

Annual Research Report 2012

FACULTY OF ENGINEERING AND APPLIED SCIENCE

# Shaping the future



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# Ahead of the curve.

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The University of Ontario Institute of Technology (UOIT) delivers a leading-edge learning environment that combines the pursuit of academic excellence, research opportunities, hands-on skills and a vibrant student life. UOIT's undergraduate and graduate programs are both responsive to students' educational needs and the market-driven requirements of employers, putting graduates one step ahead upon graduation.

UOIT's founding mission called on the university to advance the highest quality of research in order to create the highest quality intellectual property. Since its inception, UOIT has exceeded all expectations in building a strong national reputation for research excellence. The university's commitment to research excellence and innovation has resulted in millions of dollars in grants and awards, including five prestigious Canada Research Chairs, with another four in development, and six industrial research chairs. Since 2006, UOIT has had more than 80 invention disclosures; submitted more than 35 patent applications, four of which have been issued; entered into five licence agreements and supported two spinoff companies.

Innovative programs within the Faculty of Engineering and Applied Science provide high-quality engineering education through teaching and research excellence. Each one is accredited by the Canadian Engineering Accreditation Board, the highest possible affirmation of a Canadian university's engineering programs. These provide our engineering graduates with the skills needed to succeed. Our research programs are exploring new solutions to global problems and educating future leaders, who will turn great ideas into products designed to make the world a better place. In these ways, the Faculty of Engineering and Applied Science is shaping the future. It is generating new knowledge and advancing the frontiers of research helping to transform industry and society today and well into the future.



## DEAN'S MESSAGE

The UOIT success story is nothing short of remarkable. Over its first decade, the university has forged an outstanding reputation for excellence in research, strong collaborations with industry and government partners, and innovation in teaching and learning. Through its unique approach to technology-enriched learning, UOIT produces graduates prepared to thrive and excel in the 21st-century workplace, and ready to make significant contributions to society.

The Faculty of Engineering and Applied Science (FEAS) has proudly been at the forefront in the development of UOIT's impressive and diverse array of graduate and interdisciplinary research programs. Our faculty produced UOIT's first PhD recipients, and FEAS graduate student enrolment continues to grow. In addition to our doctoral degrees, the Master of Engineering and Master of Applied Science programs are also very popular.

Our outstanding faculty members are internationally renowned, driving relevant, leading-edge research in a wide range of endeavours attracting significant funding, particularly on a per-faculty basis. Within this research report, you will find a detailed snapshot of their achievements, activities and publications and an overview of how FEAS continues to push the boundaries of thinking and learning.

Modern and specialized research facilities provide an outstanding environment for student research opportunities – even at the undergraduate level. The General Motors of Canada Automotive Centre of Excellence, Clean Energy Research Laboratory, Integrated Research and Training Facility, and the Energy Systems and Nuclear Science Research Centre house research laboratories that are second-to-none in Canada.

These are exciting times. We have achieved much, but we have only just begun. We are open for business and looking toward the horizon – to strengthen existing partnerships and to build upon UOIT's growing advanced technology cluster. I invite you to explore our faculty, to visit our campus, to tour our leading-edge laboratories and facilities, and to meet our professors, staff and students.

Sincerely,

Dr. Tarlochan Sidhu  
Dean, Faculty of Engineering and Applied Science





# FACULTY AND STAFF

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## ADMINISTRATION

### DEAN

Dr. Tarlochan Sidhu, BE, MSc, PhD (University of Saskatchewan), PEng, CEng, FIEEE, FEIC, FCAE, **Professor**

### ASSOCIATE DEAN

#### - UNDERGRADUATE PROGRAMS AND EXPERIENTIAL LEARNING

Dr. Hossam Kishawy, BSc, MSc, PhD (McMaster University), PEng, FASME, FCSME, **Professor**

### ASSOCIATE DEAN

#### - GRADUATE STUDIES AND RESEARCH

Dr. Ramiro Liscano, BScEng, MScEng, PhD (University of Waterloo), PEng, SMIEEE, **Associate Professor**

### DEPARTMENT CHAIR

#### - AUTOMOTIVE, MECHANICAL AND MANUFACTURING ENGINEERING

Dr. Dan Zhang, BSc, MSc, PhD (Laval University), PEng, FEIC, FCSME, SMIEEE, **Professor**

### DEPARTMENT CHAIR (INTERIM)

#### - ELECTRICAL AND SOFTWARE ENGINEERING

Dr. Shahram ShahbazPanahi, BSc, MSc, PhD (Sharif University of Technology, Iran), PEng, **Associate Professor**

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## AUTOMOTIVE, MANUFACTURING AND MECHANICAL ENGINEERING

### CORE FACULTY

Dr. Martin Agelin-Chaab, BSc, MEng, MSc, PhD (University of Manitoba), PEng, **Assistant Professor**

Dr. Ahmad Barari, BSc, MSc, PhD (Western University), PEng, **Assistant Professor**

Dr. Ibrahim Dincer, BSc, MSc, PhD (Istanbul Technical University, Turkey), PEng, FCSME, FWIF, **Professor**

Dr. Moustafa El-Gindy, BSc, MSc, PhD (Technical University of Budapest, Hungary), FASME, **Associate Professor**

Dr. Ebrahim Esmailzadeh, BSc, MPhil, PhD (University of London, UK), CEng, PEng, FCAE, FEIC, FASME, FCSME, FIMechE, SMIEEE, **Professor**

Dr. Kamiel Gabriel, BSc, MBA, MSc, PhD (University of Manitoba), PEng, **Professor** – on leave

Dr. Marnie Ham, Diploma Engineering Technology, BSc, BSc, MSc, PhD (Queen's University), PEng, **Assistant Professor**

Dr. Yuping He, BSc, MSc, PhD (University of Waterloo), PEng, **Associate Professor**

Dr. Hossam Kishawy, BSc, MSc, PhD (McMaster University), PEng, FASME, FCSME, **Professor**

Dr. Atef Mohany, BSc, MSc, PhD (McMaster University), PEng, **Assistant Professor**

Dr. Scott Nokleby, BEng, MSc, PhD (University of Victoria), PEng, **Associate Professor**

Dr. Remon Pop-Iliev, BSc, MSc, PhD (University of Toronto), PEng, **Professor**

Dr. Bale Reddy, BTech, MTech, PhD (Indian Institute of Technology, India), **Professor**

Dr. Ghaus M. Rizvi, BE, MS, MSc, PhD (University of Toronto), PEng, **Associate Professor**

Dr. Greg Rohrauer, DEC, BEng, PhD (Concordia University), PEng, **Assistant Professor**

Dr. Marc A. Rosen, BSc, MSc, PhD (University of Toronto), PEng, FASME, FCSME, FEIC, FIEF, FCAE, FCSSE, **Professor**

Dr. Dan Zhang, BSc, MSc, PhD (Laval University), PEng, FEIC, FCSME, SMIEEE, **Professor**

### COMPLEMENTARY FACULTY

Dr. Zhaolin Wang, BSc, MSc, PhD (Zhejiang University, China), **Assistant Research Professor**

Dr. Yuelel Yang, BE, MS, PhD (University of Cincinnati), PEng, **Senior Lecturer**

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## ELECTRICAL AND SOFTWARE ENGINEERING

### CORE FACULTY

Dr. Min Dong, BEng, PhD (Cornell University), **Assistant Professor**

Dr. Mikael Eklund, BSc, MSc, PhD (Queen's University), PEng, **Associate Professor**

Dr. Hossam Gaber, BSc, MSc, PhD (Okayama University, Japan), **Associate Professor**

Dr. Ali Grami, BSc, MEng, PhD (University of Toronto), PEng, SMIEEE, **Associate Professor**

Dr. Walid Morsi Ibrahim, BSc, MSc, PhD (Dalhousie University), **Assistant Professor**

Dr. Ramiro , BScEng, MScEng, PhD (University of Waterloo), PEng, SMIEEE, **Associate Professor**

Dr. Lixuan Lu, BES, MES, PhD (Western University), **Associate Professor**

Dr. Masoud Makrehchi, BSc, MS, PhD (University of Waterloo), **Associate Professor**

Dr. Richard Marceau\*, BEng, MScA, PhD (McGill University), PEng, FCAE, **Professor**

Dr. Ruth Milman, BAsC, MASc, PhD (University of Toronto), **Assistant Professor**

Dr. Shahryar Rahnamayan, BSc, MSc, PhD (University of Waterloo), PEng, **Assistant Professor**

Dr. Jing Ren, BSc, MSc, PhD (Western University), **Assistant Professor**

Dr. Kamran Sartipi, BSc, MSc, MMath, PhD (University of Waterloo), PEng, **Assistant Professor**

