa, Mercedes Cabrerizo, Danmary Sanchez, Maria Tito, Anaelis Sesin, Ann Zong, Mourad Michel, Marc Rossman, Feng Gui, Melvin Ayala, Guillen Benavides Magno, You Xiaozhen, and Lu Wang

**Master's Students:** Eddy Ruiz, Patrice Hernandez Mathew Whittington, Nina Teng, Javier Delgado Ana Guzman, Raj Prakash, Orville Anderson Alejandro Simon, Daniel Sanchez, Adrian Marrero, and Luis Gonzalez

### Industry Partners

- The Brain Institute Miami Children's Hospital
- The Ware Foundation
- Beckman-Coulter Inc.
- Intelligent Hearing Systems
- American Epilepsy Society

### Related Laboratories and Facilities of the CATE Infrastructure

With the NSF and ONR continued support, the CATE center has helped in establishing the following laboratories: Interactive Design Laboratory for Undergraduates. *Funded by NSF-MII and Matching funds from the FIU Division of Sponsored Research and Training (DSRT)* – Housed with the ECE department facilities.

1. EEG Brain Research Laboratory. *Funded by NSF-MRI* – Housed within the Neuroscience Center at Miami Children's Hospital.

2. Web-Design Laboratory. *Funded jointly by ONR and NSF-MII* – Housed within the Engineering Information Center Facility.
3. The Computer Training Laboratory – Housed in Graham Center with the Office of Multicultural Services.

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## Center for Diversity in Engineering

**Gustavo Roig**, *Director, Associate Dean of Engineering and Professor, Electrical and Computer Engineering*

South Florida's distinction as a multi-cultured, multi-lingual region has long been a diverse source of talent for FIU, particularly in the College of Engineering and Computing. In response to the challenge of attracting this diverse community to science and engineering, the College of Engineering and Computing has created a special center for Diversity in Engineering.

By building sound foundations in sciences and mathematics, the Center helps to prepare young students to deal with the rigors of higher-level education, and Engineering in particular. Currently the Center has several on-going programs targeting Elementary, Middle, and High School level students. These programs are offered throughout the school year and during the summer. GEAR UP! (Gaining Early Awareness and Readiness for Undergraduate Programs), ENLACE MIAMI (Engaging Latino Communities for Education), FLAME (Florida Action for Minorities in Engineering), Proyecto Access/Miami PREP (Pre-freshman Engineering Program), JETS, Junior Engineering Technical Society, as a local chapter, benefits include access to superior program materials (educational packages, self assessments, real-world problem-solving scenarios, team-oriented learning and competitions). The program is designed to increase the technical skills necessary to achieve in basic, engineering skills, applied mathematics, science, and reasoning.

Project MASTT Mathematics/Applied Sciences Teachers' Training – a pre service and in service teachers' training program, funded by NASA/KSC, designed to improve the quality of elementary and middle school science and mathematics education.

The Center also provides job and scholarship opportunities for FIU students. FGLSAMP (Florida-Georgia Louis Stokes' Alliance for Minority Participation) and SHPE Honores (Society for Hispanic Professional Engineers) provide many students with financial assistance. FGLSAMP and SHPE Honores scholarship recipients are assisted in acquiring internships. Many are offered Summer Research Internships at NASA Centers around the country.

The purpose of the Center is to recruit, retain, and graduate ethnically diverse student body that will increase the representation of traditionally underrepresented ethnic and gender groups in the field of engineering and will enrich the College of Engineering and the university as a whole.

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## Center of Emerging Technology for Advanced Information Processing and High-Confidence Systems (CREST)

**Yi Deng**, *Director, Dean and Professor, School of Computing and Information Sciences*

The CREST center focuses on the following research areas: High-confidence reactive software systems, multidimensional-multimodal data modeling and query research, assistive technology research based on the design and development of real-time assistive systems, and advanced information processing with neuroscience applications. This multidisciplinary research and educational center serves as a resource for the education of underrepresented minority students as well as a driving force to increase diversity in graduate education, especially at the Ph.D. level in computer science and engineering.

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## Center for the Study of Matters at Extreme Conditions (CeSMEC)

**Surendra Saxena**, *Director and Professor, Mechanical and Materials Engineering*

CeSMEC's mission is to study the behavior of materials at high pressures and temperatures. The range of research activities includes the study of planetary interiors and of matter at extreme industrial conditions. CeSMEC is one of few facilities in the country where pressures are created to many million atmospheres and temperatures to several thousand degrees; the material is studied under such condition with x-ray and electroscopic techniques.

