Faculty of Engineering and Design

Research Review

Carleton UNIVERSITY

Canada's Capital University

The Research Review Fall 2011

Message from the Dean

Rafik A. Goubran, PhD, P.Eng.
Dean, Faculty of Engineering and Design

On behalf of the Faculty of Engineering and Design, and as Dean, I would like to formally welcome you to this edition of Research Review and share with you the wide-ranging research innovations and unique projects being undertaken by our faculty members and students. Our Faculty is renowned for its innovative programs and for working closely with industry leaders to produce solutions to real-world problems. I am pleased to introduce our recent research successes and also to highlight some of the aspects tied to the opening of the Canal Building on campus. This is a very exciting time for our Faculty and we look forward to welcoming excellent new talent to work with us.

With the completion of the Canal Building, which houses fantastic new facilities supporting research and teaching in the areas of health, aerospace, energy, sustainability and the environment, our Faculty continues its reputation for excellence. The Canal Building houses several new state-of-the-art facilities such as the Huawei-TELUS Innovation Centre for Enterprise Cloud Services. Moreover, the building's new labs, dedicated to areas such as terrestrial and extraterrestrial mobility, gas turbines, and broadband solutions have opened up new realms of explorations for faculty and students. These facilities, along with our other renowned resources such as the Pratt & Whitney Canada High-Speed Wind Tunnel, the "elite" Texas Instruments Digital Signal Processing Lab, and the Alcatel Advanced Networks Lab further our opportunities for research.

The Faculty of Engineering and Design at Carleton University is dynamic and research intensive with a tradition of anticipating and leading change. I invite our graduate students and new faculty members to our beautiful campus in the National Capital Region which is bordered by the Rideau River and Canal. Please join me in celebrating our successes and share in our commitment to the ongoing research excellence at the Faculty of Engineering and Design.

Message from the Associate Dean (Research)

Fred F. Afagh, PhD, P.Eng.
Associate Dean (Research), Faculty of Engineering and Design

The research enterprise in the Faculty of Engineering and Design has taken significant strides during 2009-2011. Parallel to the objectives of both Ontario and the University's Strategic Plans, the rapid growth of innovative research and graduate programs in new multi-disciplinary areas including health-related engineering, biomedical engineering, and sustainable and renewable energy engineering as well as fundamental research in established traditional areas is particularly exciting.

The inauguration of the recently opened $30 million Canal Building provides the Faculty with much needed space to house its new graduate programs as well as the required research infrastructure and state-of-the-art laboratories and facilities. In order to invigorate our research endeavors, we have adopted new measures to further support and enhance the research activities of our faculty. Faculty Research Mentors were established to assist our colleagues in preparing and submitting more successful Tricouncil research proposals. The Faculty Research Advisory Committee (FRAC) has now been established with the mandate to support, promote and ensure the recognition of excellence of research enterprise in the Faculty across Carleton, Ontario, Canada and internationally. Starting in September 2011, the Faculty will have the benefits of the service provided by a Research Facilitator who will be responsible for identifying, promoting and managing high value/impact research opportunities within the Faculty.

The partial impact of these measures has already manifested itself on a number of fronts. Our research funds from the National Sciences and Engineering Research Council of Canada (NSERC) Discovery Grants alone for 2010-2011 was about $2.5 million with millions of additional research dollars originating from collaboration with various provincial, national and international industrial research grants and projects. Our graduate students' population has now grown to more than 850. Research quality in our Faculty is reflected in numerous publications in leading international journals, presentations at major international conferences, and membership of our faculty on key editorial boards and conference organizing committees. Many faculty members also actively share their expertise through important consulting roles in government and industry.

The Faculty of Engineering and Design has continued to vigorously foster strong partnerships with the many leading government research laboratories and advanced technology private sector companies in the National Capital Region. These partnerships have continued to grow and flourish in the last two years, expanding opportunities for leading edge research for our graduate students, faculty members, and our industrial and government collaborators.

I invite you to explore the snapshot of our current Faculty of Engineering and Design research activities provided in this Research Review. More detail on these activities can be found on our website www.carleton.ca/engineering-design.

Research Faculty

Civil and Environmental Engineering	24
Electronics	22
Mechanical and Aerospace Engineering	39
Systems and Computer Engineering	35
Azrieli School of Architecture and Urbanism	18
School of Industrial Design	6
School of Information Technology	7
Total	**151**

Research Facilities and Infrastructure

State-of-the-art facilities and infrastructure support the research of all departments and schools in the Faculty. These laboratories are housed in the Mackenzie Building, the Minto Centre for Advanced Studies in Engineering, the Azrieli Pavilion and Theatre (location of the David J. Azrieli Institute for Graduate Studies in Architecture), the Human Computer Interface/ Visualization and Simulation (HCI/VSIM) Building and the recently completed Canal Building.

The School of Architecture maintains the Carleton Immersive Media Studio with computer facilities for 3D real-time modelling, rendering and animation, 2D CAD, desktop publishing and illustration as well as digital video, sound and image manipulation for research in architecture, urban design, heritage preservation, and related disciplines. The School also maintains design/build studios as well as fabrication facilities for woodworking, metal machining and welding, an assembly room for full-scale projects, a photographic studio, and video editing suites.

Carleton University and NRC's Fire Research facility (left), HCI/VSIM building (right-).

The Department of Civil and Environmental Engineering makes extensive use of its Structures Laboratory, which is centred on an 11 m by 27 m strong floor facility used for stress testing of large structural components. The Department is also home to the Advanced Geotechnical Research Laboratory, used to study the effects of earthquakes on building materials, and to the Environmental Engineering Laboratory, which focuses on advanced approaches to wastewater treatment. The Department is also a partner with NRC in the $10M Fire Research Facility, which opened in 2005. This facility includes a fully instrumented burn-hall to study fire propagation.

The Department of Electronics is home to the Carleton University Microfabrication Facility, Canada's only flexible research laboratory capable of manufacturing silicon microelectronic components. It is used extensively to support research on integrated sensors and photonic devices. The Department also hosts the Carleton Laboratory for Laser Induced Photonic Structures (CLLIPS), an advanced facility for the fabrication of fibre Bragg gratings and related devices. There is state-of-the-art support for the design of integrated circuits, including the most advanced industrial simulation software, and comprehensive facilities for testing RF, analog and mixed-signal ICs at frequencies up to 20 GHz. Carleton is a full partner in the Canadian Photonics Fabrication Facility (CPFF), a world-class facility for the fabrication of integrated optical and optoelectronic devices for research and prototyping.

The Department of Mechanical and Aerospace Engineering maintains an advanced wind tunnel facility that is used extensively for testing rotors for helicopters and wind turbines. The Department also has a Bridgman vacuum furnace, fully operational gas turbine engines, servo-hydraulic materials testing equipment, and extensive computer-controlled machine shop capability. Recently laboratories have been added to study the mitigation of pollutants generated in combustion, and for research in microscale electrical co-generation. Several computer networks support departmental research, with an extensive array of design, analysis and simulation software.

The Department of Systems and Computer Engineering is home to the Advanced Real-Time Simulation Laboratory, the Carleton University Biomedical Engineering laboratory (CUBE), the Broadband Communications and Wireless Systems (BCWS) Centre and the Network Management and Artificial Intelligence Laboratory, amongst others. The Texas Instruments and Nortel Networks Digital Processing Lab provides 20 DSP development systems for research on wireless communications, high-speed data and VoIP transmission.

Departments of Mechanical and Aerospace Engineering and Systems and Computer Engineering are partners in the Centre for Advanced Visualization and Simulation, housed in the new $22 million HCI/VSIM building constructed in 2007. Both of these departments also share extensive state-of-the-art research facilities in biomedical engineering and sustainable and renewable energy located in recently completed $30 million Canal Building.

All the departments and schools of the Faculty of Engineering and Design maintain high-performance computer networks based on powerful engineering workstations, providing excellent computing, CAD, and computer visualization facilities specific to their research needs.

Research Chairs:

Andy Adler
Canada Research Chair in Biomedical Engineering

Jacques Albert
Canada Research Chair in Advanced Photonic Components

Ian Beausoleil-Morrison
Canada Research Chair in Modelling and Simulation of Innovative Energy Systems for Residential Buildings

Alex Ellery
Canada Research Chair in Space Robotics and Space Technology

Matthew Johnson
Canada Research Chair in Energy and Combustion Generated Pollutant Emissions

Peter Liu
Canada Research Chair in Interactive Network Computing and Teleoperation

Banu Ormeci
Canada Research Chair in Wastewater and Public Health Engineering

Abjihit Sarkar
Canada Research Chair in Analysis and Management of Risk

Winnie N. Ye
Canada Research Chair in Nano-scale Integrated Circuit Design for Reliable Opto-electronics and Sensors

George Hadjisophocleous
NSERC Industrial Research Chair in Fire Safety Engineering

Research Highlights

Our dynamic research intensive Faculty provides our students and researchers with a unique opportunity to pursue leading edge fundamental and applied research in various fields of interest:

Biomedical Engineering
- Biological Signal Processing
- Biomechanics and Biomaterials
- Biomechanics and Prosthetics
- Biomedical Image Processing
- Medical Decision Support Systems
- Medical Informatics
- Medical Instrumentation
- Telemedicine

Civil Engineering
- Fire Safety Engineering
- Geotechnical Engineering
- Infrastucture Protection and International Security
- Structural Engineering
- Transportation Engineering
- Water Resources Engineering

Electrical and Computer Engineering
- Analysis Techniques
- Communication Systems
- Computer Systems
- Interactive Multimedia Systems
- Software Engineering
- Digital and Wireless Communications
- Microwave and Electromagnetics
- Signal, Speech and Image Processing
- Solid State Devices Integrated Circuits Technology
- Systems and Machine Intelligence
- Photonics Systems
- VLSI Design

Environmental Engineering
- Air Pollution
- Environmental Impact Assessment
- Management of Solid and Hazardous Waste
- Water and Wastewater Treatment
- Water Resources and Groundwater Management

Mechanical and Aerospace Engineering
- Aerodynamics and Fluid Dynamics
- Applied Dynamics
- Avionics Systems
- Combustion and Heat Transfer
- Materials and Manufacturing
- Robotics, Guidance and Navigation
- Solid and Fracture Mechanics
- Thermal and Fluid Engineering

Human-Computer Interaction
Information and Systems Science (Systems Engineering)
Sustainable Energy Engineering
- Efficient Electrical Energy Systems
- Mechanical Energy Conversion
- Sustainable Energy Systems

Technology Innovation Management
- Management of Engineering Processes

Carleton's Faculty of Engineering and Design has a long history of partnerships and collaboration with government and industrial laboratories locally and globally. This has given a strong practical emphasis to much of the research in the faculty, and has provided unique opportunities for graduate students and faculty researchers. Some highlights include:

- Carleton is a full partner in the Canadian Photonics Fabrication Centre, a world-class facility for semiconductor device research and prototyping operated by the National Research Council
- Carleton is a full partner with the National Research Council in the Fire Research Facility, a unique facility in Canada for the experimental study of fire propagation
- Carleton is home to VSIM, a unique multi-million dollar facility for the study of computer-aided visualization and simulation
- Carleton is the only Canadian university selected for Alcatel's Research Partner Program and hosts the Alcatel Advanced Networks Laboratory
- Carleton is a partner with several other eastern Ontario universities in the High Performance Computing Virtual Laboratory (HPCVL) which ranks amongst the fastest 200 computer systems in the world.

Carleton is also unique in the inclusion of the Schools of Industrial Design, Architecture and Information Technology with traditional engineering fields in a single faculty. The Azreili School of Architecture's Immersive Media Studio is a prime example of the benefits of this interaction between disciplines.

Department of Civil and Environmental Engineering

The Department takes pride in being a leader in research in several important and critical areas of Civil and Environmental Engineering. The Department hosts over 125 graduate students every year studying complex problems and designing innovative solutions for them. Within Civil Engineering the primary areas of research include geotechnical structures, transportation, construction materials, fire safety, risk analysis, and safety and security of civil engineering infrastructures. Within Environmental Engineering the primary areas of research include air pollution, waste management, subsurface contamination, water and wastewater treatment and environmental impact assessment. While these areas represent the broad basis of research in the Department, the research enterprise is highly integrative and addresses many important quality of life issues.

Four core themes define the Department's integrated research activities:

Engineering for Public Safety, Health, and Security

Focusing on research related to the safety of infrastructure in the face of natural and human causes, such as fires; blast loads; performance based design of built facilities; the safety of transportation systems; and the health issues associated with air and water quality.

Hazard Mitigation and Risk Assessment

Encompassing a wide range of approaches from experimental and numerical hazard modelling and risk assessment to mitigation measures for earthquakes, landslides, fires, transportation of dangerous goods and hazardous materials, blasts and high impact loads, soil liquefaction, and environmental health risks.

Dr. Basu inspecting system before starting peracetic acid wastewater disinfection experiment.

Infrastructure Engineering and Sustainability

Capturing the unique responsibility of civil engineers to build lasting, functional, and aesthetic infrastructures at optimum life cycle cost. Research on advanced materials, new sensor technologies aimed at structural health monitoring, secured energy infrastructure, intelligent transportation systems, civil engineering applications of GIS and GPS, infrastructure rehabilitation and asset management, advanced compaction techniques for highway and airfields pavements, and durability of construction materials are part of this theme.

Environmental Sustainability

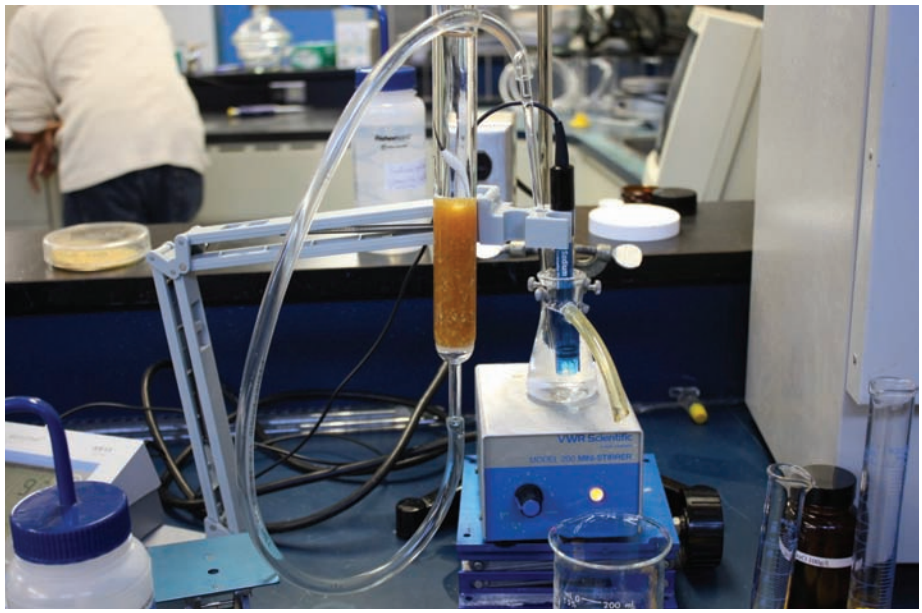
Integrating research efforts that range from multi-mode transportation systems, to life-cycle analysis associated with construction materials, management of groundwater resources, and bio-based technologies as the building blocks of a sustainable development strategy.

Research Groups and Facilities

Fire Research Facility

Carleton is a leader in fire safety research. The 18,000-square foot Facility for Fire Research is used to replicate full-scale fires in tunnels and commercial buildings for analysis of human safety, and the impact of fire on building structures, contents and the environment. Test data is used to develop new and validate existing computer models to evaluate fire safety levels in buildings. A 10-storey atrium, a burn hall and 50-metre tunnel make up the facility.

Funding and sponsorship: Canadian Foundation for Innovation, $4-million; NRC, Ottawa Fire Services, Toronto Transit Commission, Ontario Innovation Trust.



Bench scale ion exchange test for ENVE3001: environmental engineering unit operations.

Centre for Geosynthetics Research Information and Development

Geosynthetic applications for reinforced systems in soil, concrete, asphalt and pipeline systems are the core research activities which integrate geotechnical, transportation and structural engineering specialties in the following:

- Large-scale pullout resistance of geogrids in granular soils; long-term creep response of geogrids; load-deformation response of polymeric geogrids
- Response of loaded concrete columns and beams with secondary polymeric reinforcement to impact loads including blast and explosive loads; effect of geogrids on shrinkage and ductility of concrete slabs; fatigue behaviour of geogrid reinforced asphalt pavements; freeze-thaw response of geogrid reinforced concrete structures.

Projects worth more than $2,250,000 have been completed for private and government clients in Canada, the United States, Egypt, and NSERC.

Centre for Advanced Asphalt Research and Technology

Created in 1988, the centre excels in testing and improving field performance of asphalt pavements and applications of asphalt technology, including:

- A new approach to asphalt compaction in the form of a prototype roller to create a crack-free pavement surface that reduces applied stresses for compaction and has a longer duration time in contact with hot asphalt for more efficient compaction. Asphalt thus lasts significantly longer, and provides a smoother and safer ride, reducing annual resurfacing and labour costs. Partnerships: private industry, NRC
- Development of an on-site shear strength test of asphalt concrete pavements by applying a torque directly to the surface. The Carleton In-Situ Shear Strength Test has produced promising early results related to the shear strength of asphalt concrete pavement layers. A second-generation test device is under development as a trailer-mounted system for easy transportation to field sites.

Partnerships: NSERC, Ontario Ministry of Transport, U.S. National Research Council, Australia, UAE, and other private clients.

Infrastructure Protection and International Security

Since the attacks of 9/11 and the rise of international and domestic terrorism, researchers in Carleton's Department of Civil and Environmental Engineering and Norman Paterson School for International Affairs have been conducting research aligned with most of Canada's identified national critical infrastructure sectors. The research work is aimed at increasing Canada's preparedness, resiliency to, and recovery from an attack on the national critical infrastructures or in the event of a natural disaster affecting national critical infrastructure systems. Researchers are working in several areas of critical infrastructure protection including:

- blast load effects on infrastructure systems
- impact load effects on infrastructure systems
- hazard mitigation
- threat risk assessment methodologies
- safety and security of storage and transportation of energetic materials
- vulnerability assessment of critical infrastructure systems
- nuclear arms control and non-proliferation policy research
- public health safety/clean drinking water and safe, real-time monitoring of water delivery and distribution networks and systems
- policy alternatives to critical infrastructure protection.

Ottawa-Carleton Bridge Research Institute

All aspects of bridge engineering are explored in this integrated research unit of Carleton and the University of Ottawa, with emphasis on problems related to material performance, durability, structural and geotechnical engineering, and challenging new areas that require multi-disciplinary approach and innovation. Projects include:

- Long-term monitoring of the Confederation Bridge connecting Prince Edward Island to the mainland. At 13 kilometres, the world's longest bridge over ice-covered seawater has more than 700 monitoring devices, including thermal sensors, ice-load panels, corrosion sensors, wind sensors, and 76 vibration sensors. This is one of the largest data gathering studies in bridge performance undertaken to date. Data is transmitted to Carleton for the study of ice forces, thermal effects, traffic, wind, and earthquake, and for the development of structural health monitoring technologies for bridge management and decision support. Partner: the University of Calgary
- Work with National Center for Research on Earthquake Engineering Taiwan involves techniques and procedures for remote networked hybrid testing of large-scale bridge structures using Internet-based multi-site virtual laboratory testing and simulation techniques
- Advanced computer bridge analysis and design; bridge construction materials, performance and durability; nonlinear load distribution in bridges of bridge decks; non-linear analysis of long-span bridges
- Earthquake-resistant design and rehabilitation of highway bridges, seismic performance and reliability assessment of bridges, vibration and earthquake response analysis and design of long-span bridges; Funding and sponsorship: NSERC, PWGSC, MTO, SCBL and other private industry partners. Research collaboration: NCREE, NRC, PWGSC, NSC.

Ottawa-Carleton Earthquake Engineering Research Centre

North American and global earthquake engineering problems of international interest are explored through links to scientists and research institutions worldwide, and university, industry, and government agencies in Canada. Earthquake engineering ground motions, dynamics of structures, advanced structural systems and design for earthquake resistance, and seismic design code and standard development are among the research topics.

Transportation Research Centre

Tools to make roads, cars and drivers smarter through better planning, improved traffic control and safer vehicles are investigated, including building Intelligent Transportation Systems to incorporate technology into highway infrastructure with advanced traffic control, and traveler information systems. Travel demand management, the land use impacts of telecommuting, energy and environmental factors in urban transportation and sustainable transportation reflect the diversity in research projects.

Sponsors of current and recent projects of the Transportation Research Centre include the Ministry of Transportation of Ontario, Transport Canada and AUTO21, a federal Centre of Excellence, and more than 120 industry, government and institutional partners. Carleton served as co-leader of the Canadian Automobile Research Simulation (CARS) project as a part of the research network in Intelligent Systems and Sensors, testing extensive navigation assistance and complex driver information systems with simulated road, driver and vehicle conditions. The Centre has completed sponsored projects worth more than $1.5 million.

Ottawa-Carleton Geo-Engineering Research Centre

The Ottawa-Carleton Geo-engineering Research Centre is a collaborative venture between geo-engineering faculty members at Carleton and University of Ottawa. The purpose of this centre is furthering knowledge in geotechnical and geoenvironmental engineering through development of collaborative research projects with emphasis on interacting with industry. The Centre's members from different departments at both universities are involved in wide range of challenging research in different areas of soil mechanics, rock mechanics, foundation engineering, geoenvironmental engineering, municipal and mine waste management, hydrogeology, soil and foundation dynamics, earthquake engineering and urban geotechnical engineering.

Research in Environmental Engineering

Water Resources

Since the Walkerton tragedy, Canadian researchers have focused more intensively on groundwater protection and groundwater management. Carleton scientists have several projects dedicated to safeguarding our drinking water resources such as:

- Contaminated sites that have been impacted by past industrial use (Brownfields) have the potential to contaminate our drinking water resources for long periods of time. Researchers at Carleton are improving our understanding of the movement, distribution and remediation of non-aqueous phase liquids (NAPLs; e.g. gasoline, solvents, etc.) in the subsurface
- Biological clogging processes in filtration of water treatment systems. Numerical models are being developed to help predict and understand the clogging process.

Water and Wastewater Treatment

Safe and efficient drinking water and wastewater treatment are among the most pressing issues for cities and towns across Canada. The research program aims to improve the performance of existing treatment processes and develop new treatment technologies for water and wastewater treatment. Research areas include fate and persistence of pathogens and chemicals during treatment processes; fouling rates of the bioreactor membrane systems; removal of endocrine disrupters, pharmaceuticals and recalcitrant compounds; ultraviolet disinfection and advanced oxidation processes; and treatment and disposal of biosolids. The research program has a strong practical component and has collaborations with municipalities and consulting companies.

Industrial Waste

Both hard rock and oil sands mining are key industries in the Canadian economy, and both have substantial challenges to their sustainability. Carleton researchers are leaders in the field of minimizing impacts from residuals (tailings) of hard rock and oil sands mining. The scale of tailings impoundments is vast as are the potential challenges associated with potential impacts, such as water recovery from the tailings, contamination of groundwater and surface waters, and reclamation of impoundment footprints. Carleton researchers are working closely with both hard rock and oil sands mining operations run by Canadian companies in Alberta as well as in Africa, South America, and Australia.

Waste Management

Developing innovative and alternative waste management strategies is important if we are to reduce our environmental footprint and greenhouse gas emissions. Researchers at Carleton are focusing on improving waste management practices by developing and enhancing waste-to-energy alternatives and through using a life cycle assessment approach to evaluate different waste management strategies.

Air Quality

Collaborative research with Environment Canada's Emissions Research and Measurement Division at the Thornton Environmental Technology Centre in Ottawa involves a range of projects:

- characterization of volatile organic compound and particulate matter emissions from motor vehicles
- development of an Ottawa micro-environment database for air pollutants outdoors and in vehicles
- greenhouse gas and pollutant emissions from hybrid vehicles with advanced emission control technologies
- greenhouse gas and pollutant emissions from off-road engines.

Graduate Programs

The M.Eng., M.A.Sc., and Ph.D. in Civil Engineering and in Environmental Engineering are offered through the Ottawa-Carleton Institute for Civil Engineering (OCIECE) and the Ottawa-Carleton Institute for Environmental Engineering (OCIEE), respectively. These are both offered jointly with the Department of Civil Engineering (and Chemical Engineering in the case of Environmental Engineering) at the University of Ottawa, and are collectively one of the largest Civil and Environmental graduate programs in Canada.

A. O. Abd El Halim, F.C.S.C.E., FCAE, P.Eng.

Professor

Research

Safety and security of transportation infrastructure; improving the engineering resistance of civilian critical infrastructure to blast loadings and man-made attacks; analytical and theoretical modeling of asphalt pavement systems (highways, airfields); experimental and laboratory investigations; field evaluation and assessment; use of geosynthetic materials to reinforce civil engineering systems; life cycle analysis and economics of transportation.

Application

Development of protective shields for transporting hazardous materials, enhancing the resistance of concrete structures to blast loading through the use of steel/polymer grids. Assessment of the critical oil infrastructure. Design and development of the AMIR asphalt compactor and the In-SIST field testing facility.

Activities

- Chair of Transportation Division Sandford Fleming Award, Canadian Society of Civil Engineers, completed (2010)
- Member on several technical committees in TRB, CSCE and CTAA

Onita Basu, P.Eng.

Assistant Professor

Research

The impact of integrated processes in dynamic systems; optimization of full-scale system, investigation of alternative disinfection technologies; study of nutrient phase separation related to polymer selection; impact of process selection on effluent quality, bioreactor/ membrane systems.

Activities

- Member of the Stakeholders Review Group for the Ministry of the Environment Guidance Manual for Optimization of Sewage Treatment Plants (2009-2010)
- Session Co-Chair of 44th Central Canadian Symposium on Water Quality Research – Environmental Modelling (2009)

Abass Braimah, P.Eng.

Assistant Professor

Research

Blast load effects on structures; critical infrastructure protection; structural response to extreme loads; impact load effects on structures; and use of advanced composite materials in civil engineering structures.

Application

Blast risk and vulnerability assessment of critical infrastructure, development of blast mitigation strategies for critical infrastructure protection.

Activities

- Chair of sub-committee on CSA A279 – Blast Resistant Buildings
- Member of ASCE – Technical Committee on Blast, Shock, and Impact

George Hadjisophocleous, PhD, FSFPE, P.Eng.

NSERC Industrial Research Chair in Fire Safety Engineering, Professor

Research

Fire risk analysis; fire and smoke movement modeling; computational fluid dynamics; response of timber-frame walls and floors to fire; connections in fire, design fires; occupant response and evacuation in fires; atrium smoke exhaust, fire safety in tunnels and transportation facilities.

Application

Fire safety in buildings, performance-based codes, fire safety in tunnels and subway stations, smoke management in atria.

Activities

- Member of IAFSS Committee (2009-present)
- Member of Editorial Board of Fire Technology
- Coordinator of CIB W-14 Fire
- Fellow of Society of Fire Protection Engineers (SFPE)
- Member of ULC Fire Test Committee (2005-present)
- Member of ASHRAE Technical Committee TC 5.9 – Enclosed Vehicular Facilities

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Amir Hakami

Assistant Professor

Research

Air quality modeling; forward and backward/adjoint sensitivity analysis; modeling as policy support tool; uncertainty analysis; data assimilation; inverse modeling; numerical analysis in air quality models.

Application

Air pollution decision support; air pollution health effects; air pollution economics; optimal design of air pollution control strategies; integration of satellite observations with air quality models; inverse modeling for constraining emission inventories; air quality forecasting; air pollution exposure/risk assessment, integrated assessment.

Activities

- Session Co-chair of 2nd international workshop in air quality forecasting research, Halifax (2010)
- Session Co-chair of 10th annual CMAS conference, Chapel Hill (2010)
- Member of CMAS, UNC – external advisory board
- Member of AWMA-OVC – Board of Directors

Yasser Hassan, P.Eng.

Associate Chair (Graduate Studies), Department of Civil and Environmental Engineering, Professor

Research

Modeling of roadway alignments; effect of driver perception and behaviour; reducing collision risk through better design and consideration of human factors; design consistency and its relation to traffic safety; quality criteria for winter maintenance activities; anti-icing practices; new technologies and materials.

Activities

- Member of Transportation Research Board Committee on Operational Effects of Geometrics (AHB65)

Neal Holtz

Associate Chair (Undergraduate Studies), Department of Civil and Environmental Engineering, Associate Professor

Research

CAE; design codes and standards; software development; computer-aided learning; 3D computer graphics modeling; databases and Internet-based information services with a focus on computer-based representation of highly technical documents such as building codes and standards, and the integration of these with applications software.

Jagmohan Humar, F.C.A.E., F.C.S.C.E., F.E.I.C., P.Eng.

Distinguished Research Professor

Research

Dynamics of structures; response of structures to seismic ground motion; analysis of soil-structure interaction and dam-reservoir-foundation interaction under dynamic loading; dynamic response of bridges; displacement-based seismic design.

Applications

Development of National Code for earthquake resistant design.