Dr. Tarlochan Sidhu, BE, MSc, PhD (University of Saskatchewan), PEng, CEng, FIEEE, FEIC, FCAE, **Professor**

Dr. Shahram ShahbazPanahi, BSc, MSc, PhD (Sharif University of Technology, Iran), PEng, **Associate Professor**

Dr. Vijay Sood, BSc, MASc, PhD (Bradford University, UK), FIEEE, FEIC, **Associate Professor**

Dr. Ying Wang, BEng, MASc, PhD (University of Waterloo), **Assistant Professor**

Dr. Ying Zhu, BSc, MSc, PhD (University of Toronto), **Assistant Professor**

### COMPLEMENTARY FACULTY

Dr. Eyhab Al-Masri, BS, MS, PhD (University of Guelph), **Lecturer**

Dr. Michael Bennett, BSc, MA, PhD (Western University), PEng, PMP, **Lecturer**

Dr. Namdar Saniei, BSc, MSc, PhD (University of Toronto), **Lecturer**

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### STAFF

#### ADMINISTRATIVE SERVICES PERSONNEL

Maria Barrese, **Administrative Assistant**, Clean Energy Research Lab

Christine Burnell, **Manager**, Finance and Administration

Joanna Campbell, **Senior Academic Advisor**

Karla Gomez, **Executive Assistant to the Dean**

Beverley McComb, **Administrative Assistant**

Tammy Mulley, **Academic Advisor**

Svetlana Novak, **Graduate Program Assistant**

Tina Petralito, **Program Assistant**

Nicole Suss, **Academic Advisor**

#### TECHNICAL SERVICES PERSONNEL

Cliff Chan, PEng, **Engineering Specialist**

Masoud Farzam, PEng, **Engineering Specialist**

Mike Macleod, **Lab Specialist**

Nathan Percival, **IT Specialist**

Edward Secnik, **Manager**, Clean Energy Research Lab

Hidayat Shahid, PEng, **Manager**, Technical Services

Qi Shi, PEng, **Engineering Specialist**

Leon Wu, PEng, **Lab Specialist**

\*Currently appointed as Provost



## ACADEMIC PROGRAMS

The Faculty of Engineering and Applied Science at UOIT strives to provide the highest quality undergraduate and graduate education. We offer undergraduate degree programs leading to a Bachelor of Engineering (BEng) in the following areas:

- Automotive Engineering;
- Electrical Engineering;
- Manufacturing Engineering;
- Mechanical Engineering; and
- Software Engineering.

Designed to meet the needs of industry and society, these programs provide a solid education in basic sciences, mathematics, computing and design, along with knowledge in the respective fields of engineering science. Our unique and innovative programs include:

- Canada's only degree programs in Automotive Engineering and Manufacturing Engineering;
- Broad programs in Mechanical and Electrical Engineering;
- Unique Mechatronics and Energy options in Mechanical Engineering;
- One of only seven Software Engineering programs in Ontario;
- Engineering and Management option (five-year) for all programs; and
- Practical co-op, internship and career opportunities with leading employers.

In addition, the Faculty of Engineering and Applied Science offers graduate programs leading to the degrees of Master of Applied Science (MASc), Master of Engineering (MEng) and Doctor of Philosophy (PhD), in the following areas:

- Automotive Engineering (MASc and MEng);
- Electrical and Computer Engineering (MASc, MEng and PhD);
- Engineering Management (MEngM); and
- Mechanical Engineering (MASc, MEng and PhD).

The MASc program is research-oriented and entails a combination of course-based learning and a thesis that involves original research. The MEng program is a professional master's program for upgrading technical skills and knowledge, with an emphasis on course-based learning that can be accompanied by a major project. The PhD program leads to the highest academic degree. It involves a combination of academic coursework and a dissertation, which requires a significant detailed body of original research that leads to innovative new research outcomes.



# RESEARCH FUNDING

The Faculty of Engineering and Applied Science conducts leading-edge, value-added research in focused strategic areas. Faculty members are internationally renowned and award-winning professors in their respective fields of research. They have a wide range of expertise and experience in teaching, research and graduate student supervision. Their research activities attract funding through grants and other support from a range of sources, including industry, government agencies and other organizations. These include the Natural Sciences and Engineering Research Council of Canada (NSERC), Canada Foundation for Innovation (CFI), and the Canada Research Chairs (CRC) program. These programs award funds on a competitive basis to university researchers across Canada.

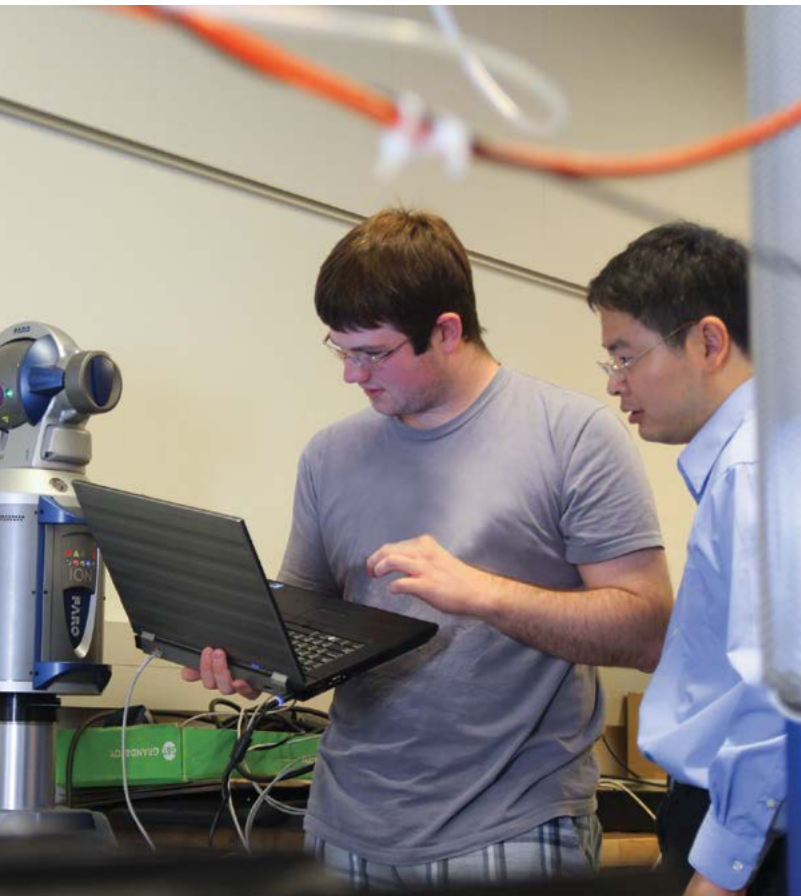
The Faculty of Engineering and Applied Science has numerous research programs and activities that secure about \$4 million of research funding annually. When ranked by criteria such as research impact and productivity of journal/conference articles published, UOIT has one of the foremost engineering faculties in Canada. In various specific areas, we are an international leader, with developments that have led to patents and prestigious recognitions around the world. The research activities are conducted in state-of-the-art research centres and buildings.

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## PARTNERS

An extensive number of research projects in our faculty involve industrial partners. There are over 40 industrial and funding institutions that are part of research projects with our faculty members. The Faculty of Engineering and Applied Science gratefully acknowledges the support given to its research programs by its partners:

AlphaChill Corporation  
Atomic Energy of Canada Limited  
AUTO21 Networks Centres of Excellence  
BRIC Engineered Systems  
Bruce Power  
Cameco Corporation  
Canada Foundation for Innovation  
Canada Research Chairs Program  
Canadian Design Engineering Network  
CANMET Energy Technology Centre  
Canadian Georexchange Coalition  
Canadian Natural Gas Vehicle Alliance  
Cleanfield Energy Inc.  
Defence Research and Development Canada  
Durham Strategic Energy Alliance  
Envirochill Corp.  
Environment Canada  
General Motors of Canada Limited  
Genist Systems Inc.  
Honeywell Aerospace  
Italian Aerospace Research Centre  
Linde Gas Inc.  
Manitoba Hydro  
Marnoch Thermal Power Inc.  
Messier-Dowty Inc.  
Minerva Canada  
MITACS  
Natural Science and Engineering Research Council of Canada  
North American Rectifier Inc.  
Ontario Centres of Excellence  
Ontario Ministry of Research and Innovation  
Ontario Ministry of the Environment  
Ontario Power Generation  
Phoenix Canada Oil Company Limited  
Planet Car Inc.  
Research in Motion  
SABIC Innovative Plastics  
Virtual Dynamics Inc.  
Volvo Group Trucks Technology



