Western

UNIVERSITY · CANADA

Kamran Siddiqui, PhD, PEng

Associate Dean, Graduate and Postdoctoral Studies
Professor, Mechanical Engineering

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Associate Dean, Research
Professor, Software Engineering

Faculty of Engineering
Western University
London, Ontario, CANADA

April 2021

Western Engineering

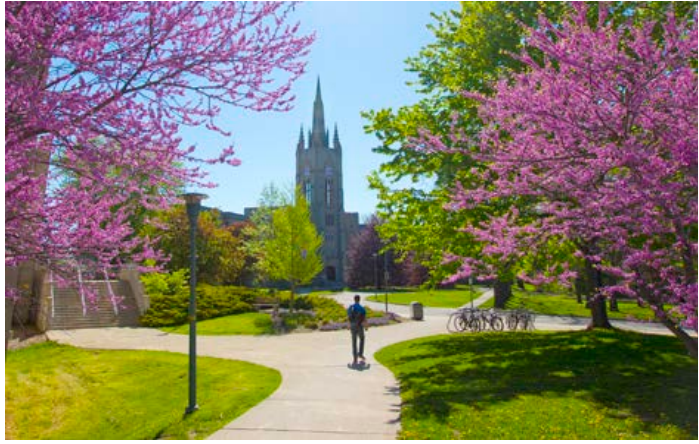
The University of Western Ontario (Western University) is situated in London, Ontario located about 200 km south-west of Toronto - with a population of about 385,000

Western University

- Founded in 1878, one of Canada's oldest universities
- Canada's sixth-largest university
  - 1,325 full-time faculty members
  - 40,000 students from 128 countries
  - 12 faculties and schools, and three affiliated university colleges
- 400+ majors, minors & specializations
- 120 professional & graduate programs
- Research-intensive: $238M annually

Western University

- One of the oldest and most beautiful university campuses in Canada
- Ranked amount the top 1% of higher education institutions worldwide
- One of the highest national entrance averages of first-year students at 90.6%
- 95.2% employment rate after graduation
- More than 325,000 alumni in 150 countries worldwide
- 26 faculty recipients of 3M National Teaching Fellowships-2nd highest in Canada



Signature Research Areas

- Neuroscience and Brain & Mind
- Child & Youth Development
- Global Health Equity & Social Innovation
- Imaging
- Materials & Biomaterials
- Environmental Sustainability & Green Energy
- Wind Engineering & Natural Disaster Mitigation
- Philosophy of Science
- Planetary Science & Exploration
- Musculoskeletal Health

Western Engineering

Western Engineering

Founded in 1954, we are home to:

- Department of Chemical & Biochemical Engineering
- Department of Civil & Environmental Engineering
- Department of Electrical & Computer Engineering
- Department of Mechanical & Materials Engineering
- School of Biomedical Engineering
- John M. Thompson Centre for Engineering Leadership and Innovation

Western Engineering Facilities

Four buildings on Western's Main Campus:

- Spencer Engineering Building
- Thompson Engineering Building
- Claudette MacKay-Lassonde Pavilion
- Amit Chakma Engineering Building

Western Engineering by the Numbers

- 110 faculty members
- 80+ staff members
- 2000+ undergraduate students
- 800+ graduate students
  - 300+ PhD students (research-based)
  - 200+ MESc students (research-based)
  - 300+ MEng students (course-based)
- More than 11,000 alumni

Western Engineering Graduate Programs

- Master of Engineering (MEng) – Course based
- Master of Engineering Science (MESc) – Thesis based
- Doctor of Philosophy (PhD) – Thesis based

WE Graduate and Postdoctoral Studies Website: https://www.eng.uwo.ca/graduate



Master of Engineering (MEng)

- Course-based program
- Admission: A minimum of 70% average (North American Standard) based on last two years of Bachelor's degree
  - English Language Proficiency requirements (where applicable)
- Program requirements: 10 courses or 8 courses + Project
  - 8 Technical courses + 2 Professional courses
  - 6 Technical courses + Project + 2 Professional courses
- Normal study period: **1 year**

Master of Engineering Science(MESc)

- Achieved through a combination of course-work and Masters thesis research
- Admission: A minimum of 78% average (North American Standard) based on last two years of Bachelor's degree
  - English Language Proficiency requirements (where applicable)
  - Acceptance by a Faculty supervisor(s)
- Program requirements: **4 courses** + thesis
- Normal study period: **2 years**
- Opportunities for professional development through courses and workshops