All materials are subject to three fundamental variables – the variables of temperatures, chemical composition, and pressure. Modern science has vigorously used only the first two variables in exploring nature and creating several amenities of modern civilization. Pressure, the third fundamental variable altering all states of matter, has been for years a relatively minor esoteric sub-field.

The creation of this center is providing FIU's graduate students and faculty the opportunity to perform fundamental and applied research in high-pressure physics, high-pressure chemistry, and materials science. The center is raising the infrastructure at FIU to the level required to initiate world-class research in an emerging area of science and engineering.

Recent additions of a Hydrogen-Storage Materials Research Facility and a Microplasma CVD Diamond Growing Laboratory, researcher can perform synthesis of novel materials for a variety of industrial applications.

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## Distributed Multimedia Information Systems Laboratory

**Shu-Ching Chen**, *Director and Associate Professor, School of Computing and Information Sciences*

Another of our research efforts is the Distributed Multimedia Information System Laboratory (DMIS). Its mission is to conduct leading edge research in multimedia database systems, data mining, networking and wireless, GIS and Intelligent Transportation Systems. Other research areas of this effort include Multimedia Communications and Networking, Digital Library, 3D Animation, and Distributed Computing .

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## Division of Corporate and Global Programs

**Jainendra Nvalakha**, *Director and Professor, School of Computing and Information Sciences*

The **Division of Corporate and Global Programs ((DCGP)** is the organization unit within **-CGP)** develops, promotes and manages academic programs offered under the rubric of Executive Engineering Education in the **College of Engineering and Computing** that is responsible for managing the engineering programs offered under the rubric of **Executive Engineering Education**. These programs fall in the following categories:

The DCGP is managed by a director reporting to the Dean of Engineering & Computing. The director and staff of the DCGP work with department chairs, center directors and faculty members to identify corporate and global partners; develop, promote and manage Executive Engineering Programs; and identify new opportunities and new markets for all programs that are offered by the College of Engineering and Computing. Various categories of programs in which the DCGP-division is involved include the following;

#### **Global Programs**

The global programs focus on the demonstrated education and training needs of selected industrial sector(s) in the host country. These programs are offered in collaboration with a sponsor which is a reputed university or institution that can support the delivery of the program by providing appropriate infrastructure facilities like classrooms, library and computer laboratories. The programs are designed in consultation with the faculty of the sponsor and the industry representatives in the host country. The goal of the global programs is to complement the existing academic programs offered by the sponsoring institution.

#### **Global Programs**

- Corporate Programs
- Certificate Programs
- Weekend Programs
- International Student Transfer Programs

Global programs are offered in a foreign country and focus on the demonstrated education and training needs of selected industrial sector(s) in the host country. The programs are offered in collaboration with a local institution that supports the delivery of the program by providing appropriate infrastructure facilities like classrooms, library and computer laboratories.

All participants in the program proceed as a cohort through a lock-step curriculum of the selected courses. The local faculty from the host country is also involved in teaching to enrich the program by integrating the economic, cultural, social, political and legal issues of the host country in the curriculum.

#### **Corporate Programs**

The Corporate Programs are designed for an individual corporation leading to an academic degree, certificate or short-term executive development program. The programs are delivered on site and the program delivery is supported by providing infrastructure facilities. Corporate programs are designed to meet the specific educational and training needs of the corporate clients.

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## **Engineering Information Center (EIC)**

**Hernan Bormey, Director**

Create a technology that will help save lives or create your own website, simulate an electronic circuit, design a

bridge, or just browse the Internet. The possibilities are endless at Engineering Information Center

EIC helps faculty, scientists, researchers, and students to conduct cutting edge research and work on system designs, networking, scientific visualization, 3D Modeling, simulations, virtual reality, computer animation, and other computer and software applications.

The Center manages an array of Novell, Windows, and UNIX network servers that provide faculty, staff and students with the capacity to share valuable resources; therefore, fostering an atmosphere where collaboration and instruction grow with a synergy that is unique. Beyond the college community, EIC participates in sponsoring special outreach programs for the Miami-Dade County Public Schools by exposing young minds to latest technologies.

EIC is also home to The Graphic Simulation Laboratory with focus on Scientific Visualization, 3D Computer Modeling, and Virtual Reality, which have helped researchers to develop a wide array of technologies, strategies, and information designs. GSL has collaborated with NASA, The Center for Super Computing Applications, National Science Foundation, Computational Science Institute, Shodor Organization, Macromedia, and Kellogg Foundation, just to mention a few. From hardware to software support to 3D modeling of a heart valve, EIC delivers exceptional services with a personal touch.