# FACULTY RESEARCH AREAS

## AUTOMOTIVE, MANUFACTURING AND MECHANICAL ENGINEERING



**Dr. Martin Agelin-Chaab**  
Bluff body aerodynamics; flow control; shear flows; turbulence; vehicle thermal management; and ventilation effectiveness



**Dr. Ahmad Barari**  
Automotive body and structural design; CAD/CAM/CAE; CMM and surface metrology; design for manufacturing/assembly; durability and fatigue; rapid prototyping; surface modelling; surface reverse engineering; vehicle life cycle; and vehicle structural stiffness



**Dr. Ibrahim Dincer**  
Drying; electric vehicles; energy and exergy; energy conversion and management; energy efficiency; heat and mass transfer; hydrogen and fuel cell systems; integrated energy systems; refrigeration; renewable energies; thermal energy storage; and thermo-dynamics



**Dr. Moustafa El-Gindy**  
Automotive system design; braking systems and performance; crash testing and simulation; engine simulation; finite element analysis of tire modelling; hybrid electric vehicle simulation; ride quality; tire mechanics; tire/road interaction mechanics; and vehicle dynamics

**Dr. Ebrahim Esmailzadeh**  
Active vibration control; intelligent and electric vehicles; nonlinear adaptive and optimal control systems; nonlinear dynamical systems; vehicle dynamics; and vibrations of machines and flexible and distributed systems

**Dr. Kamiel Gabriel (on leave)**  
Boiling and two-phase flows; energy conservation; fluid physics and heat transfer at reduced gravity (microgravity space sciences); heat-recovery systems; and thermofluids in power plants



**Dr. Marnie Ham**  
Applied statistics; asymmetric incremental sheet forming; life cycle engineering (LCE) and ecodesign; sheet metal forming; statistical quality control; and surface texture and quality



**Dr. Yuping He**  
Application of multidisciplinary optimization; automated design synthesis; mechatronic systems; modelling and simulation; and vehicle system dynamics



**Dr. Hossam Kishawy**  
Finite element modelling and residual stresses; high-speed machining; manufacturing; modelling and optimization; and stress analysis



**Dr. Atef Mohany**  
Acoustic emission and noise control in automotive, aerospace, and energy systems; active control of flow-excited acoustic resonances; aeroacoustics; fatigue assessment of structures; flow-acoustic coupling and flow-induced vibrations; and mechatronics



**Dr. Scott Nokleby**, Associate Cameco Research Chair  
Advanced kinematics of robots and mechanisms; automation; mechanisms; mechanism and robot design; mechatronics; mobile-manipulator systems; optimal design; redundant manipulator systems; and robotics



**Dr. Remon Pop-Iliev**, NSERC-GMCL Senior Chair in Innovative Design Engineering  
Engineering design; engineering materials; manufacturing engineering; and technologies for the manufacture of cellular materials and composites



**Dr. Bale Reddy**

Advanced energy systems; advanced power plant cycles; biomass combustion and gasification; cogeneration; combined cycle power generation; energy conservation; exergy analysis; fluidized bed combustors; gas-solid flows in advanced combustors; heat transfer; solar energy; thermal design and optimization; waste heat recovery



**Dr. Ghaus Rizvi**

Advanced polymer and composite processing and characterization; artificial wood; biomaterials development; macromolecular; nano-composite; and processes and materials for tissue scaffolds and skeletal structures



**Dr. Greg Rohrauer**

Advanced composite materials; alternative-fueled and hybrid vehicles development; analysis and design of composite pressure vessels; manufacturing technology and application; materials testing; vehicle battery testing; and vehicle dynamics



**Dr. Marc Rosen**

Cogeneration; district energy; electricity generation; environmental impact assessment and reduction; exergy analysis; heat transfer; hydrogen energy and fuel cells; integrated energy systems; modelling and simulation of energy systems; solar energy; sustainable energy; thermal energy storage; thermodynamics



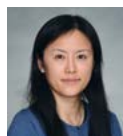
**Dr. Dan Zhang**, Canada Research Chair in Robotics and Automation, Tier 2 High performance parallel/hybrid robotic machine tools development; reconfigurable/modular robots for sustainable/green manufacturing systems; micro/nano manipulation and MEMS devices (sensors); web-based remote manipulation; rehabilitation robots; resilient robots; rescue robots





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## ELECTRICAL, COMPUTER AND SOFTWARE ENGINEERING



**Dr. Min Dong**

Adaptive signal processing for communication systems and networks; broadband wireless access communication systems and mobile networks; statistical signal processing; and wireless communications



**Dr. Mikael Eklund**

Autonomous systems and robotics; biomedical signal processing; health informatics; hybrid and discrete event control; information technology for assisted living; medical image processing; nonlinear system identification and control; and real-time event stream processing

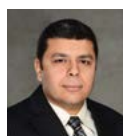


**Dr. Hossam Gaber**

Intelligent modelling and simulation for process engineering; intelligent modelling and simulation for process engineering; intelligent safety and diagnostic systems; risk-based control system design and optimization; and risk-based green hybrid energy production and supply systems

**Dr. Ali Grami**

Digital transmission systems; mobile commerce applications characterization; and satellite and wireless communications



**Dr. Walid Morsi Ibrahim**

Distributed generation (DG); plug-in hybrid electric vehicles (PHEVs); power quality; power system operation and control, distributed generation (DG); renewable energy (wind and solar); signal processing applications in power systems; smart grid and smart meters; and vehicle-to-grid (V2G)



**Dr. Ramiro Liscano**

Distributed systems; pervasive and mobile computing; sensor networks; autonomic computing (policy-based decision support systems and distributed access management); security (covert communication in MANETs)



**Dr. Lixuan Lu**

Maintenance; networked control systems; nuclear reactor instrumentation and control; probabilistic safety assessment; and reliability



**Dr. Masoud Makrehchi**

Data mining; mining and analysis of complex networks; social computing; social networks; statistical machine learning; web and text mining; and web intelligence



**Dr. Richard Marceau**

Analysis and planning; power systems operations; and symmetric operation of AC power transmission systems



**Dr. Ruth Milman**

Constrained systems; model predictive control systems; nonlinear control; optimization; and systems control theory



**Dr. Shahryar Rahnamayan**

Computer vision; evolutionary computation; image processing; machine intelligence; and optimization and its applications in real-world problems



**Dr. Jing Ren**

Haptics and virtual reality; image processing; robotics and control; and soft computing



**Dr. Kamran Sartipi**

Electronic health; knowledge engineering (decision support systems, mined-knowledge recovery); reverse engineering (execution pattern mining); security and privacy; service-oriented architecture (smart and mobile services and interactions); and software engineering

**Dr. Shahram ShahbazPanahi**

Array processing; cooperative communications; detection and estimation; dynamic spectrum access; smart antennas; statistical signal processing; and wireless communications



**Dr. Tarlochan Sidhu**

Adaptive relaying of distribution and transmission systems; grid integration issues with distributed generation; power systems; protection of flexible AC transmission systems; protection of smart grids; real-time metering and controls; voltage collapse prediction and protection



**Dr. Vijay Sood**

Control and protection of power systems; HVDC and FACTS controllers for power transmission systems; and modelling of power electronics converters using EMTP RV



**Dr. Ying Wang**

Computer aided design; electromagnetic modelling; radio wave propagation modelling in micro-cellular wireless communication systems; RF/microwave engineering; and satellite and wireless communications

**Dr. Ying Zhu**

Application-layer data dissemination; overlay networks; peer-to-peer networks; and quality-of-service

# RESEARCH AREAS AND LABORATORIES

## AUTOMOTIVE, MANUFACTURING AND MECHANICAL ENGINEERING

Advanced research is conducted in the technologies of automotive, mechanical and manufacturing engineering. These are often interdisciplinary and overlap with each other, such as automotive HVAC sub-systems and new materials of component manufacturing.

FEAS is a leader in automotive research and engineering with innovative research programs that are finding new solutions to automotive problems and educating future engineers who will turn great new ideas into commercial products in the automotive and other industries.

Specific areas of current faculty research in automotive engineering include:

- Alternative fuels;
- Automotive aerodynamics;
- Automotive communications, software and electronics;
- Automotive manufacturing and materials;
- Chassis design;
- Electric and hybrid vehicles;
- Fuel cells and hydrogen;
- Noise, vibrations and harshness;
- On-board energy systems;
- Vehicle dynamics and performance; and
- Vehicle thermal management.

Associated research laboratories include:

- AeroAcoustics and Noise Control Laboratory;
- Electric Vehicle and Battery Systems Laboratory;
- Multidisciplinary Vehicle Design Laboratory; and
- Vehicle Dynamics and Crash Simulations Laboratory.