Doctor of Philosophy (PhD)

- Achieved through a combination of course-work and PhD thesis research
- Admission: A minimum of 78% average (North American Standard) based on Master's degree
  - English Language Proficiency requirements (where applicable)
  - Acceptance by a Faculty supervisor(s)
- Program requirements: **8 courses** (exemption for up to 4 courses from Master degree could be considered) + thesis
- Normal study period: **4 years**
- Opportunities for professional development through courses and workshops

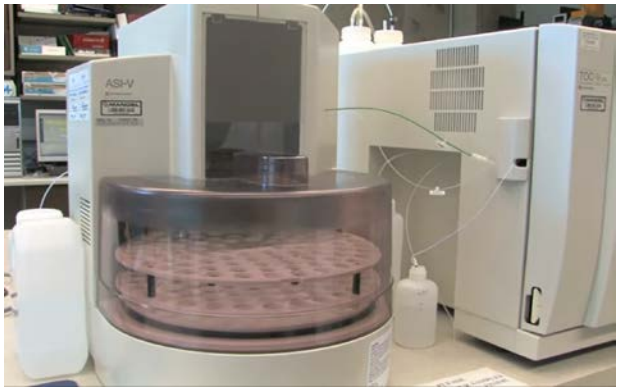
Western Engineering Research Specialization for Graduate Studies

- Department of Chemical & Biochemical Engineering
- Department of Civil & Environmental Engineering
- Department of Electrical & Computer Engineering
- Department of Mechanical & Materials Engineering
- School of Biomedical Engineering

WE Research Website: https://www.eng.uwo.ca/research

Department of Chemical & Biomedical Engineering – Areas of Research

- Biomaterials and Biochemical
- Environmental and Green Engineering
- Particle Technologies and Fluidization
- Macromolecular and Materials Engineering
- Reaction and Process Systems Engineering
- Water and Energy



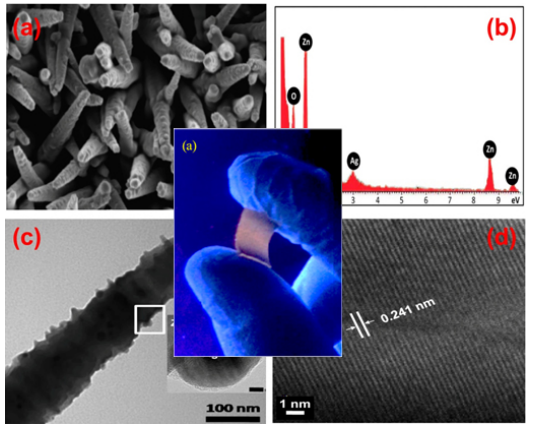
Biomaterials and Biochemical Engineering

Research Focus:

- Bio-separation, bio-remediation, bio-pharmaceuticals
- Bio-polymers, bio-sensors, bio-reactor design
- Tissue engineering, materials for biomedical applications, and drug delivery.

Microalgae cultivation

Tissue Engineering



Biomimetic Nanostructures used for Inhibiting the Growth of Biofilm

Faculty Members: A. Bassi, L. Flynn, B. Gillies, D. Karamanev, K. Mequanint, L. Rehmann, A. Rizkalla, and J. Zhang

Environmental and Green Engineering

Research Focus:

- Green energy from agriwaste and hydrogen production
- Biofuel cells, bio-refinery
- Green solvents and materials development
- Chemical and biological wastewater treatment.

Ionic liquid based biorefining

Pollution Prevention

Thermal biomass processing

Faculty Members: A. Bassi, F. Berruti, C. Briens, P. Charpentier, H. de Lasa, J. Herrera, D. Karamanev, G. Nakhla, A. Prakash, A. Ray, M. Ray, L. Rehmann, and J. Zhu.

Particle Technologies and Fluidization

Research Focus:

- Fluidization (gas-solid, liquid-solid, multi-phase, circulating fluidized bed)
- Industrial crystallization
- Coating, drying and high shear granulation.