Activities

- Member of Editorial Board – International Journal Structural Dynamics and Earthquake Engineering (2008-present)
- Member of Canadian Standing Committee on Earthquake Design (1995-present)
- Member, Executive of Canadian Association for Earthquake Engineering (2003-present)

O. Burkan Isgor, P.Eng.

Associate Professor

Research

Durability of concrete structures; theory and modeling of corrosion of steel in concrete; service life prediction of reinforced concrete structures; computational material science (continuum and ab initio approaches); non-destructive and model assisted testing; use of sustainable and recyclable materials in construction.

Application

Corrosion and its prevention in structures; investigation of performance of coatings using electrochemical impedance spectroscopy; nano-scale investigation of passivity of steel in highly alkaline environments using FIB/TEM and XPS; use of recycled aggregate concrete as a structural material.

Activities

- Vice President (Technical Division) of the Canadian Society for Civil Engineering (2009-2011)
- Chair of CSCE – Mechanics and Materials Division (2007-2009)

Karim Ismail, P.Eng.

Assistant Professor

Research

Modelling of sustainable modes of transportation with special focus on non-motorized modes of transportation: crowd dynamics, application of computer vision technologies for data collection and behavioural analysis. Road safety analysis: surrogate safety measures, vision-based road safety analysis and holistic safety analysis with special focus on sustainable modes of transportation. Highway design: development of probabilistic standards for highway geometric design, reliability and risk analysis. Modelling and evaluation of intelligent transportation systems with special focus on freight: simulation of cargo and carrier movements at border and inland inspection stations.

Activities

- Invited Member of Transportation Research Board Pedestrian Committee (2011)
- Member of Transportation Research Board Surrogate Safety Measures Subcommittee (2010)
- Young Researcher Paper Award (ANB20), Transportation Research Board (2010)
- Outstanding Paper Award (ANF10), Transportation Research Board 89th Annual Meeting (2010)

Deniz Karman, P.Eng.

Professor

Research

Air pollution sources and control methods; characterization and modeling of mobile source emissions; environmental performance and life cycle analysis of alternative fuels and vehicles; impact of motor vehicle emissions on urban air quality; motor vehicle emission inventories and regional air quality modeling; measurement and modeling of urban air quality in micro-environments; greenhouse gas emissions from industrial and transportation sources.

Application

Emission characteristics and performance evaluation of gasoline-electric hybrid and plug-in hybrid vehicles under Canadian conditions. Source Apportionment and intra-urban variability of PAHs in Ontario sites using receptor models. Emission modelling for on-road vehicles with temporal and spatial resolution in Edmonton.

Ata Khan, F.I.T.E., F.C.S.C.E., P.Eng.

Professor

Research

Intelligent transportation-cognitive vehicle; modeling and simulation; policy and planning; engineering economics; safety, efficiency, sustainable development; energy and environmental factors in transportation.

Application

Urban and intercity transportation. Multimodal transportation. Traffic management and control. Road safety. Sustainable development. Urban planning.

Activities

- Associate Editor of Canadian Journal of Civil Engineering
- Member of Sustainable Development Committee, CSCE
- Member of Education Council, Institute of Transportation Engineers
- CFI Grant Review
- Technical Program Committee, ITS Canada 2010 Conference
- PEO Infrastructure Panel (2010)
- TV Panel Discussion (2010)
- Consultant to private sector companies (Intelligent Transportation Systems Projects)

Heng Aik Khoo, P.Eng.

Associate Dean (Academic-Student Affairs), Faculty of Engineering and Design, Associate Professor

Research

Steel structures and pipelines; modeling and testing to predict the performance of steel pipelines and structures subjected to different loading conditions; fracture mechanics; low cycle fatigue; constitutive relationship.

Application

Evaluate the performance of and develop design guidelines for steel structures and pipelines.

Activities

- Executive Council Member of CSCE, Mechanics and Materials Division

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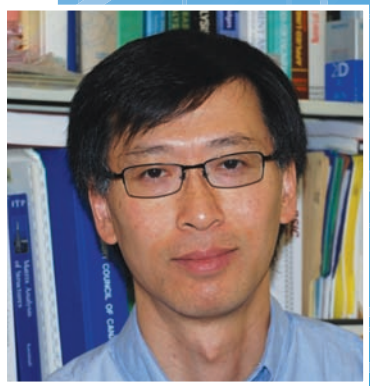
David Lau, F.C.S.C.E., P.Eng.

Professor



Research

Structural dynamics and earthquake engineering; structural health monitoring and assessment of bridge structures; development of intelligent systems for infrastructure asset management and decision support; application of information technologies in structural engineering; rehabilitation of existing bridges, liquid storage tanks and other infrastructure; seismic application of advanced composite materials.

Activities

- Chair of Seismic working Group and Member of ISO Offshore Structures, Harmonized Canadian Advisory Committee
- Member of Seismic Activities on Non-Structural Components in Building Applications, ISO Technical Committee
- Member of Seismic Risk Reduction of Operational and Functional Components of buildings, Canadian Standards Association
- Associate Member of Design and Construction of Building Components with Fibre-Reinforced Polymers, Canadian Standards Association
- Member of Gas and Liquid Fuel Division, Technical Council of Lifeline Earthquake Engineering
- Visiting Professor of Hohai University, China
- Visiting Professor of National Center for Research on Earthquake Engineering, Taiwan

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Banu Örmeci

Canada Research Chair in Wastewater and Public Health Engineering, Associate Professor

Research

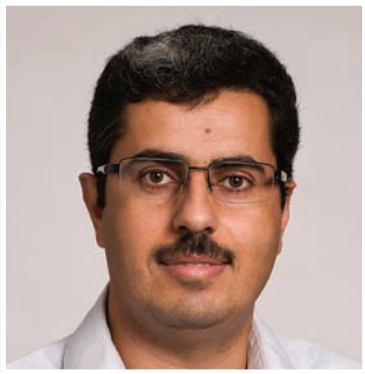
Treatment and management of biosolids, disinfection of water and wastewater, advanced ultraviolet processes, fate and survival of pathogens through treatment processes, removal of emerging contaminants such as endocrine disrupting and pharmaceutical compounds from water and wastewater.

Application

Optimization of treatment processes. Development of new and innovative treatment technologies.

Activities

- Editorial Board Member of the Journal of Residuals Science and Technology
- President and Board Member of Women in Science and Engineering (WISE), Ottawa Chapter (2010)
- Faculty Advisor of Carleton University WISE Student Chapter
- Newsletter Editor of International Water Association (IWA) – Specialist Group on Sludge Management
- Ambassador for Canadian Association on Water Quality (CAWQ)
- Research Award Finalist of OCRI (Ottawa Centre for Research and Innovation) (2010)
- Carleton University Outstanding Mentor Award Nominee (2010)



Mohammad T. Rayhani, P.Eng.

Assistant Professor

Research

Seismic site response and soil-structure interaction, soil and foundation improvement solutions for seismic hazard, geotechnical hazards investigation and mitigation, geotechnical aspects of landfill design.

Application

Earthquake resistant design, seismic retrofitting techniques for foundations of existing structures, municipal solid waste management.

Activities

- Member of local organization committee for CSCE annual conference Ottawa (2011)
- Reviewer for Canadian Geotechnical Journal, ASCE J. of Testing and Evaluation, J. of Contaminant Hydrology, Canadian Aeronautics and Space Journal

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Juan Salinas, P.Eng.

Professor

Research

Wood engineering; behaviour of wood structures; structural reliability; strength-deformation characteristics of mechanical fasteners and connectors; evaluation of structural integrity of building components and systems; building design and construction; distance education; international development; forest products.

Application

Forensic surveying and accident investigation development of technical standards for forest products educational programs in wood engineering.

Activities

- Training of law enforcement personnel in forensic surveying and accident investigation
- Industrial development of forest products in Latin America
- Canadian Wood Council. Board of Directors. Education Advisor for Canadian Wood Council
- CSA o86. Canadian Wood Engineering Code. Task force on fire design.

Abhijit Sarkar, P.Eng.

Canada Research Chair in Analysis and Management of Risk, Associate Professor

Research

Uncertainty quantification (to predict malfunctioning of engineering systems under catastrophic conditions, e.g. explosion, earthquake); risk analysis (implications for risk assessment projects in aerospace and petroleum industries, risk modelling for defense initiatives); nonlinear, stochastic and chaotic vibration; structural acoustics and fluid structure interaction; stochastic finite element; flow through disordered porous media; domain decomposition of stochastic PDEs, data assimilation and parallel computing for large-scale stochastic system.

Application

Civil and environmental engineering.

Activities

Member:

- Probabilistic Methods Committee, American Society of Civil Engineers (ASCE)
- Dynamics Committee, American Society of Civil Engineers (ASCE)

Edward Sherwood

Assistant Professor

Research

Reinforced and prestressed concrete structures; masonry structures; integration of modern materials, rehabilitation techniques and analytical methods with current concrete design practices; design methods for structures incorporating fibre-reinforced concrete, high-performance concrete and high-strength reinforcement; shear behaviour of large, lightly-reinforced concrete structures; applications of advanced composite materials in concrete construction; concrete durability and corrosion; design and upgrading of concrete infrastructure for extreme events such as blast, impact and fire.

Paul H. Simms, P.Eng.

Associate Professor

Research

Unsaturated soil mechanics; microscale modelling of porous media; evaporation and cracking in porous media; rheology of non-Newtonian fluids; coupled analysis of fluid flow, heat flow, and volume change in porous media.

Application

Mine waste management, including hard rock mining and oil sands surface mining. Specific topics include surface deposition of thickened tailings, underground backfill, unsaturated flow modelling, and reclamation cover design for waste impoundments. Other applications include shallow geothermal energy, and sensor design for unsaturated soils.

Activities

- Short course leader (2010)
- Internal conferences on paste and thickened tailings (2011)

Siva Sivathayalan, P.Eng.

Associate Professor

Research

Geotechnical earthquake engineering; liquefaction; laboratory testing; constitutive relations; geosynthetics and geofoams; design of foundations, slopes, and retaining walls.

Activities

- Sections Representative in the Executive Committee of Canadian Geotechnical Society
- Secretary of Canadian Foundation for Geotechnique

Paul J. Van Geel, P.Eng.

Chair, Department of Civil and Environmental Engineering, Professor

Research

Hydrogeology; groundwater; contaminant transport; movement, distribution and remediation of immiscible fluids like oil, gasoline and solvents that enter the subsurface due to spills, leaking storage facilities or improper disposal; transport of landfill leachate, petroleum hydrocarbons and chlorinated solvents in the subsurface environment; multiphase flow; waste management; bioreactor landfill design and optimization; waste to energy alternatives; life cycle assessment of waste management strategies; biological clogging of unsaturated soils; septic systems; groundwater resources protection and management.

Application

Assessment and clean-up of contaminated sites (Brownfields). Design of bioreactor landfills and alternative waste management facilities. Compare waste management strategies using LCA to assess costs, energy use and environmental impacts. Design of septic systems to treat wastewater from homes and small commercial/industrial facilities. Assessment and management of groundwater resources.

Ehab Zalok, P.Eng.

Assistant Professor

Research

Fire-structure interaction, reinforced concrete and steel structures. Evaluation of structural aspects of fire safety in buildings by using experimental work and computer modelling. Identification of the fire hazard in buildings by analyzing thermal response of structures and fire resistance of building elements under different fire scenarios; and finally developing performance-based Fire-Structural designs, design fires and fire scenarios in buildings using modeling (computational fluid dynamics–zone modeling) approach. Currently investigating new research opportunities in Canada, under the general theme of how the integration of building information models with fire simulation software can improve the understanding of fire-damaged structures and behaviour of structural and combustible materials under actual use conditions.

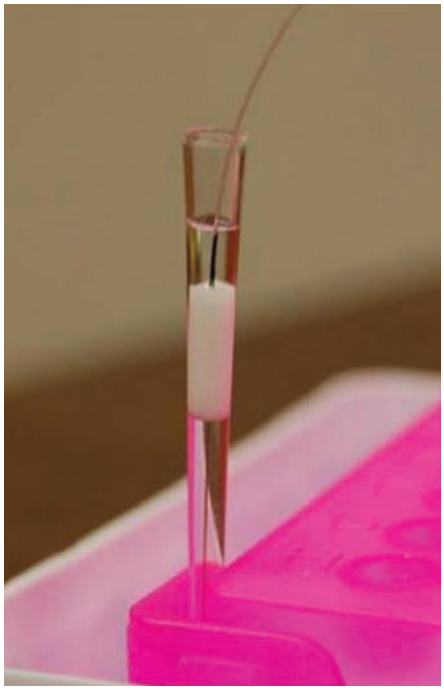
Department of Electronics

Carleton's leadership in advanced components for communications, computing and sensing applications is enhanced by an emphasis on hardware development and verification. Innovative foundation technologies are developed in unique in-house fabrication facilities.

Given the growing complexity, multidisciplinary nature and scale of integration of advanced components, research activities are also geared to innovation with development of powerful modeling and CAD tools. Expertise applies to design automation, mixed-signal and microwave/radio frequency and photonics, opto-electronics, MEMs, and packaging.

Close ties provide rich research opportunities with partners such as Ericsson, IBM, Best Medical Canada, PMC Sierra, the federal Communications Research Centre, Department of National Defence and the National Research Council Canada. Academic alliances reach across the country and around the world: from the University of Arizona and Georgia Institute of Technology to l'Institut National des Sciences Appliquées (INSA) Toulouse and Finland's University of Oulu.

NSERC funds major research in the form of Strategic Research and Special Research Opportunity grants. Other sponsors are Ontario Centres of Excellence (OCE), Canadian Microelectronics Corporation (CMC Microsystems) and Canadian Institute for Photonic Innovations (CIPI). Joint initiatives include Alcatel, Peleton Photonic Systems and LxSix Photonics, involving academic, industry and government scientists with ties to global corporations and international organizations. Carleton is an active partner in the Ottawa Region's high-technology research clusters. The Ottawa Photonics Cluster (OPC) is the largest concentration of photonics industry in Canada. The scientific community has benefited from photonics expertise at Carleton, a member of the Ottawa Photonics Research Alliance and the OPC.



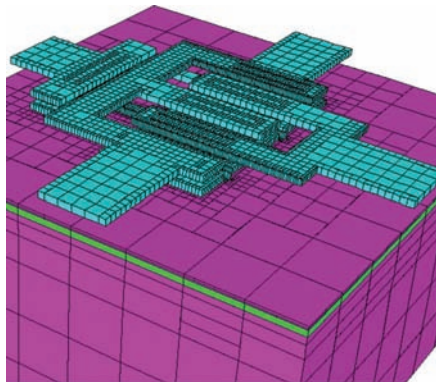
A fiber optic probe is used to recognize the binding of DNA molecules in solution.

Electronics engineering research at Carleton is concentrated in three core areas:

Advanced Components for Communications, Computing and Sensing Applications

Research focuses on advanced components to boost speed, efficiency, accessibility and agility of communications and information processing systems. Applications are geared to enhancing the performance-to-cost ratio with innovative technologies to reduce power consumption, interference and manufacturing costs, and improve process tolerance. Two concepts are actively pursued:

- System on a chip: advanced multi-functional components with automated manufacturing processes. Leading-edge research involves miniature CMOS radio transmitter chips with embedded antennas



3D ATAR model of a transistor cell package.

- System in a package: mixed technology integration combined with optical and opto-electronics components. World-class research covers high-performance oscillators in high-frequency signal generation.

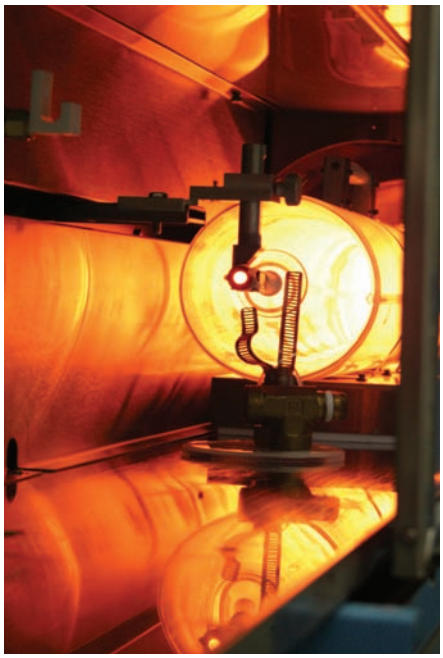
Specialized fields include opto-electronic circuits and optical interconnects. Carleton's expertise lies in micro-electro-mechanical (MEMs) systems-based circuits, which integrate micro-mechanical elements and sensors with electronics on silicon chips. Research covers enhanced Q filters with digital circuitry.

Computer-Aided Design for Very Large Scale Integration (VLSI)

Next generation CAD algorithms and design automation tools for efficient and accurate modeling, analysis and optimization of electronic circuits and interconnects are developed here. A broad spectrum of methodologies and tools are applied to develop high-speed components and systems, from wireless to optical systems in photonics. Special areas involve simulating radio frequency circuits and micro-electro-mechanical systems (MEMs) to predict system response. New neural network based algorithms are used for fast modeling and optimization of microwave circuits and devices. Powerful CAD tools and methodologies are developed for analysis of signal integrity in high-speed VLSI systems.

Microdevice Fabrication and "Green Electronics"

A combination of sensing, communication and self-powering capabilities is merged into high-speed electronics on silicon chips. Research explores opportunities to integrate photonic, electronic and micro-mechanical devices onto a single platform at on-site fabrication facilities. Applications cover telecommunications, microelectronics, bio-photonics, and chemical and mechanical sensor manufacture. Specific projects include integration of optical communication components with the widely used CMOS semiconductor and silicon sensors for x-rays in biomedical applications. Greater functionality while preserving



Oxidation Furnace.

low fabrication costs allows wider application of photonic devices in biomedical diagnostics, environmental testing and communications. In addition, polymer based devices and nanotechnology are being investigated to allow energy harvesting and storage for a variety of eco-friendly applications.

Computer-Aided Engineering Research Laboratory

New generation CAD algorithms and tools are developed for easier, more efficient and accurate modeling/analysis/optimization processes. Research focuses on issues common to high-speed circuits and interconnects: signal integrity, modeling and simulation of high-speed interconnects, design tools for radio frequency and wireless applications, design tools for MEMS and opto-electronic applications, and mixed-domain simulation. Research also covers the optimum use of multiple CPU cores and multiple-thread algorithms for efficient computational effort.

The NeuroModeler Laboratory

Advanced neuro-modeling techniques for computer-aided design of high-frequency electronic circuits are developed to exploit the power of neural networks. Fast neural network based models are developed for high-frequency components, both linear and nonlinear, using EM-based training for passive component models and physics-based training for active device models. Techniques for circuit design and yield optimization using passive/active neural models are also being developed. A recent breakthrough is a dynamic neural network based technique for behavioural modeling of nonlinear circuits directly from external data. The work will be useful for modeling and design optimization of high-speed, high frequency IC packages and receiver/transmitter circuits.

CMC Integrated Circuit Design Laboratory

This lab has the capability for design, optimization and layout of analog ICs, mixed-signal and digital ICs, radio frequency/ microwave ICs, monolithic microwave ICs, electro-optic and photonic devices. Researchers work with some of the latest Sun workstations capable of computationally intensive CAD simulations.

A full range of industry standard IC simulation software is available, running HP ADS, Cadence Design Systems, Matlab, HSPICE, Spectre, Sonnet and HFSS. Software for simulation of photonic devices includes OptiBPM, OptiFDTD, FEMLAB, and APSS. Cadence's Virtuoso is available for IC layout prior to fabrication of designs.

Broadband IC Measurement Laboratory

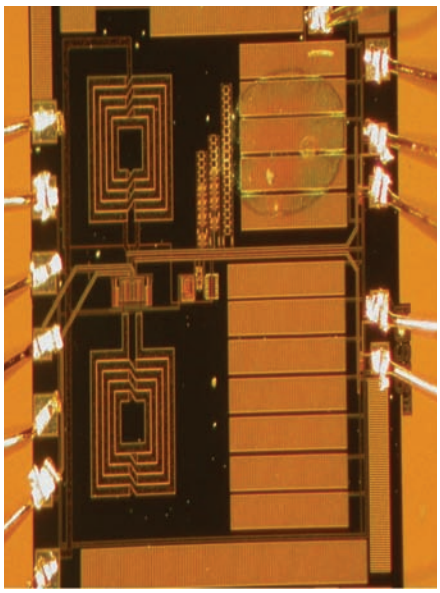
A highly equipped facility, the lab has test capability for the full range circuitry: RF circuits, RF passive components and RF circuits such as oscillators and low-noise amplifiers, broadband and electro-optical circuits, and analog, mixed signal and digital circuits. Digital circuits include processors and controllers used in a system-on-a-chip. A probe station allows testing of wafers. Testing can also be done on packaged parts. Research includes analog and radio frequency integrated circuit design with applications in cell phone components such as amplifiers to help pick up very faint signals, computer applications such as components to enable wireless hook-up to the Internet, or wireless medical applications, such as heart-rate monitors.

Microwave and Electromagnetics Laboratory

Microwave devices and circuits for communications applications are investigated. The lab is well equipped for RF-, microwave-and millimetre-wave testing of packaged or on-wafer devices and components. Active opto-electronic devices and circuits can be characterized along with RF, MEMS, antennas, multi-layer circuits, on-wafer and packaged devices. The lab is equipped with a probe station with four positioners and high-frequency probes. The lab also has a large anechoic chamber with associated signal sources and components for accurate fully automated antenna characterization.

Carleton University MicroFabrication Facility (CUMFF)

Well-established design and fabrication processes are already beginning to allow the seamless monolithic integration on a single chip of photonic, electronic and micro-mechanical functionality. This has a significant impact on industries such as telecommunications, microelectronics, bio-photonics, and chemical and mechanical sensor manufacture. Silicon-based photonics in particular have the potential to reshape the opto-electronics industry. Development and high-volume manufacture may lead to the fabrication of optical components in a manner similar to the micro-electronics industry.



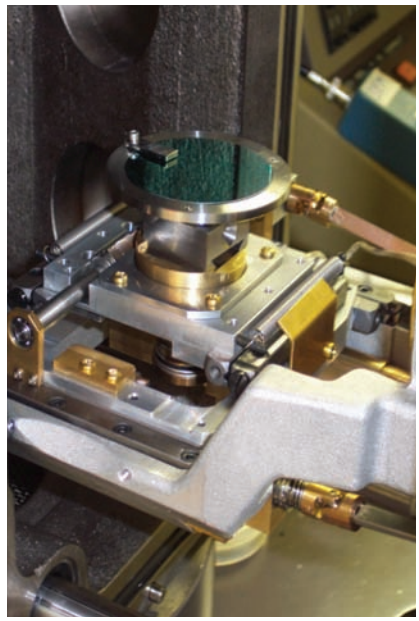
2.4 GHz Filter.

SOC integration of sensor functions and photonic devices with control electronics is the focus of much of the research activity for the Department of Electronics. Carleton's MFF is the only Canadian research laboratory in university, government or industry capable of integrating CMOS electronics with sensors or other devices in silicon. Building on more than 25 years of experimental research on mainstream micro-electronics applications, including process technology, device physics and innovative circuit techniques, MFF today supports projects on silicon photonics, biomedical devices, wireless communication and micro-electro-mechanical systems (MEMS) integrated with CMOS. The laboratory is also used to enhance the capabilities of commercial CMOS and BiCMOS chips through post-processing, in which additional components such as integrated antennas are added to commercial integrated circuit cores.

Industry and government collaborating partners include Thomson-Neilsen Electronics, Micronet, NRC, CRC, IBM, SciSense, Gennum, Celestica, Group IV Semiconductor, and Nortel.

Canadian Photonics Fabrication Centre (CPFC)

Carleton University is a full partner in the Canadian Photonics Fabrication Centre, located at the National Research Council Canada's main Ottawa campus. The centre draws on facilities and research expertise in photonic materials and devices at the NRC's Institute for Microstructural Sciences (NRC-IMS). Carleton researchers have access to equipment, research activities, and incubation facilities for projects at a national level and in concert with photonics technology clusters within Canada. Projects involve silicon-on-insulator (SOI) and control of stress induced birefringence, where splitting of light in SOI waveguides improves component functionality in telecommunications systems. Other research covers very fast switching of optical signals in indium phospide devices to increase the ability to quickly reroute signals.



E-beam Direct-write Lithography System.

Graduate Programs

The M.A.Sc., M.Eng. and Ph.D. in Electrical Engineering are offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE), which is joint with the Department of Systems and Computer Engineering at Carleton University and the School of Information Technology and Engineering at the University of Ottawa. This arrangement offers our students access to an extremely wide range of graduate courses in ECE.

Ramachandra Achar, P.Eng.

Professor

Research

Signal and power integrity; circuit modeling, simulation and optimization; high-speed interconnects; parallel algorithms; model-reduction techniques; CAD for RF, MEMS, wireless and optoelectronic applications; EMC/EMI; mixed-signal analysis; nonlinear circuit analysis/modeling.

Application

Modern CAD tools to accelerate high-speed electronic product design.

Activities

- Distinguished Lecturer (DLP), Circuits and Systems Society (2011-2013)
- Guest Editor of IEEE – CPMT Transactions (2011)
- General Co-Chair for EPEPS-2010, Austin and EPEPS-2011, San Jose
- Chair of Joint Chapters of Circuits and Systems Society (CAS) – Electronic Devices Society (EDS), Solid State Circuits Society (SSC) of IEEE Ottawa Section
- Steering Committee Member of IEEE International Conference on Electrical Performance of Electronic Packages (EPEPS) IEEE International Conference on Electrical Design of Advanced Packages (EDAPS)
- Technical Program Committee Member of IEEE International Conferences: EPEPS, EDAPS, SPI
- Technical Committee Member of Electrical Design, Modeling & Simulation (TC-EDMS- TC-12)
- Senior Member of IEEE; IEEE MTT, CAS, EDS, SSC and EMC societies

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Jacques Albert, P.Eng. (Quebec)

Canada Research Chair in Advanced Photonic Components, Professor

Research

Design, fabrication and characterization of photonic components; fibre and waveguide lasers; optical fibre sensors; photosensitivity; photonic packaging; state-of-the-art laser irradiation facilities to design, fabricate, and characterize optical components and sub-systems.

Application

Plasmonics; oil and gas exploration and exploitation; structural and environmental sensing; biomedical instrumentation; telecommunications.

Activities

- Program Chair of International Optical Fiber Sensors conference, DFS-21 (2011)
- Associate Editor of Optics Express
- Program committee member of OSA – Conference on Lasers and Electro optics, CLEO (2009-2011)
- Program committee member of IEEE Photonics Society Annual meeting (2009-2011)

Robert Gauthier, P.Eng.

Associate Professor

Research

Photonic crystals and photonic quasi-crystals bandgap and defect state engineering; laser trapping, manipulation, orientation and ablation of micron sized objects; simulation software development for physics end engineering applications. Facilities include silicon photonic optical and electrical characterization laboratory; silicon photonic electro-optical device fabrication laboratory (CUMFF); computation network.

Application

Photonic crystal and quasi-crystal research focuses on integrated optic device designs for optical communications and biosensing applications as well as fundamental research in theoretical foundations of bandgaps in circularly symmetric dielectric structures. Laser trapping is used for the activation of micro-mechanical machines, cell sorting and periodic material assembly.

Activities

- Member of editorial board of Journal Optics and Laser Technology

Pavan Gunupudi, P.Eng.

Associate Chair (Graduate Studies), Department of Electronics, Associate Professor

Research

Multi-disciplinary system simulation; parallel circuit/system simulation; signal integrity; design automation of high-speed VLSI and RF circuits; simulation of silicon-photonics and microwave photonics circuits and systems; electrical and optical device modeling; model-order reduction, electrical/optical interconnects; artificial neural networks, design centering and optimization, electromagnetic compatibility.

Application

High-speed VLSI circuits; signal integrity; RF and microwave circuit analysis and simulation; silicon-photonics and microwave-photonics; yield analysis for ICs.

Activities

- Director of Ottawa-Carleton Institute for Electrical and Computer Engineering
- Member of Technical Program Committee for IEEE Workshop on Signal Propagation on Interconnects
- Collaborative research with Optiwave Systems Inc. on simulation of opto-electronic circuits and systems
- Co-author of optoelectronic simulation tool, OptiSPICE
- Collaborative research with Communications Research Centre of Canada (CRC) on simulation of microwave photonics systems
- Collaborative research with Queen's University and McGill University

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Robert Harrison

Distinguished Research Professor

Research

Nonlinear phenomena in ferromagnetics, electromagnetics, and microwave networks; nonlinear transmission lines for pulse sharpening and frequency multiplication.

Application

Accurate physical modelling of high-order ferromagnetic hysteretic behavior in energy–conversion systems and for generalized magnetics design software; pulse diagnostics in plasma physics, signal regeneration in ultra-high-speed computer and communications systems, frequency multiplication.

Activities

- Cooperative research projects with the Institute of Microwaves and Photonics (IMEP), Universite Joseph-Fourier, Grenoble, France

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Tad Kwasniewski, P.Eng. (Quebec)

Professor

Research

Circuit design; digital circuit design – ASIC; mixed-signal circuit design; wireline and wireless circuits; new circuit techniques; silicon technology circuit implementation; algorithms for programmable digital hardware (reconfigurable signal processing hardware, MIMO ASIC oriented optimization); data communications techniques ranging from wireless through wireline to backplane and PCB data transmission between chips.