The field of mechatronics/manufacturing is a focus area of active faculty research. Mechatronics engineering combines mechanical engineering with elements of electronics, computer, control and software engineering. Examples of electronics and mechanical systems that use automated and intelligent control are industrial robots, digital cameras and aircraft cruise control.

Active research is also conducted in the development of advanced processes and methodologies for manufacturing. Manufacturing has a vital role in the Ontario economy, accounting for about one-quarter of its gross domestic product. The Durham Region Manufacturing Association, for example, represents more than 100 manufacturing companies in Durham Region.

Specific areas of current faculty research in manufacturing include:

- Dynamics, vibration and noise;
- Engineering design;
- Manufacturing and materials;
- Mechanics of solids and structures; and
- Robotics, automation and controls.

Associated research laboratories include:

- Active Vibration Control Laboratory;
- Advanced Materials Engineering Laboratory;
- Advanced Metrology Laboratory;
- Centre for Engineering Design, Automation and Robotics;
- Laboratory for Applied Research on Design and Engineering of Composite Materials; and
- Mechatronic and Robotic Systems Laboratory;
- Machining Research Laboratory; and
- Robotics and Automation Laboratory.

The faculty's research in energy/thermofluids focuses on the development of sustainable energy solutions for generation, storage and distribution of energy. This builds on Durham Region's strengths in the energy sector, such as the Durham Strategic Energy Alliance (DSEA) and the nearby nuclear industry, which is home to most of Ontario's nuclear stations. DSEA is a consortium of industry, private sector, municipal governments and academia that includes leaders of the energy sector.

Specific areas of current faculty research in energy include:

- Biomass combustion and gasification;
- Energy conversion and management;
- Fuel cells and integrated energy systems;
- Hydrogen production, storage, transportation, delivery and use;
- Heat transfer, fluid mechanics and multiphase flows;
- Integrated and combined cycle power generation;
- Modelling and simulation of energy systems;
- Multi-generation energy systems;
- Refrigeration and air conditioning;
- Renewable energy systems (wind, solar, geothermal); and
- Thermal energy storage.

Associated research laboratories include:

- Advanced Energy Systems Research Laboratory;
- Sustainable Energy Systems Laboratory;
- Sustainable Hydrogen Production Research Laboratory;
- Two-phase Flow Laboratory; and
- Thermal Engineering and Microfluidics Laboratory.

## ELECTRICAL, COMPUTER AND SOFTWARE ENGINEERING

The Faculty of Engineering and Applied Science conducts transformative research in electrical, computer and software engineering. This includes the analysis, development and testing of electrical and computer technologies and their components, as well as their integration into complex software and communication systems.

The electrical, computer and software engineering sectors have a vital role in the Canadian economy. Innovative research is being conducted to address various technological challenges such as providing more capable telecommunications networks (wireless and the Internet), intelligent control systems (with higher speed, better precision and lower cost) and power smart grids. Software systems engineering research is performed on computer programs and their integration into computer systems, as well as a range of applications. Software systems engineering is the core component of the growing software sector and is increasingly important in many industries, including telecommunications, power generation, biomedical and manufacturing systems.

Specific focus areas of faculty research include:

- Automatic/intelligent sensing and control;
- Biomedical engineering, health informatics, and telehealth;
- Haptics and virtual reality;
- Knowledge Discovery
- Medical and mobile robotics;
- Mobile and pervasive computing;
- Multi-variable optimization;
- Networked and distributed control systems;
- Network security;
- Power systems and smart grid engineering;
- Satellite communications;
- Sensor networks;
- Service Computing;
- Statistical and array processing; and
- Wireless communications and signal processing.

Associated research laboratories include:

- Advanced Multi-disciplinary Laboratory for Smart Software Systems (Multi-SmartSS Lab);
- Communication Networks Laboratory;
- Computational Intelligence Laboratory
- Distributed and Mobile Sensing Laboratory;
- Health Informatics Research Laboratory;
- Intelligent Systems Laboratory;
- Microfabrication Laboratory;
- Smart Electric Power Grid Laboratory; and
- Wireless Communications and Signal Processing Laboratory
- Distributed and Mobile Systems Lab (DAMSEL).



# FACULTY NEWS HIGHLIGHT

## AUTOMOTIVE ENGINEERING PROFESSOR RECEIVES RESEARCH FUNDING FOR VEHICLE SAFETY

Protecting vehicle passengers in side crashes with trucks, helping Canadian seniors drive safely and advancing electric vehicle technologies are just a few of the projects that will benefit from a \$22 million investment by Canada's automotive research program, the AUTO21 Network of Centres of Excellence. The funding will support 40 automotive R&D projects at Canadian universities in partnership with more than 100 public and private sector companies.

Among the projects being funded is a collaborative research effort headed by Dr. Moustafa El-Gindy, associate professor, Faculty of Engineering and Applied Science (FEAS). He is leading a team of researchers in a project valued at \$515,770 over two years to develop new protection devices for side crashes involving passenger vehicles and large trucks. Dr. El-Gindy's project also involves Volvo Group Trucks Technology, the Canada Foundation for Innovation, the Government of Saskatchewan Ministry of Highways and Infrastructure, the University of Regina and the Concordia Centre for Advanced Vehicle Engineering (CONCAVE) at Concordia University in Montreal, Quebec.

The funding was announced by the Honourable Gary Goodyear, Minister of State, Science and Technology, at an AUTO21 conference in Montreal, Quebec. The \$22 million will support the projects for two years and includes \$10 million from the Government of Canada through the federal Networks of Centres of Excellence program. The remaining \$12 million consists of contributions from Canada's automotive sector, including numerous automakers, parts manufacturers and material suppliers.

"Our government's first priority is the economy—creating jobs, growth and long-term prosperity," said Minister of State Goodyear. "The ideas, products and technologies generated by these AUTO21-funded research projects will create jobs and businesses, help develop highly skilled people, strengthen our economy and improve the long-term competitiveness of our Canadian automotive industry."

"With their industry partners, AUTO21 researchers are developing solutions for cleaner, safer vehicles and roads," said Stephen Beatty, chair of the AUTO21 board of directors and managing director of Toyota Canada Inc. "The projects supported by this investment will provide solutions to the issues most pressing in today's automotive sector while providing training to hundreds of Canadian graduate students."





“The research focuses on two streams of improving side under-ride collision safety,” said Dr. El-Gindy. “First is the development of passive guards to act as a physical barrier to an automobile wedging under a commercial vehicle. Second is the development of automobile safety mechanisms such as pre-emptive deployment of airbags in a collision through the use of wireless and sensor technologies.”

“UOIT is extremely proud of the outstanding innovative research Dr. El-Gindy continues to champion in collaboration with his research partners,” said Dr. Michael Owen, associate provost, Research. “We anticipate that findings from this project will lead to future commercialization opportunities with industry and ultimately make Canadian vehicles and highways safer down the road.”

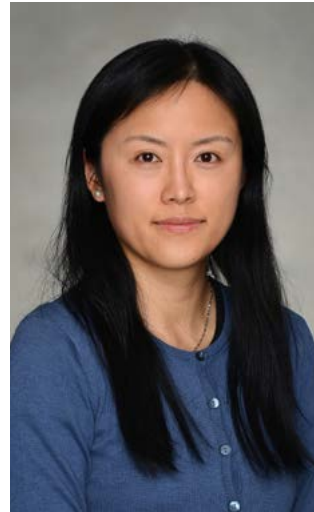
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*Dr. Moustafa El-Gindy (centre) discussing a research project with UOIT Automotive Engineering master's degree students Todd Macdonald (left) and Patrick Galipeau-belair (right).*



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## ELECTRICAL ENGINEERING PROFESSOR RECEIVES FUNDING FOR CLEAN TECHNOLOGY SOLUTIONS



Communications technology may soon go green, thanks to new funding for clean technology solutions research. Dr. Min Dong was recently awarded \$140,000, over the next five years, through the Ministry of Economic Development and Innovation's Early Researcher Awards program. The prestigious ERA program is intended to attract and retain the best and brightest researchers around the world to ensure Ontario remains at forefront of leading-edge research.

“Technology is in high-demand across the globe, and this research has the potential to further improve wireless technology while helping the environment at the same time.”

Dr. Dong's award will fund the project entitled: Building Green Communications through Co-operation: Fundamental Limits and Practical Techniques. She will conduct research on sustainable wireless technology to address the inefficiency faced in the current technologies in energy consumption and carbon emissions. Her goal is to create theories and technologies that lead to new wireless solutions and infrastructures that aggressively improve energy efficiency and conservation while increasing the reliability, speed and range of communications to meet the growing wireless service demand. Her work will help keep Ontario's wireless industry at the forefront of this high-demand technology and bring benefits of green technology solutions to other sectors.