Riser Simulator

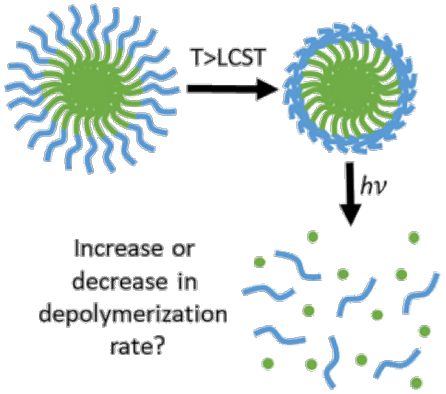
High Quality Powder Coating Process Using Ultra-fine Powders

Faculty Members: A. Bassi, F. Berruti, C. Briens, L. Briens, H. de Lasa, A. Hrymak, A. Prakash, M. Ray, S. Rohani, J. Zhang, and J. Zhu.

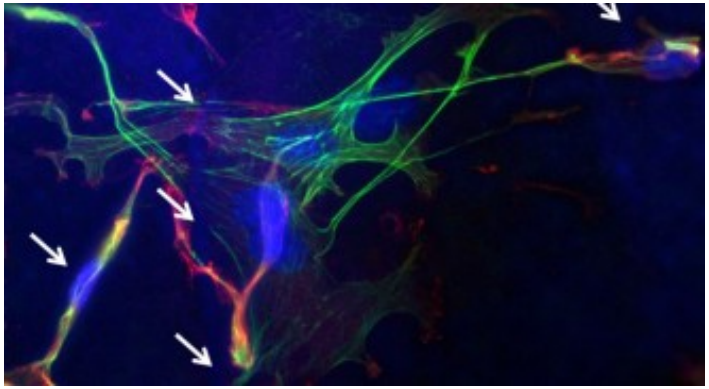
Macromolecular and Materials Engineering

Research Focus:

- Production, manipulation, characterization and application of advanced materials.
- Fundamental research in controlling polymer and nanostructures using various synthesis and advanced characterization techniques.
- Functional biomaterials, light weight composites and materials needed in alternative energy application.



Multi-stimuli-responsive self-immolative polymer assemblies



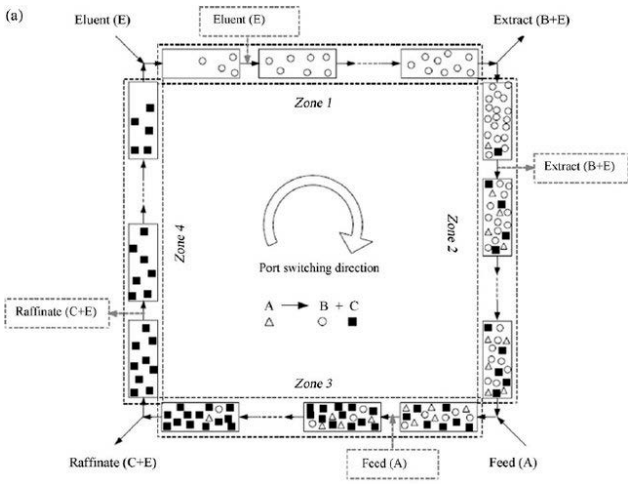
Mechanically Competent and Biocompatible Hybrid Biomaterials

Faculty Members: P. Charpentier, J. Herrera, B. Gillies, A. Hrymak, K. Mequanint, L. Rehmann, S. Rohani, A. Rizkalla, C. Xu, J. Zhang, and J. Zhu

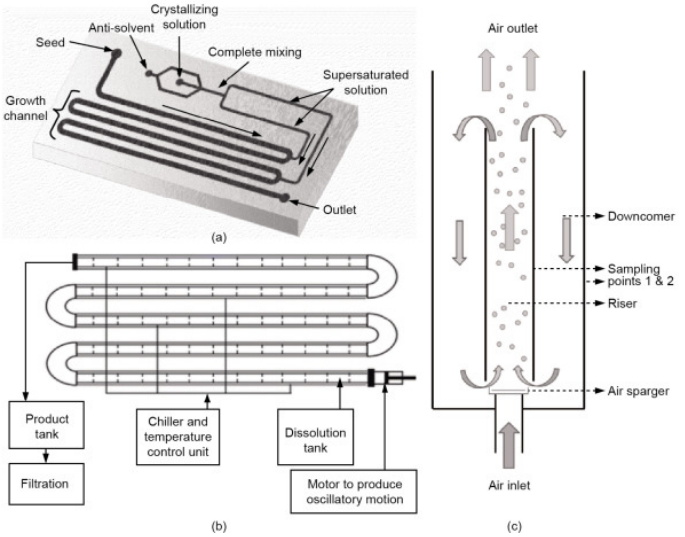
Reaction and Process Systems Engineering