Application

Wireline communications; frequency synthesis; wireless communications.

Activities

- Consulting on wireline communications, frequency synthesis, IC design for communications.
- Collaborating with CRC, industrial companies (including internship of students), University of Nanjing

Leonard MacEachern, P.Eng. (Nova Scotia)

Associate Professor

Research

Microelectronics; mixed-signal circuits and optoelectronics; laser modeling and predistortion; calibration methods for analog circuits.

Application

Integrated laser predistorter; low-power ADCs; distributed linearized CMOS amplifiers; radio-over-fibre.

Activities

- IEEE reviewer
- Springer Journal reviewer

Ralph Mason, P.Eng.

Associate Professor

Research

RF and Mixed signal IC design; analog IC design techniques, tools, circuit and systems, volume manufacturing and low power circuits.

Application

Low power wireless ICs.

Activities

- Collaborative research with Canadian Research Center, “Millimeter Wave Circuits”
- Collaborative research with Standard Microsystems Corporation, “Circuits for High Frequency Wireless Transceivers”
- Collaborative research with Kaben Wireless, “Millimeter Wave Oscillators with Programmable Output Phase”

Steven McGarry, P.Eng.

Associate Professor

Research

Organic and organic/inorganic semiconductor device physics and technology, including device design, characterization, fabrication processes, modelling and application in integrated circuits, optoelectronics and electrochrotronics. Complex electronic/ionic systems using organic and hybrid materials; novel photovoltaic device structures; polymer super/ultracapacitors for integrated power storage; flexible or conformal devices and systems; nanostructured and nanocomposite materials and their applications.

Application

Complex neuromorphic devices and systems; alternative energy generation and storage; optical interfacing – generation, modulation, and detection.

Michel Nakhla, P.Eng., IEEE Fellow

Chancellor's Professor

Research

Parallel processing, modeling and simulation of high-speed interconnects, signal integrity, packaging, nonlinear circuits, multidisciplinary optimization, model-reduction techniques, statistical analysis, wavelets and neural networks, opto-electronic systems, design centering, thermal design, electromagnetic radiation and interference.

Application

Design of RF and high-speed circuits and systems.

Activities

- Associate Editor of IEEE – Transactions on Advanced Packaging
- Member of the Executive Committee of the IEEE International Signal Propagation on Interconnects Workshop (SPI)
- Member of the Technical Program Committee of the IEEE International Microwave Symposium (IMS)
- Member of the Technical Program Committee of the IEEE Conference on Electrical Performance of Electronic Packaging (EPEPS)
- Member of the editorial board Research Letters on Electronics
- Member of the CAD committee (MTT-1) of the IEEE Microwave Theory and Techniques Society
- Member of Technical Program Committee of Frontiers in Analog Circuit (FAC) Synthesis and Verification Workshop (2011)

Calvin Plett, P.Eng.

Chair, Department of Electronics, Professor

Research

Analog, mixed signal, radio-frequency integrated circuits, CMOS, BiCMOS, SiGe, wireless, inductors, transmission lines, electro-optical interface, equalizers.

Application

Analog and radio-frequency integrated circuits for wireless and wireline communications and for wireless medical applications.

Activities

- Senior Member of IEEE
- Member of Audio Engineering Society
- Strategic Research with the University of Calgary, McGill, "Design of Integrated Wireless Platform for Vital Sign Monitoring"
- Collaborative Research with Gennum, Ciena, and CRC

John W. M. Rogers, P.Eng.

Associate Professor

Research

Radio Frequency integrated circuits; fractional-N frequency synthesizers; various wireless applications including ultra wide band, and wireless local area networks; wireless and coaxial. TV tuners.

Application

Low power, miniature IC chips for wireless communications.

Activities

- Senior Member of IEEE
- Coauthor of Radio Frequency Integrated Circuit Design and Integrated Circuit Design for High Speed Frequency Synthesis

Langis Roy, P.Eng.

Associate Dean (Planning), Faculty of Graduate and Postdoctoral Affairs, Professor

Research

Monolithic integrated Si/GaN/GaAs circuits; high-performance microwave circuit packaging; integrated active antennas; numerical techniques in electromagnetics; optoelectronic packaging; monolithic microwave integrated circuits; low temperature co-fired ceramics; micro-electro-mechanical systems; RF; millimeter-waves.

Application

Wireless electronic devices that can communicate faster than currently available products, yet are smaller, reconfigurable, more efficient and lower-cost. An example is the integration of antennas directly on – or in the same package as – the transmitter and receiver chips, thereby enabling the transmission of high-definition biometric data via a wireless link.

Activities

- Evaluator, PROMPT-Quebec Partenariats de Recherche Orientes en Microelectronique, Photonique et Telecommunication, Strategic Project Selection Panel (2008-2010)
- L. Roy, "Miniaturization and Integration of Telecom Components Using LTCC SiP Design", Alcatel-Alenia Space Seminar Series, Toulouse
- Session co-chair and organizer ANTEM 2010 Conference, Ottawa, Canada; ACES Conference, Williamsburg, VA (2011)
- Industry Collaborations: SkyWave, DragonWave, RIM, Best Theratronics (2010, 2011)
- Academic Collaborations: Royal Military College; U of Rennes, INSA-Rennes, INSA-Toulouse, U of Limoges, U of St-Etienne; U of Oulu; KAUST (2010, 2011)
- CEAB Electrical Engineering Program Visitor (2011, 2012)

Maltham Shams

Assistant Professor

Research

High-speed and low-power circuits; system on chip; delay estimation and optimization; modern asynchronous circuits; arithmetic blocks; energy estimation and optimization; RF logic circuits; computer architecture; logical balance; CMOS logic styles; DSP and wireless; modeling of CMOS logic styles; adiabatic computing; biomedical and environmental; MOSFET modeling.

Application

Microprocessors and ASICs, DNA detection, artificial eyes, artificial organs.

Activities

- Collaboration with Ottawa Heart Institute and Medical Devices
- Member of Carleton Senate

Tom Smy, P.Eng.

Professor

Research

Physical simulation of thin film processing, and thermal, electrical, and electromagnetic phenomena. This work has lead to the development of a suite of physical software tools (SIMBAD/3D-FILMS/Atar) marketed world-wide for simulation and modeling of material parameters and device characteristics of microelectronic systems, nano-structured materials and thin films. Work is ongoing in the development of an multi-energy domain opto-electronic simulator (Optispice) in collaboration with Optiwave (Ottawa).

Application

The SIMBAD simulation suite has been widely applied in the development of Silicon chip technology and in the creation of nano-structured thin films. Optispice has a wide variety of applications in optical, sensor and telecommunications systems.

Activities

- Ongoing collaborations with a number of international (IBM) and local companies (Optiwave)

Alan Steele, P.Eng.

Special Assistant to the Provost for Student Academic Engagement, Associate Professor

Research

Nonlinear optical fibre; optical switching; optical bistability and instabilities; fibre gratings; mode-locking of fibre lasers; simulation of photonic systems. Engineering education research.

Application

Nonlinear properties of optical fibre that provide a route to optical pulse generation and shaping; fibre structures such as gratings or rings that allow further control and manipulation of optical pulses; uses in optical communications or optical sensors. Engineering education research activities are focused on the use of new technology in teaching, project work, and design education.

Activities

- Provost Teaching Fellow – awarded (2011)
- Founding member of the Canadian Engineering Education Association (2010)
- Associate Dean of Student Affairs (2008-2010)

Barry Syrett, P.Eng.

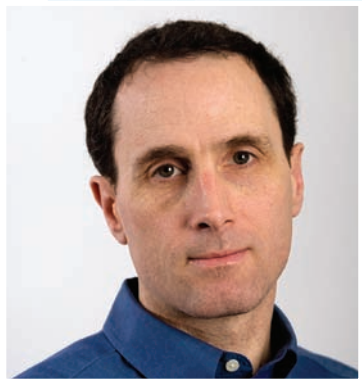
Associate Chair (Undergraduate), Department of Electronics, Professor

Research

Photonic devices – modelling and design of novel photonic switches, attenuators and modulators especially for planar optical integrated circuits; RF/microwave devices and circuits – modelling of electronic devices and circuit design (microwave and monolithic microwave integrated circuits) at RF and microwave frequencies for wireless applications; optical control of microwave circuits – use of optics to tune and control microwave devices and circuits.

R. Niall Tait, P.Eng.

Professor



Research

Micro-fabrication and micro-electro-mechanical systems (MEMS); thin film processing materials and technologies; silicon and MEMS sensors; MEMS and sensor integration with CMOS signal conditioning circuitry; RF and microwave MEMS devices; infrared sensing and imaging; silicon photonic and plasmonic devices; amorphous semiconductor devices; micro-fluidic effects and devices.

Application

Optical and wireless communication and interconnect components, infrared cameras, gas sensors, biomedical sensors.

N. Garry Tarr, P.Eng.

Chancellor's Professor

Research

Silicon semiconductor device physics and technology: device design, fabrication processes, characterization, modelling and application in integrated circuits and optoelectronics; monolithic integration of optical components with CMOS electronics for sensing and communications; integrated waveguide optical devices in silicon-on-insulator; silicon sensors for ionizing radiation for biomedical applications; silicon photovoltaics.

Applications

Silicon-based biomedical sensors; components for optical telecommunications and optical interconnect, and photovoltaics.

Jim Wight, P.Eng.

Chancellor's Professor

Research

Antenna structures, millimeter-wave circuits, phase-locked circuits, and transceiver architectures for wireless/satellite communications, radar, and radio navigation. Fresnel zone plate antennas, and artificial microwave volume hologram antennas for low profile apertures. Lower-ground coplanar waveguide transmission lines for millimeter-wave silicon based integrated circuits. Monolithic micro-machined resonators for millimeter-wave oscillators. GaN power-amplifier linearization circuits, and hybrid RF/digital feed-forward filters for frequency agile base-station transceivers. Spoofing/anti-spoofing of the synchronization circuits in GPS receivers.

Application

Wireless and satellite communications; radar surveillance, tracking and imaging; GPS and radio navigation.

Activities

- Consultant, Chief Scientist, and Principal Architect for several wireless companies, including Kaben Wireless Silicon, IceFyre Semiconductor, BelAir Networks, and Aurora Wireless
- Joint researcher with the Communications Research Center, and the Defence Research & Development Canada, Ottawa

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Winnie N. Ye, P.Eng.

Canada Research Chair in Nano-scale Integrated Circuit Design for Reliable Opto-electronics and Sensors, Assistant Professor

Research

Design, fabrication and characterization of silicon based photonic devices; nano-scale integrated circuit design for optoelectronic sensors; system-on-chips for biomedical and environmental sensing Applications; athermal photonic integration design; thin film silicon based solar cells; subwavelength devices design.

Application

Biomedical and environmental sensing; biophotonic diagnostic tools; telecommunications; photovoltaics.

Activities

- Chair of the Scientific Committee of the International Conference on Electrical and Computer Systems (ICECS'12), Ottawa, Canada
- Scientific committee member for the International Conference on Nanotechnology: Fundamentals and Applications (ICNFA'10 and ICNFA'11), International Academy of Science, Engineering and Technology (ASET)
- Keynote speaker for the International Conference on Nanotechnology: Fundamentals and Applications (ICNFA'10), Ottawa, Canada (2010)

Q. J. Zhang, P.Eng., IEEE Fellow

Professor

Research

Electronic CAD; neural networks; optimization; high-frequency electronic/electromagnetic modeling and design; methodologies and tools for designing high-speed/high-frequency electronic circuits in wired and wireless electronic systems; neural network and optimization methods for modeling and design of electromagnetic structures and microelectronic devices and circuits.

Application

Microchip design.

Activities

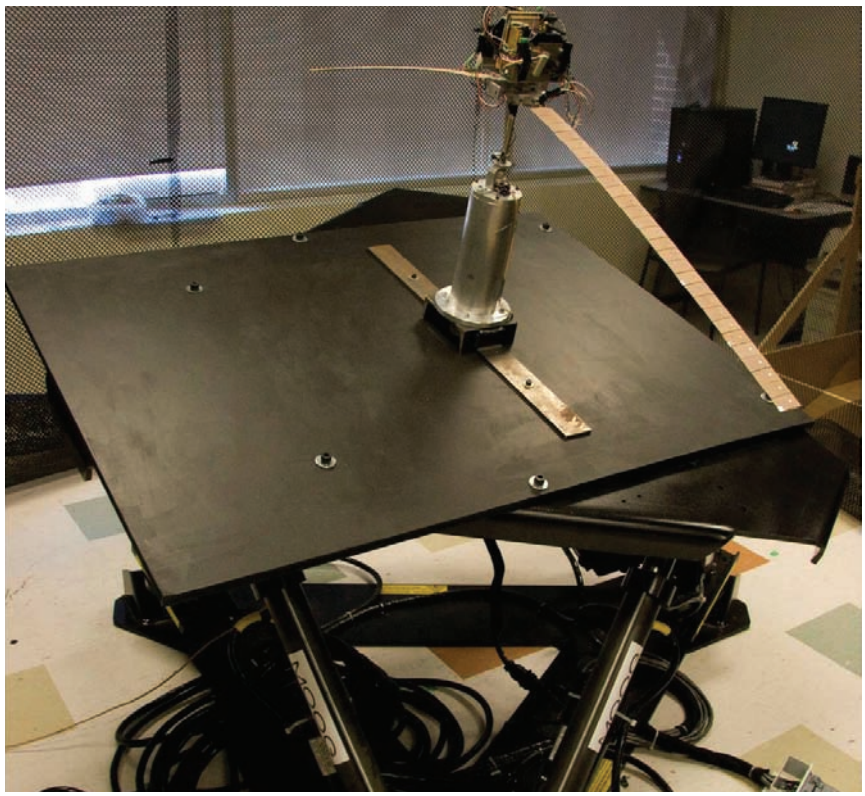
- Fellow of Electromagnetics Academy
- Member of Editorial Board, IEEE Transactions on Microwave Theory and Techniques
- Member of Editorial Board, International Journal of Numerical Modeling
- Associate Editor of International Journal of RF and Microwave CAE
- Associate Editor of Journal of Circuits, Systems and Computers
- Member of Technical Committee on CAD (MTT-1) of the IEEE MTT Society
- Member of Technical Program Review Committee, IEEE MTT-S International Microwave Symposium, Anaheim, CA (2010); and Baltimore, MD (2011)

Department of Mechanical and Aerospace Engineering

Department faculty lead very effective cross-disciplinary research endeavours aimed at specific application issues and development of the fundamental governing principles. Nearly 40 years of research associated with advancing Gas Turbine Technology represents the most obvious and long-standing example of application-based cross-disciplinary research.

Today, Mechanical and Aerospace Engineering at Carleton includes one of the largest and most effective university-based Gas Turbine Technology research groups with extensive programs related to internal aerodynamics, aeroelasticity, combustion, system design and performance, high temperature materials and coatings, and repair and overhaul technologies. This research is supported by well-equipped laboratories including multiple wind and water tunnels and unique material processing and surface-coating equipment.

Well-developed application-focused research is also aimed at innovative developments and designs in the areas of unmanned aerial vehicles, flight simulators, rotorcraft and wind-turbine structures and aerodynamics, vehicle dynamics and simulation technologies, biomedical engineering and design of devices, convective heat transfer characteristics in supercritical fluids with application to nuclear-reactor cooling, robotics, navigation, combustion, and many programs supporting the development of sustainable energy sources.



A six-degree-of-freedom motion platform for testing the aerodynamic and aeroelastic behaviour of helicopter rotor blades during take-off and landing on ships in rough seas. The combined effect of the rotor aerodynamics, ship motion, and shipdeck aerodynamics can lead to excessive deflection of the rotor blades, risking helicopter damage or danger to crew on the deck.

Complementing the extensive experimental research, the Department is at the leading edge of the development and application of innovative analytical and numerical techniques for problems in the fields of solid mechanics, fracture mechanics and fluid mechanics. Cutting-edge work involves development of the Quasicontinuum Method, the Boundary Integral Equation Method, Finite Element Methods for solid-mechanics applications and computational fluid dynamics algorithms.

Department research benefits from strong relationships with many external research centres both locally and around the world. Research collaborations and funding arrangements exist with several Institutes of the National Research Council of Canada, Environment Canada, Natural Resources Canada, National Defence, the Ottawa Hospital and the Canadian Space Agency. Major industry partners include Pratt & Whitney Canada Inc., United Technologies, Deloro-Stellite, Indal Technologies, Liburdi Engineering, Magellan Aerospace, Augusta SpA., Atomic Energy of Canada Ltd., Rolls-Royce Canada and the Petroleum Technology Alliance of Canada, among many others. Department faculty have been very successful at supporting research through grants from NSERC, the Ontario Centres for Excellence, Canada Foundation for Innovation, and the Ontario Research Fund.

The scope of graduate student research is expanded through exchange agreements with many leading universities including Delft University of Technology, the University of Glasgow and the University of Sao Paulo.

Department research is primarily focused in the following areas:

Aerodynamics

Aerodynamics research in the department focuses on gas-turbine internal flows, aerodynamics of lift-generating surfaces on fixed- and rotary-wing aircraft, spacecraft and rocket propulsion systems, and wind turbines. This research is supported by multiple wind tunnels ranging from transonic to low speed facilities, a large-scale water channel, and extensive computational facilities for parallel computing. Research focuses on:

- transonic axial-flow turbines with ultra-high blade loading operating at low Reynolds numbers
- secondary loss control in axial turbines through endwall contouring
- mixing performance of gas-turbine lobed mixers
- instability and laminar-to-turbulent transition in separated and free shear layers
- aerodynamics and aeroacoustics of rotorcraft blade/vortex interactions
- design of ejector-engine nozzles
- aerodynamics of unmanned aerial vehicles operating at low altitude and in wind gusts.

Aerospace Structures

Research concentrates on optimizing aircraft design and evaluating new materials, processes, and technology for aircraft structural applications. Several servo-hydraulic materials and structure test systems are available to Department researchers with current projects related to:

- fibre metal laminates for aircraft structures that provide improved damage tolerance, integrity and fatigue properties
- rotorcraft technology research centres on helicopters and wind turbines with the aim of developing new smart structures to reduce rotorcraft noise and vibration
- dynamics and aerodynamics of shipboard helicopter operation
- improved understanding of fatigue nucleation and short fatigue crack growth behaviour of aerospace aluminium alloys.

Biomedical Engineering

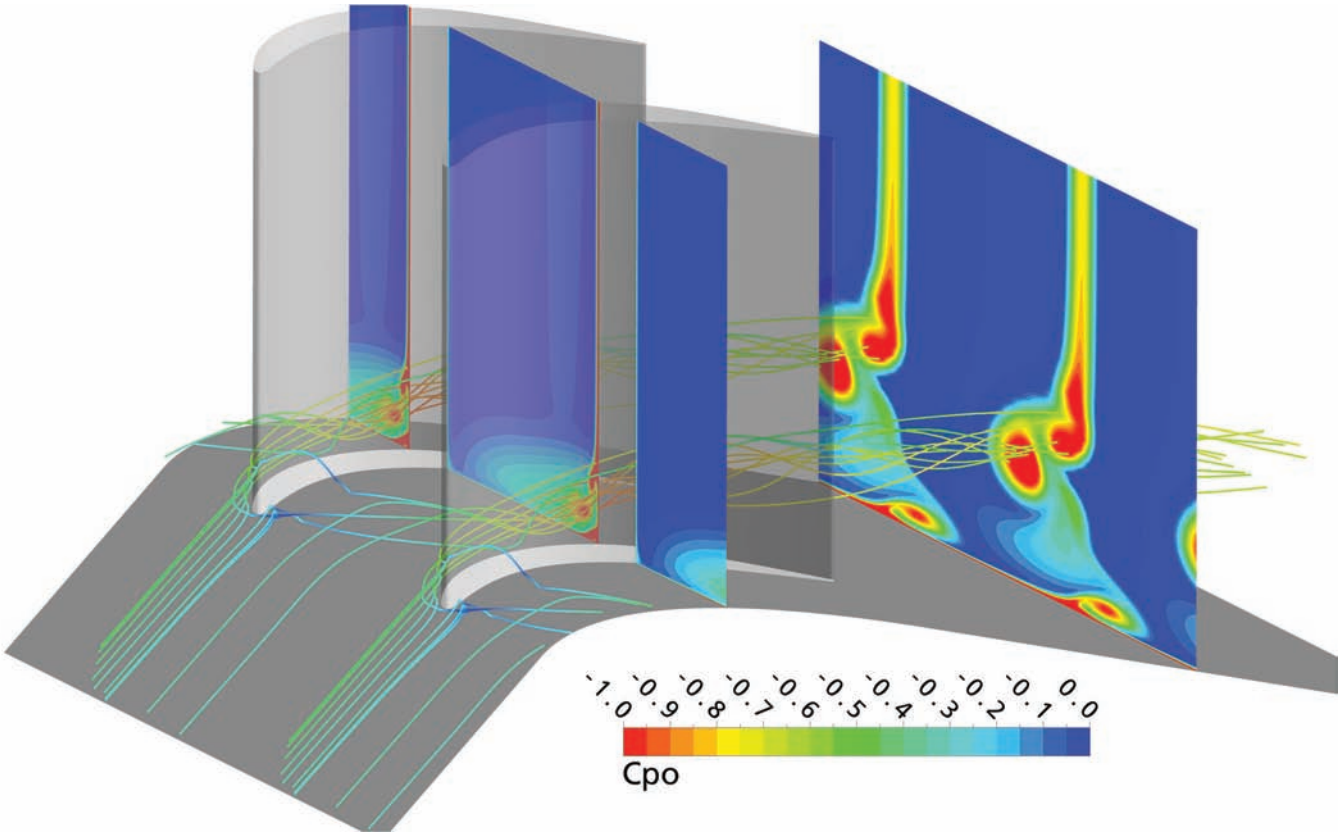
The application of mechanical engineering disciplines to the biomedical field is a rapidly growing area of research. Department faculty have strong collaborative research with biomedical engineering research centres, the pharmaceutical industry, and manufacturers of medical devices, with current research programs involving:

- evaluation of polymers for implantable medical devices
- design of prosthetic limbs
- dynamics and control of actuators for variable stiffness limbs
- regeneration of bone using tissue engineering approaches
- fracture fixation and bone regeneration
- two phase flows associated with aerosol generation from commercial pharmaceutical inhaler devices and deposition losses in oral and nasal airways
- tumour chemotherapy enhancement using a micro-bubble infusion pump
- mathematical modeling of the cardiovascular system
- design optimization of the Intra Aortic Balloon Pump
- prosthetic wrist implants and fracture fixation plates
- biomechanics of musculoskeletal injury in skilled musicians
- intelligent vision systems for robotic assisted surgery.

Sustainable Energy Conversion

Advanced research in this area involves evaluation and modeling of two-phase flows with applications in automotive air conditioning systems, fuel cells, solidification processes, heat pipes and oil flares. Several major laboratory facilities include aerosol generators, combustion facilities, and a gas turbine engine modified for alternative fuel combustion research. Applications deal with satellite thermal control, gas turbine cooling, and materials processing and cooling of electronic microprocessors along with research in:

- developing zero-emission, gas-turbine-based plants for power generation
- bio-fuel combustion in gas turbines
- mathematical modeling and manufacturing of two-phase capillary pumped heat transfer devices such as conventional heat pipes and loop heat pipes
- developing efficient and environmentally friendly automobile air conditioning systems
- measurement and modeling of soot formation in multi-component fuels
- pollutant emissions and control of oil-field flares



A computational fluid dynamics simulation of flow near the hub of an axial-flow turbine blade. The planes show contours of nondimensional total pressure (Cpo), where the red areas indicate high-loss flow and the blue indicate flow with negligible total pressure loss. The streamlines indicate swirling flow between the blades. Minimizing the losses associated with this swirling flow is of primary interest to the blade designer.

- stratified combustion
- micro-cogeneration based upon fuel cells and Stirling cycles
- building performance simulation
- optimization of solar energy utilization
- alternative cooling approaches.

Materials and Manufacturing Processes

The optimization of processing, microstructure and properties of advanced materials is a focus of research at Carleton. Extensive experimental programs and development of computer simulation methods is underway. Among the major facilities available is a high temperature vacuum Bridgman furnace for producing directionally solidified and single crystal structures, and an air plasma spray facility. Research thrusts include:

- titanium aluminide intermetallics for low pressure and power turbine blades
- investigation of processing, composition and phase stability of single crystal superalloys for high-pressure turbine blade applications
- mathematical and computational modeling to design ceramic thermal barrier coatings with high reflectance to radiation in advanced gas turbine engines
- development of special elements and techniques for adaptive and automatic finite element analysis, for thermal and stress analysis of welds and related manufacturing processes
- integration of a graphical user-interface for the pre-processing of hexahedral elements derived from free-meshed tetrahedral elements
- modeling of dendrite growth, development of micro-macro models of solidification processes, and phase field micromechanics models of the martensitic transformation
- development of innovative superalloys and their composites for high-temperature wear/corrosion applications
- development of new coatings and coating processes for thermal erosion and resistance
- manufacture and properties of carbon nanotube-polymer matrix composites.

Solid and Fracture Mechanics

Development of advanced methods for fatigue and fracture assessment of engineering structures in the pressure vessel, aerospace, automotive and offshore industries is the focus in this research area. Research enables realistic correlations of fatigue and fracture properties obtained from laboratory test specimens to the actual full-scale engineering structures, and:

- finite element modeling of materials damage to develop a physics-based holistic life prediction methodology for aerospace components and structures
- efficient boundary element methods for stress analysis; exact volume-to-surface integral transformation in the development of boundary integral equations for anisotropic bodies with body forces and/or thermal effects
- fracture mechanics of advanced composite materials
- stress analysis of micro-electronic packaging
- multi-scale modeling of plasticity and fracture in metals
- development of the Quasicontinuum Method for mixed continuum and atomistic simulation of the mechanical response and fracture mechanics of polycrystalline materials.

Robotics, Control, Guidance and Navigation

Advanced application of robots and control/navigation of autonomous vehicles and satellites are focal points in this research area. Facilities include industrial robots for testing control/calibration strategies. Projects include:

- robot mechanical systems and kinematic calibration
- mechanism synthesis and applied dynamics
- development of innovative simulator motion platforms with unlimited rotational degrees of freedom
- sensor fusion techniques and control of autonomous formation flying
- design and development of active systems for control of rotorcraft blade dynamics
- autonomous vehicles engineering
- systems control and estimation theory
- mining robotics and automation
- coordinated control of multivehicle systems.

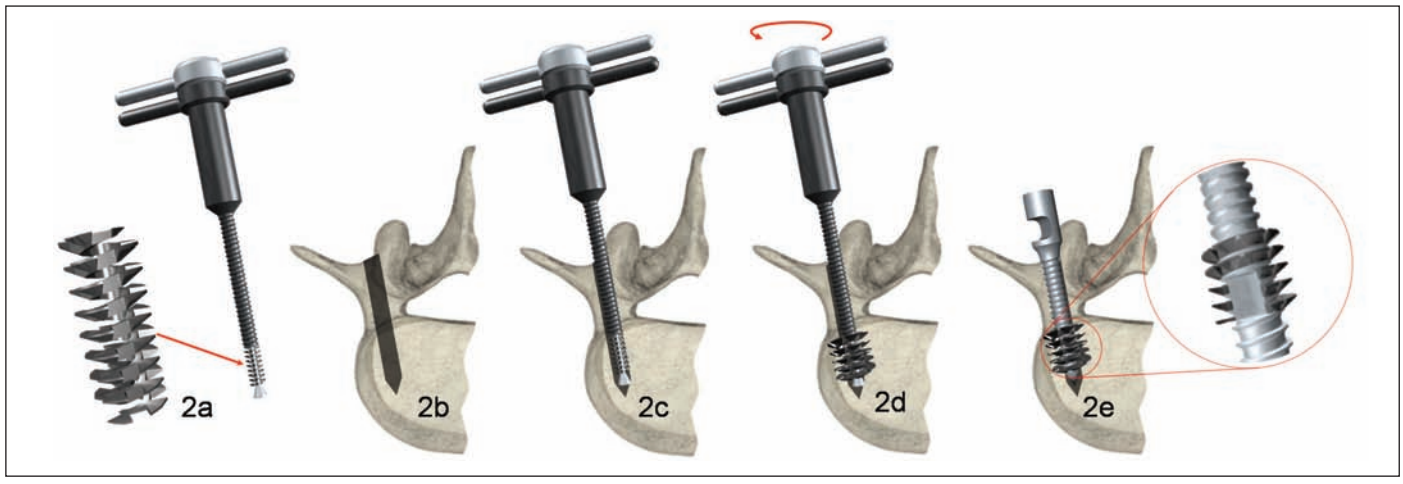
Space Technology

Satellite, rocket and other spacecraft engineering is dedicated to low-cost space launch systems, hypersonic and high-speed flows, inertial technology and air-breathing propulsion concepts with excellence in:

- rocket-based combined cycle engines for more efficient use of atmospheric oxygen during launch
- development and testing of gyro wheel-based satellite control systems
- analytical and experimental techniques in loss of rotation in tethered spacecraft
- application of loop heat pipes for spacecraft thermal control
- space robotics, satellite servicing and planetary rovers.