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## **Engineering Manufacturing Center (EMC)**

**Shih-ming Lee, Director, Chairperson and Associate**

*Professor, Industrial and Systems Engineering*

**Mario Sanchez, Senior Engineer and Manager**

The objective of the Engineering Manufacturing Center (EMC) is to prepare manufacturing engineers for an era where enterprises will be mostly information-based and international in nature. It is divided into major labs which provide a seamless integration of computerized engineering tools for design (CAD), manufacturing (CAM), inspection and rapid prototyping (RP) for mechanical and electronic product design and fabrication.

The *Rapid Product Realization Laboratory* consists of a design front end, an RP center for mechanical/electrical components, and computer driven manufacturing and inspection systems. The design center enables design with Pro/Engineer and analysis byfinite element packages. The RP facility utilizes three different techniques: stereolithography, fused deposition modeling and laminated object manufacturing. Mechanical parts are fabricated with a Vertical Machining Center, a CNC turning center, an EDM machine and a traveling wire EDM. Production capabilities are enhanced by an injection molding machine and dimensional analysis, verification and reverse engineering capabilities are provided by a coordinate measuring machine.

EMC regularly schedules training courses in Pro/Engineer and other industry-specific software at substantial discounts. Course instructors typically come from industry, bringing real-life hands-on experiences to the class. Companies served by EMC range from entrepreneurial to the well-established, some of which include aerospace, automotive, marine, medical and consumer product manufacturers. EMC's resources and technical expertise in speciality areas, such as rapid

product design/development and manufacturing are available to the industrial community. For more information, call the EMC at (305) 348-6557, Mario Sanchez ([sanchem@fiu.edu](mailto:sanchem@fiu.edu)), or refer to our website at [www.eng.fiu.edu/MRC](http://www.eng.fiu.edu/MRC).

## Eugenio Pino and Family Global Entrepreneurship

**Alan L. Carsud**, *Executive Director*

The Eugenio Pino and Family Global Entrepreneurship Center at Florida International University, founded in 2003 with a grant from the Kauffman Foundation of Kansas City, facilitates all entrepreneurial activities at FIU. The Center provides campus-wide awareness of entrepreneurship as an approach to life that enhances and transcends traditional academic experiences. It is woven into the fabric of the university through entrepreneurial activities and courses across the university. The multi-dimensional nature of the Center allows it to address the unique entrepreneurial needs of one of the nation's largest ethnically diverse academic institutions, located in one of America's most entrepreneurial and dynamic international cities, Miami. In 2004 the Center was named for Eugenio Pino a Cuban-American serial entrepreneur and his family.

## FEEDS Programs

**Mercy Rueda Schott**, *Director*

The Florida Engineering Education Delivery System (FEEDS) is a statewide distance learning system providing access to graduate and undergraduate level engineering courses and programs to individual students anywhere and anytime, whether it is at home or the workplace. Courses are delivered through one or more of the following methods: CD-Rom, streaming video over the Internet; and fully on-line.

FEEDS offers engineering students and professionals with work and family responsibilities the flexibility to take courses around their busy schedules. It also provides convenience to those who are not within driving distance of an academic institution. It allows them to continue their professional development, which plays an important role in the growth of high technology industries.

Currently, students can select the necessary courses from FIU via distance learning to obtain a Master's degree in Civil Engineering, Environmental Engineering, Construction Management and Engineering Management and a bachelor's degree in Construction Management.

A student taking a course through FEEDS must meet the same requirements as the student on campus and will earn the same credit as if he/she were to attend classes on campus. A student need not be enrolled in a graduate or undergraduate degree program in order to take a course. However, a student who intends to seek admission to a program should be aware that no more than six (6) graduate or fifteen (15) undergraduate credits are allowed to be transferred into a program.

## Future Aerospace Science and Technology Center for Space Cryoelectronics (FAST)

**Grover Larkins**, *Director and Professor, Electrical and Computer Engineering*

FAST-SC is one of six centers created by the Air Force as part of its minority university enhancement program, providing research experience opportunities for undergraduate and graduate students.

The FAST Center evaluates novel applications of space-based cryo-electronics, initially studying new systems for reduction in losses of feed and phase shift networks in phased array transmitter systems. This involves development of low-loss active integrated low-noise phased array or post-processed phased array down-converter receiving systems, high gain-low loss, low noise micro and millimeter wave circuits and systems for space based applications. Of particular interest is the ability to design and fabricate integrated systems which could be used as "steerable" phased array antennas with, frequency-agility.

Current research is focused on issues relating to: Superconducting Micro-Electro-Mechanically switched filters and phase shifters.