Research Focus:

- Development of new catalytic materials and innovative reactor design for multiphase and multifunctional reactors
- Optimization and advanced control of multi-scale process systems, ranging from molecular level to the enterprise level



Simulated moving bed reactor



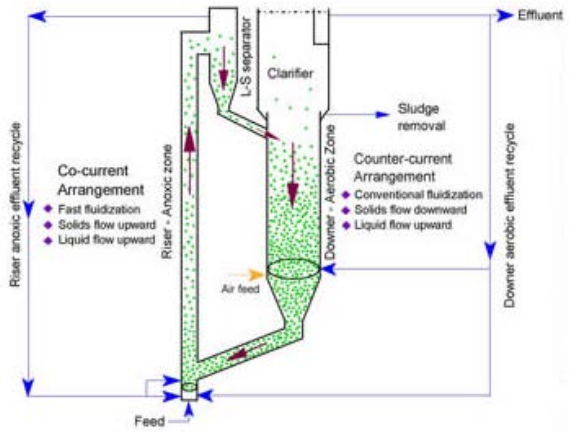
Microfluidic crystallization

Faculty Members: P. Charpentier, H. de Lasa, J. Herrera, A. Hrymak, A. Prakash, A. Ray, M. Ray, and S. Rohani.

Water and Energy

Research Focus:

- High-rate wastewater treatment technologies
- Combined sewer overflow treatment
- Water Reuse; microbiology & ecotoxicity



Novel Wastewater Treatment System

Greenway wastewater treatment plant

Faculty Members: A. Bassi, Franco Berruti, C. Briens, P. Charpentier, H. de Lasa, G. Nakhla, A. Prakash, A. Ray, M. Ray, L. Rehmann, and C. Xu.

Department of Chemical & Biomedical Engineering – Research Facilities

Institute for Chemicals and Fuels from Alternative Resources (ICFAR)

- Leader in the development of technologies and processes for production of chemical and fuels from alternative resources
- Specializing in biomass and waste conversion, fluid-coking technologies

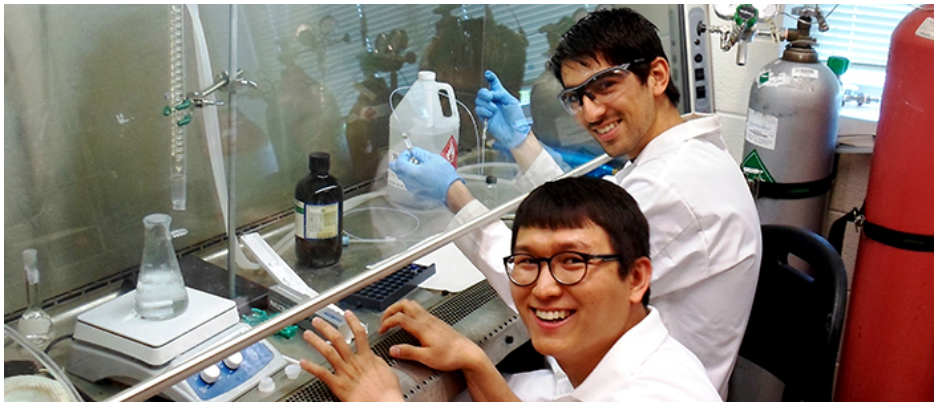
Department of Civil & Environmental Engineering – Areas of Research

- Environmental and Water Resources
- Geotechnical and Geoenvironmental
- Structural and Infrastructural
- Wind Engineering and Environmental Fluid Mechanics

Environmental and Water Resources

Research Focus:

- Acid rock drainage
- Coupled liquid, vapour and heat transfer in soils
- Electrokinetic dewatering
- Soil and groundwater remediation
- Detection of soil and groundwater contamination
- Resuspension of flooded mine tailings
- Landfill leachate treatment



Faculty Members: M. Dagnew, J. Gerhard, M.R. Najafi, G. Nakhla, M.L. Nehdi, C. Power, C. Robinson, S.P. Simonovic, E.K. Yanful