## FEAS RESEARCH FACILITIES

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### ONTARIO POWER GENERATION ENGINEERING BUILDING

The 40,000-square-foot, three-storey Ontario Power Generation (OPG) Engineering building has 17 laboratories, including state-of-the-art facilities and equipment for teaching and research. The advanced learning areas include a rapid prototyping and manufacturing lab, a combustion and engines lab, a mechatronics and robotics lab, and an emerging energy systems lab with solar, wind, hydrogen and fuel-cell technology.

UOIT graduate students also have access to powerful computing resources necessary to support their studies and research. This includes dedicated engineering computer labs, featuring state-of-the-art workstations and software.

UOIT is a member of the Partners for the Advancement of Collaborative Engineering Education (PACE), a program which links its business partners – General Motors, Autodesk, HP, Oracle and Siemens – with leading academic institutions worldwide to prepare future engineers, designers and analysts to play key roles in the automotive product lifecycle management team of the future. Engineering graduate students at UOIT have full access to the hardware and extensive PACE software for their studies.

In addition, UOIT is a member of the Shared Hierarchical Academic Research Computing Network (SHARCNET), a consortium of Ontario universities and colleges, with a cluster of high-performance computers enabling advanced computational research. SHARCNET provides support for intensive numerical simulations by engineering graduate students and researchers.

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### ENERGY SYSTEMS AND NUCLEAR SCIENCE RESEARCH CENTRE

The Energy Systems and Nuclear Science Research Centre (ERC) is a 9,290 square-metre building with unique capabilities and facilities in geothermal, hydraulic, hydrogen, natural gas, nuclear, radiation, solar and wind energy technologies. The ERC is the result of a joint \$45.4-million investment from both the federal and provincial governments as part of the Knowledge Infrastructure Program (KIP). The centre has space and offices for faculty, staff and graduate students in the Faculty of Engineering and Applied Science. The ERC has research labs for computational simulations in various engineering disciplines, particularly for electrical power systems and smart grid research. The building features a glass-covered four-storey Atrium, a 72-seat lecture theatre, three 50-seat classrooms, two 30-seat tutorial rooms with flexible seating, as well as numerous other labs and student-study breakout rooms.



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## GENERAL MOTORS OF CANADA AUTOMOTIVE CENTRE OF EXCELLENCE

The General Motors of Canada Automotive Centre of Excellence (ACE) is the first climatic testing and research centre of its kind in Canada, and in many respects the world. This multi-purpose, 16,300-square-metre facility, is owned and operated by UOIT and is a truly independent, commercial operation.

ACE is divided into two distinct areas: a core research facility and an integrated research and training facility.

The core research facility offers a range of full-sized test chambers that allow for full climatic, structural durability and lifecycle testing. The signature test chamber is one of the largest and most sophisticated climatic wind tunnels in the world. The wind tunnel has a large yawing chassis dynamometer (road simulator) that can, for the first time anywhere, test properties in crosswinds. Among the other chambers is a climatic four-post shaker that can test a vehicle's ability to handle a wide range of road conditions in Arctic or high desert conditions.

The integrated research and training facility spans five floors with space dedicated for research, education and training. This facility is fostering an environment for collaboration and interaction between industry, researchers and students.

ACE was developed in partnership with UOIT, General Motors of Canada, the Government of Ontario, the Government of Canada and PACE.

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## CLEAN ENERGY RESEARCH LABORATORY

Officially opened in September 2010, the Clean Energy Research Laboratory (CERL) is a cutting-edge laboratory that pioneers clean energy research and discovers major new energy solutions to the problem of climate change. CERL's mission is to develop clean energy technologies and move them from the laboratory to commercial and industrial application. Current research projects in CERL include: hydrogen production; heat engines (specifically a Marnoch heat engine); chemical heat pumps; and nano- and micro-scale energy systems.

Through a \$10 million project over a five-year period, CERL researchers are working on the world's first lab-scale demonstration of an integrated copper-chlorine cycle for thermochemical water splitting and nuclear hydrogen production. The 33-member UOIT-led team comprises eight collaborating institutions and universities from five countries, six industrial partners and two local organizations in Durham Region.



# SELECTED JOURNALS, CONFERENCE AND TECHNICAL PUBLICATIONS AND PATENTS

## AUTOMOTIVE, MANUFACTURING AND MECHANICAL ENGINEERING

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M. Agelin-Chaab, M. Tachie, "Turbulent round offset jets", *Technical Report*, 2012

M. Agelin-Chaab, "Backward facing step turbulent flow over rough surfaces", *9th European Fluid Mechanics Conference*, Rome, Italy, September 9-13, 2012

M. Agelin-Chaab, "An experimental study of plane free jet from a vertical slot diffuser", *CSME International Congress*, Winnipeg, Manitoba, June 4-6, 2012

### Dr. A. Barari

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S. Tebby, A. Barari, E. Esmailzadeh, "Optimization of vehicle structure considering torsion stiffness using simple structural beam frame-approach", *Canadian Society for Mechanical Engineering International Congress 2012*, Winnipeg, Manitoba, June 4-6, 2012

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Md. Tarique, I. Dincer, C. Zamfirescu, "Experimental investigation of scroll based organic Rankine cycles", *Sixth International Green Energy Conference*, pp. 724-731, Eskisehir, Turkey, June 5-9, 2011

### Dr. M. El-Gindy

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## ELECTRICAL, COMPUTER AND SOFTWARE ENGINEERING

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#### Dr. A. Grami

A. S. Zahmati, X. Fernando, A. Grami, "A continuous-time Markov chain model and analysis for cognitive radio networks", *International Journal of Communication Networks and Distributed Systems*, vol. 8, nos. 3/4, pp. 195-212, 2012

A. Sepasi Zahmati, X. Fernando, A. Grami, "Steady-state Markov chain analysis for heterogeneous cognitive radio networks", *IEEE Sarnoff Symposium*, Princeton, New Jersey, April 2010

V. Havary-Nassab, S. Shahbazpanahi, A. Grami, "Optimal distributed beamforming for two-way relay networks", *IEEE Transactions on Signal Processing*, pp. 1238-1250, March 2010

#### Dr. R. Liscano

J. K. Jacoub, R. Liscano, J. S. Bradbury, "Assessment of software modelling techniques for wireless sensor networks: A survey", *Sensors and Transducers Journal*, Vol. 14-1, 2012, pp. 18-46

R. Liscano, J. K. Jacoub, A. Dersingh, J. Zheng, M. Helmer, C. Elliott, A. Najafzadeh, "Network performance of a wireless sensor network for temperature monitoring in vineyards", *8th ACM Symposium on Performance Evaluation of Wireless Ad Hoc, Sensor, and Ubiquitous Networks*, November 3-4, 2011, pp. 125-130

J. Khalil, R. Liscano, "Wireless sensor actor network simulation for a fire extinguishing system", *2nd International Conference on Ambient Systems, Networks and Technologies*, September 19-21, 2011, pp. 874-880

A. Najafzadeh, R. Liscano, M. Vargas Martin, M. Salmanian, P. C. Mason, "Challenges in the implementation and simulation for wireless side-channel based on intentionally corrupted FCS", *2nd International Conference on Ambient Systems, Networks and Technologies*, September 19-21, 2011, pp. 165-172

N. Qwasmi, F. Ahmed, R. Liscano, "Simulation of DDOS attacks on P2P networks", *IEEE International Conference on High Performance Computing and Communications*, September 1-3, 2011, pp. 610-614

J. K. Jacoub, R. Liscano, J. Bradbury, "A survey of modelling techniques for wireless sensor networks", *5th International Conference on Sensor Technologies and Applications*, August 22-24, 2011

#### Dr. L. Lu

N. Khan, L. Lu, "Decentralized state-space controller design of a large PHWR", *Nuclear Technology*, 2011

A. W. Al-Dabbagh, L. Lu, "Reliability modelling of networked control systems using dynamic flowgraph methodology", *Reliability Engineering and System Safety*, Vol. 95, pp. 1202-1209, 2010

A. W. Al-Dabbagh, L. Lu, "Design and reliability prediction of the control system for nuclear-based hydrogen production with copper-chlorine thermochemical cycle", *International Journal of Hydrogen Energy*, Vol. 35, pp. 966-977, 2010

L. Lu, J. Lei, "Design and reliability prediction of a distributed landing gear control system", *Aircraft Engineering and Aerospace Technology*, Vol. 82, No. 1, pp. 15-22, 2010