Graduate Programs

The M.A.Sc. and M.Eng. in Aerospace, Materials, or Mechanical Engineering and Ph.D. in Aerospace and Mechanical Engineering are offered through the Ottawa-Carleton Institute for Mechanical and Aerospace Engineering, which is joint with the Department of Mechanical Engineering at the University of Ottawa. This arrangement offers our students access to a substantially wide range of graduate courses in Aerospace, Materials, and Mechanical Engineering. Students can also study toward the M.A.Sc. in Biomedical Engineering through the Department's involvement in the Ottawa-Carleton Institute for Biomedical Engineering. This Institute is joint between four academic units at Carleton University and three at the University of Ottawa. Finally, a recently-established master's program in Sustainable Energy Engineering and Policy, co-offered by three engineering departments and by the School of Public Policy and Administration, enables students to study the policy and engineering aspects of energy generation, conversion, distribution and utilization in an interdisciplinary setting.



The insertion process of a novel helical bone anchor into a lumbar vertebra during spinal fusion surgery. The helical bone anchor increases the fixation strength of screws in patients with poor quality and osteoporotic bone.

Fred F. Afagh, P.Eng.

Associate Dean (Research), Faculty of Engineering and Design, Professor

Research

Structural modelling of thin-walled, open and closed cross-section beams; dynamic modelling and stability of helicopter rotors; modelling and investigation of blade-sailing effects in shipboard rotor aircraft, using numerical and analytical methods; controlling blade-sailing phenomena by using smart structures technology; optimization of actuator configuration and positioning using genetic algorithms; stability analysis of elastic systems subjected to follower type forces.

Application

Development of smart structures for aerospace applications. Elastic and dynamic stability of various structural systems and elements.

Activities

- Editorial Advisory Board of Asian Journal of Engineering and Applied Technology

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Mojtaba Ahmadi, P.Eng.

Associate Professor

Research

General areas of robotics and controls; biomechatronics and bio-inspired robotics; robotic rehabilitation and virtual gait retraining; assistive devices and exoskeletons for walking; dynamics of walking for robots and biological systems; stability and efficiency of biped walking and passive dynamics walking; linear, nonlinear, and learning control theory; general mechatronic design process and simulation; advanced sensing and actuation technologies; robotic arm design and control; optimization methods for design and control.

Application

New rehabilitation technologies for post-stroke patients; assistive devices for people with walking disability and elderly; development and control of intelligent legged robots; biomedical robots; design and analysis of robotic systems for aerospace applications.

Activities

- Committee Member of International Conference on Robotics and Applications (2008-2011)
- Session Chair of IEEE Conference on Advanced Intelligent Mechatronics AIM (2010)
- Technical Program Member of International Conference on Intelligent Robotics and Applications ICIRA (2011)
- Invited Speaker for Clarkson University, New York (2010)
- Invited Speaker for Elizabeth Bruyere Hospital, Ottawa (2011)

Andrei Artemev, P.Eng.

Associate Chair (Graduate Studies), Department of Mechanical and Aerospace Engineering, Associate Professor

Research

Development of computer simulation methods for structure and properties of solid materials and structure evolution in phase transformations. Phase field models of domain structures in thin ferroelectric films and nano-composites. Micro-macro models of phase transformations and phase-field micromechanics models of the martensitic transformation. Computer modeling and damage analysis of functional composite materials.

Ian Beausoleil-Morrison, P.Eng.

Canada Research Chair in Modelling and Simulation of Innovative Energy Systems for Residential Buildings, Associate Professor

Research

Reduced energy consumption; environmental impact of providing energy services to housing; micro-cogeneration; building performance simulation.

Application

Micro-cogeneration of heat and electricity for buildings based upon fuel cells and stirling cycles; building performance simulation; optimization of solar energy utilization; alternative cooling approaches for residential buildings.

Activities

- Editor of International Journal of Building Performance Simulation

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Robert Bell, P.Eng.

Professor

Research

Fatigue and fracture mechanics; development of life prediction software, multiple crack initiation, crack interaction and coalescence, weight function techniques, experimental studies; damage-tolerance performance of laser-welded aluminium joints and laser-welded stringer/skin panels; stress analysis and fatigue endurance of elastomer materials using the Finite Element Methods. Fatigue performance of friction-stirred welded joints. Residual stress measurements using compliance methods.

Cynthia Cruickshank

Assistant Professor

Research

System and component level modelling of solar thermal energy systems and sensible heat storages, supported by experimental analysis; investigations related to the impact of large-scale implementation of solar thermal systems on electric utility peak loads; optimization and integration of new solar thermal technologies with conventional heating and cooling systems; experimental and numerical evaluation of flowing electrolyte direct methanol fuel cells.

Application

The design and optimization of small-scale thermal energy storages for potable water applications; the design and integration of solar combined systems, for space and water heating including their integration with conventional building systems; investigations related to advanced buildings, including energy efficient and sustainable energy concepts for commercial and residential applications.

Anton de Ruiter

Assistant Professor

Research

Guidance, navigation and control systems, spacecraft attitude determination and control, spacecraft formation flying, unmanned aerial vehicle (UAV) obstacle avoidance, rover navigation, global navigation satellite systems (GNSS) based navigation.

Activities

Senior Member of the American Institute for Aeronautics and Astronautics (AIAA)

Alex Ellery

Canada Research Chair in Space Robotics and Space Technology, Associate Professor

Research

Muscle-like behaviours for robotic manipulators; forward model augmentation to feedback control of manipulators; micro-penetrator development; micro-rover development; optic flow and potential field-based navigation.

Application

Space-based manipulators; planetary rovers; lunar base infrastructure development.

Jason Etele, P.Eng.

Associate Professor

Research

Numerical simulation of high speed reactive flows and mixed subsonic/supersonic streams. Design of next generation launch vehicles using the “ejector inlet”, an airbreathing engine based on the Rocket Based Combined Cycle (RBCC) concept. Experimental and numerical investigation of building generated turbulence and its effect on the flight of small Unmanned Aerial Vehicles (UAVs); development of control techniques to stabilize UAV flight through urban environments.

Activities

- Visiting Researcher at the Japanese Aerospace eXploration Agency (JAXA) Kakuda Space Center
- Invited participant in The Technical Co-operation Program (TTCP) at Defence Research and Development Canada (DRDC) Valcartier
- Invited presentor at Tottori University, Japan

Daniel Feszty, P.Eng.

Associate Professor

Research

Rotary-wing aerodynamics, i.e. computational and experimental analysis of the flow around helicopter and wind turbine rotors, with particular emphasis on the development of active control technologies for improving performance and for controlling vibration and noise.

Hanspeter Frei, P.Eng.

Assistant Professor

Research

Development of novel implants that enhance the fixation of bone screws in low quality bone and ”smart” adaptive implants that ensure appropriate loading of healing bone and combine this technology with tissue engineering to ensure an optimal biomechanical and biological environment for fracture repair and bone regeneration.

Application

Loss of the biomechanical integrity of the skeleton due to fracture or loss of bone tissue often leads to premature disability and leaves the patient with a reduced quality of life. The economic burden on the health care system of skeletal conditions such as osteoporosis-related fractures, osteolytic bone loss and other bone defects related to trauma, bone tumors and surgical resections is enormous. Despite considerable research efforts in implant design, augmentation methods and regenerative medicine approaches, the surgical treatment of the bone deficient skeleton remains challenging with unsatisfactory clinical outcomes.

John Gaydos, P.Eng.

Associate Professor

Research

Capillarity and surface fluid mechanics applied to measurement techniques for liquid-fluid surface tension and interfacial energy; contact angle and line tension on patterned surfaces; application of semiconductor fabrication processes to microfluidic device research and development.

Application

Surface phenomena (e.g. soap bubbles) are easy to generate but difficult to explain because of the molecular forces at the interface. Modeling of these surface effects is important in nano-technology and the miniaturization of many devices. There are numerous applications.

John Goldak, P.Eng.

Distinguished Research Professor

Research

Designer driven nonlinear transient FEM analysis of manufacturing processes such as welding, heat treating and casting to optimize the design and production of industrial structures. Development of software environments that enable designers to accurately simulate and optimize the manufacturing processes and in-service behavior of complex structures. The geometry of parts are usually imported from CAD systems.

Application

Simulating welding of welded structures such as tractor frames to manage distortion that impacts manufacturing costs and residual stress that impacts fatigue life; simulating the heat treatment of gears to predict distortion; residual stress and hardness and then optimize heating process; simulating fabrication and in-service behaviour of piping systems.

Activities

- Member of Advisory Committee and Invited Keynote Lecture
- Member of International Seminar on Welding Science and Engineering, WSE (2011)
- CCWS Seminar (2011)
- Joining and Welding Research institute, Osaka University, Osaka, Japan

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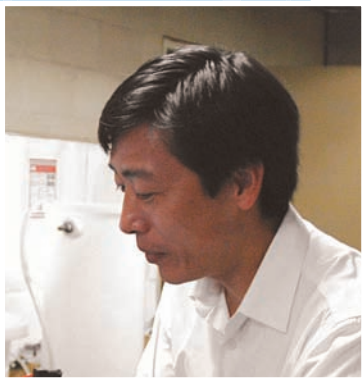


Junjie Gu, P.Eng.

Associate Professor

Research

Transport phenomena in micro-scale processes; two-phase flow and heat transfer; heat pumps and refrigeration; automobile air conditioning systems; sorptive refrigeration; solar air conditioning; waste-heat refrigeration; waste-heat power generation; renewable energy; energy systems; coal gasification.

Application

Automobile air conditioning systems; sorptive refrigeration; solar air conditioning; waste-heat refrigeration; waste-heat power generation; coal gasification.

Activities

- Founder of Carleton Student Branch – ASHRAE

M. John D. Hayes, P.Eng.

Associate Professor

Research

Robotic mechanical systems; machine vision; kinematic calibration; mechanism synthesis; applied dynamics; theoretical kinematics; computational geometry; simulation; simulator motion platform design, in particular the *Atlas Motion Platform*; visual servoing; medical devices.

Application

Industrial robotics, biomedical robotic devices, self-deployed heart assist devices (stents), kinematic and dynamic control of simulator motion platforms.

Activities

- Editorial Board, Transactions of the Canadian Society for Mechanical Engineering (CSME)
- Carleton University Faculty Advisor for CSME
- Treasurer of CSME
- Communications Officer for Canadian Committee for the Theory of Machines and Mechanisms

Xiao Huang, P.Eng.

Professor

Research

Design and fabrication of advanced thermal barrier coatings; erosion and wear resistant coatings; coatings for SCW nuclear reactors; wide gap braze repair of gas turbine components; high temperature thin film temperature sensors; plasma spraying of nano-structured coatings; sintering of porous media; component failure analysis and prevention.

Application

Gas turbine industry, energy sector.

Activities

- Committee Vice Chair of Manufacturing, Materials and Metallurgy Committee, International Gas Turbine Institute, Turbo Expo (2009-2010)
- Committee Chair of Manufacturing, Materials and Metallurgy Committee, International Gas Turbine Institute, Turbo Expo (2011-2012)

Matthew Johnson, P.Eng.

Canada Research Chair in Energy and Combustion Generated Pollutant Emissions, Associate Professor

Research

Detection and quantification of fugitive emissions in the upstream energy industry; novel optical diagnostics for particulate matter (PM) in plumes; soot emissions from turbulent flames and gas flares; mitigation of greenhouse gas emissions from flares; aerodynamic flame stabilization in low-NOx burners; transport and deposition of inhaled medical aerosols; experimental fluid mechanics; application of laser diagnostics.

Application

Reduction of pollution, especially emissions associated with energy production in Canada.

Activities

- Conference Chair for Combustion Institute/Canadian Section (CI/CS) Technical Conference (2010)

Tarik Kaya, P.Eng.

Professor

Research

Two-phase heat transfer; heat pipes for electronics cooling; loop heat pipes; spacecraft thermal control; mathematical modeling and manufacturing of two-phase capillary pumped heat transfer devices.

Application

Spacecraft thermal control; electronics cooling.

Activities

- Member of the SAE International Organizing Committee
- Associate Editor of Int. J Energy & Technology

Jeremy Laliberté, P.Eng.

Assistant Professor

Research

Air vehicle conceptual design, uninhabited aircraft systems development, design of lightweight metallic and composite aerospace structures, out-of-autoclave manufacturing of polymer composites, direct digital manufacturing, low velocity impact damage testing and modeling, durability and degradation of polymer composite materials.

Application

Novel aerospace vehicle design; uninhabited aircraft systems; lightweight materials and structures.

Activities

- Member and Academic Coordinator of Unmannned Systems Canada
- Member of Organizing Committee – Unmanned Systems Canada Student UAV/UGV Competition (2007, 2009, and 2011)
- Session developer for Aerospace Structures and Materials Symposium, CASI AERO (2011)
- Session Developer for Conference and Exhibition, SAMPE (2010)

Rob Langlois, P.Eng.

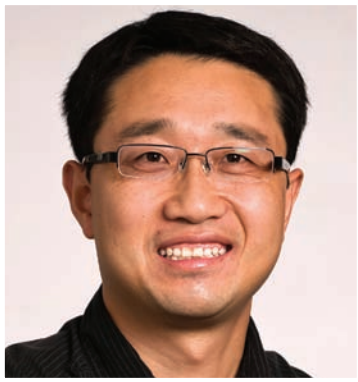
Professor

Research

Applied multibody dynamics; mathematical modelling and computer simulation; vehicle dynamics.

Application

Shipboard helicopter operation; shipboard mechanical systems, postural stability analysis; vehicle and system simulation.



Jie Liu

Assistant Professor

Research

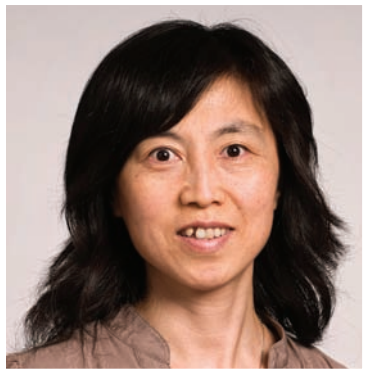
Machine condition monitoring; failure prognostics and health management; vibration and system control; fault tolerant control; intelligent mechatronic systems; smart sensing; machine learning; instrumentation and measurement.

Application

The condition monitoring and health management research endeavors to improve the system diagnostic and prognostic reliability in various mission-critical engineering applications, e.g., aircrafts, spacecrafts, power plants, chemical plants, wind turbines, automotive assembly lines, and large manufacturing facilities. The vibration and intelligent control research aims to equip robotic hands with learning capability through advanced machine learning so as to build effective hand rehabilitation devices for the persons with hand disability, thereby offering substantial social benefits by empowering the ageing population and disabled community. The smart sensing research intends to develop next-generation super-sensitive low-field magnetic sensors. Based on quantum tunneling technology, these sensors possess the potential to replace the currently-existing eddy current sensors thanks to their advantages of high sensitivity, small size, low cost, and low power consumption.

Rong Liu, P.Eng.

Associate Professor



Research

Erosion/corrosion resistance/mechanisms of superalloys and their coatings' improvement in metal-on-metal bearings for orthopedic implants high-temperature tribological behavior and mechanisms of superalloys carbon fibre reinforced stellite alloy composites.

Application

Design, development and characterization of new materials for high-temperature and severe wear/corrosion operation environments such as mechanical, oil, chemical, automotive and aerospace industries.

Activities

- Lead Guest Editor for Special Issue "High- and Superhigh- temperature Tribological Behavior of Tribological Materials and Coatings" of the journal Advances in Tribology
- A member of the Scientific Committee of the International Conference on Composites Engineering

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Edgar A. Matida, P.Eng.

Associate Professor

Research

Aerosol science and technology (aerosol characterization and deposition); nozzle sprays; dispersed two-phase random-walk models; dispersed two-phase impinging jets; large eddy simulation (LES); laser-doppler velocimetry (LDV); particle image velocimetry (PIV).

Application

Pharmaceutical aerosols (pressurized metered dose inhalers) and add-on spacer devices; nasal drug delivery; diesel fuel characterization; airfoil-vortex interaction related to rotorcraft; fuel cell modelling.

Activities

- Member of the Editorial Board of the Journal of Aerosol Medicine and Pulmonary Drug Delivery

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J. Moyra McDill, P.Eng.

Professor

Research

A priori determination of thermal-mechanical deformation of an industrial robot arm; adaptive, thermal-mechanical finite element analysis; materials in biomedical engineering.

Application

Thermal-mechanical deformation in a robot linkage; tet-to-hex application for Bayer Healthcare Diagnostics.

Activities

- Commissioner of Canadian Nuclear Safety Commission
- Fellow and President-Elect of Canadian Academy of Engineering

Glenn McRae, P.Eng.

Professor

Research

Studies of hydrogen solubility and delayed hydride cracking in zirconium alloys; designing and fabricating a robust manual multileaf collimator to shape radiotherapy beams during Cobalt-60 cancer treatments in developing countries; solid state X-ray dosimetry for quality assurance of procedures to sterilize donated blood; coupling neutron-activation analysis and single photon emission computed tomography to make a non-invasive 'nSPECT' bone-cancer imager, and a calibration 'flood' source; development of new technique to measure impact damage in composite materials; development of new method to detect fingerprints on brass shell casings.

Application

Nuclear reactors; experimental studies are done at Chalk River Lab and Argonne National Laboratory; corrosion engineering; corrosion of rebar in concrete; accelerated testing of novel coatings used to protect aluminum beverage cans; sustainable energy engineering – translucent aerogels with high insulating values for skylights and windows.

Ronald E. Miller, P.Eng.

Professor

Research

Nano-mechanics; multiscale and molecular dynamics simulations of metallic and hydrocarbon systems; high-performance computing applications of multi-scale modeling in materials science; development of interatomic potentials for materials science.

Applications

Delayed hydride cracking in nuclear reactors; oil breakdown mechanisms; effects of radiation on materials in nuclear reactors.

Activities

Recent Books:

- "Modeling Materials: Continuum, Atomistic and Multiscale Techniques" E.B. Tadmor and R.E. Miller, Cambridge University Press (2011)
- "Continuum Mechanics and Thermodynamics: From Fundamental Concepts to Governing Equations" E.B. Tadmor, R.E. Miller and R.S. Elliott, Cambridge University Press (2011)
- Instructor, "Tutorial on atomistic simulations using standardized interatomic potentials," Short Course at USNCCM-11 (http://www.usnccm.org), Minneapolis, MN (2011)
- Co-organizer, Minisymposium, "Recent Advances in the Quasicontinuum Method and other Atomistic/Continuum coupling Techniques," 11th U.S. National Congress on Computational Mechanics, Minneapolis, MN (2011)

Fred Nitzsche, P.Eng.

Professor

Research

Smart helicopter and gas turbine blades; active vibration and noise reduction in helicopters, gas turbine and turboprop aircraft; reducing buffeting of vertical fins in fighter aircraft; improved performance of fighters at high angles of attack; stability of fly-by-wire aircraft; flutter analysis in the transonic regime.

Application

Reduction of noise and vibration in aircraft brings great improvement in usability and reduced environmental impact in both civilian and military applications. The new technology of active (or smart) structures is very helpful in this effort.

Activities

- Leader of Rotorcraft Research Group (Carleton University)
- Chair of technical sessions at numerous international conferences
- Guest lectures at MIT, University of Rome III, University LaSapienza (Rome), DLR (German Aerospace Centre), University of Sao Paulo (Brazil), Swiss Federal Laboratories
- Member of AIAA (American Institute of Aeronautics and Astronautics) Structural Dynamics Technical Committee
- Member of the International Organizing Committee of ICAST (International Conference on Adaptive Structures Technologies)

Donald Russell, P.Eng. (Nova Scotia)

Associate Dean (Academic Planning and Policy), Faculty of Engineering and Design, Professor

Research

Dynamics and Modelling of mechanical systems; biomechanics; interaction between mechanical and biological systems; prosthetic limbs; biomechanics of piano playing and related injuries; patient simulators.

Application

Improved design of prosthetic limbs; evaluating the relationship between piano techniques and the occurrencee of piano playing related injuries.

Activities

- Past-President of the Canadian Canadian Medical and Biological Engineering Society
- Adjunct Professor for the School of Music, University of Ottawa

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Henry M. J. Saari, P.Eng.

Associate Chair (Undergraduate), Department of Mechanical and Aerospace Engineering, Associate Professor

Research

Processing and properties of gas turbine materials (powder metallurgy, casting – directional solidification and single crystal, heat treatment, titanium aluminides, superalloys); solidification process modelling; corrosion of materials in supercritical carbon dioxide; thermal analysis (DTA, DSC, phase transformations, thermophysical properties).

Application

Development of lightweight materials for aircraft gas turbine blade Applications, leading to improved efficiency and power output. Material compatibility for supercritical carbon dioxide gas turbines used for high efficiency power generation.

Activities

- Executive Member of ASM International – Ottawa Valley Chapter

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Herb Saravanamuttoo, F.A.S.M.E., F.C.A.S.I., F.I.Mech.E., P.Eng

Distinguished Research Professor

Research

Gas turbine performance; engine health monitoring.

Activities

- Recipient of ASME R. Tom Sawyer Award

Jurek Sasiadek, P.Eng.

Professor

Research

Guidance, navigation and control (GNC); robotics; sensor and data fusion; mechatronics; space robotics; unmanned aerial vehicles; mobile robots; intelligent and adaptive control systems; autonomous systems; non-linear control; cooperative robot control; vision systems; global positioning systems (GPS); inertial navigation systems; control systems theory; aerospace control systems; control theory and Application; energy systems control; biomedical and bioengineering systems.

Application

Aerospace technologies; UAV, mobile robots for security; autonomous flying planes and helicopters, spacecraft formation flying; power plant stations; energy systems; heart and cardiovascular health monitoring using imaging and CT methods.

Activities

- Director of American Council of Automatic Control
- Member of the Council, International Federation of Automatic Control (IFAC)
- AIAA Guidance, Navigation and Control Technical Committee Member
- Chair of IEEE Joint Robotics and Control System Society, Chapter in Ottawa

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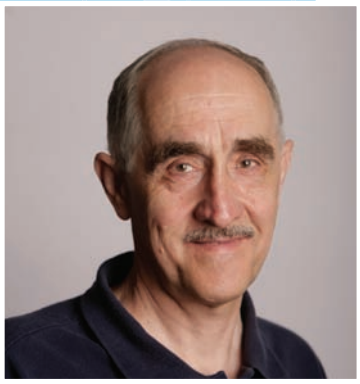
Steen A. Sjolander, P.Eng.

Pratt and Whitney Canada Research Fellow
Chancellor's Professor

Research

Turbomachinery aerodynamics; axial-flow compressors and turbines; experimental techniques for low-speed and transonic aerodynamics of turbomachinery; transition from laminar to turbulent flow; flow control for turbomachinery; computational fluid dynamics; gas turbine engines; low emissions; greenhouse gas reduction.



Paul V. Straznicky, P.Eng.

Professor

Research

Aircraft structures, structural behavior of fibre metal laminates; fatigue; aircraft design; manufacturing of composite materials; unmanned vehicle systems.

Choon Lai Tan

Professor

Research

Computational mechanics/stress analysis; boundary element methods; fracture mechanics; anisotropic thermoelasticity; mechanics of composites.

Activities

- Member of Editorial Board for Computer modeling in Engineering and Sciences; Electronic Journal for boundary Elements; Advances in Fracture mechanics; Book Series, WIT Press, U.K.
- Member of International Scientific Committee: International Conference on Computational & Experimental Sciences (ICCES) Conference series; Boundary Element Techniques (BeTeq) Conference series; Asia-Pacific International Conferences on Computational Methods in Engineering (ICOME); ICF12 Conference, Technical Program Committee

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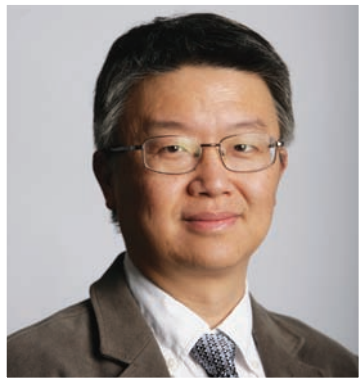
Xin Wang, P.Eng.

Professor



Research

Solid mechanics, linear and nonlinear fracture mechanics, finite element method, fatigue and fracture analyses of engineering materials and structures, structural integrity assessment methods, material characterization and numerical simulation of metal forming process.

Application

Fatigue and fracture assessment of engineering components in pressure vessel and offshore and aerospace industries research enables laboratory testing to better predict the fatigue and fracture properties of actual full-scale engineering studies; development of advanced manufacturing process for metal forming industries.

Activities

- Member of Scientific Committee, Session Organizer/Chair – ASME International Conference on Offshore Mechanics and Arctic Engineering (2010-2011)
- Member of Editorial Board – Advances and Applications in Mechanical Engineering and Technology (Scientific Advances Publishers, ISSN: 0976-142X)
- Member of Technical Committee – ASTM E08 on Fatigue and Fracture Mechanics

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Jo Y. Wong, F.I.Mech.E., F.A.S.M.E., F.C.S.M.E., C.Eng., P.Eng.

Distinguished Research Professor

Research

Ground transportation technology; off-road vehicle engineering; planetary rover mobility; road vehicle dynamics; applications of advanced technologies to vehicle engineering; air cushion technology; magnetic levitation systems.

Activities

- Member of Editorial Boards – Vehicle System Dynamics, International Journal of Heavy Vehicle Systems, and Journal of Terramechanics
- Past President of International Society for Terrain-Vehicle Systems

Metin I. Yaras, P.Eng.

Chair, Department of Mechanical and Aerospace Engineering, Professor

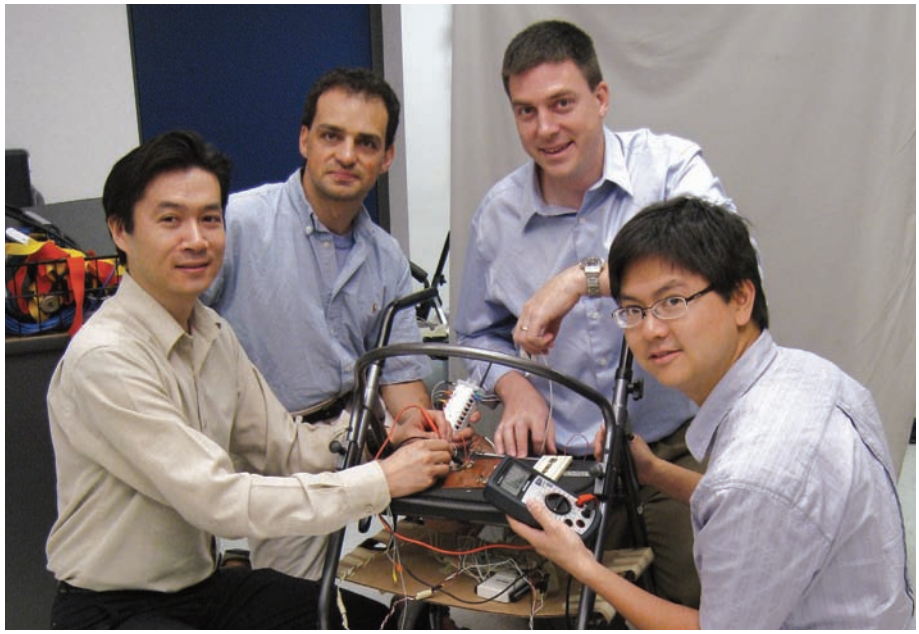
Research

Numerical and experimental study of fluid flows. Current projects focus on: study of instability and transition of wall-bounded, separated, and free shear layers through wind-tunnel tests and direct numerical simulations; transition control in separated shear layers; direct numerical simulation and experimental study of convection heat transfer in supercritical fluids as related to the cooling of fuel rods in Generation-IV nuclear reactors; aerodynamics of lobed mixers with three-dimensional inflow velocity fields; aerodynamics of low-Reynolds-number airfoils for gas-turbine, UAV-propeller and wind-turbine applications; development of a novel hydrokinetic turbine for tidal-current and river applications with improved power-to-size ratio; computational study of blood flow in the aorta.

Department of Systems and Computer Engineering

The Department of Systems and Computer Engineering is one of the largest and most research intensive departments of Electrical and Computer Engineering in Canada and recognized as one of the world leaders in software engineering and computer systems engineering.

The Department has research strengths in communications, software design, computer systems, biomedical engineering and technology management. Our communications research group is internationally recognized and supported by a strong team of faculty members. We have expertise in Broadband and Wireless Communications and Network Communications. Researchers are collaborating with world leading industrial partners to develop the next generation of broadband wireless communication networks. We have developed a very strong biomedical research group which includes two Canada Research Chairs. They have developed better methods for diagnosing diseases, improved the computer-assisted analysis of medical data and researched innovative systems for training doctors, such as surgical simulators. Our Software Engineering research team is ranked as one of the best in the world and is internationally recognized. They have developed new methods of software validation and verification and have made recent advances in computer network intrusion detection. Our strong team of computer systems researchers has been thriving over three decades and there too we are ranked as one of the best programs in the world. Researchers are developing new algorithms for cloud computing and security. Other researchers are developing methods of artificial intelligence and multi agent learning algorithms with applications in robotics. The department also has a prominent research group in simulation and visualization. Our DSP lab is the only “elite” Texas Instrument DSP lab in the country.