Geotechnical and Geoenvironmental

Research Focus:

- Tunneling and underground structures
- Dynamics of soils and foundations
- Soil-structure interaction
- Design, analysis and construction of piles
- Machine foundation

Faculty Members: M.H. El Naggar, J. Gerhard, G. Nakhla, T.A. Newson, C. Power, C. Robinson, A. Sadrekarimi, J.Q. Shang, E.K. Yanful

Structural and Infrastructural

Research Focus:

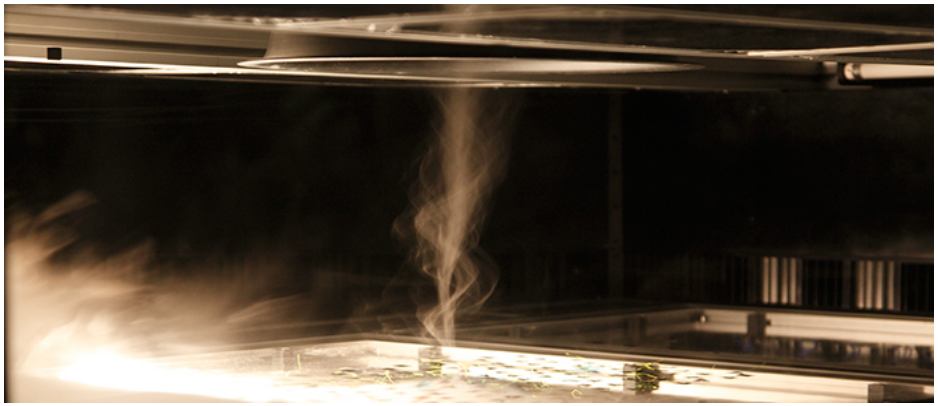
- Effect of earthquakes and wind loads on structures
- Structural safety and code calibration
- Finite element development
- Fluid-structure interaction
- Analysis, design and stability of shell structures
- Dynamics of structures

Faculty Members: F.M. Bartlett, A. El Ansary, A. El Damatty, M.H. El Naggar, H-P Hong, M.L. Nehdi, T.A. Newson, A. Sadhu, M.A. Youssef, W. Zhou

Wind Engineering and Environmental Fluid Mechanics

Research Focus:

- Impact of climate variability and change
- Manage of water resources under extreme climates (Floods and Droughts)
- Risk and reliability
- Mitigation of roof collapses due to ponding and snow loads



Faculty Members: G. Bitsuamlak, G.A. Kopp, C.M. Miller, H. Peerhossaini

Department of Civil & Environmental Engineering – Research Facilities

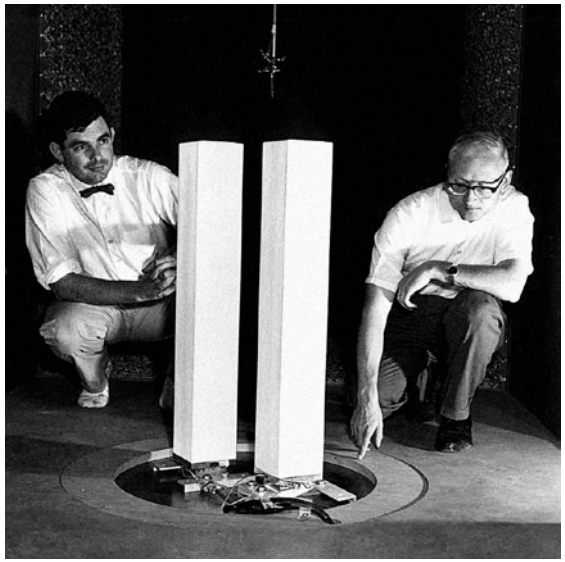
Wind Engineering, Energy and Environment (WindEEE) Research Institute