A. W. Al-Dabbagh, L. Lu, A. Mazza, "Modelling, simulation and control of a proton exchange membrane fuel cell (PEMFC) power system", *International Journal of Hydrogen Energy*, vol. 35, pp. 5061-5069, 2010

F. Ahmed, L. Lu, G. F. Naterer, "Reactivity control and load cycling of CANDU system", *23rd IEEE Canadian Conference on Electrical and Computer Engineering*, Calgary, Alberta, May 2-5, 2010

#### Dr. R. Milman

R. Milman, "Active set methods applied to model predictive control – A natural tool for solving the quadratic programming problem", *Invited Lecture*, Concordia University, Montreal, Quebec, May 3, 2012

M. Abbas, J. M. Eklund, R. Milman, "Real-time analysis for nonlinear model predictive control of autonomous vehicles", *25th Annual Canadian Conference on Electrical and Computer Engineering*, April 29-May 2, 2012

#### Dr. W. Morsi

W. G. Morsi, "A wavelet-based approach for reactive power metering in modern three-phase grids considering time-varying power quality disturbances", *Electric Power Systems Research*, Vol. 87, pp. 31-38, June 2012

W. G. Morsi, "Electronic reactive energy meters performance evaluation in environment contaminated with power quality disturbances", *Electric Power Systems Research*, Vol. 84, No. 1, pp. 201-205, March 2012

W. G. Morsi, C. P. Diduch, L. Chang and M. E. El-Hawary, "Wavelet-based reactive power and energy measurement in the presence of power quality disturbances", *IEEE Transactions of Power Systems*, Vol. 26, No. 3, pp. 1263-1271, August 2011

C. Church, W. G. Morsi, C. P. Diduch, L. Chang, M. E. El-Hawary, "Voltage collapse detection using ant colony optimization for smart grid applications", *Electric Power Systems Research*, Vol. 81, No. 8, pp. 1723-1730, August 2011

J. Plastino, W. G. Morsi, "On the modelling of dynamic voltage restorer for voltage sag mitigation in standalone power system", *IEEE Electrical Power and Energy Conference*, Winnipeg, Manitoba, 2011

P. Rosario, W. G. Morsi, L. Chang, "Application of PSO to optimize the operation of electric water heaters for reserve provision", *IEEE Electrical Power and Energy Conference (EPEC)*, Winnipeg, Manitoba, 2011

W. G. Morsi, M. E. El-Hawary, "On an effective method for formulating electric power systems problems for creating online assessments for students' performance evaluation", *IEEE Canadian Conference on Electrical and Computer Engineering*, Niagara Falls, Ontario, 2011

#### Dr. S. Rahnamayan

F. Bourennani, S. Rahnamayan, "Heterogeneous text and numerical data mining with possible applications in business and financial sectors", *Semantic Technologies for Business and Information Systems Engineering: Concepts and Applications*, IGI Global Publishers, 2012

H. Wang, S. Rahnamayan, S. Zeng, "Generalized opposition-based differential evolution: An experimental study", *International Journal of Computer Applications in Technology (IJCAT)*, Vol. 43, No. 4, 2012

F. Bourennani, S. Rahnamayan, G. F. Naterer, "Optimal design methods for hybrid renewable energy systems" (in press), *International Journal of Green Energy*, 2012

S. Rahnamayan, G.G. Wang, M. Ventresca, "An intuitive distance-based explanation of opposition-based sampling" (in press), *Journal on Applied Soft Computing - Elsevier*, March 2012

A. Darvish, S. Rahnamayan, Z. Salami Mohamad, "Interactive evolutionary-based image thresholding", *Genetic and Evolutionary Computation Conference*, Philadelphia, Pennsylvania, July 7-11, 2012

A. Esmailzadeh, S. Rahnamayan, "Center-point-based simulated annealing", *Canadian Conference on Electrical and Computer Engineering*, Montreal, Quebec, April 29-May 2, 2012

H. Wang, Z. Wu, S. Rahnamayan, C. Lic, S. Zeng, D. Jiang, "Particle swarm optimization with simple and efficient neighbourhood search strategies", *International Journal of Innovative Computing and Applications*, Vol. 3, No. 2, 2011, pp. 97-104

#### Dr. J. Ren

X. Huang, A. Bari, S. Zaheer, T. Looi, J. Ren, J. Drake. "3D curve constrained deformable registration using a neuro-fuzzy transformation model", *International Conference of the IEEE Engineering in Medicine and Biology Society*, 2012

X. Huang, S. Zaheer, A. Bari, T. Looi, J. Ren, J. Drake. "Extraction of liver vessel centerlines under guidance of patient-specific models", *International Conference of the IEEE Engineering in Medicine and Biology Society*, 2012.

T. Sun, E. Esmailzadeh, J. Ren, Y. He, "Lateral stability improvement of car-trailer systems using active trailer braking control", *CSME Symposium on Advanced Road Vehicles*, 2012X.

Ding, Y. He, J. Ren, T. Sun. "A comparative study of control algorithms for active trailer steering systems of articulated heavy vehicles", *American Control Conference*, 2012

### Dr. K. Sartipi

P. Jayaratna, K. Sartipi, "HL7 v3 message extraction using semantic web techniques", *International Journal of Knowledge Engineering and Data Mining*, Vol. 2, No. 1, pp. 89-115, 2012

M. Najafi, K. Sartipi, "Extending SOA architecture using generic service representatives", *Journal of Service Oriented Computing and Applications*, Springer, Vol. 5, No. 4, pp. 245-264, 2011

K. Sartipi, N. Archer, M. H. Yarmand, "Challenges in developing effective clinical decision support systems", pp. 1-20, chapter of ebook: *Efficient decision support systems: Practice and challenges – from current to future*, INTECH Publishing, September 2011

M. Najafi, K. Sartipi, N. Archer, "A QoS-aware decision model for web service development: Server-side data services or client-side task services", *IBM CASCON Conference*, pp. 271-286, Toronto, Ontario, November 2011

A. Yousefi, K. Sartipi, "Identifying distributed features in SOA by mining dynamic call trees", *IEEE International Conference on Software Maintenance*, pp. 73-82, Williamsburg, Virginia, September 2011

M. Najafi, K. Sartipi, N. Archer, "Information, knowledge, and task web services using generic service representatives", *International Conference on Semantic Web and Web Services*, pp. 6-11, Las Vegas, Nevada, 2011

### Dr. S. Shahbazpanahi

S. ShahbazPanahi, M. Dong, "Achievable rate region under joint distributed beamforming and power allocation for two-way relay networks" (in press), *IEEE Transactions on Wireless Communications*, 2012

Y. Jing, S. ShahbazPanahi, "Max-min optimal joint power control and distributed beamforming for two-way relay networks under per-node power constraint" (in press), *IEEE Transactions on Signal Processing*, June 2012

S. Shahbazpanahi, M. Dong, "A semi-closed-form solution to optimal distributed beamforming for two-way relay networks" (in press), *IEEE Transactions on Signal Processing*, Vol. 60, pp. 1511-1516, March 2012

M. Zaeri-Amirani, S. Shahbazpanahi, T. Mirfakhraie, K. Ozdemir, "Performance trade-off in bidirectional network beamforming" (in press), *IEEE Transactions on Signal Processing*, 2012

H. Chen, A.B. Gershman, S. Shahbazpanahi, "Filter-and-forward distributed beamforming for two-way relay networks in frequency selective channels", *IEEE Transactions on Signal Processing*, vol. 60, pp. 1927-1941, April 2012

S. Talwar, Y. Jing, S. Shahbazpanahi, "Joint relay selection and power allocation for two-way relay networks", *IEEE Signal Processing Letters*, Vol. 18, pp. 91-94, February 2011

### Dr. V. K. Sood

E. Al-nabi, B. Wu, N. Zargari, V. Sood, "Input power factor compensation for high-power current source converter-fed PMSM drive using d-axis stator current control", *IEEE Transactions on Industrial Electronics*, Vol.59, No.2, pp. 752-761, 2012

S. Chiniforoosh, H. Atighechi, A. Davoudi, J. Jatskevich, A. Yazdani, S. Filizadeh, M. Saeedifard, J. A. Martinez, V. Sood, K. Strunz, J. Mahseredjian, V. Dinavahi, "Dynamic average modelling of front-end diode rectifier loads considering discontinuous conduction mode and unbalanced operation", *IEEE Transactions on Power Delivery*, Vol. 27, No. 1, pp. 421-429, 2012

E. Tara, S. Filizadeh, J. Jatskevich, E. Dirks, A. Davoudi, M. Saeedifard, K. Strunz, V. K. Sood, "Dynamic average-value modelling of hybrid-electric vehicular power systems", *IEEE Transactions on Power Delivery*, Vol. 27, No. 1, pp. 430-438, 2012