Biomedical engineering researchers instrument a rollator to achieve sonar obstacle avoidance and wireless patient usage and health monitoring.

Carleton University’s location in the National Capital City of Ottawa has provided us with easy access to the major government research laboratories such as the National Research Council, the Communications Research Centre and Defence Research and Development Canada. Our research is supported by a wide array of industrial leaders including, IBM, Intel, Samsung, Mitel, Alcatel, Huawei, Telus, Ericsson, RIM and many others. Several industrial partners have donated fully equipped labs for use in research and graduate training, including Mitel, Alcatel-Lucent, Huawei, Telus, RIM and IBM.

Computer Systems Engineering

Reliable computer systems underlie many modern systems. This requires careful engineering of software as well as trustworthy hardware-software

co-design for systems that involve computers as an embedded element. Research is currently underway for devising effective middleware techniques for providing interoperability and performing resource management in large distributed systems. There is a substantial effort to model and improve the performance and reliability of software systems ranging from embedded communications software to enterprise service systems.

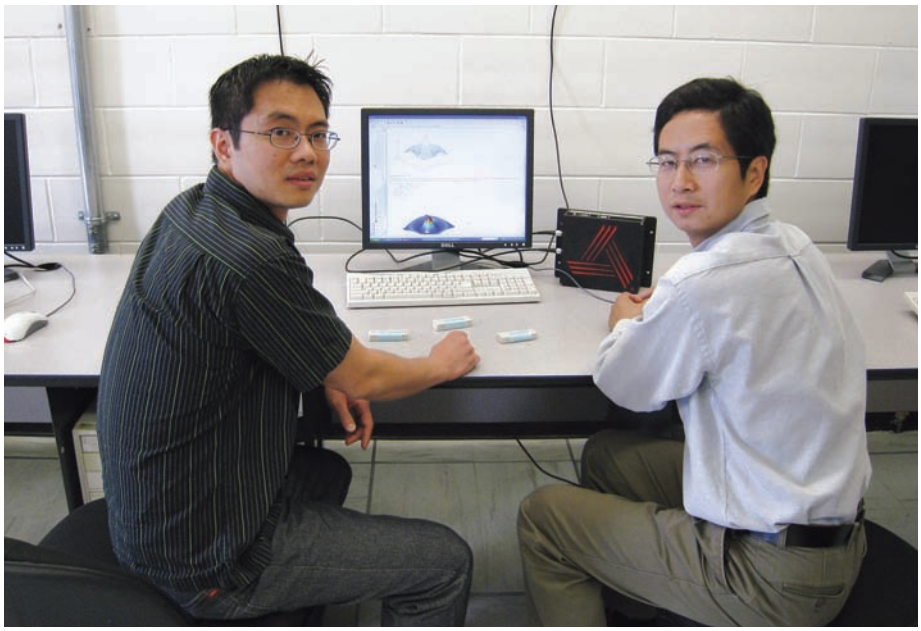
Software Engineering

Research pertains to many aspects of software engineering including, but not limited to, requirement engineering, model driven engineering (mainly UML-based software development), software architectures, product lines, aspect oriented programming, verification, validation and testing, and software maintenance. Research focuses on technology evaluation (empirical software engineering) as well as the development of improved methodologies, the overall objective being to offer effective and efficient methodologies to develop dependable software systems (aerospace, health care, telecom, security).

Computer Communications, Distributed Systems, and Multimedia

This area focuses on advanced computer networks and on some contemporary computer applications.

Professor Richard Dansereau who is part of the Speech, Signal and Image Processing program.



Professors Richard Yu and Jerome Talim who are part of the Computer Communications, Distributed Systems, and Multimedia program.

Research in this area includes traffic modeling, algorithmic performance analysis, MPEG video, multicasting, IP, network security, information assurance, network architecture and applications, multimedia, animation, computer vision, virtual reality environments, and real-time, parallel, and distributed systems.

Digital and Wireless Communications

Reliable, efficient communication of voice and data (including images and video) is a cornerstone of the modern economy. Research in the Department covers all aspects of communication, including mobile wireless systems, optical networks, network traffic modeling and protocols, cellular, ad hoc, and sensor networks, cross-layer optimization, compression algorithms, Voice-over-Internet-Protocol, and quality of service, etc. Collaborations include those mentioned above as well as Bell, the Communications Research Centre, National Defence Canada, IDT Canada, Intel (USA), RIM, Huawei, Telus and Samsung (Korea).

Signal, Speech, and Image Processing

This involves the acquisition and processing of all kinds of data, including acoustic, voice, images, video, biomedical, etc. Applications include noise reduction, speech quality enhancement, Voice-over-Internet-Protocol, and improved video conferencing. As the volume of data increases, work on compression of data and reliable transmission over noisy wireless channels also becomes more important. Another important research thrust is the processing of biomedical signals.

System and Machine Intelligence

Computer-based systems can undertake more advanced functions as their 'intelligence' increases. Research addresses issues on a broad spectrum of machine intelligence, from classical optimization and control to new methods such as genetic algorithms and swarm intelligence. Applications include improved design of systems, better control of robots, better control of prostheses, and better diagnosis of diseases.

Biomedical Engineering

Research in biomedical engineering reflects the diverse and interdisciplinary nature of this field. Analysis of biomedical signals is a key thrust, e.g. ultrasound, NMR/MRI, electrical impedance tomography, infrared imaging, electrocardiography, electromyography, heart sounds, 'electronic nose' sensor data, and multi-sensor stethoscopes. The development of biomedical instruments and devices is a second thrust, e.g. the design of improved user interfaces for assistive devices, again relying on our strengths in signal processing and artificial intelligence. Finally, there is significant research activity within the field of biomedical informatics, including both bioinformatics and clinical informatics.

Technology Innovation Management

The development and commercialization of new technologies is a process that is as complex as the technologies themselves. Research in this area focuses on commercialization and business development beyond the laboratory, including methods to grow technology businesses, particularly during the early stages of the technology lifecycle. Applications involve capturing value from technology in open environments, product development management, venture capital, technology company creation, and management in the development of telecommunications technology intensive products and services.

Research Groups and Facilities

Labs are equipped with world-class technology under the sponsorship of industry leaders.

Texas Instruments Digital Processing Lab

Carleton is the only Canadian participant in TI's North American ELITE DSP Lab program. The lab is equipped with 20 DSP development systems for work on new technologies for wireless communications, high-speed data and VoIP transmission. Research also centres on advanced wireless devices, advanced Internet access, advanced conferencing terminals, and video processing for image compression and medical imaging.

Alcatel-Lucent Advanced Networks Lab

Carleton is the only Canadian university selected for Alcatel-Lucent's Research Partner Program, which fosters innovation through strategic research partnerships. The lab is equipped with three ATM switches, bridges, and interface cards. Research focuses on computer networks, with the goal of improving network management, performance, and Quality of Service through rapid analysis and quality control.

Mitel Networks and Analog Devices Incorporation VoIP Lab

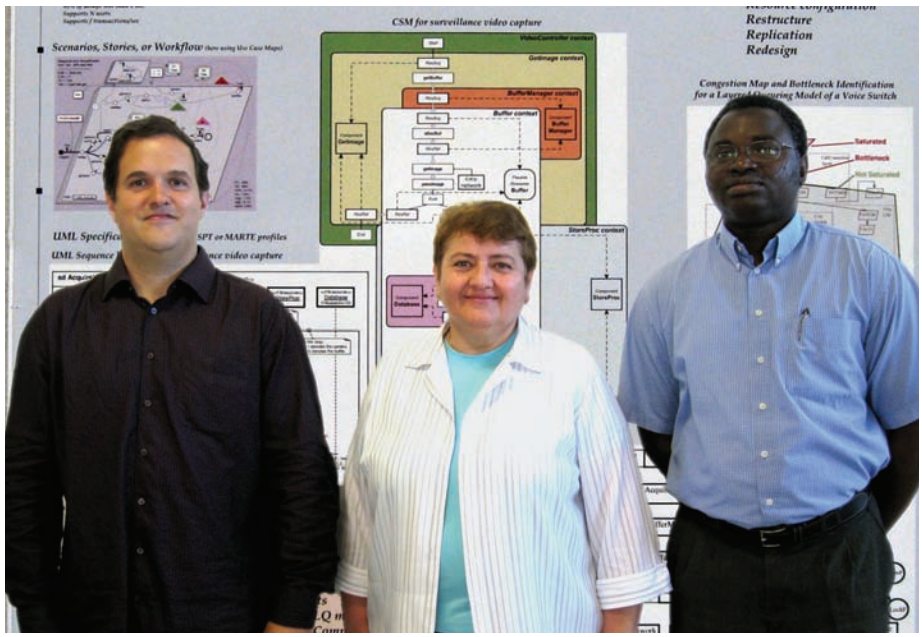
Based on the Mitel Integrated Communications Platform (ICP3200), the lab is equipped with 20 development stations; each with a PC and three phones (analog, digital, IP) modified to allow full access from the PX through an ICE from ADI. Other equipment includes a speech quality analyzer, speech recognition system, video cameras, and Quality of Service testing equipment. Research concentrates on Internet telephony, next-generation telephone equipment and services, and systems technology. Advanced technology in speech quality enhancement, high-fidelity stereophonic sound for telephones, and voice and speaker recognition is also pursued.

Broadband Communications and Wireless Systems Centre

One of the largest Canadian university research groups in wireless communications, the Centre's interdisciplinary constituency includes Electronics Department researchers engaged in wireless-related projects. The Ottawa region is an R&D seedbed for industry and government, both major contributors to research at the centre. Research topics cover a wide range in this area including propagation and channel modeling, modulation, coding and synchronization, signal processing, radio resource management, multi-hop and cooperative communications, broadband wireless systems, ad hoc and sensor networks, wireless protocols for access multimedia and the Internet, mobile computing, and mobility management.

Real-Time and Distributed Systems Lab

Performance and resource management aspects of parallel and distributed systems are explored. This includes



Some of the members of the Real-time and Distributed Systems (RADS) research centre (from left to right): Gabriel Wainer, Dorina Petriu, Samuel Ajila.

Companies Founded by Carleton Faculty and Graduates:

this should not be considered a complete list

ActivePotato Corp.
Advanced Bioelectric Corp.
AmikaNow! Corp.
Angiograms for Software Analysis Inc.
Atsana Semiconductor Corp.
AvalonDSP Consulting Inc.
Avtech Electrosystems Ltd.
Bajai
Bedarra Corp.
Biotech Networks Inc.
Blue Gate Integrated Circuit Solutions
Bradley Systems Inc.
Burnsco Technologies Inc.
Buystream Inc.
Cadabra Design Automation Inc.
Calligraphics Computer Calligraphy
CertainKey Inc.
CompEngServ Ltd.
Computer Based Information Systems
Computer Managed Information Ltd.
Corporate Renaissance Group Inc.
CPAD Technologies Inc.
Crocus Product Design
Dedicated Technologies Corp.
Design Interpretive
Design Workshop
Digital Guard Corp.
DM Solutions Group Inc.
DOMUS Software Ltd.
Dreaming Owl
DW Product Development Inc.
Edigenous Technology
Ellistar Sensor Systems Inc.
Espial Group Inc.
Forensic Computing of Ottawa Inc.
Galazar Networks Inc.
GasTOPS
GlobalX Communications Inc.
Goldak Technologies
Grade (A) Student Inc.
Green Avenue Ventures Inc.
HardStorage.com
IatroQuest Corp.
ICHU Intranet Learning Inc.
IDS Intelligent Detection Systems Inc.
Ingenia Communications Corp.
InGenius Engineering Inc.
InGenius People Inc.
Integra Solutions
Interactive Circuits and Systems Ltd.
Isosceles Information Solutions Inc.
Kaben Research Inc.
Katsura Investments
Kelsar Inc.
Learning Dimensions Inc.
Lightera Networks Inc.
Lumic Electronics Inc.
Maplebrook Consulting Inc.
MarketAccess Communications Inc.
MARSWorks Inc.
Maskery & Associates
MB Foster Associates Ltd.
MeetingSoft Inc.
Molecular Ligand Technologies
Multiprocessor Toolsmiths Inc.
New Paradigm Technologies Inc.
Non-linear creations
Northwood Geoscience Ltd.
Northwood Technologies Inc.
Object Technology International Inc.
Optimal Data Group Inc.
Optovation Corporation
PC Edge Inc.
Phibian Technologies Inc.
Philsar Semiconductor Inc.
PlanetGiftCertificate.com
Provenance Systems Inc.
RealDecoy, Inc.
Resonance Microwave Systems Inc.
RoadStar GPS
Roshnee
RoweBots, Inc.
S2io Technologies Canada
SAGUS Security Inc.
Sedona Networks
Serence Inc.
SiteBrand Corp.
SofTV.net
SOMA Networks, Inc.
Strategic Focus
SuitesOnline.com
Sybarus Technologies
Tanjun Solutions Inc.
Tarian Software
Tekrib Inc.
Tempest Consulting
Tempest Management Corp.
The Object People
The Puffin Group Inc.
Trican Consulting Group
Trican Multimedia Solutions Inc.
TrueArc Corp.
TWLinks Inc.
UpTangent
Ventrada Systems Inc.
Virtual MarketPlace
Virtual Wave Inc.
WaveAccess Ltd.
webHancer Corp.
Webmama.com Inc.
Wireless System Technologies
ZIM Technologies International Inc.

matching the software architecture to the system requirements and evaluating implementation architectures (e.g. for scalability). New methodologies for hardware-software co-design are also under development, including the formalization of Use Case Maps and ways of designing event-driven software through "Software Computer-Aided-Design". Software performance engineering is also studied, including methods for predicting the performance of concurrent systems.

Software Quality Engineering Laboratory

Dedicated to developing new methodologies and prototype tools to produce higher quality software, the lab focuses on applied software engineering research. Activities concentrate on the verification and validation of software systems with a particular emphasis on object-oriented systems and high-dependability systems. Model driven development and object-oriented analysis and design with the Unified Modeling Language (UML) are studied, as is software quality assurance and control based on quantitative methods and experimental software engineering. The lab also researches automated testing of object-oriented, distributed, and real-time systems and automated support for impact analysis of object-oriented designs and change management. Collaborators include the Research Center on Software Technology at the University of Sannio, Italy; Simula Labs, University of Oslo, Norway; Triskell Group, IRISA, University of Rennes, France; IBM Rational and Siemens.

Robotics in Health Care.

Biomedical Engineering Laboratory

Lab equipment includes three thermographic cameras, a sixteen-channel biological signal acquisition system for collecting myoelectric signals, ECGs, and EEGs, AlphaMOS Prometheus and Cyranose electronic noses, electrical impedance tomography and respiratory inductance plethysmography systems, a benchtop NMR spectrometer, and ultrasonic medical imaging/measurement systems. Advanced technologies are under development for diagnostics and treatment. Projects include signal processing and compression of medical data in noisy environments, artificial intelligence systems for estimating clinical outcomes in neonatal intensive care infants and other medical situations, intelligent sensor systems for remote monitoring, myoelectric control of upper arm prostheses, prediction of gene regulation and protein structure and function through bioinformatics, developing a diagnostic aid tool for rheumatoid arthritis, imaging of regional lung function using electrical impedance tomography, ultrasonic medical imaging and diagnosis as well as applications in telesurgery and telemedicine.

Collaborators include the Children's Hospital of Eastern Ontario, University of Ottawa Heart Institute, Ottawa Hospital Rehabilitation Centre, Health Canada, and the SCO Health Service.

Advanced Laboratory for Real-Time Simulations

The lab equipment consists of a high-performance computing platform to support an advanced real-time simulation engine (including hardware-in-the-loop and graphics workstations for human interaction). The Lab is devoted to research into real-time modeling and simulation, and into the creation and execution of very large and complex models with strong timing requirements. Research includes mechanisms for automatic generation of executable models derived from specifications of the systems and formal methods for modeling and simulation. Focus is on very practical projects using advanced development tools and 3D visualisation. Research projects include model-based development of embedded and real-time applications, parallel and distributed simulation techniques, interoperability of executing models, and 3D visualisation. Collaborations of the lab include McGill, Concordia, ACIMS (University of Arizona, USA), Polytech de Marseille, Université de Nice/INRIA Sophia-Antipolis, Université Blaise Pascal (France). The lab is one of the members of Carleton University Centre for Visualization and Simulation (V-Sim).

Graduate Programs

The M.A.Sc., M.Eng. and Ph.D. in Electrical Engineering are offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE), which is joint with the Department of Electronics at Carleton University and the School of Information Technology and Engineering at the University of Ottawa. This arrangement offers our students access to an extremely wide range of graduate courses in ECE. The M.Sc. in Information and Systems Science is a conversion program offered to applicants who have a background in a technical area other than electrical or computer engineering or computer science, and is joint with the School of Computer Science, and the School of Mathematics and Statistics. The M.A.Sc. and M.Eng. in Technology Innovation Management provide advanced education at the interface of telecommunications technology and technology management. The M.A.Sc. in Biomedical Engineering is an interdisciplinary degree program offered through the Ottawa-Carleton Institute for Biomedical Engineering (OCIBME) which combines the resources of several departments at both Carleton University and the University of Ottawa, and draws upon the expertise of medical research units.

Andy Adler, P.Eng.

Canada Research Chair in Biomedical Engineering, Professor

Research

Development of novel biomedical measurement devices and medical image and signal processing algorithms, and, biometrics imaging and security systems, and the associated algorithms, measurement devices, and privacy and security aspects.

Application

Electrical impedance tomography for monitoring of lung and heart functions; image reconstruction algorithms for ill-conditioned systems with correlated data; statistical models to compare human versus machine face recognition; demonstrated vulnerabilities in biometric encryption; algorithms to measures of biometric information content and sample quality; measuring parameters for conducted energy weapons safety.

Activities

- Maintainer of EIDORS open source toolkit for Impedance Imaging Reconstruction (www.eidors.org)
- Review Committee for NSERC/CIHR CHRP Grant Program (2009-2011)
- Program Committee Member of Intl. Joint Conf. – Biometrics (2011)
- Program Committee Member for Elec. Imp. Tomography (2011)
- Developer of Octave open source software (www.octave.org)
- Member of Canadian Advisory Committee – ISO JTC1/SC37 Biometrics

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Victor Aitken, P.Eng.

Associate Professor

Research

Control systems; state estimation; data and information fusion; redundancy; sliding mode systems; non-linear systems; vision, mapping and localization; sensing, control and state estimation methods for navigation and guidance of unmanned vehicle systems; vision, state estimation and information fusion for robotics and biomedical applications.

Application

The research has been applied in large scale robotic landmine detections systems for the Canadian military, automation of underground mining machines for Canadian industry, and in detection and analysis of eye motion for automation of retinal surgery.

Activities

Program Committees:

- IEEE Int. Instrumentation and Measurement
- IEEE Int. Conf. Automation and Logistics
- IEEE Int. Wkshp. Robotic & Sensor Environments

Samuel A. Ajila, P.Eng.

Associate Professor

Research

Software reengineering and maintenance, software evolution and change management, aspect oriented design and programming (aspect composition and testing), and knowledge discovery and acquisition with applications in software engineering. The impacts of knowledge delivery factors on software development effectiveness and the effects of open source software (OSS) on the economics of software development.

Application

The research has been applied to software intensive systems (Real Time and Distributed Systems); industrial processes; and avionic systems.

Tony Bailetti

Director of the Technology Innovation Management (graduate) program, Associate Professor

Research

Technology commercialization; distributed product development; growing companies in open environments; open source software; technology company creation. Design and implementation of methods to grow technology businesses, particularly during the early stages of the technology life cycle; capture value from technology in open environments; design and develop complex products.

Activities

Vice-President, Research, Executive Council, Engineering and Technology Management Education and Research Council

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Amir Banihashemi, P.Eng.

Professor

Research

Digital and wireless communications; information theory and coding; theory and implementation of iterative coding schemes; joint source-channel coding; space-time coding and processing; analog decoding; multimedia transmission over Internet and wireless links; cooperative coding and communication; distributed source/channel coding, compressive sensing.

Application

Digital and wireless communications; communication theory; signal processing.

Activities

- Director of Broadband Communications and Wireless Systems (BCWS) Centre
- Editor of IEEE – Transactions on Communication

Adrian Chan, P.Eng.

Associate Professor

Research

Biomedical engineering; biological signals (ECG, EEG, myoelectric signals); signal processing; pattern recognition; assistive devices; electronic noses.

Application

Multi-modal non-invasive sensor systems for remote and/or portable monitoring (e.g. Smart Rollator project); non-linear biological signal processing for prosthetic control and fatigue monitoring; detection and identification of bacteria using electronic noses.

Activities

- Associate Director of Ottawa-Carleton Institute of Biomedical Engineering (2009-present)
- Awards Committee Member for Canadian Medical and Biological Engineering Society (2008-present)
- Website, IEEE EMBS Ottawa Chapter (2005-present)

John Chinneck, P.Eng.

Professor

Research

Optimization (i.e. determining an optimal choice when restricted by constraints); mathematical programming; operations research; modelling; mixed-integer programming; linear and non-linear programming, especially global optimization; heuristics; infeasibility analysis; developing algorithms to analyze and debug optimization models and to speed optimization solutions.

Application

Optimization is widely used in engineering and business. An example is optimal scheduling for airlines in delivering passengers at minimum cost against constraints of aircraft maintenance and crew scheduling. Recent application has been in improved task allocation in cloud computing.

Activities

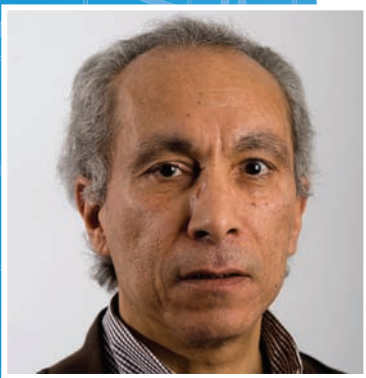
- Editor in Chief of The INFORMS Journal on Computing
- Program Committee, CPAIOR conference, Berlin (2011)
- Program Committee, INFORMS Computing Society Conference, Monterey (2011)
- Program Committee, ICORES conference, Vilamoura, Portugal (2012)

Richard Dansereau, P.Eng. (Manitoba)

Associate Professor

Research

Digital signal processing; biomedical signal processing; multimodal and audio-visual signal processing; scalable wavelet video compression; voice over IP (VoIP); signal separation; quality of service (QoS); video quality metrics; wavelets; fractal measures; non-linear and chaotic dynamic systems; speaker tracking and speech enhancement/separation by correlating acoustic speech and visual lip reading; obtaining clean fetal ECG signals without interference from the signals from the mother; measuring QoS for video conferencing or video on demand.



Mohamed El-Tanany, P.Eng.

Professor

Research

Wireless and wired communication systems; EHF and UWB channels; software defined radio receivers; synchronization of communications receivers; synchronization of OFDM receivers for satellite and mobile radio channels; synchronization of direct sequence and frequency hopped spread spectrum receivers; modelling wireless channels with emphasis on UWB and unlicensed bands above 20 GHz.

Babak Esfandiari

Associate Professor

Research

Agent-based systems; network computing; object-oriented design and languages.

Application

Network supervision, autonomous robotics and the World-Wide Web.

Activities

- Editorial Board of Computational Intelligence
- Program Committees:
  - International Joint Conferences on Artificial Intelligence, IJCAI (2011)
  - ICCBR Workshop on Case-Based Reasoning for Computer Games
  - IEEE International Conference on Ubiquitous Intelligence and Computing, UIC (2011)
  - IEEE International Conference on Internet of Things, IoT (2011)
  - International Conference on Computer Science and its Applications, CSA (2011)
  - Canadian Semantic Web Symposium, CSWS (2011)
  - Conference Francophone d'Apprentissage, CFA (2011)

David Falconer, P.Eng., IEEE Fellow

Distinguished Research Professor

Research

Communication theory; broadband wireless communication systems; frequency domain space-time processing; communication theory and signal processing applied to advanced communications systems: modulation, coding, adaptive equalization and space-time processing. Air interface, system deployment techniques and radio channel characterization for next-generation wireless access systems, allowing ubiquitous coverage at bit rates up to 100 Mb/s or higher, with full mobility.

Application

Advanced, future-generation wireless systems.

Activities

- Member of peer review committee for evaluation of Communication Network Technology area of Defence Research and Development Canada (2010)
- Panels co-chair, IEEE Vehicular Technology Conference, Ottawa (2010)
- Co-chair of Workshop on "Broadband Single Carrier and Frequency Domain Communications" at IEEE Globecom (2010)
- Co-guest editor of special issue "Advances in Single Carrier Block Modulation with Frequency Domain Processing", EURASIP Journal on Advances in Signal Processing (2010-2011)
- Member of Carleton University External Research Awards and Honours Committee

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Greg Franks, P.Eng.

Assistant Professor

Research

Software performance engineering; analytic performance modeling using "layered queues"; discrete event simulation of distributed computer systems. Reverse engineering of distributed software systems through trace analysis; model building, solution and analysis process; software engineering; operating systems; operating system schedulers.

Application

Performance models of distributed computing systems are beneficial at all stages of a project. Models are used to set performance budgets for components, to find feasible designs and locate bottlenecks, and to plan the resources for installed systems, leading to substantial cost savings for a performance-sensitive project.

Activities

- Publicity Co-Chair for ICPE (2012)

Monique Frize, P.Eng.

Distinguished Research Professor

Research

Biomedical engineering; clinical decision-support systems; thermal medical image collection and analysis; telemedicine; ethics for engineers; women in science and engineering; artificial intelligence tools applied to decision-making in the clinical environment; medical equipment management in developed and developing countries.

Application

Clinical decision-making tools for physicians and parents, for example estimating pre-term births and delivery mode, outcomes for neonatal intensive care infants, aiding parents in the decision-making process. Thermal imaging to assess pain, potential muskulo-skeletal injuries in piano players, level of inflammation in rheumatoid arthritis patients. Development of medical technology management model in industrialized and developing countries.

Activities

- Editorial Boards for Biomedical Engineering Online, and Medical Engineering & Physics
- Past President of International Network of Women Engineers and Scientists
- President of INWES Education and Research Institute
- Chair of Pathmakers Council and MRI YSTOP
- Project leader, Affiliated Scientist
- Visiting Professor at Ottawa Hospital Research Institute (OHRI)
- Research Associate at Coventry University

Rafik A. Goubran, P.Eng.

Dean, Faculty of Engineering and Design, Professor

Research

Digital signal processing and its applications in biomedical engineering, sensors, smart homes, and speech processing; echo and noise cancellation, pattern recognition, and classification.

Application

Patient monitoring using non-intrusive sensors (pressure-sensitive mats); environmental sensors (RFID and electronic noses); smart-phone based sensors (accelerometers); wearable sensors (ECG, skin conductance, breathing monitors); heart and lung sound analysis; thermal cameras; smart hearing aids; speech quality enhancement; broadband and stereophonic VoIP; and smart multimedia VoIP terminals.

Activities

- Co-Leader and Research Scientist for TAFETA – Elisabeth Bruyere Research Institute (2005-2011)
- TPC Member of IEEE-MeMeA-2011 and IEEE-I2MTC-2011
- Co-Chair of IEEE-WARM-2010 and IEEE-MeMeA-2010
- Chair of the Council on Ontario Deans of Engineering – CODE (2009-2011)

James Green, P.Eng.

Associate Professor

Research

Bioinformatics; machine learning; pattern classification; proteomics; applications of nonlinear system identification; assistive devices; high performance computing on the Cell BE processor.

Application

Characterization of protein structure and function from sequence; prediction of post-translational modification of proteins; species-specific prediction of protein secondary structure; hardware acceleration of bioinformatics algorithms; computational identification of thyroid response elements; development of novel assistive devices for persons with disabilities and the elderly.

Activities

- Secretary of IEEE EMBS Ottawa Chapter (2007-present)

Events 2009-2011

October, 2009

- Professor Abd El Halim (Civil and Environmental Engineering) received the Award of Academic Merit from the Transportation Association of Canada (TAC) for his distinguished academic career and numerous achievements.

- Professor Q.J. Zhang (Electronics) won a Strategic Projects Grant to research on "Knowledge-based Modelling and Optimization Technology towards Multi-Disciplinary Design of High-Frequency Components and Communication Subsystems".

November, 2009

- Professor Moyra McDill (Mechanical and Aerospace Engineering) was the recipient of a 2009 Ontario Professional Engineers Award – Engineering Medal in the Engineering Excellence Category – from the Ontario Society of Professional Engineers for her exemplary service in her field to her community and profession.

April, 2010

- Professors S. Majumdar and G. Wainer are the winners of a major collaborative research grant from Ontario Centres of Excellence and Cistel.

May, 2010

- Professors R. Achar and Q.J. Zhang (Electronics) were the recipients of the 2010 Research Achievement Awards.

September, 2010

- The new Master of Infrastructure Protection and International Security (MIPIS) degree was launched in the Department of Civil and Environmental Engineering as an Interdisciplinary program with the Norman Paterson School of International Affairs.

- The new Master's program in Sustainable and Renewable Energy Engineering degree was launched as an interdisciplinary program between the Faculty of Engineering and Design and Faculty of Public Affairs.

November, 2010

- Professors T. Kunz and H. Yanikomeroqlou (Systems and Computer Engineering) were the recipients of Carleton University's first round of Faculty Graduate Mentoring Award.