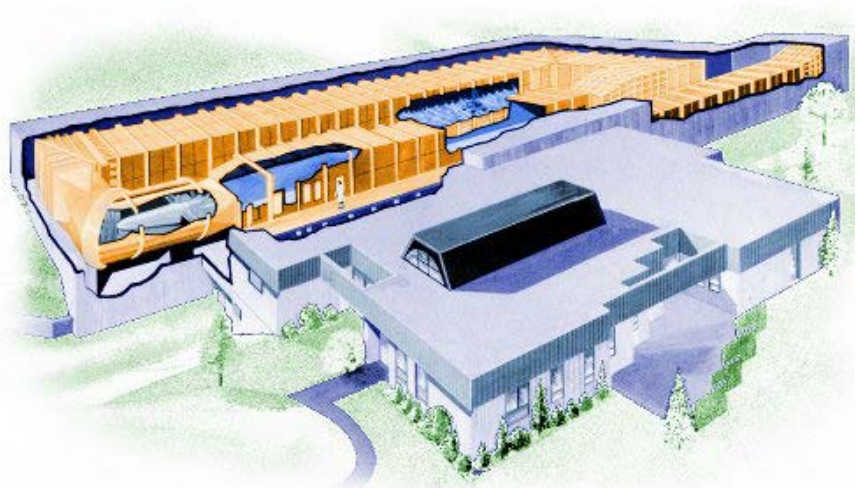
- Globally-unique research facility to study a wide range of wind systems including downbursts and tornados and their impact on structures and environment

Department of Civil & Environmental Engineering – Research Facilities

Boundary Layer Wind tunnel Laboratory

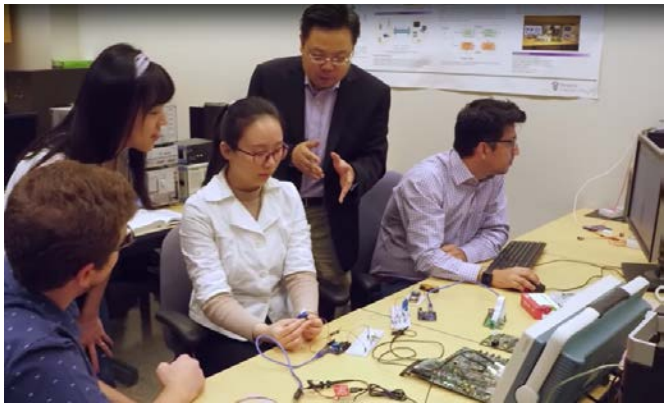
- Five wind tunnel test areas
- Used to investigate the aerodynamics of buildings, bridges and other structures





Department of Electrical & Computer Engineering – Areas of Research

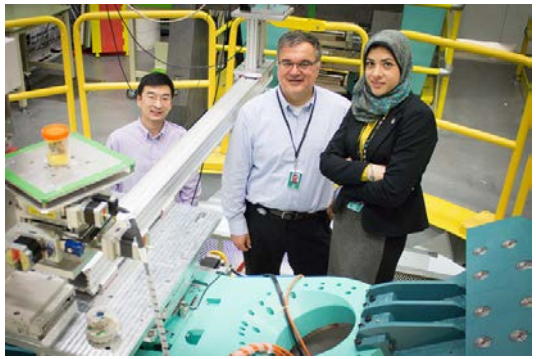
- Biomedical Systems
- Communication Systems and Data Networking
- Microsystems and Digital Signal Processing
- Power Systems
- Robotics and Control
- Software Engineering



Biomedical Systems

Research Focus:

- Computer vision
- Acoustic/ultra-sound, CT, MRI and other medical imaging and analysis
- Surgical simulation, virtual and augmented reality
- Haptics and teleoperation
- Computer-assisted surgery, minimally-invasive surgery



Advanced medical imaging

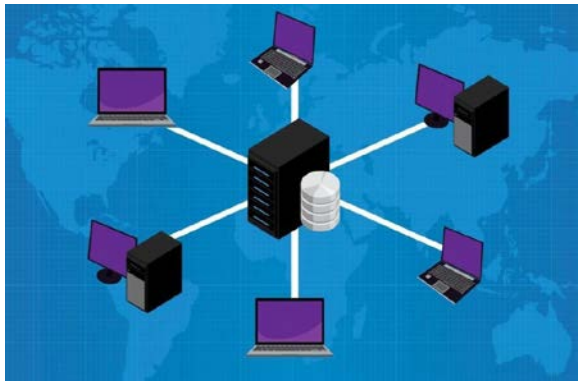
Surgical technologies

Faculty Members: J. Lacefield, H. Ladak, V. Parsa, R. Patel, A. Samani, A. Trejos