E. Al-nabi, B. Wu, N. Zargari, V. Sood, "Power factor compensation for CSC-fed PMSM drive using d-axis stator current control", *International Electric Machines and Drives Conference*, Niagara Falls, Ontario, May 2011

S. Salem, V.K. Sood, "Series converter-based FACTS controllers - simulation and design", *IJEST Journal, Special Issue on Power System and Apparatus Transients Measurement, Modelling and Simulation*, 2011

D. Singh, K. Duggal, V.K. Sood, "Impact of islanding and resynchronization on distribution systems", *IEEE Electrical Power and Energy Conference*, Winnipeg, Manitoba, October 2011

K. Narendra, D. Fedirchuk, N. Zhang, R. Midence, N. Perera, V. K. Sood, "Phase angle comparison and differential rate of change methods used for differential protection of busbars and transformers", *IEEE EPEC Conference*, October 2011

### Dr. Y. Wang

Y. Wang, M. Yu, H. Kabir, Q. Zhang, "Application of neural networks in space-mapping optimization of microwave filters", *International Journal of RF and Microwave Computer-Aided Engineering*, Vol. 22, No. 2, pp. 159-166, 2012

M. A. Ismail, Y. Wang, M. Yu, "Advanced design and optimization of large scale microwave devices", *IEEE MTT-S International Microwave Symposium*, Montreal, Quebec, June 2012

M. Yu, and Y. Wang, "Overview of the research and applications of the space-spectral domain approach (SSDA)", *IEEE MTT-S International Microwave Symposium*, Montreal, Quebec, June 2012

M. Yu, Y. Wang, "Inline cross-coupled coaxial cavity filter", *U.S. Patent 8,085,118 B2*, December 27, 2011

S. Li, Y. Wang, "Design of enhanced microwave multiplexing networks with H-plane T-junctions", *Asia-Pacific Microwave Conference 2011*, Melbourne, Australia, December 2011

M. Yu, Y. Wang, "Synthesis and beyond: Advanced techniques for filter and multiplexer synthesis and design by optimization", *IEEE Microwave Magazine*, Vol.12, No.6, pp. 62-76, 2011

## RECENT SELECTED RESEARCH GRANTS, CONTRACTS, AWARDS AND HONOURS

### GRANTS AND CONTRACTS

#### Dr. A. Barari

Natural Sciences and Engineering Research Council of Canada (NSERC) Engage Grant, "Automated Vision-Based Tool Holder Calibration for Collision-Free Milling", \$24,844, 2012

Ontario Centres of Excellence (OCE) Grant, "Piece-Count Automated System", \$3,500, 2012

OCE Grant, "Machining Chatter Control Mechanism", \$2,500, 2011

Canadian Foundation for Innovation (CFI) Leaders Opportunity Fund, "Integrated Research Platform for Pattern Recognition of Machining Errors", \$168,912, 2011

Federal Economic Development Agency for Southern Ontario (FedDev) Applied Research and Commercialization Initiative, Durmach Tools and Manufacturing, \$69,200, 2011

#### Dr. A. Grami

NSERC Discovery Grant, "Next Generation Multi-Band Satellite Systems", \$18,000, 2012

#### Dr. I. Dincer

NSERC Discovery Grant, "Performance Improvement of Thermal Energy Storage Systems", \$30,000, 2012

OCE Collaborative Grant, Cleanfield Energy Inc., "Development of a Novel Ammonia-Water Heat Engine for Power and Heat Co-Generation", \$285,930, 2010-2012

Mitacs-Accelerate Grant, "Harnessing Aerodynamic Energy from Vehicle Motion", \$15,000, 2011

OCE Connections Grant, "Building PEM Fuel Cell Stacks with Different Configurations", \$3,500, 2012

Ontario Partnership for Innovation and Commercialization (OPIC) Grant, "Photo Electrochemical Chloroalkali Process Reactor", \$10,000, 2012

Mitacs Grant, "Workshop on the Recent Advances in Fuel Cells", \$12,000, 2011

Mitacs Grant, "Summer Course on Exergy and Its Applications for Better Environment and Sustainability", April 30-May 6, 2012; Oshawa, Ontario, \$40,000, 2012

#### Dr. M. Dong

CFI Leaders Opportunity Fund, "Research Laboratory for Integrated High-Speed Broadband Wireless Communication Systems", \$245,000, 2012

MEDI Early Researcher Award, "Building Green Communications Through Cooperation: Fundamental Limits and Practical Techniques", \$190,000, 2012-2017

NSERC Discovery Grant Award, "Resource-constrained Communications and Networking through Adaptation and Cooperation", \$29,000, 2012

NSERC Strategic Project Grant, "Future Ubiquitous Green Mesh Relay Network Design Based On Distributed Beamforming" (co-investigator), \$501,000, 2010-2013

NSERC Collaborative Research and Development Grant, "Cognitive Sensing for Dynamic Spectrum Access" (co-investigator), \$123,000, 2010-2013

#### Dr. M. Eklund

NSERC Discovery Grant, "Real-Time Predictive Modelling Methods Using Multi-Rate Physiological Time Series Data for the Prediction of Disease Onset", \$18,000, 2012

OPIC Proof of Principle Grant, "Remote Computer Aided Diagnostics System", \$10,000, 2012

#### Dr. M. El-Gindy

AUTO21 Grant, "Protection Devices for Disproportioned Side Crashes", \$263,770, 2012-2014

Volvo Group Trucks Grant, "3-D FEA Truck Tire-Soft Terrain Modelling", \$150,000, 2011-2013

CFI Grant, "Truck-Driver-Road Interaction Simulator", \$92,886, 2012

#### **Dr. E. Esmailzadeh**

NSERC Discovery Grant, “Semi-Automated Optimal Vibration Suppression of Flexible Structures”, \$30,000, 2012

#### **Dr. H. Gaber**

NSERC Discovery Grant, “Intelligent Safety Systems for Green Energy and Production Facilities”, \$20,000, 2012

National Telecommunications Regulatory Authority (NTRA), Egypt, “Smart Grid Frequency Monitoring Network (FNET) Architecture and Applications” (co-investigator), \$340,000, 2012-2014

Qatar National Research Foundation, “Development of Design and Operation Support System For

Risk-Based Energy Conservation and Supply Management of Industrial and Societal Facilities” (co-investigator), \$1,021,613, 2012-2014

HOPE, Industrial Collaboration Contract, “Study and Preliminary Experimental Setup for Fusion Focus Effect”, \$75,000, 2012

#### **Dr. M. Ham**

FedDev Grant, “SeaStryder”, \$104,000, 2011-2012

NSERC Collaborative Research and Development (CRD) Grant, “Architectural Applications Using Single Point Incremental Forming”, \$133,000, 2010-2012

NSERC Discovery Grant, “Critical Factors, Limits and Applications in Incremental Forming”, \$17,500, 2012

#### **Dr. Y. He**

NSERC Discovery Grant, “Design of Active Safety Systems for Long Combination Vehicles Considering Driver-Vehicle-Road Interactions”, \$20,000, 2012

OPIC Proof of Principle Grant, “Development of Active Trailer Steering Systems for Multi-Trailer Articulated Heavy Vehicles”, \$10,000, 2012

OPIC Proof of Principle Grant, Phase II, “Validating and Optimizing Prototype of Active Trailer Steering Systems for Multi-Trailer Articulated Heavy Vehicles”, \$51,400, 2012-2013

FedDev Applied Research and Commercialization Initiative, “A New Active Safety Systems for Multi-Trailer Articulated Heavy Vehicles”, \$100,000, 2012-2013

#### **Dr. H. Kishawy**

NSERC Engage Grant, “Online Control of the Machined Surface Quality”, \$25,000, 2012

NSERC Discovery Grant, “Machining of Metal Matrix Composites and Attainable Surface Integrity”, \$32,000, 2012

NSERC Discovery Accelerator Supplements (DAS) Grant, “Machining of Metal Matrix Composites and Attainable Surface Integrity”, \$40,000, 2012

OCE Connection Grant, “Centrifugal Pump with Variable Cutwater for Automotive Engine Cooling Systems”, \$3,500, 2012

#### **Dr. R. Liscano**

NSERC Discovery Grant, “Autonomic Computing in Heterogeneous Sensor Networks”, \$19,000, 2012

#### **Dr. L. Lu**

NSERC Engage Grant, “Design and Implementation of the Preliminary Automation System for the CANBERRA Gas Filling Station of Geiger Mueller Detectors”, \$25,000, 2011

NSERC Discovery Grant, “Reliability and Safety Assessment of Wireless Networked Control Systems”, \$18,500, 2011