## High Performance Database Research Center

**Naphtali Rishe**, *Director and Professor, School of Computing and Information Sciences*

One of our research efforts is the High-Performance Database Research Center (HPDRC). HPDRC conducts research on such theoretical and applied issues as Internet-distributed heterogeneous databases, database design methodologies, database design tools, information analysis, multi-media databases, database languages, data compression, spatial databases, and data visualization. The Center also designs specific database systems for highly complex applications.

## International Hurricane Research Center (IHRC)

**Stephen P. Leatherman**, *Director*

**Kegi Zhang**, *Laboratory for Coastal Research, Co-Director*

**Shahid Hamid**, *Laboratory for Insurance, Financial and Economic Research, Director*

**Arindam Chowdhury**, *Laboratory for Wind Engineering Research, Director, and Assistant Professor, Civil and Environmental Engineering*

**Dario Moreno**, *Laboratory for Social Science Research, Director*

Florida International University's International Hurricane Center has officially changed its name to the International Hurricane Research Center (IHRC). The change was made to better reflect the Center's research initiatives.

Serving the state of Florida, the IHRC is a Type I interdisciplinary research center focused on the mitigation of hurricane damage to people, the economy, and the built and natural environments. This designation makes the IHRC Florida's official hurricane research center for 11 universities comprising the state university system.

The citizens of the U.S. East and Gulf Coasts and Caribbean Islands are severely impacted by hurricanes, and IHRC promotes an interdisciplinary, large-scale disaster research agenda to address this vulnerability. Disciplines such as architecture, business, economics, engineering, finance, geosciences, insurance, political science, sociology, and urban planning are involved in a

long-term, integrated research program that helps Florida, the nation, and its regional neighbors to mitigate hurricane exposure.

The Center developed as a result of a public-private partnership between the We Will Rebuild Foundation, an organization formed to spearhead the rebuilding of Dade County in 1992 after Hurricane Andrew, and FIU. The IHRC works in conjunction with the National Hurricane Center, which is also located at the FIU University Park Campus in West Miami-Dade.

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## Lehman Center for Transportation Research (LCTR)

**L. David Shen, P.E., T.E.** *Director, Associate Dean of Engineering, and Professor, Civil and Environmental Engineering*

**Fang Zhao, P.E.** *Deputy Director and Associate Professor, Civil and Environmental Engineering*

**Sylvan C. Jolibois, Jr.,** *Deputy Director and Associate Professor, Civil and Environmental Engineering*

**Albert Gan,** *Deputy Director and Associate Professor, Civil and Environmental Engineering*

The Lehman Center for Transportation Research (LCTR) at Florida International University was established in 1993 in honor of Congressman Bill Lehman and his tireless efforts to make South Florida a better place for all of us. The center's vision is to become a strong 'state-of-the-art' transportation research and training facility. LCTR is committed to serve and benefit our society by conducting research to improve mobility, hence the quality of life issues, develop partnerships in the transportation industry, and educate a multidisciplinary workforce to plan, manage and implement transportation systems.

Faculty, staff and students at LCTR are involved in research related to the design and operation of transportation systems, public policy, air pollution, and the application of geographic information systems and other advanced technologies such as artificial neural networks and scientific visualization in transportation. Future plans include networking with the public and private industry to collaborate on transportation related research. In addition, applied research will be conducted on, but not limited to intelligent vehicle and highway systems.

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## Motorola Nanofabrication Research Facility

**W. Kinzy Jones,** *Director and Professor, Mechanical and Materials Engineering*

**Neal Ricks,** *Lab Manager*

The first centralized facility of its kind in Florida, the Motorola Nanofabrication Research Facility is an open-access initiative in support of nano-scale devices, systems and materials research that encompasses a broad range of technologies and capabilities. The facility provides nanofabrication, analytical instrumentation, materials characterization and process-development laboratories for students, faculty and industrial researchers. This \$15 million Research Facility is an integral part of the Advanced Materials Engineering Research Institute (AMERI), FIU's broader materials research program.

Harnessing the synergy inherent in the study and development of nanoscale technologies, the facility boasts:

- Specialized equipment required to develop new and novel fabrication techniques unique to the creation of functional materials and devices that are no greater than 100 nanometers (1,000 times smaller than the diameter of a human hair);
- A full complement of standard semiconductor processing equipment to leverage the capabilities of robust and proven techniques; and
- State-of-the-art analytical tools to study, and characterize these nano-sized devices, as well as the materials and processes used to make them.