January, 2011

- Professor H. Yanikomeroqlu was the recipient of a major MRI grant from Ontario Ministry of Research and Innovation, Huawei and Telus to research "Enabling Technologies for Next Generation Wireless Cellular Networks".

April, 2011

- Professor G. Wainer (Systems and Computer Engineering) won the Outstanding Professional Contribution Award given by the International Society for Modelling and Simulation (SCS).

May, 2011

- Professors E. Matida (Mechanical and Aerospace Engineering) and P. Simms (Civil and Environmental Engineering) were the recipients of the 2011 Research Achievement Awards.

June, 2011

- The establishment of "Huwaei-Telus Innovation Centre for Entreprise Cloud Services at Carleton University" located in the new Canal building and within the Faculty of Engineering and Design was announced.

- Professors R. Langlois and I. Beausoleil-Morrison (Mechanical and Aerospace Engineering) each were the lead applicants in two separate successful CFI Super Leaders Opportunity Fund grants to establish two separate unique and state-of-the-art research laboratories for wind and solar energy research.

July, 2011

- Professor Richard Yu (Information Technology) was the recipient of an Early Researcher Award.

September, 2011

- The Azrieli School of Architecture and Urbanism launched three new graduate programs: Master of Architectural Studies for students interested in pursuing in-depth architectural research, Master of Architecture Professional which focuses on creativity and innovation within practical parameters, and PhD in Architecture, a comprehensive doctoral program that fuses research with critical practice in architecture.

- The School of Industrial Design launched a new Master of Design program that is focused on advancing knowledge in the field of design through research in the areas of advanced materials and manufacturing processes, visualization, design and culture, extreme environments, sustainable design and strategic design research.

- In collaboration with 13 different Schools and Departments across the university ranging from Architecture and Industrial Design to Psychology and Journalism a new multidisciplinary Master's degree program in Human-Computer Interaction (HCI) is launched with research interest and focus on ways interactive technologies can improve the life quality for people at work, at play and at home.

Roshdy Hafez, P.Eng.

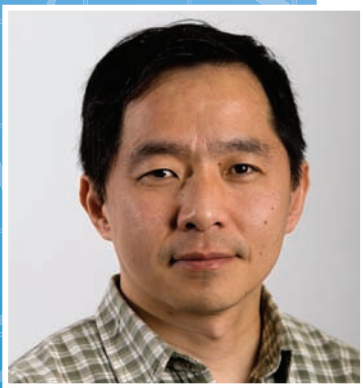
Professor

Research

Wireless theory; local access technologies: OFDM, CDMA; 3G/4G broadband wireless access; LANs and ad hoc networking; RF design and integrated fibre/wireless local loops with applications in sensors networking and ad hoc coverage extensions; wireless security, monitoring and control; broadband access in rural areas.

Activities

- Senior Advisor for wireless industrial and government labs



Changcheng Huang, P.Eng.

Associate Professor

Research

Traffic modelling and fast simulation techniques; network congestion control and Quality of Service (QoS) mechanisms; network failure detection and protection mechanisms; Internet architecture and protocols; QoS issues in wireless and sensor networks.

Application

Virtual Private Networks (VPN) Peer-to-peer multimedia services; Voice over IP services; environmental monitoring; traffic engineering for carrier networks.

Activities

- Technical Program Committee Member for International Conferences and Workshops

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Thomas Kunz

Professor

Research

Ad hoc networks and sensor networks: network protocol issues, middleware, and innovative applications, e.g. Quality of Service (QoS) support; maximizing the network capacity through appropriate MAC and routing protocols; performance and fairness of TCP; clock synchronization and localization protocols; smart grid/smart homes.

Activities

- Technical Adviser for Communications Research Centre, Industry Canada
- Technical Program Committee Member for International Conferences and Workshops
- Editorial Board Member of Open Source Business Resource (2007)
- Guest Editor for Open Source Business Resource special issue on Open Mobile Platforms (2010)
- TPC Co-Chair of Wireless Models, Simulations and Experiments Track – IFIP Wireless Days (2011)
- Workshop Co-Chair for Workshop on Multihop Wireless Network Testbeds and Experiments, Istanbul, Turkey (2011)

Yvan Labiche, P.Eng.

Associate Professor

Research

Software verification and validation; Software testing: unit/integration/system testing, procedural/OO software, real-time software, functional/structural testing; Software maintenance; Software engineering; Model-based software engineering, Unified Modeling Language (UML): UML-based software development, UML-based software testing, UML models quality; Search-based software engineering; Empirical software engineering; Technology evaluation. In the top-five Canadian software engineering scholars for the period 1996-2006 (Computer and Information Science, Vol. 3, No. 2, May 2010).

Application

Medical Imaging Software, Aerospace Software, Telecom Software, Network Security; Real-time (soft/hard) software; Embedded software; Procedural software, Object-Oriented software.

Activities

- Program Committee Member of IEEE ICST (2010, 2011), IEEE ICSM (2010), IEEE ISSRE (2010), Models (2010), IEEE QSIC (2010, 2011), IEEE SBST (2011), IEEE SSBSE (2010, 2011), ACM GECCO (2010, 2011)

John Lambadaris

Professor

Research

Applied stochastic processes; stochastic optimization; queuing theory; mixed signal electronic design; communication systems hardware. Analysis and modeling of traffic in modern computer and communication networks; voice over IP (VoIP); architectures and performance evaluation; optimal control of optical networks; resource allocation and routing; congestion control for Internet; active queue management and scheduling algorithms; security applications wireless sensor networks for remote control, surveillance and security, RF board design-RF tranceiver architectures-signal integrity.

Activities

- Co-founding member of the Research Center for Technology Innovation (RCTI), http://www.ottawatechwiki.com/wiki/index.php?title=Carleton_University
- Co-founder and President of Sombra Labs Inc.
- Regular reviewer for IEEE

Peter Xiaoping Liu, P.Eng.

Canada Research Chair in Interactive Networking Computing and Teleoperation, Associate Professor

Research

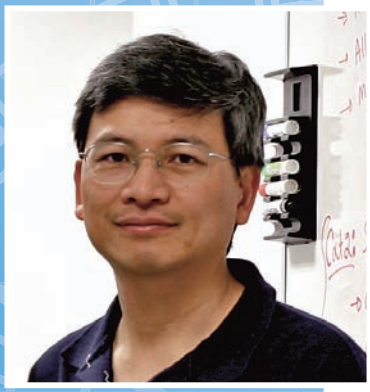
Network-based tele-operation and tele-robotics; context-aware networks, robotic surgery; surgical simulation; haptics; wireless sensor networks; robots and intelligent systems.

Application

Telesurgery; minimally invasive surgery; surgery training systems.

Activities

- Leading Guest Editor:
  - Focused Section on Wireless Mechatronics for IEEE/ASME Transactions on Mechatronics (2011)
  - Special Issue on HAVE, IEEE Transactions on Instrumentation and Measurement (2011)
- Associate Editor:
  - IEEE Transactions Automation Science and Engineering
  - IEEE/ASME Transactions Mechatronics
  - International Journal of Robotics and Automation
  - Journal of Intelligent Service Robotics
  - Control and Intelligent Systems
- General Chair of IEEE International Workshop on Haptic Audio Visual Environments and their Application (2010 and 2011)
- Publicity Chair of 13th IASTED International Conference on Control and Applications CA (2011)
- Publicity Chair of IEEE International Conference on Automation and Logistics (2010-2011)
- Organizing Chair of IEEE International Conference on Information and Automation (2011)
- Program Co-Chair of IEEE/ASME Conference on Advanced Intelligent Mechatronics (2010)
- Poster Session Chair of the Eighth World Congress on Intelligent Control and Automation (2010)



Chung-Horng Lung, P.Eng.

Associate Chair (Graduate Studies), Department of Systems and Computer Engineering, Associate Professor

Research

Software Engineering; software architecture; software re-engineering; domain engineering; generative programming; design patterns; software performance engineering; autonomic computing; computer networks; traffic engineering; security, network measurement, quality of service (QoS); wireless ad-hoc networks; sensor networks; methods to facilitate tele-operations from the network perspective; distributed systems: web services, load balancing, and XML routing and filtering.

Application

In increasing system/software performance and improving software quality and in improving network performance and enhancing network robustness.

Sammy Mahmoud, P.Eng.

Professor

Research

Radio-over-fibre; broadband wireless networks; sensor networks; optical communications; VLSI in telecom; biomedical devices; large-scale wireless networks where many devices and other intelligent systems are interconnected' new architectures for wireless networks incorporating radio-over-fibre systems, sensor networks and optical communications; speech processing for telecommunication systems; transmission of multimedia signals over high-speed networks.

Activities

- Chair of Technical Program Committee, NCIT
- Program Chair of multi-year research project on opto-electronic and photonics fabrication associated with Canadian Photonics Fabrication Centre, developed jointly with National Research Council of Canada

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Shikharesh Majumdar, P.Eng.

Professor

Research

Resource management on Clouds and Grids; resource management on Sensor Networks; Web Services-based inter-operable systems; XML filtering and forwarding; design of middleware to optimize interoperability; operating systems; grids: computing, data and sensor; telecommunication systems; distributed systems; high performance systems; impact of both wireless and optical networks on resource management and performance; performance modeling; high performance parallel Web servers; telecommunication servers.

Application

Cloud for sensor-based bridge infrastructure management; utility computing, cloud computing, scientific computing, high performance systems, telecommunication systems, medical information systems, enterprise extranets.

Activities

- Director of Carleton University Research Centre on Real Time and Distributed Systems
- Area Editor for Simulation Modeling Practice and Theory
- National Examiner for Association of Professional Engineers
- General Chair of IEEE/ACM CCGrid (2012)
- Member of Sterling Committee for ICPE, CCGrid (2010-2011)
- Member of Program Committee forMSoP2P (2012), SRMPDS (2010-2011), ADVCOMP (2010-2011), INTENSIVE (2010)
- Session Chair for CCGrid (2010)

Andrew Marble, P.Eng.

Assistant Professor

Research

Integrated systems combining hardware, pulse sequences, and signal processing techniques for low field NMR and MRI. Magnetic resonance, the technology behind an MRI scan, is a powerful tool for medical diagnostics and other non-invasive sensing applications.

However, its utility and availability has been traditionally limited by the need for large, expensive instrumentation like the hospital MRI machines familiar to most people. Research includes expanding the applicability of magnetic resonance by designing small, low cost dedicated scanners. Current scanners are big for a reason: the size and shape are necessary to generate the carefully controlled magnetic fields needed for an MRI scan.

Development of new optimization techniques which allow the same type of magnetic fields to be created from much more compact instruments is underway. Using these ideas along with new signal processing and control techniques, a family of small, low cost MRI equipment is being designed and built, with applications in nondestructive testing for both healthcare and material science.

Ian Marsland, P.Eng.

Associate Professor

Research

Digital communication; wireless communication; equalization; MIMO systems; iterative detection and decoding; error control coding; advanced receiver architectures for efficient wireless communication systems.

Application

Wireless systems that are capable of serving more people with increased reliability and transmission speeds.

Activities

- TPC – 4th Workshop on Broadband Wireless Access

Yuu Ono, P.Eng.

Associate Professor

Research

Sensors, technique and system for biomedical monitoring/diagnosis/ characterization; ultrasound measurement and imaging.

Application

Physiological monitoring; medical imaging and diagnosis; biological tissue characterization; real-time monitoring, control and optimization of material processes; materials characterization; and non-destructive evaluation of products and structures.

Trevor W. Pearce, P.Eng.

Associate Professor

Research

Real-time systems; real-time operating systems; embedded systems; modeling and simulation; real-time simulation; simulation interoperability; human-in-the-loop and hardware-in-the-loop simulation; simulation standards.

Application

Increasing the use of modeling and simulation in the engineering of real-time systems; Improving the application of hard real-time system performance prediction by accounting for run-time overheads more accurately.

Activities

- Drafting Committee Member of IEEE Standard Modeling and Simulation (M&S) and High Level Architecture (HLA)

Dorina C. Petriu, P.Eng.

Professor, Canadian Academy of Engineering Fellow, Engineering Institute of Canada Fellow

Research

Software performance engineering; Model-Driven Development; real-time and distributed software; model transformations; integrating performance analysis in the software development process.

Activities

- Member of NSERC Evaluation Group for Discovery grants in Computer Science (2010-2012)

Editorial Boards:

- Journal of Software and Systems Modeling (SoSyM)
- International Journal of Advanced Media and Communication
- Guest Editor, Journal of Systems and Software, Special Issue: MODELS (2010)

Conference Committees:

- PC Co-Chair of 7th ACM Sigsoft International Conference on the Quality of Software Architectures QoSA (2011)
- Steering Committee Member for 2nd ACM/SPEC International Conference on Performance Engineering ICPE (2011)
- Steering Committee for MODELS (2011 and 2010)
- PC Chair of International Conference on Model Driven Engineering Languages and Systems MODELS (2010)
- Program Committee Member for 10 conferences and workshops (2011)
- Program Committee Member for 12 conferences and workshops (2010)

Howard Schwartz, P.Eng.

Chair, Department of Systems and Computer Engineering, Professor

Research

Reinforcement learning; multi robot learning; adaptive control; robot control; system identification and estimation. Investigation of methods of computer learning, with focus on robotic applications. Algorithms related to methods of reinforcement learning, fuzzy control, system identification and estimation are developed to automatically adjust and adapt robot behaviour. Robots learn how to work together and how to compete. Ideas associated with genetic algorithms and game theory are also being investigated.

Application

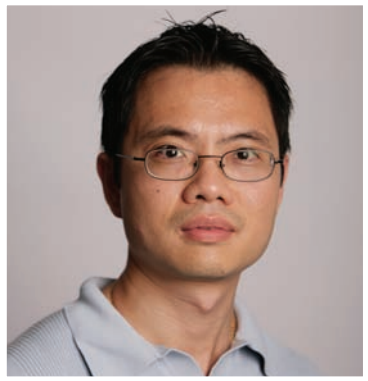
Working with industry in enhancing robot situational awareness for bomb disposal robots. Applications in the use of robots for perimeter security. We are working with industrial partners in developing learning models for cellular network synchronization. Robots learn how to work together and how to compete for applications in security, mapping and search and rescue.

Activities

- TPC member for the International Conference on Control and Applications (2010 and 2011)
- Chair of Session on Machine Learning at the American Control Conference (2011)

Jérôme Talim, P.Eng.

Associate Chair (Undergraduate Studies), Department of Systems and Computer Engineering, Assistant Professor



Research

Development and evaluation of sensors network based protocols in event detection (such as fire detection), in system monitoring and in disaster evacuation strategy and management plans. IPv4 to IPv6 transition modeling. Network topology exploration. Network monitoring and troubleshooting. Data classification and filtering.

Application

Java Video capture, and Java and Flash 3D animations

Gabriel A. Wainer

Associate Professor

Research

Modelling and simulation methodologies; real-time and embedded systems; parallel and distributed simulation; Web-Service oriented simulation.

Application

Forest fire spreading; biomedical applications; embedded real-time software development; computer networks performance; defense and emergency response; crowd and evacuation simulation; simulation in architecture.

Activities

- General Chair:
  - Symposium on Theory of Modeling and Simulation, Boston, MA (2011)
  - Summer Computer Simulation Conference. Ottawa, ON (2010)
  - Symposium on Theory of Modeling and Simulation, Orlando, FL (2010)
- Steering Committee of:
  - SimuTools (2010 and 2011)
  - SummerSim. Ottawa, ON (2010)
- Vice-President Publications. Society for Modeling and Simulation International (2010–)
- Special Issues Editor of SIMULATION SAGE (2008–)
- Associate Editor of the Journal of Defense Modeling and Simulation (2008–)
- Editorial Board of Wireless Networks, Springer (2009–)
- Keynote at Modeling and Simulation Symposium – Discrete event modeling and simulation, Merida, Venezuela (2010)
- Panel Speaker for PADS – Future Trends in Distributed Simulation and Distributed Virtual Environments, Nice, France (2011)

Michael Weiss

Associate Professor

Research

Open source; ecosystems; mashups; patterns; and social network analysis.

Activities

- Member of the Technology Innovation Management program
- Director of the Technology Innovation Management program (2010)
- Program Chair of the European Conference on Patterns of Programming Languages (EuroPLoP) (2010)

Murray Woodside, P.Eng.

Distinguished Research Professor

Research

Improving the performance of complex distributed computer software by the use of performance models; deriving models from annotated software designs in UML; deriving models from traces and other measurements; model-solving algorithms; strategies and tools for performance improvement; usability of modelling; accuracy of solutions; architectural patterns for high-performance systems. Autonomic control based on models, and estimation of model parameters and structure by tracking filters.

Application

Many applications from web services and enterprise computing through communications switching systems and voice-over-IP to embedded systems; autonomic systems; component-based software; product lines; modelling of mechanisms that enhance reliability and security.

Halim Yanikomeroglu, P.Eng.

Professor

Research

Physical, medium access, and networking layers, and the cross-layer aspects of wireless communications systems and networks; radio access network (RAN) architectures; relay/multihop/mesh networks; cooperative communications; radio resource management; cognitive radio, spectrum, opportunistic spectrum access; interference modeling.

Application

Personal; mobile; cellular; wireless communication systems and networks (including LTE-advanced; 4G, beyond-4G).

Activities

- Carleton University Faculty Graduate Mentoring Award (2010)
- Carleton University Graduate Students' Association Excellence Award in Graduate Teaching (2010)
- Carleton University Research Achievement Award (2009)
- General Co-Chair of IEEE Vehicular Technology Conference (VTC) (2010-Fall)
- Steering Committee Member of IEEE Wireless Communications and Networking Conference (WCNC)
- Former Chair of IEEE Technical Committee on Personal Communications
- Funded projects with Huawei, RIM, Samsung, and CRC (Communications Research Centre Canada)
- Involved in the organization of 100+ conferences
- 20+ tutorials in world's leading international conferences
- Adjunct professor at King Saud University Advanced Technology Research Center (Riyadh, Saudi Arabia)

A Brief History of the Faculty of Engineering and Design

1942: Carleton College is founded.

1945: First-year engineering classes are offered in the Faculty of Arts and Sciences.

1957: The School of Engineering is established.

1963: The Faculty of Engineering is established.

1968: The School of Architecture is established.

1973: School of Industrial Design is established.

1981: The degree in Computer Systems Engineering is established.

1986: An annex on the top floor of the Architecture Building is constructed to provide additional space for the Faculty of Engineering.

1988: Canada's first Bachelor of Engineering program in Aerospace Engineering is established. Bell-Northern Research Ltd. and NSERC provide funding for an Industrial Research Chair in computer-aided engineering in the Department of Electronics. The Departments of Electronics and Systems and Computer Engineering are major partners in the Telecommunications Research Institute of Ontario (TRIO), one of seven Centres of Excellence chosen by the provincial government for scientific research.

1992: The Minto Centre for Advanced Studies in Engineering is opened. The new Bachelor of Engineering program in environmental engineering is established in the Department of Civil and Environmental Engineering.

1994: The M.Eng. program in Telecommunications Technology Management is inaugurated.

1997: New undergraduate program in Communications Engineering established. Co-operative education programs are offered in all engineering programs.

1998: New undergraduate programs established in Engineering Physics and in Software Engineering.

1999: A $6.4-million expansion to the Minto Centre for Advanced Studies in Engineering is approved. Three new floors provide additional teaching and research space to accommodate significant growth in informational technology programs. New M.Eng. and Ph.D. programs in Environmental Engineering are established.

2001: Industrial Research Chair in Fire Safety Engineering is established in the Department of Civil and Environmental Engineering.

2002: Carleton University and Algonquin College establish the Carleton School of Information Technology, which offers an undergraduate Bachelors of Information Technology.

2003: $18 million Azrieli Pavilion approved to house the Carleton School of Information Technology, the National Capital Institute of Telecommunications, and the graduate program in Architecture.

2006: The graduate Joint Institute for Biomedical Engineering is established, involving the Departments of Systems and Computer Engineering and Mechanical and Aerospace Engineering and several other departments at both Carleton and the University of Ottawa. The Joint Institute offers a new M.A.Sc. program in Biomedical Engineering. An undergraduate program in Biomedical and Electrical Engineering is also inaugurated.

2007: A new $22 million building to house the Centre for Advanced Visualization and Simulation and the Human-Computer Interface Institute opens. A new stream, Space Systems Design, is added to the undergraduate program in Aerospace Engineering.

2008: The School of Architecture is renamed the Azrieli School of Architecture and Urbanism in honour of a $5.5M endowment to the school by alumnus Dr. David J. Azrieli. New undergraduate programs in Biomedical and Mechanical Engineering and in Sustainable and Renewable Energy Engineering are launched, as is a new Masters degree program in Industrial Design.

2009: Construction begins on the Canal Building, which will provide space for expansion of research and teaching activity in biomedical engineering and sustainable and renewable energy.

2010: Two new Master's programs in Infrastructure Protection and International Security and Sustainable and Renewable Energy Engineering are launched.

2011: The new $30 million Canal Building that houses state-of-the-art laboratories and research facilities in biomedical engineering and sustainable and renewable energy engineering opens.

Azrieli School of Architecture and Urbanism

The School is recognized nationally and internationally as a research leader in the history and theory of architecture, architectural pedagogy, conservation of heritage architecture, hybrid forms of representation, materiality and methods of construction.

Digital Model, Rideau Chapel (Ottawa).

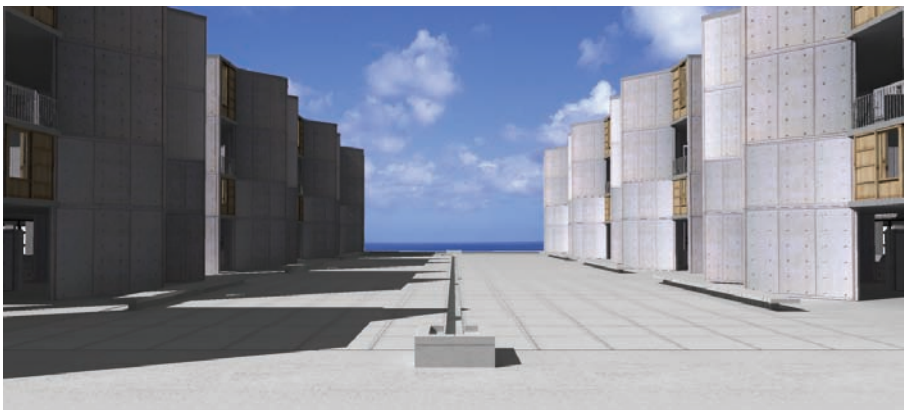
The school knows that architecture and urbanism are inadequate compensations for human suffering, for unattained happiness, for lost innocence, but they are compensation nonetheless, they are remarkable gifts of consciousness to humans. With the amazing breakthroughs taking place in the many sciences, we are on the verge of vital revolutions in urbanism and architecture.

Scientific advances are now able to give a reason for the ways we perceive the built world around us and navigate within it and for apparatuses embedded in our physical environment that can affect our cognition, problem solving ability, mental health and mood. We shape the built environment and built environment shapes us since edifices edify us and we erect them.

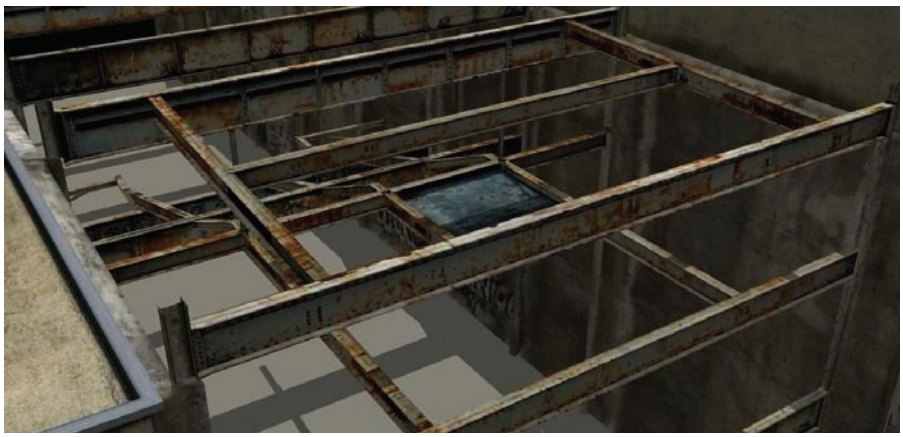
As Hippocrates, the Romans, and Jung knew and neuroscientists know, the built world affects our physical and, above all, our mental health. Physicians focus on patients as individuals with health problems, but when so many have the same problems, such as cardiovascular disease, diabetes, obesity and depression, we must realize that their poor health is not caused only by a subjective lack of discipline but may be a result of the built environments in which they live. It is time for a shift in architectural researches and to focus on programs intentionally conceived to facilitate the understanding and applications of design protocols and evaluations aiming to physical and mental well-being.

Research in the fields of representations, materiality, structural and formal de-formations is essential to develop a discipline of architecture aiming at well-being. The school is developing a critical discourse that addresses the interrelationship of architectural history, theories and practices in a comprehensive method to understand the well-being as a complex construct that by concerning optimal experience and performance must deal with the both sides of the current research on the making of happiness: 1) on architectural well-being as a hedonic approach, which focuses on happiness and defines well-being in terms of pleasure attainment and pain avoidance, and 2) the eudemonic approach, which focuses on meaning and self-realization and defines well-being in terms of the degree to which a person is fully functioning.

Most of the research engages the periphery, the invisible, and the excluded, and it must, reflectively, embrace and incorporate otherness into praxis. Through mediation, it unveils the material and structural connection with well-being, i.e. the sensorial and neural genesis of architecture. The questions of materiality, structural and formal de-formations are crucial since a proper interaction with the question of representations can considers both perspectives concerning the nature of well-being, its antecedents, and its stability across time and culture.



Digital Model, Salk Institute (La Jolla, California).



Digital Model, Materials study (Boulevard St. Laurent, Montreal).

The genuine materiality of the discipline of architecture belongs to the human experience of construction. Establishing a fundamental world-making relationship between material order and cultural order. The practice and the discipline of architecture is thinking "with stuff" rather than thinking "about stuff". By way of a sequence of deforming operations based on composition and decomposition, weighting, ordering, deletion and supplementation, and distortion of the built world, architects make structures that organize, maintain, sustain and support a happy and healthy life within the places that they graphically conjure.

Many aspects of the making of the built environment resist changes, even when architectural researches have adequately revealed key aspects that need to be modified. Consequently, a further scope of research in the school is the investigation on how to achieve adequate means for professional communication, education and promotion of a sustainable "well-being architecture" by researching the different representational, functional, aesthetic, and emotional needs and expressions of organizations and individuals.

Research Groups and Facilities

Carleton Immersive Media Studio (CIMS)

The mandate of CIMS is to advance the study and use of innovative forms of representation that can both reveal the invisible measures of architecture and animate the visible world of construction. CIMS does not endorse the dominant and misleading obsessions of seamless virtual worlds and infinitesimal precision. We are committed to innervating processes of architectural imagination by establishing a mutual symbiosis between digital and fabricated 2D and 3D representations. CIMS is an interdisciplinary research unit that intertwines content-based and applied research agendas to investigate applications for emerging digital and network technologies in the creation and dissemination of cultural content related to architecture.

CIMS is located in Carleton's recently constructed Visualization and Simulation Building (VSIM). Our 750 square meters research facility is equipped with access to LightPath and CANet4 connectivity. CIMS' state-of-the-art fabrication and communications technologies, including the Hybrid Training and Research Laboratory, are designed specifically for remote collaborative research projects. Past and current projects address heritage conservation, remote collaborative design, medical imaging, and the visualization of simulation models.

Carleton Solids And Light Tectonics laboratory for studies in materiality (CSALT)

The CSALT laboratory is committed to the study of materiality in architecture. Our objective is to research traditional building technologies and, in particular, those material properties that have been displaced or forgotten in current practice. This historical framework acts as a springboard to inform new material technologies and "hybrid" forms of contemporary building practice that contribute to the needs of contemporary and sustainable construction.

CSALT is located in the Architecture Building and hosts a materials library, testing facilities, and CNC milling. The lab has access to wood, metal, and "wet" workshops.

Carleton De-Formation Cluster

Interdisciplinary research is based on a sequence of de-forming operations based on composition/de-composition, weighing, ordering, deletion/supplementation, numerical analysis, and distortion. Architects design structures that organize, maintain, sustain and support the places that they forecast. The canonical attitude towards structure (setting an identity between spatial and structural units, placement and displacement) should be made while simultaneously reinforcing and challenging the sense of space, place and practical functions within structural hierarchies and architectural history. Working methodologies involve pre-digital, exploratory and physically based parametric modeling leading to further digital analysis of the acquired results for structural and architectural development.

K.S. Andonian, M.R.A.I.C.

Professor

Research

Knowledge & info-technologies in architecture; early & medieval Christian church architecture; architecture & philosophy; systems design & social, economic, cultural & environmental sustainability; color, texture & materiality of the other; genetics of urbanism; globalization, gentrification, urbanization.