#### **Dr. R. Milman**

NSERC Discovery Grant, “Optimization Based Control for Constrained Systems with Fast Dynamics”, \$20,000, 2012

#### **Dr. A. Mohany**

NSERC Discovery Grant, “Flow-Sound Interaction of Multiple Bare and Finned Cylinders in Cross-Flow”, \$23,000, 2012

New Brunswick Innovation Foundation Grant, “Acoustic Resonance of Multiple Bare Cylinders in Cross-Flow”, \$25,000, 2011

NSERC RTI Grant, “High-Speed Centrifugal Blower for Experimental Aeroacoustics”, \$15,400, 2011

#### **Dr. W. Morsi**

OCE Grant with Ontario Power Generation (OPG) Hydro One and Siemens, “Zonal Energy Management and Optimization System for Smart Grid Application” (co-investigator), \$600,000, 2011-2014

NSERC Discovery Grant, “Managing the Impact of the Electrified Transportation Sector on the Electric Grid”, \$22,000, 2012

NSERC RTI Grant, “Energy Management in Smart Grids”, \$55,000, 2012

#### **Dr. S. B. Nokleby**

NSERC CRD Grant with University Network of Excellence in Nuclear Engineering (UNENE), OPG and Cameco Corp., “Development of New CANDU Fuel Channel Inspection Tools for Increased Inspection Speed”, \$390,000, 2012-2015

NSERC Discovery Grant, “Integrated Kinematic Control of Mobile Manipulators”, \$20,000, 2012

FedDev Ontario Grant, Applied Research and Commercialization Initiative, “Design and Development of Enhanced Conveying Technologies”, \$93,600, 2010-2012

#### **Dr. R. Pop-Iliev**

NSERC Chairs in Design Engineering, “NSERC-Ontario Power Generation Senior Chair in Innovative Design Engineering” (with V. Sood and J. Froates), \$2,647,800, 2012-2017

CFI New Initiatives Fund, “Centre for Characterization of Polymers and Cellular Polymeric Composites (CCPCPC)” (with G. Rizvi), \$878,051, 2011-2016

#### **Dr. S. Rahnamayan**

NSERC Discovery Grant, “Opposition-Based Evolutionary Algorithms: Towards Solving High-Dimensional Optimization Problems Efficiently”, \$20,000, 2012

FedDev Ontario - Applied Research and Commercialization Initiative Fund, “Fast Registration for Atlas-Based MRI Image Segmentation”, \$130,000, 2011- 2012

UNENE/OPG Grant, “Statistical Signal Processing for Non-Destructive Testing for Nuclear Industry” (co-investigator), \$270,000, 2011-2014

Ryerson University Research Fund, “An Image-guided Robotic System for High Intensity Focused Ultrasound” (co-investigator), \$10,000, 2012

#### **Dr. B. Reddy**

NSERC Discovery Grant, “Advanced Biomass, Coal and Natural Gas Based Energy Systems with Carbon Dioxide Capture”, \$22,140, 2012

#### **Dr. J. Ren**

NSERC Discovery Grant, “Dynamic 3D Haptic Virtual Fixtures for Minimally Invasive Beating Heart Surgery”, \$18,000, 2011

#### **Dr. G. Rohrauer**

Automotive Partnership Canada (APC) Research Grant, GM Canada, “Thermal Management System Technology Development for Extended Range Electric Vehicles” (with I. Dincer, M. Eklund, G. F. Naterer, R. Pop-Iliev), \$163,913, 2012

Auto21 NCE Grant, “Hybrid Active Safety Systems and Grid Interfacing”, \$36,750, 2012

DSEA Grant, “Electric Vehicle Charging Project Pilot”, \$12,000, 2011

#### **Dr. G. Rizvi**

NSERC/SABIC Innovative Plastics CRD Grant, “Fundamental Studies into Causes of Colour Mismatch”, \$132,931, 2012

Auto21 Grant, “Recyclable, Light-Weight Polymeric Nanocomposites” (Principle Investigator: H. Naguib), \$57,250, 2011

#### **Dr. M. A. Rosen**

CFI Leaders Opportunity Grant, “Truck-Driver-Road Interaction Simulator” (co-investigator), \$232,214, 2012

NSERC Strategic Network Grant, “NSERC Smart Net-zero Energy Buildings Strategic Research Network” (co-investigator), \$10,679,000, 2011-2016

NSERC Discovery Grant, “Integrated Systems for Trigenation and District Energy: Modelling, Optimization and Improvement”, \$32,000, 2012

Best in Science Program Grant, Ontario Ministry of the Environment, “Thermal Sustainability and Environmental Impacts of Low-temperature Geothermal Energy Systems on Groundwater and Surface Water Resources in Ontario”, \$139,750, 2009-2012

#### **Dr. K. Sartipi**

Ontario Research Fund (ORF) Grant, “System for Timely Delivery of Large Data Sets in a Regional/National Electronic Health Record” (co-investigator with McMaster University), \$50,000, 2012-2014

McMaster-Waterloo Joint Bioinformatics Initiative, “Data Collection Centre for the Analysis of Clinical Data Obtained from a Multi-Centre Network of Clinics for IBD Patients” (co-investigator with University of Waterloo), \$22,500, 2011

NSERC Discovery Grant, “Environment for Smart, Customizable, and Collaborative Service Analysis and Integration”, \$14,000, 2012

#### **Dr. S. Shahbazpanahi**

NSERC Discovery Grant, “Power and Bandwidth Efficient Relay-Assisted Communications”, \$40,000, 2012

Ministry of Research and Innovation (MRI) Early Researcher Award, “Distributed Signal Processing for Collaborative Communications”, \$150,000, 2010-2013

NSERC CRD Grant, “Cognitive Sensing for Dynamic Spectrum Access” (with M. Dong), \$123,000, 2010-2013

#### **Dr. V. K. Sood**

NSERC Discovery Grant, “HVDC and FACTS Based Power Transmission Systems”, \$20,000, 2012

NSERC Co-Chair in Design Engineering, “NSERC-Ontario Power Generation Senior Chair in Innovative Design Engineering” (with R. Pop-Iliev and J. Froates), \$2,647,800, 2012-2017

#### Dr. Y. Wang

NSERC Discovery Grant, “Efficient Modelling, Design and Optimization Methodologies for Advanced Microwave/Millimeter-Wave Passive Devices”, \$18,000, 2012

CFI Grant, “Research Laboratory for Integrated High-Speed Broadband Wireless Communication Systems” (co-investigator), \$245,000, 2011

#### Dr. D. Zhang

NSERC Discovery Grant, “Integrated Optimization of Parallel Robot Performance for Advanced Manufacturing Systems”, \$27,000, 2012

Mitacs Strategic Grant, “Several New Mathematical Models for the Integrated Optimization and Control of Human-Friendly Parallel Robots for Advanced Healthcare and Biomedical Manipulation”, \$55,000, 2012

MRI Early Researcher Grant, “Development of High Performance Parallel Robotic Machine for Reconfigurable Manufacturing Systems”, \$30,000, 2012

Canada Research Chairs program grant, “Higher Performance Robot for Advanced Manufacturing”, \$100,000, 2012

## AWARDS AND HONOURS (2011-12)

#### Dr. M. Dong

Ontario MEDI Early Researcher Award, 2012

Co-author for finalist paper for Best Student Paper Award, IEEE Workshops on Computational Advances in Multi-Channel Sensor Array Processing, 2011

#### Dr. E. Esmailzadeh

Fellow, Canadian Academy of Engineering, 2012

Teaching Excellence Award, Faculty of Engineering and Applied Science, 2011

#### Dr. Y. He

UOIT Faculty of Engineering and Applied Science Capstone Design Competition Award, Faculty Advisor of Top Student Team, 2012

#### Dr. H. A. Kishawy

Fellow, Engineering Institute of Canada, 2012

Fellow, Canadian Society for Mechanical Engineering, 2012

#### Dr. B. V. Reddy

UOIT Teaching Excellence Award, Faculty of Engineering and Applied Science, 2011

#### Dr. M. A. Rosen

President's Award, Canadian Society for Mechanical Engineering, 2012

Fellow, Canadian Society for Senior Engineers, 2012

#### Dr. S. Shahbazpanahi

UOIT Research Excellence Award, 2012

Co-author for a finalist paper for Best Student Paper Award, IEEE Workshops on Computational Advances in Multi-Channel Sensor Array Processing, 2011

#### Dr. D. Zhang

Best Professor Award, UOIT Engineering Students Society, 2012

Fellow, Engineering Institute of Canada, 2011

Best paper award, IEEE International Conference on Robot, Vision and Signal Processing, Kaohsiung, Taiwan, November 21-23, 2011

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