## The Nanotechnology Faculty Team

**Arvind Agarwal,** *Assistant Professor, Mechanical and Materials Engineering*

**Wonbong Choi,** *Associate Professor, Mechanical and Materials Engineering*

**Roman Chomko,** *Assistant Research Professor, Electrical and Computer Engineering*

**Eric Crumpler,** *Assistant Professor, Biomedical Engineering*

**George Dulikravich,** *Professor and Chair, Mechanical and Materials Engineering*

**Sukky Jun,** *Assistant Professor, Mechanical and Materials Engineering*

**Sakhrat Khizroev,** *Associate Professor, Electrical and Computer Engineering*

**Grover Larkins,** *Associate Professor, Electrical and Computer Engineering*

**Watson Lees,** *Associate Professor, Chemistry*

**Wenzhi Li,** *Research Faculty, Chemistry*

**Anthony McGoron,** *Assistant Professor, Biomedical Engineering*

**Roberto Panepucci,** *Assistant Professor, Electrical and Computer Engineering*

**Surendra Saxena,** *Professor, Mechanical and Materials Engineering*

**Frank Urban,** *Associate Professor, Electrical and Computer Engineering*

**Yuriy Vlasov,** *Assistant Professor, Electrical and Computer Engineering*

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## Telecommunications and Information Technology Institute

**Niki Pissinou,** *Director and Professor, Electrical and Computer Engineering*

Florida International University (FIU) recognizes the need to nurture highly trained personnel for the nation's industry and business, develop research to support the rapidly expanding high-tech industry and become proactive in technology transfer. Thus, ensuring continued economic growth and prosperity in the region. In order to fully meet today's technological demands, FIU has established the Telecommunications and Information Technology Institute (IT<sup>2</sup>). IT<sup>2</sup> promotes advanced multidisciplinary education and research focused on telecommunications and information technologies. IT<sup>2</sup>'s mission is to:

- 1) Deliver high quality telecommunications and information technology education and training.
- 2) Conduct and promote research to enhance Florida's role as a leader in telecommunications and information technology.
- 3) Offer training that is needed to foster business development and workforce preparedness.

- 4) Promote technology transfer to enhance the enabling technologies of the telecommunication and information technology industries.

In fulfilling its mission, IT<sup>2</sup> promotes multidisciplinary collaboration and serves as the catalyst to promote intellectual cross-fertilization among disciplines. This effort results in the synergistic enhancement of teaching and research, so critical in the telecommunications and information technology fields, where disciplinary barriers are falling and lines are blurred. An objective of the Institute is to infuse telecommunications and information technology content into the curriculum at all appropriate levels. To fill the urgent demand of industry, the institute is developing interdisciplinary telecommunication programs that provide certificate programs, Bachelors, Masters and Ph.D. degrees.

IT<sup>2</sup> constitutes an infrastructure that is viable for cutting edge research activities. Researchers at the institute conduct funded research and development targeted at solving complex problems conducive to the early identification of high impact opportunities. Of particular importance to the institute's research efforts is the emerging global wireless, optical and personal communications infrastructure and the ability to represent, store and access information to perform a variety of information related tasks. To provide an effective forum for original research results and to foster communication among researchers, industry leaders can collaborate on education, training, and re-engineering the telecommunications workforce of the future. The alliance provides effective ways to educate the workforce of the 21<sup>st</sup> century. In accordance, the institute provides technical assistance and applied research services to transfer acquired knowledge and technologies to the commercial sector. The IT<sup>2</sup> team can work with industrial organizations to tap into some technological innovations that drive the industry to its strategic advantage.

For more information, contact Dr. Niki Pissinou, the director of the Telecommunications and Information Technology Institute, at (305) 348-3987 or visit our Website at [www.it2.fiu.edu](http://www.it2.fiu.edu).

#### **Core Faculty**

**Niki Pissinou**, *Director and Professor*

**Kia Makki**, *Lucent Technology Professor*

**Hao Zhu**, *Assistant Professor*

**Jian Wang**, *Assistant Professor*

#### **Affiliated and Research Faculty**

**Kang Yen**, *Chairperson and Professor, Electrical and Computer Engineering*

**Wannava Subbarao**, *Professor, Electrical and Computer Engineering*

**Tadeuz Babij**, *Professor, Electrical and Computer Engineering*

**Jean Andrian**, *Associate Professor, Electrical and Computer Engineering*

**Shih-Ming Lee**, *Chairperson and Associate Professor, Industrial and Systems Engineering*

**Ronald Giachetti**, *Associate Professor, Industrial and Systems Engineering*

**Marc Resnick**, *Associate Professor, Industrial and Systems Engineering*

**Osama Mohammed**, *Associate Chairperson and Professor, Electrical and Computer Engineering*

**Juan Polanco**, *Research Faculty*

**Lance Hester**, *Research Faculty*

**S. Huang**, *Research Faculty*