Activities

- Member of Conference Organizing Committee for InterSymp (2006-2011)
- 18th-23rd International Conferences on Systems Research and Cybernetics, held in Germany
- Co-Chaired Opening Plenary Sessions and delivered five Keynote Addresses
- Organized & chaired 1st and 2nd International W/S on Broadening the Scope of Architectural Creativity, Finland & Turkey (2008-2010)
- Organized & chaired 1st-4th International Symposia on Architecture of 21st Century – In Search of New Paradigms, Germany (2008-2011)

Manuel Antonio Báez

Associate Professor

Research

Investigation of fundamental integrative principles of form, structure and generative processes in nature, architecture and engineering. Development of research related design concepts, construction systems, processes and educational methods. Interdisciplinary research inspired by: the nature of materials and integrative processes; morphology; developmental biology; complexity theory; emergence; and natural systems theory.

Application

Research into architectural design and construction applications.

Activities

- Director of Crossings Interdisciplinary De-Formation Research Unit, Azrieli School of Architecture and Urbanism
- Tedx Carleton U invited research presentation on the theme *Ideas Driving Innovation*: http://manuelbaez.pbworks.com/w/page/28875606/TEDx-presentation (2010)
- Recipient of Foundry Program Innovation Grant, Carleton University (2008)
- Scientific Advisory Committee Member of Wessex Institute of Technology, Southampton, UK

Sheryl Boyle

Associate Professor

Research

Adaptive reuse; materials, durability/sustainability; traditional building technologies, non-visual senses.

Application

Implementation of traditional building technologies and materials in contemporary design.

Activities

- Articles on non-visual senses in architecture
- Lime plaster technologies

Yvan P. Cazabon, M.R.A.I.C.

Associate Professor

Research

International development; peri-urban high-density housing in Africa; alternative materials application studies; theatre and performance: set-design and construction; history/theory of architectural technology; critical review of building practice and material application.

Roger Connah

Associate Director (Graduate), Azrieli School of Architecture and Urbanism, Associate Professor

Research

Writing, critical fictions and expanded architecture (critical pedagogies); the use and abuse of contemporary philosophy in architecture; narratives, reception and shape of architectural history, theory and education; calligraphisms; information and cognitive mappings (graphics, film and communication); (il)literacy and hybrid critical writing; new collaborative, interactive and interdisciplinary practices for architecture (trans-architectural practice; www.heron-mazy.net); ongoing research on Islam and Modernity, on writing and ignorance.

Kelly Crossman

Associate Professor

Research

Interaction of architecture and contemporary thought with special reference to documentary records and texts in the context of critical, media and digital theory. Nationalist ideologies and architectural conceptualization during the 19th and 20th centuries. Historiographical and formal themes in the history of Canadian architecture. Diffusion of modernist architectural ideology and modes of practice including the particular influence of Team X, CIAM and GSD Harvard. Emerging themes in contemporary architectural practice.

Activities

- Publisher and Editor of Al – Architecture and Ideas, a Journal of the History, Theory, Criticism and Practice of Architecture

Janine Debanné

Associate Director (Undergraduate), Azrieli School of Architecture and Urbanism, Associate Professor

Research

History and phenomenology of architecture; architectural dimensions; modern dwelling; the reception and appropriation of built architecture including documentation from the point of view of dwellers and architects and measurement of existing dwellings; micro-histories (Lafayette, the Outaouais Region); drawing as architectural ideation: sketching, diagramming and embodied experience, mental mapping.

Application

Design (general); design strategies for urban residential architecture, design teaching, urban analysis and planning.

Tom Dubicanac, O.A.A.

Associate Professor

Research

Video and architectural modeling; computer animation, graphics, and painting.

Mariana Esponda

Assistant Professor

Research

Restoration techniques and methodologies in Spain and Mexico, restoration of archeological areas using the same material, specifically in the Mediterranean and Mesoamerican regions, preservation in the modern buildings of Catalan architect Josep Lluis Sert in three different contexts: Spain, United States & Canada. Evolution of construction techniques in vernacular architecture, modern architectural icons, adaptive reuse of historical buildings, evolution of materials, durability studies of the design and construction of historic buildings. Seismic Restoration; the uses, effects and preservation of reinforced concrete in modern and antique buildings; and the use of concrete as the architectural language of the twentieth century.

Application

Traditional building technologies for new uses in architecture, especially in heritage buildings. Development and uses of reinforced concrete during the modern era to identify building technology, language-innovation, signs of deterioration and their repair.

Activities

- Member of Scientific Committee of the Latin American Congress of Historical Construction
- Member of ICOMOS Canada Scientific Committee
  - Documentation Conservation Modern Movement
  - Society of Architectural Historians

Stephen Fai, M.R.A.I.C.

Director of the Carleton Immersive Media Studio (CIMS), Associate Professor

Research
Representation of architecture; religion in architecture; microhistories.

Application
Hybrid representations; ethno-cultural materials and methods of construction; visualization (architecture, science, engineering).

Lucie Fontein, O.A.Q., LEED Accredited Professional

Associate Professor

Research
Hospitable (sustainable) design with an emphasis on daylighting; 20C Dutch Domestic Architecture; pedagogical issues with respect to the teaching of building technology.

Activities
- Board Member of Architecture Research Centers Consortium
- Editorial Board Member of Greening the Curriculum
- Executive Board Member of Illuminating Engineering Society, National Capital Section

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Marco Frascari

Director Azrieli School of Architecture and Urbanism, Professor

Research
Neuro-Architecture; Neo-Medievalism; genetic and hybrid representations in architecture; architectural imagination; cratsmanship in drawings and construction.

Application
Neuro-Transactions in the profession: 1) architectural presentation, 2) design, 3) drafting construction documents and construction detailing.

Activities
- Member of the editorial board of the architectural magazine Interstices
- Member of the International Advisory Board of AHRA (Architectural Humanities Research Association)
- Member of the Assessment Committee of Canadian Architectural Certification Board
- By Bishop appointment, Architectural Consultant to the Engineer in charge of Sant Andrea [Mantova, Italy]
- Seminar (continuing education) on Neuro-Architecture for OAA

Benjamin Gianni

Associate Professor

Research

Housing history; housing typology; housing policy; urban and suburban morphology; historical development of suburbs; planned communities; urban design; post-WWII urbanism; smart growth and sustainable urbanism; renewal and redevelopment of public housing stock; judicial education; e-learning.

Activities

- Seconded to the National Judicial Institute as Senior Advisor and Coordinator of Electronic Resource Development
- Vice-Chair, Board of Directors of the Ottawa Art Gallery Art Gallery

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Federica Goffi

Associate Professor

Research

History of visual representation. Study of sustainability and historical preservation. Aural architecture. Hybrid technologies and history of construction. History and theory of the notion of conservation. Micro-historical studies focused on time in its threefold nature of ‘time’, ‘weather’, ‘tempo’.

Application

Hybrid Drawings. Conference Papers and Book chapters. Archival research.

Activities

- Co-ordinator of Forum Lecture Series
- Member of AHRA (Architectural Humanities Research Association)

Paul Kariouk

Associate Professor

Research

Twentieth-century architectural history and theory; history and theory of landscape architecture; relationships between collective identity, memorialization, and urban space. Private design practice: Kariouk Associates www.kariouk.com

Activities

- Co-ordinator of Forum Lecture Series
- Co-Op Advisor
- Member of American Institute of Architects
- Member of Royal Architectural Institute of Canada
- Board of Advisors to the Dean for the School of Architecture, University of Virginia

Stanley Loten

Distinguished Research Professor

Research

Mesoamerican archaeology; architecture and the sites of Tikal, Guatemala; architecture of Altun Ha, Beliza and Lamanai, Belize; Andean archaeology; architecture at the pre-Inca site of Marcahuamachuco, Peru.

Application

Controlling architectural stratigraphy in ancient architectural structures of Central America and the Andean region.

Shelagh McCartney

Assistant Professor

Research

Urbanization and housing; informal housing and urbanization processes; urban growth dynamics; urban design; urban morphology; housing morphology; aboriginal housing policy; aboriginal land policy; private public development; urban renewal; real estate development; real estate finance; strategic planning; research methods; negotiation and conflict resolution in urban environments.

Inderbir Singh Riar

Lecturer

Research

History and historiography of modern architecture; theories of post-war urbanism, including Team 10; technology and the avant-garde; megastructures and canadian modernism; utopia and utopianism; world's fairs and ephemeral events.

Qi Zhu

Assistant Professor

Research

Comparative studies on Eastern and Western architectural thinking and crafting traditions, traditional Chinese vernacular buildings, their aesthetics, technologies and the inherited ecological philosophies; digital technologies (CAD/CAM) in architectural design and practice; architectural lighting and museum exhibition design and technologies.

Activities

- Co-ordinator of Pit Lecture Series

School of Industrial Design

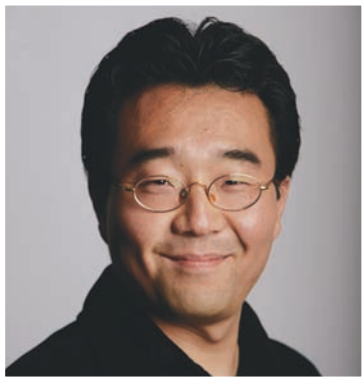
The School of Industrial Design has a well-recognized technically oriented design curriculum with strengths in materials and manufacturing processes, CAD applications, ergonomic functionality and environmentally sustainable design.

The School conducts ongoing applied research in the areas of materials, manufacturing processes, prototyping methods, advanced visualization, extreme environments, sustainable design, human-oriented design, interactive product design, design research methods and strategic design planning. The School has an extensive track record with industry-sponsored research and is actively building involvement in more significant collaborative funded research initiatives in the areas of health care, rapid prototyping, and the application of interactive technologies.

Task analysis research improves helicopter interior configurations for forest firefighting crews in Ontario.

This wheeled walker has electronic sensors providing added safety and ease of use for elderly users.

www.carleton.ca/engineering-design/research



WonJoon Chung

Assistant Professor

Research

Cross Functional Collaborative Prototyping (CFCP) during initial product definition; user-centered product design; design methods for product innovation.

Application

Design a Cross Functional Collaborative Prototyping (CFCP) activity to foster a mutually satisfactory solution among experts in a team; develop an early prototype to create a clear product definition in an interdisciplinary collaboration in design, especially, for one that fosters group negotiation, knowledge sharing and creation processes.

Lois Frankel

Associate Professor

Research

Wearable computing for healthcare; design for aging; user-centered design; ethnographic design research; interaction design; form and colour; drawing principles and applications.

Application

Interactive product design; ethnographic design studies; jewellery design; wearable computing devices.

Thomas Garvey

Director, School of Industrial Design, Associate Professor

Research

Product development for extreme and minimal environments; Japanese approaches and adaptations to minimal space living; population density and factors in the effective use of minimal space; emergency and medical response equipment; healthcare products and patient environments.

Activities

- Acuity Adaptable Patient Room Prototype Project. Clemson-Carleton Collaboration for Spartanburg Healthcare System
- Global University Programs in Healthcare Architecture (GUPHA). Industrial and Universal Design Taskforce

Bjarki Hallgrimsson

Associate Professor

Research

Industrial design practice and product development; rehabilitation and ambulatory assistive devices, medical products manufacturing, prototyping; computer aided design applications; patent expert witness.

Application

Product design and development of new products; rollators and other ambulatory assistive devices; plastic part design and manufacturing; expert witness patent litigation.

Activities

- Smart Rollator Project
- Book on prototyping methods
- Rehabilitation Engineering and Assistive Device Technology Association
- Royal Ontario Museum of Art, DX Design Exchange, “Circa 1955/2005 Half a century of Canadian design”, currently displayed at terminal 1 of Toronto Pearson International Airport. The award winning “Filterstream vacuum” is featured in this mix of Canadian domestic appliances
- Echo-Vue Project

Lorenzo Imbesi

Associate Professor

Research

Architect and PhD in Environmental Design. Research and didactic field is about design theories and culture, while focusing on the narrative, social and ethical impact of new technologies and artifacts. Current research looks at new expressions and critical roles of the design industry in contemporary societies.

Activities

- Faculty member and researcher at Sapienza University in Rome
- An avid critic and essayist for many years
- Co-director of the magazine DIID – Disegno Industriale
- Keynote speaker and co-ordinator of many international conferences
- Curator for numerous design exhibitions
- Author of InterAction by Design, 09 YoungDesign, Ethics & Design and D_Generation

Carleton School of Information Technology

The Carleton School of Information Technology research programs have two main themes: networking and interactive multimedia technologies.

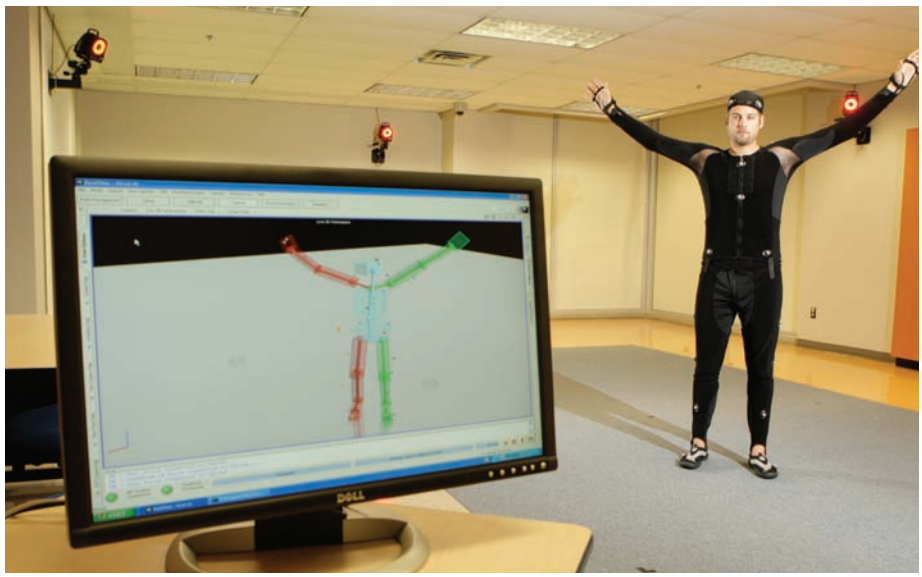
Networking Research

Computer communication networks play an increasingly important role in the infrastructure of every business in a modern technological society. Research in the networking group covers all aspects of communication networks, including design, architecture, protocols, management, control, security, and information assurance schemes for wireless/wired networks. The group has secured grants from funding sources such as CFI, NSERC and OCE, and enjoys collaborations with major government labs, universities across Canada and around the world, and global industrial leaders, such as Cisco, Alcatel-Lucent, Nortel and Solena Networks.

Interactive Multimedia Research

Advances in multimedia systems, human computer interaction, and related technologies are changing the face of art, entertainment, communication, and many other services. Interactive Multimedia is a broad research area that brings together topics from computer animation and game design to virtual reality, immersive environments, and multimedia-rich web applications. It deals with how new hardware and software systems can be used to create, interact with, and perceive new digital media content. The facilities include motion capture, rendering farm, sound studio, and general purpose multimedia labs with audio/video equipment. The group has very close ties with industry, collaborates with researchers from Canadian and international universities, and is supported by federal and provincial funding sources, such as NSERC, SHHRC, OCE and ORNEC.

Active gaming using accelerometer sensor networks as input to a dancing game.



Capture processing for animation, games and interactive applications.

Ali Arya

Interactive Multimedia and Design Coordinator, Associate Professor

Research

Virtual worlds and characters; social, educational and collaborative online environments; computer games and interactive stories; human-computer interaction; computer graphics and animation; new media and digital art; image processing and computer vision; simulation and modeling; artificial intelligence; multimedia and software project management.

Application

Carleton Virtual (3D Virtual Environment for Education and Research); iFACE (Interactive Facial Animation – Comprehensive Environment); Virtual Pow-wow (Virtual Environment for Native Dance); intelligent framework for procedural animation of human behaviours.

Activities

Journal Editorial Board:

- International Journal on Computer Games Technology
- The Open Cybernetics and Systemtics Journal

Conference International Program Committee:

- FutureTech
- Computer Graphics International
- IEEE Digital Entertainment and Creative Technology
- CyberGames

Chris Joslin

Associate Professor

Research

Scalable video & image coding; media adaptation; 3D medical imaging & simulation; virtual reality tools & systems; capture & analysis of 2D and 3D data; real-time graphics and animation.

Application

Scalable video streaming; medical simulation tools; real-time visualisation platforms; data capture and analysis.

Activities

- Conference Chair of Computer Graphics International (2011)
- Technical Program Committee Member for Computer Graphics International, IEEE Virtual Reality, Computer Animation and Social Agents, Computer Graphics Theory and Applications, ACM Multimedia, IEEE Signal-Image Technology and Internet-based Technology, International Conference On Multimedia and Expo, Graphics Interface, GameOn Asia
- Editorial Review Board Member of International Journal of Creative Interfaces and Computer Graphics
- Canadian Delegate for International Standards Organisation, Joint Technical Committee (JTC1), Sub-Committee 29 (Coding of audio, picture, multimedia and hypermedia information), which includes Working Groups 1 (coding of still pictures) and 11 (coding of moving pictures and audio)

Ashraf Matrawy

Network Technology Coordinator, Associate Professor

Research

Resilient and secure network and applicationi architectures; attack-resilient network architectures; collaborative network and software architectures; multimedia networking and applications; group communications architectures such as peer-to-peer and multicast.

Applications

Securing new computing paradigms such as cloud computing and pervasive mobile applications.

Activities

- Member of the editorial board, IEEE Communications Surveys and Tutorials Journal
- Member of the IEEE Communication Society technical committees on:
  - Communications and Information Security
  - Communication Systems Integration and Modeling
- Grant Reviewer (NSERC, British Columbia Innovation Council)
- Program Co-Chair, First Workshop on Cooperative Mobile Protocols and Applications, CMPA (2010)
- Technical Program Committee member of IEEE International Conference on Multimedia and Expo (2011), IEEE International Conference on Communications (ICC) (2005-2011), IEEE Global Communications Conference (GlobeCom) (2006-2011), IEEE Conference on Local Computer Networks (LCN) (2005-2010), IEEE symposium on Computers and Communications (2010)

www.carleton.ca/engineering-design/research

Marc St-Hilaire

Associate Director, School of Information Technology, Associate Professor

Research

Computer networks; Telecommunications network planning; network architecture; network optimization; mobile computing; wired and wireless communication networks; wireless sensor networks; smart home networking.

Application

Wireless/wireline communication systems; planning algorithms for service providers; smart homes.

Activities

- Technical Program Co-Chair of 5th IFIP Wireless Days (2011)
- Workshop Co-Chair of Multihop Wireless Network Testbeds and Experiments Workshop, IWCMC (2011)
- Technical program committee member for several international conferences

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Anthony Whitehead

Director, School of Information Technology, Associate Professor

Research

Entertainment technologies, video processing; computational video; image processing; computer vision; sensor networks as input devices; pattern matching; and graphics.

Application

Video games; medical and therapeutic devices; television and film visual effects; animation systems; personal sensor networks.

Activities

- Author of Portable Image & Video Library (PIL), The Projective Vision Toolkit (PVT)

F. Richard Yu

Associate Professor

Research

Wireless/wireline networking; cross-layer design and optimization in wireless networks; security in wireless networks; green information technology; multimedia over wireless networks.

Application

Wireless/wireline networks systems, security and health monitoring systems.

Activities

- Editor of IEEE Communications Surveys and Tutorials
- Associate Editor of ACM/Springer Wireless Networks
- Associate Editor of EURASIP Journal on Wireless Communications and Networking
- Associate Editor for Wiley – Security and Communication Networks
- Editor for Wiley – Wireless Communications and Mobile Computing
- Editor, Ad Hoc and Sensor Wireless Networks Journal
- Editor of International Journal of Wireless Communications and Networking
- TPC Co-Chair of IEEE Vehicular Technology Conference (VTC) – Wireless Network Track, Yokohama, Japan (2012)
- TPC Co-Chair of IEEE Globecom'11 – Cognitive Radio Networks Symposium, Houston, Texas (2011)
- TPC Co-Chair of IEEE INFOCOM'2011 Workshop on Green Communications and Networking, Shanghai, China (2011)
- TPC Co-Chair of the 9th Conference on Communication Networks and Services Research Conference (CNSR), Ottawa, Canada (2011)

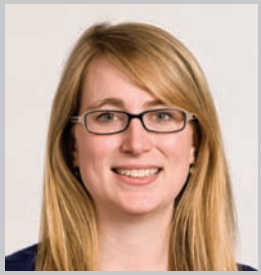
Graduate Studies

Graduate students are an essential part of any research program. The Faculty of Engineering and Design offers a full range of master's and doctoral programs in Engineering, as well as PhD and research-oriented master's degrees in Architecture. Many students are well funded through a combination of a research assistantship, a teaching assistantship, and scholarship funding. Many Engineering programs are offered in Joint Institutes with the University of Ottawa, allowing students access to a wide range of graduate courses at the two universities. Some of the Institutes are among the largest programs in their disciplines in Canada.

Graduate Student Enrolment Fall 2008

Program		
Architecture	Master's	103
Industrial Design	Master's	20
Civil and Environmental Engineering	Master's	108
	PhD	47
Electronics	Master's	75
	PhD	54
Mechanical and Aerospace Engineering	Master's	109
	PhD	46
Systems and Computer Engineering	Master's	206
	PhD	86
	Total	**854**

New Faculty Members



Audrey Girouard, PhD

Assistant Professor, School of Information Technology

Human-computer interaction; next generation user interfaces; tangible user interfaces; adaptive interfaces; interactions with flexible displays; affective computing; brain computer interfaces; reality based interaction; machine learning applied to HCI.

Co-Chair of Program Committee for ACM TEI Tangible, Embedded and Embodied Interaction Conference; Guest Editor, Interacting with Computers, Special Issue on Organic User Interfaces (2012);

TPC, Work in Progress, ACM CHI Conference on Human Factors in Computing Systems (2011);

TPC, ACM ICMI International Conference on Multimodal Interaction (2011).

Craig Merrett

Assistant Professor, Department of Mechanical and Aerospace Engineering

Aero-servo-viscoelasticity; unsteady aerodynamics; stability analysis of viscoelastic structures; and applications of viscoelastic material models for engineering design; flight vehicles; renewable energy devices; composite materials and biological simulacra.

William (Liam) O'Brien

Assistant Professor, Department of Civil and Environmental Engineering

Applications of building performance simulation, including: optimization of low-energy buildings, visualization of energy flows, solar energy systems, retrofitting buildings, daylighting and control, and the impact of occupant behavior.

Calvin Rans

Assistant Professor, Department of Mechanical and Aerospace Engineering

Fatigue and damage tolerance of lightweight aerospace structures; mechanistic modelling of damage formation and growth; design of damage tolerant fibre metal laminate (FML) and other hybrid metallic-composite structures; joining technologies; maintenance, repair, and overhaul of aircraft structures.

Research Index

Key:

- ARC: Architecture
- CEE: Civil and Environmental Engineering
- CSIT: Carleton School of Information Technology
- DOE: Department of Electronics
- MAE: Mechanical and Aerospace Engineering
- SCE: Systems and Computer Engineering
- SID: School of Industrial Design

19th and 20th century Nationalist ideologies and architectural conceptualization
Crossman (ARC)

20th century Dutch domestic architecture
Fontein (ARC)

20th century architectural history and theory
Kariouk (ARC)

3G/4G broadband wireless
Hafez (SCE)

accuracy of solutions
Woodside (SCE)

ad hoc networks
Kunz (SCE)

adaptive control
Schwartz (SCE)

adaptive reuse
Boyle (ARC)

adaptive thermal-mechanical FEA
McDill (MAE)

adiabatic computing
Shams (DOE)

aerosol science
Matida (MAE)

aerospace structure and materials
Laliberté (MAE)

agent-based systems
Esfandiari (SCE)

air cushion technology
Wong (MAE)

air pollution control
Karman (CEE)

air vehicle conceptual design
Laliberté (MAE)

alternative fuels and vehicles
Karman (CEE)

alternative materials application studies
Cazabon (ARC)

analog and digital IC design
Mason (DOE)

analog and RF IC design
Plett (DOE)

analog decoding
Banihashemi (SCE)

Andean archaeology
Loten (ARC)

anisotropic thermoelasticity
Tan (MAE)

antenna structures
Wight (DOE)

anti-icing practices
Hassan (CEE)

architecture and contemporary thought: documentary records and texts in the context of critical, media and digital theory
Crossman (ARC)

architectural design and construction applications
Báez (ARC)

architectural dimensions and modern dwelling
Debanné (ARC)

architectural history and phenomenology
Debanné (ARC)

architectural imagination
Frascari (ARC)

architectural lighting and museum exhibition and technologies
Zhu (ARC)

architectural materials, durability/sustainability and traditional building technologies
Boyle (ARC)

architecture and philosophy and early and Medieval Christian Church architecture
Andonian (ARC)

architecture and religion
Fai (ARC)

architecture and the sites of Tikal, Guatemala
Loten (ARC)

architecture at the pre-Inca site of Marcahuamachuco, Peru
Loten (ARC)

architecture of Altun Ha, Beliza and Lamanai, Belize
Loten (ARC)

arithmetic blocks
Shams (DOE)

artificial intelligence Frize,
Pagurek (SCE)

assistive devices
Chan (SCE)

aural architecture
Goffi (ARC)

automobile air conditioning systems
Gu (MAE)

automotive multimedia interfaces
Joslin (CSIT)

autonomic computing
Lung (SCE)

autonomous robots
Hayes (MAE)

autonomous systems
Sasiadek (MAE)

axial-flow compressors and turbines
Sjolander (MAE)

bioinformatics
Green (SCE)

biological clogging of unsaturated soilsvan
Geel (CEE)

biological signals (ECG, EEG, myoelectric signals)
Chan (SCE)

biomechanics
Liu, Frei, Russell (MAE)

biomedical devices
Frei, McRae (MAE)
Mahmoud, Ono (SCE)

biomedical engineering
Shams (DOE)
Frei, Hayes, Russell (MAE)
Adler, Chan, Dansereau, Frize, Mahmoud, Ono (SCE)

biomedical measurement devices
Adler (SCE)

biomedical robotic systems
Hayes (MAE)

biometrics imaging and security systems
Adler (SCE)

blade-sailing
Afagh (MAE)

bone screws
Frei (MAE)

boundary element analysis
Hartley (CEE)
Tan (MAE)

broadband integrated circuits
Syrett (DOE)

broadband wireless
Falconer, Hafez, Mahmoud (SCE)

buffeting in fighter aircraft
Nitzsche (MAE)

building design and construction
Salinas (CEE)

building performance simulation
Beausoleil-Morrison (MAE)

cacotechnology
Frascari (ARC)

CAD
Zhu (ARC)
Humar (CEE)
Achar, Gunupudi, Zhang (DOE)
Hallgrimsson (SID)

Canadian architecture
Crossman (ARC)

capillarity
Gaydos (MAE)

carbon-nanotube/polymer composites
Miller (MAE)

cardiovascular system dynamics
Russell (MAE)

casting Goldak
Saari (MAE)

cellular automata
Báez (ARC)
Wainer (SCE)

cellular network planning
St-Hilaire (CSIT)

chaos encryption
Steele (DOE)

Chinese architecture and theories related to
Zhu (ARC)

circuit design
Kwasniewski (DOE)

clinical decision-support systems
Frize (SCE)

clock synchronization
Kunz (SCE)

CMOS logic MacEachern,
Shams (DOE)

cogeneration
Beausoleil-Morrison (MAE)

collective identity, memorialization, and urban space and the relationship between these concepts
Kariouk (ARC)

combustion
Johnson (MAE)

communication networks
Lambadaris, Pagurek (SCE)

communication theory
Falconer (SCE)

comparative studies in Eastern and Western architecture
Zhu (ARC)

complexity, emergence, and natural history theories
Báez (ARC)

component failure analysis
Huang (MAE)

composite erosion
Huang (MAE)

composites
Liu (MAE)

computational fluid dynamics
Hadjisophocleous (CEE)
Etele, Feszty, Sjolander (MAE)

computational material science
Isgor (CEE)
Miller (MAE)

computational mechanics
Tan, Wang (MAE)

computational video
Whitehead (CSIT)

computer architecture
Shams (DOE)

computer games
Arya (CSIT)

computer graphics and animation
Dubicanac (ARC),
Arya (CSIT)

computer graphics
Whitehead (CSIT)

computer modeling
Holtz (CEE)

computer networks
Lung (SCE)

computer vision
Andonian (ARC)
Whitehead (CSIT)

computer-aided learning
Holtz, Humar (CEE)

concrete structures
Isgor, Sherwood (CEE)

congestion control
Huang, Lambadaris (SCE)

constitutive relations
Khoo, Sivathayalan (CEE)

construction systems
Báez (ARC)

construction techniques in vernacular architecture
Esponda (ARC)

contaminant transport van
Geel (CEE)

context-aware networks
Liu (SCE)

control systems
Sasiadek (MAE)
Aitken (SCE)

cooperative communication
Banihashemi (SCE)

corrosion
Isgor (CEE)

crack interaction and coalescence
Bell (MAE)

Cross Functional Collaborative Prototyping (CFCP)
Chung (SID)

crystalline materials (atomistic simulation)
Miller (MAE)

damage-tolerance of aluminium joints
Bell (MAE)

data communications
Kwasniewski (DOE)

data mining
Ajila (SCE)

databases and Internet-based information services
Holtz (CEE)

defects in solid materials
Artemev (MAE)

delay estimation and optimization
Shams (DOE)

deriving models from annotated software designs in UML
Woodside (SCE)

deriving models from traces and other measurements
Woodside (SCE)

design automation tools
Gunupudi (DOE)

design codes and standards
Holtz (CEE)

design concepts, construction systems, processes and educational methods related to the development of research
Báez (ARC)

design consistency and its relation to traffic safety
Hassan (CEE)

design education
Burns (SID)

design education for engineers
Burns (SID)

design fires
Hadjisophocleous (CEE)

design of foundations, slopes, and retaining walls
Sivathayalan (CEE)

design of middleware
Majumdar (SCE)

design patterns
Lung (SCE)

design theory and industry's impact on contemporary society
Imbesi (SID)

design tools for RF, wireless, MEMS and optoelectronic applications
Achar, Ye (DOE)

development and testing of software to ensure dependability
Briand (SCE)

developmental biology
Báez (ARC)

DEVS formalism
Wainer (SCE)

diffusion bonding of titanium alloys
Huang (MAE)

digital and wireless communications
Banihashemi (SCE)

digital circuit design
Kwasniewski (DOE)

digital communication
Marsland (SCE)

digital signal processing
Dansereau, Goubran (SCE)

digital video distribution
Matrawy (CSIT)

disinfection technologies
Basu (CEE)

dispersed two-phase impinging jets
Matida (MAE)

dispersed two-phase random-walk models
Matida (MAE)

distance education
Salinas (CEE)

distributed product development
Bailetti (SCE)

distributed source/channel coding
Banihashemi (SCE)

distributed systems
Majumdar (SCE)

domain engineering
Lung (SCE)

drawing as architectural ideation
Debanné (ARC)

DSP and wireless
Shams (DOE)

dynamic modelling of helicopter rotors
Afagh (MAE)

dynamic response of bridges
Humar (CEE)

dynamics (applied)
Hayes (MAE)

dynamics (multibody)
Langlois (MAE)

dynamics of mechanical systems
Russell (MAE)

dynamics of structures
Humar (CEE)

e-learning
Gianni (ARC)

earthquake engineering
Hartley, Law (CEE)

echo and noise cancellation
Goubran (SCE)

ecodesign
Burns (SID)

economic analysis
Abd El Halim (CEE)

educational and collaborative online environments
Arya (CSIT)

ecosystems
Weiss (SCE)

effect of driver perception and behaviour
Hassan (CEE)

EHF and UWB channels
El-Tanany (SCE)

electromagnetic compatibility
Achar (DOE)

electronic noses
Chan (SCE)

embedded systems
Pearce (SCE)

embodied experience
Debanné (ARC)

Báezemergency and medical response equipment
Garvey (SID)

empirical software
Labiche (SCE)

energy and environmental factors in transportation
Khan (CEE)

energy consumption
Beausoleil-Morrison (MAE)

energy estimation and optimization
Shams (DOE)

engine health monitoring
Saravanamuttoo (MAE)

engineering economics
Khan (CEE)

engineering management
Muegge (SCE)

entertainment technologies
Whitehead (CSIT)

environmentally sustainable design and manufacture
Burns (SID)

equalization
Marsland (SCE)

ergonomic workstation design
Burns (SID)

erosion/corrosion resistance/
mechanisms of superalloys
Liu (MAE)

error control coding
Marsland (SCE)

ethics for engineers
Frize (SCE)

evaluation of coating bonding strength
Liu (MAE)

evaluation of structural integrity of
building components and systems
Salinas (CEE)

evaporation and cracking in
porous media
Simms (CEE)

experimental fluid mechanics
Johnson, Sjolander (MAE)

failure detection and protection
mechanisms
Huang (SCE)

fatigue and fracture mechanics
Bell, Wang (MAE)

fault diagnosis and management in
communications networks
Pagurek (SCE)

ferromagnetism
Harrison (DOE)

fibre and waveguide lasers
Albert (DOE)

fibre optical sensors for monitoring
physiological parameters
Gauthier (DOE)

fibre gratings
Steele (DOE)

fire and smoke movement modeling
Hadjisophocleous (CEE)

fire risk analysis
Hadjisophocleous (CEE)

fire safety
Hadjisophocleous (CEE)

flame stabilization
Johnson (MAE)

flow control devices
Feszty (MAE)

flow control for turbomachinery
Sjolander (MAE)

flow through disordered porous media
Sarkar (CEE)

fluid flow in porous media
Simms (CEE)

fluid mechanics (surface)
Gaydos (MAE)

flutter analysis in the transonic regime
Nitzsche (MAE)

forest products
Salinas (CEE)

form, colour and noise of products
Burns (SID)

form, structure, and process in
nature and engineering and their
fundamental integration
Báez (ARC)

fractal measures
Dansereau (SCE)

fractional-N frequency synthesizers
Rogers (DOE)

fracture mechanics
Khoo (CEE)
Liu, Tan (MAE)

frequency domain space-time
processing
Falconer (SCE)

gas turbine engines
Sjolander (MAE)

gas turbine materials (superalloys
and titanium aluminides)
Saari (MAE)

gas turbine performance
Saravanamuttoo (MAE)

generative programming
Lung (SCE)

genetic and hybrid representations
in architecture
Frascari (ARC)

geosynthetic materials
Abd El Halim (CEE)

geosynthetics & geofoams
Sivathayalan (CEE)

geotechnical earthquake engineering
Sivathayalan (CEE)

globalization, gentrification and
urbanization
Andonian (ARC)

global navigation satellite systems
(GNSS) based navigation
De De Ruiter (MAE)

GPS receivers
Wight (DOE)

greenhouse gas emissions from flares
Johnson (MAE)

greenhouse gas emissions from
industrial and transportation sources
Karman (CEE)

greenhouse gas reduction
Sjolander (MAE)

grids: computing, data and sensor
Majumdar (SCE)

ground transportation technology
Wong (MAE)

groundwater resources protection
and management
van Geel (CEE)

growing companies in open environments
Bailetti (SCE)

guidance, navigation and control (GNC)
Sasiadek, De De Ruiter (MAE)

haptics
Liu (SCE)

healthcare products and patient
environments
Garvey (SID)

heat pipes for electronics cooling
Kaya (MAE)

heat pumps and refrigeration
Gu (MAE)

heat treating
Goldak (MAE)

helicopter rotors
Feszty (MAE)

heuristics
Chinneck (SCE)

high frequency filter design
Rogers (DOE)

high performance parallel Web servers
Majumdar (SCE)

high performance systems
Majumdar (SCE)

high-frequency electronic/
electromagnetic modeling and design
Zhang (DOE)

high-performance computing
applications of multi-scale modeling
in materials science
Miller (MAE)

high-performance microwave
circuit packaging
Roy (DOE)

high-performance systems
Woodside (SCE)

high-speed analog and RF filtering
Mason (DOE)

high-speed and low-power circuits
Shams (DOE)

high-speed interconnects
Achar (DOE)

history and historiography of modern
architecture
Riar (ARC)

history and theory of architecture
Cazabon, Debanné,
Fai, Kariouk (ARC)

history of visual representation
Goffi (ARC)

hospitable (sustainable) design
with an emphasis on daylighting
Fontein (ARC)

housing history, typology, policy and
urban and suburban morphology
Gianni (ARC)

human-Computer Interaction
Arya (CSIT)

human-in-the-loop and
hardware-in-the-loop simulation
Pearce (SCE)

hybrid technologies
Boyle, Goffi (ARC)

hydrogeology
van Geel (CEE)

image processing
Whitehead (CSIT)

image sensors
MacEachern (DOE)

impact of both wireless and optical
networks on resource management
and performance
Majumdar (SCE)

impact of motor vehicle emissions
on urban air quality
Karman (CEE)

improved performance of fighters at
high angles of attack
Nitzsche (MAE)

industrial design practice and
product development
Hallgrimsson (SID)

inertial navigation systems
Sasiadek (MAE)

infeasibility analysis
Chinneck (SCE)

information technologies in architecture
Andonian (ARC)

information fusion
Aitken (SCE)

information technologies in structural
engineering
Lau (CEE)

information theory and coding
Banihashemi (SCE)

infrastructure asset management
Lau (CEE)

integrated active antennas
Roy (DOE)

integrated systems
Marble (SCE)
Syrett (DOE)

intelligent agents
Pagurek (SCE)

intelligent and adaptive control systems
Sasiadek (MAE)

intelligent systems
Khan (CEE)

intelligent transportation systems
Yanikomeroglu (SCE)
Liu (MAE)

interaction between mechanical and
biological systems
Russell (MAE)

interactive and interdisciplinary prac-
tices for architecture
Crossman (ARC)

interactive multimedia and dynamic
media adaptation
Joslin (CSIT)

international development
Cazabon (ARC)
Salinas (CEE)

internet architecture and protocols
Huang (SCE)

intra-aortic balloon pumps
Yaras (MAE)

iterative detection and decoding
Marsland (SCE)

Japanese approaches and adaptations
to minimal space living
Garvey (SID)

joint source-channel coding
Banihashemi (SCE)

judicial education
Gianni (ARC)

kinematic calibration
Hayes (MAE)

knowledge acquisition and management
Ajila (SCE)

laboratory testing
Sivathayalan (CEE)

landfill design
van Geel (CEE)

LANs and ad hoc networking
Hafez (SCE)

large eddy simulation (LES)
Matida (MAE)

large-scale wireless networks
Mahmoud (SCE)

laser diagnostics
Johnson (MAE)

laser trapping, manipulation, orientation
and ablation of micron size objects
Gauthier (DOE)

lead-free journal bearing materials
Liu (MAE)

life cycle analysis
Abd El Halim (CEE)

linear and non-linear programming
Chinneck (SCE)

linear, nonlinear, and real-time control
Ahmadi (MAE)

liquefaction
Sivathayalan (CEE)

lobed mixers with three-dimensional
inflow velocity fields
Yaras (MAE)

local access technologies: OFDM, CDMA
Hafez (SCE)

local and regional case studies
Debanné (ARC)

logical balance
Shams (DOE)

loop heat pipes
Kaya (MAE)

low cost space launch systems
Etele (MAE)

low cycle fatigue
Khoo (CEE)

low emissions
Sjolander (MAE)

low temperature co-fired ceramics
Roy (DOE)

low-loss radio frequency waveguides
integrated on silicon
Tarr (DOE)

machine and biological locomotion
Ahmadi (MAE)

machine condition monitoring
Liu (MAE)

machine learning
Green (SCE)

machine vision
Hayes (MAE)

macro-and micro-diversity techniques
Yanikomeroglu (SCE)

magnetic levitation systems
Wong (MAE)

management
Pagurek (SCE)

manufacturing processes
Goldak (MAE)

masculinity and femininity (gender)
in design activities
Burns (SID)

masonry structures
Sherwood (CEE)

materials; durability and
sustainability research
Boyle, Esponda (ARC)

mathematical modeling St-Hilaire (CSIT),
Kaya, Langlois (MAE)

mathematical programming
Chinneck (SCE)

measurement and modeling of urban air quality in micro-environments
Karman (CEE)

measuring QoS for video conferencing or video on demand
Dansereau (SCE)

mechanical design
Saari (MAE)

mechanical fasteners and connectors
Salinas (CEE)

mechanics of composites
Tan (MAE)

mechanism synthesis
Hayes (MAE)

mechatronics Ahmadi,
Sasiadek (MAE)

medical equipment management in developed and developing countries
Frize (SCE)

medical image and signal processing
Adler (SCE)

medical pre/intra-operative planning and visualisation
Joslin (CSIT)

megastructures and Canadian modernism
Riar (ARC)

MEMS
Gunupudi, Tait (DOE)

Mesoamerican archaeology
Loten (ARC)

meta-heuristics
St-Hilaire (CSIT)

micro-electro-mechanical systems
Roy (DOE)

microbubble generation for biomedical purposes
Gu (MAE)

microelectronic systems
Smy (DOE)

microelectronics
MacEachern, Mason (DOE)

microfluidic devices
Gaydos (MAE)

microstructural modelling of porous media
Simms (CEE)

microwave monolithic integrated circuits
Syrett (DOE)

millimetre-waves
Roy (DOE)

MIMO systems
Marsland (SCE)

mitigation of natural hazards caused by landslides and earthquakes
Law (CEE)

mitigation of the effect of network denial-of-service attacks
Matrawy (CSIT)

mixed signal IC design
Kwasniewski, Lambadaris, Mason (DOE)

mixed-domain simulation
Achar (DOE)

mobile agents
Pagurek (SCE)

mobile computing
St-Hilaire (CSIT)

mobile source emissions
Karman (CEE)

mode-locking of fibre lasers
Steele (DOE)

model building, solution and analysis process
Franks (SCE)

model reduction
Achar, Gunupudi (DOE)

model transformations
Petriu (SCE)

model-driven software development
Briand, Labiche, Petriu (SCE)

model-solving algorithms
Woodside (SCE)

modelling
Achar (DOE)
Chinneck (SCE)

modelling and measurements of data network traffic
Matrawy (CSIT)

modelling and simulation
Khan, Khoo (CEE)
Achar, Nakhla (DOE)
Pearce, Wainer (SCE)

modelling of CMOS logic styles
Shams (DOE)

modelling of dendrite growth
Artemev (MAE)

modelling of roadway alignments
Hassan (CEE)

modelling wireless channels
El-Tanany (SCE)

models to support networks control (controlling the admission, the fairness in the sharing of resources, wireless sensor networks
Talim (SCE)

modern architectural icons
Esponda (ARC)

modern asynchronous circuits
Shams (DOE)

molecular dynamics
Isgor (CEE)

monolithic integration of optical components with CMOS electronics
Tarr (DOE)

monolithic integrated circuits
Roy (DOE)

morphology
Báez (ARC)

MOSFET modeling
Shams (DOE)

motor vehicle emission inventories and regional air quality modeling
Karman (CEE)

MRI technology
Marble (SCE)

multi-antenna systems
Yanikomeroglu (SCE)

multidisciplinary simulation
Gunupudi (DOE)

multimedia for mobile applications
Joslin (CSIT)

multimedia over wireless networks
Yu (CSIT)

multimedia systems
Arya (CSIT)

multimedia transmission over Internet and wireless links
Banihashemi (SCE)

multimodal and audio-visual signal processing
Dansereau (SCE)

multiphase flow
van Geel (CEE)

nano-mechanics and nano-composites
Miller (MAE)

nanostructured materials
Smy (DOE)

natural systems theory
Báez (ARC)

neo-Medievalism
Frascari (ARC)

network computing
Esfandiari (SCE)

network-based tele-operation and tele-robotics
Liu (SCE)

networking (intelligent routing, load balancing, handoff)
Yanikomeroglu (SCE)

networks
St-Hilaire (CSIT)

neural networks
Zhang (DOE)

neuro-architecture and genetic and hybrid representations of architecture
Frascari (ARC)

new media and digital art
Arya (CSIT)

new product development
Muegge (SCE)

non-destructive testing
Isgor (CEE)

nonlinear and chaotic dynamic systems
Dansereau (SCE)

nonlinear circuits
Achar (DOE)

nonlinear control
Sasiadek (MAE)
Schwartz (SCE)

nonlinear optical fibre
Steele (DOE)

nonlinear phenomena in microwaves and electromagnetics
Harrison (DOE)

nonlinear system identification
Green (SCE)

nonlinear systems
Aitken (SCE)

nonlinear transient FEM analysis
Goldak (MAE)

nonlinear transmission lines
Harrison (DOE)

nonlinear, stochastic and chaotic vibration
Sarkar (CEE)

novel optical diagnostics for PM in plumes
Johnson (MAE)

nozzle sprays
Matida (MAE)

numerical techniques in electromagnetics
Roy (DOE)

object-oriented design and languages
Esfandiari (SCE)

obsolescence, wear-and-tear, and product life
Burns (SID)

OCR-to-speech on mobile devices to assist the visually impaired
Dansereau (SCE)

off-road vehicle engineering
Wong (MAE)

open source
Weiss (SCE)

open source software
Bailetti (SCE)

operating systems
Franks, Majumdar (SCE)

operations research
Chinneck (SCE)

optical bistability and instabilities
Steele (DOE)

optical communications
Mahmoud (SCE)

optical fibre sensors
Albert (DOE)

optical fibers
Gunupudi (DOE)

optical networks
Huang (SCE)

optical switches
Steele, Syrett (DOE)

optimal control of optical networks
Lambadaris (SCE)

optimization
Achar, Gunupudi, Zhang (DOE)
Afagh (MAE)
Chinneck (SCE)

opto-electronic circuits
Gunupudi, McGarry (DOE)

optoelectronics
MacEachern, McGarry, Roy, Tarr, and Ye (DOE)

organic and organic/inorganic semiconductor device physics and technology
McGarry (DOE)

oxidation resistant coatings
Huang (MAE)

parallel and distributed simulation
Wainer (SCE)

parallel computing for large-scale stochastic system
Sarkar (CEE)

parameterization
Gunupudi (DOE)

partial crack closure in shells
Liu (MAE)

particle image velocimetry (PIV)
Matida (MAE)

pathogens and chemicals in the environment
Örmeci (CEE)

patient simulators
Russell (MAE)

pattern classification
Green (SCE)

pattern recognition
Chan, Goubran (SCE)

pedagogical issues with respect to the teaching of building technology with respect to philosophy
Crossman (ARC)

peer-to-peer applications in wireless networks
Matrawy (CSIT)

performance and fairness of TCP
Kunz (SCE)

performance evaluation
Lambadaris (SCE)

performance evaluation of email messages filtering systems
Talim (SCE)

performance modeling
Franks, Majumdar, Woodside (SCE)

peri-urban high-density housing in Africa
Cazabon (ARC)

phase transformations
Saari (MAE)

phased arrays
Wight (DOE)

photonics and biomedical devices
McRae (MAE)

photonic components
Albert (DOE)

photonic crystal materials
Gauthier (DOE)

photonic crystals and photonic bandgap materials
Gauthier (DOE)

(silicon) photonic devices: design, fabrication, and characterization
Ye (DOE)

photonic packaging, reliability of photonic devices
Albert (DOE)

photosensitivity
Albert (DOE)

planetary rovers
Wong (MAE)

plasma spraying
Huang (MAE)

policy and planning
Khan (CEE)

population density and factors in the effective use of minimal space
Garvey (SID)

portland cement chemistry
Isgor (CEE)

preservation in modern buildings of Catalan architect Josep Lluis Sert in three different contexts: Spain, United States & Canada
Esponda (ARC)

post-war urbanism
Riar (ARC)

process modelling
Saari (MAE)

product design and innovation
Chung (SID)

product development
Garvey (SID)

prosthetic limbs
Russell (MAE)

protection and security of transportation infrastructure
Halim (CEE)

proteomics
Green (SCE)

protocols
Lung (SCE)

quality criteria for winter maintenance activities
Hassan (CEE)

quality of service (QoS)
Dansereau, Lung (SCE)

quantitative evaluation of network infrastructure and information security
Matrawy (CSIT)

queue management and scheduling
Lambadaris (SCE)

queuing theory
Lambadaris (SCE)

radar
Wight (DOE)

radio resource management
Yanikomeroglu (SCE)

radio-over-fibre
Mahmoud (SCE)

radio-over-fibre systems
Mahmoud (SCE)

radiotherapy
McRae (MAE)

real-time 3D graphics and animation
Joslin (CSIT)

real-time and embedded systems
Wainer (SCE)

real-time operating systems
Pearce (SCE)

real-time simulation
Pearce (SCE)

real-time systems
Pearce (SCE)

receiver architectures
Marsland (SCE)

reception and appropriation of built architecture
Debanné (ARC)

reducing collision risk through better design and consideration of human factors
Hassan (CEE)

redundancy
Aitken (SCE)

rehabilitation and ambulatory assistive devices
Hallgrimsson (SID)

rehabilitation of infrastructure
Lau (CEE)

reinforced and prestressed concrete structures
Sherwood (CEE)

relay/multihop/mesh networks
Yanikomeroglu (SCE)

remediation
Boyle (ARC)

resource allocation and routing
Lambadaris (SCE)

resource management on Grids
Majumdar (SCE)

response of structures to seismic ground motion
Humar (CEE)

response of timber-frame walls and floors to fire
Hadjisophocleous (CEE)

restoration techniques and methodologies in Spain and Mexico, specifically in the Mediterranean and Mesoamerican regions
Esponda (ARC)

reuse in software engineering
Ajila (SCE)

RF design and integrated fibre/wireless local loops with applications in sensors networking and ad hoc coverage extensions
Hafez (SCE)

RF integrated circuits
MacEachern, Shams, Rogers (DOE)

RF
Roy (DOE)

RF transceiver architectures
Lambadaris (SCE)

rheology of non-Newtonian fluids
Simms (CEE)

risk analysis
Sarkar (CEE)

road vehicle dynamics
Wong (MAE)

robot control
Schwartz (SCE)

robotic surgery
Liu (SCE)

robotic vision systems
Hayes (MAE)

robotics
Ahmadi, Ellery, Hayes, Sasiadek (MAE)

Rocket Based Combined Cycle (RBCC) engines
Etele (MAE)

rotorcraft aerodynamics and performance
Feszty (MAE)

router techniques to support congestion control in IP networks
Matrawy (CSIT)

safety, efficiency, sustainable development
Khan (CEE)

secure communications
Steele (DOE)

security in wireless networks
Yu (CSIT)

seismic application of advanced composite materials
Lau (CEE)

seismic restoration
Esponda (ARC)

semiconductor devices (e.g. device modeling)
Syrett (DOE)

sensible heat storages
Cruickshank (MAE)

sensor and data fusion
Sasiadek (MAE)

sensor networks as input devices
Whitehead (CSIT)

sensor networks
Kunz, Lung, Mahmoud (SCE)

sensors
Tait (DOE)

septic systems
van Geel (CEE)

service life prediction of reinforced concrete structures Isgor,
Sherwood (CEE)

signal integrity
Achar, Gunupudi (DOE)
Lambadaris (SCE)

signal processing
Chan (SCE)

signal separation
Dansereau (SCE)

silicon semiconductor device physics and technology
Tarr (DOE)

silicon technology circuit implementation
Kwasniewski (DOE)

simulation
Hayes (MAE)

simulation software development for physics end engineering applications
Gauthier (DOE)

simulation standards
Pearce (SCE)

simulator motion platform design
Hayes (MAE)

sintering of porous media for high-temperature applications
Huang (MAE)

sliding mode systems
Aitken (SCE)

slope stability
Law (CEE)

smart helicopter blades
Nitzsche (MAE)

social network analysis
Weiss (SCE)

social User Interfaces
Arya (CSIT)

soft soils
Law (CEE)

software architecture
Lung (SCE)

software defined radio receivers
El-Tanany (SCE)

software development
Holtz (CEE)
Gauthier (DOE)

software engineering
Franks, Labiche, Lung (SCE)

software evolution and change management
Ajila (SCE)

software performance engineering
Franks, Lung, Petriu (SCE)

software processes and workflows
Ajila (SCE)

software product lines and system family engineering
Ajila (SCE)

software quality measurement, control and assurance
Briand (SCE)

software re-engineering
Ajila, Lung (SCE)

software testing
Labiche (SCE)

software verification and validation
Briand, Labiche (SCE)

soil-structure interaction
Humar (CEE)

solar air conditioning
Gu (MAE)

solar thermal energy systems
Cruickshank (MAE)

solid mechanics
Wang (MAE)

soot (PM) formation in turbulent flames and gas flares
Johnson (MAE)

sorptive refrigeration
Gu (MAE)

space robotics
Sasiadek (MAE)

space technology
Ellery (MAE)

space-time coding and processing
Banihashemi (SCE)

spacecraft
de Ruiter (MAE)

spacecraft thermal control
Kaya (MAE)

speaker tracking
Dansereau (SCE)

speech processing
Mahmoud (SCE)

stability analysis
Afagh (MAE)

stability of fly-by-wire aircraft
Nitzsche (MAE)

state estimation
Aitken (SCE)

steel structures and pipelines
Khoo (CEE)

stochastic finite element
Sarkar (CEE)

stochastic optimization
Lambadaris (SCE)

stochastic processes
Lambadaris (SCE)

strategies and tools for performance improvement
Woodside (SCE)

stress analysis
Bell (MAE)

structural acoustics and fluid structure interaction
Sarkar (CEE)

structural analysis of building frames
Hartley (CEE)

structural damage accumulation
Salinas (CEE)

structural dynamics and earthquake engineering
Lau (CEE)

structural health monitoring
Khoo, Lau (CEE)

structural integrity assessment methods
Wang (MAE)

structural reliability
Salinas (CEE)

structure evolution in phase transformations
Artemev (MAE)

suburbs: historical development of
Gianni (ARC)

superalloys
Liu (MAE)

surgical simulation
Liu (SCE)

sustainability and historical preservation
Goffi (ARC)

sustainable design
Boyle (ARC)

sustainability: economic, cultural and environmental and systems design
Andonian (ARC)

synchronization of communications receivers
El-Tanany (SCE)

system identification and estimation
Schwartz (SCE)

system on chip
Shams (DOE)

technology and the avant-garde
Riar (ARC)

technology commercialization
Bailetti (SCE)

telecommunication network planning
St-Hilaire (CSIT)

telecommunication systems
Majumdar (SCE)

telemedicine
Frize (SCE)

theatre and performance: set design and construction
Cazabon (ARC)

theoretical kinematics
Hayes (MAE)

theory and implementation of iterative coding schemes
Banihashemi (SCE)

theory and modeling of corrosion of steel in concrete
Isgor (CEE)

thermal barrier coatings
Huang (MAE)

thermal medical image collection and analysis
Frize (SCE)

thermal networks
Gunupudi (DOE)

thermophysical properties
Saari (MAE)

thin films
Smy (DOE)

thin films
Tait (DOE)

tidal-current power-generation
Yaras (MAE)

traditional building technologies and combination of organic and inorganic materials
Boyle (ARC)

traffic engineering
Lung (SCE)

traffic modeling and fast simulation techniques
Huang (SCE)

transition control in separation bubbles
Yaras (MAE)

transition from laminar to turbulent flow
Sjolander (MAE)

transmission line structures
Wight (DOE)

transmission of multimedia signals over high-speed networks
Mahmoud (SCE)

transport and deposition of inhaled medical aerosols
Johnson (MAE)

transport phenomena in micro-scale processes
Gu (MAE)

treatment and management of biosolids
Örmeci (CEE)

treatment of high ammonia loadings on plant performance
Basu (CEE)

tribaloy alloys
Liu (MAE)

turbomachinery aerodynamics
Sjolander (MAE)

two-phase flow and heat transfer
Gu, Kaya (MAE)

ultrasound measurement and imaging
Ono (SCE)

ultraviolet processes
Örmeci (CEE)

ultrawideband, mixed-signal circuits
MacEachern (DOE)

UML performance models
Petriu (SCE)

uncertainty quantification
Sarkar (CEE)

unmanned aerial vehicles
Sasiadek, De Ruiter (MAE)

unmanned vehicle systems
Aitken (SCE)

unsaturated soil mechanics
Simms (CEE)

urban design, redevelopment of public housing stock
Gianni (ARC)

urban renewal
Boyle (ARC)

usability of modeling
Woodside (SCE)

utopia and utopianism
Riar (ARC)

vehicle dynamics
Langlois (MAE)

vehicle engineering
Wong (MAE)

ventricular assist devices
Russell (MAE)

vibration and noise reduction in helicopters and turboprop aircraft
Nitzsche (MAE)

video and architectural modeling; computer animation, graphics and painting
Dubicanac (ARC)

video quality metrics
Dansereau (SCE)

virtual environments
Joslin (CSIT)

virtual environments
Petriu (SCE)

virtual worlds and characters
Arya (CSIT)

vision systems
Sasiadek (MAE)

vision, mapping and localization
Aitken (SCE)

visual serving
Hayes (MAE)

VLSI
Gunupudi (DOE)
Mahmoud (SCE)

voice over IP (VoIP)
Dansereau, Lambadaris (SCE)

voltage-controlled oscillators
Rogers (DOE)

waste-heat power generation
Gu (MAE)

waste-heat refrigeration
Gu (MAE)

water and wastewater treatment
Örmeci (CEE)

wavelets
Dansereau (SCE)

wearable computing for healthcare
Frankel (SID)

web services-based inter-operable systems
Majumdar (SCE)

welding
Goldak, Huang (MAE)

wide-gap brazing of superalloys
Huang (MAE)

wind gust and UAV modelling for low level flight
Etele (MAE)

wired and wireless communication networks
St-Hilaire (CSIT)

wireless ad hoc networks
Lung (SCE)

wireless and sensor networks
Huang (SCE)

wireless and wired communication systems
El-Tanany (SCE)

wireless communication
Marsland, Yanikomeroglu (SCE)

wireless medical applications
Plett (DOE)

wireless networks
Yu (CSIT)

wireless security, monitoring and control
Hafez (SCE)

wireless sensor networks
Liu (SCE)

wireless theory
Hafez (SCE)

wireless/wireline networking
Yu (CSIT)

wireline and wireless circuits
Kwasniewski (DOE)

world's fairs and ephemeral events
Riar (ARC)

women in science and engineering
Frize (SCE)

wood engineering
Salinas (CEE)

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