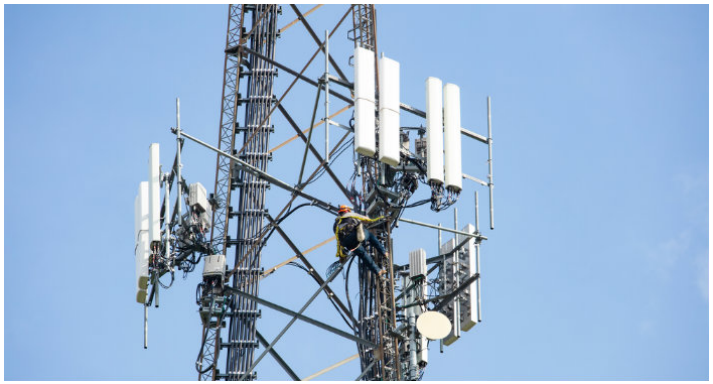
Communication Systems and Data Networking

Research Focus:

- Circuit simulation, high-speed communication
- Efficient, secure, reliable wireless and satellite communication
- Networking protocols and architecture. Network flow control, simulation and fault tolerance
- Intelligent networks, software defined networks



Network communication



Wireless communication

Faculty Members: A. Dounavis, S. Primak, Q. Rahman, R. Rao, A. Shami, X. Wang

Microsystems and Digital Signal Processing

Research Focus:

- Industrial control systems
- Cryptographic and arithmetic hardware acceleration
- Audio processing, speech synthesis and recognition
- Fault-tolerant computing
- Nanoscale sensing

Speech synthesis and recognition

FPGA-based Hardware Design

Faculty Members: J. Jiang, V. Parsa, A. Reyhani, J. Sabarinathan

Power Systems Engineering

Research Focus:

- Renewable energy, smart grids
- Power grid protection and stability
- Nuclear power control systems and simulation
- Power switching, transmission and conversion
- Wind energy

Power generation and distribution

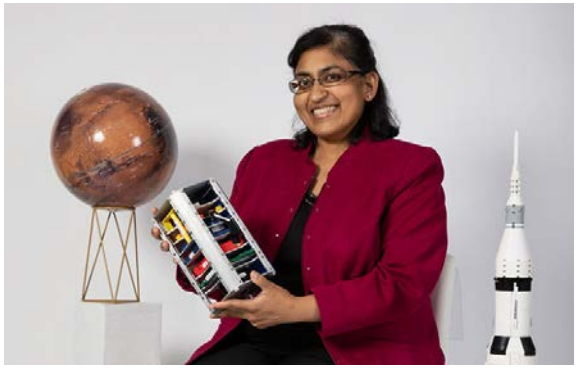
Nuclear Power Control Systems

Faculty Members: F. Badrkhani, J. Jiang, J. Moschopoulos, R. Varma

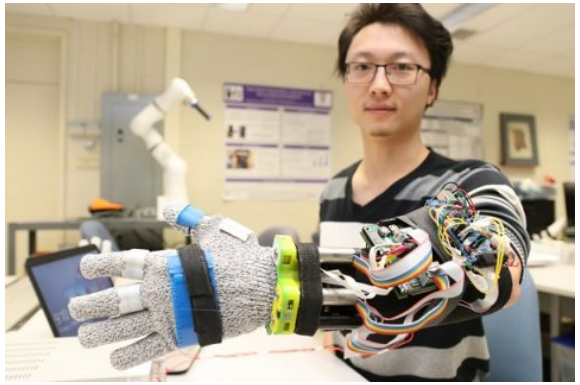
Robotics and Control

Research Focus:

- Industrial robotics
- Robotics theory (locomotion, coordination)
- Autonomous systems for planetary exploration
- Wearable and medical mechatronics
- Robotically assisted surgery



Planetary exploration



Wearable mechatronics

Faculty Members: L. Brown, K. McIsaac, R. Patel, I. Polushin, J. Sabarinathan, A. Trejos

Software Engineering

Research Focus:

- Software estimation, testing and lifecycle management
- Web services, cloud computing, IoT, distributed systems
- Artificial intelligence, machine learning, data analytics, big data
- Resource estimation and surveillance, health informatics
- Human-computer interaction
- Cybersecurity, cryptography, privacy, identity and trust

AI and Machine Learning

Cybersecurity

Faculty Members: L. Capretz, M. Capretz, R. Eagleson, A. Essex, H. Ghenniwa, K. Grolinger, A. Ouda, Q. Rahman, A. Shami

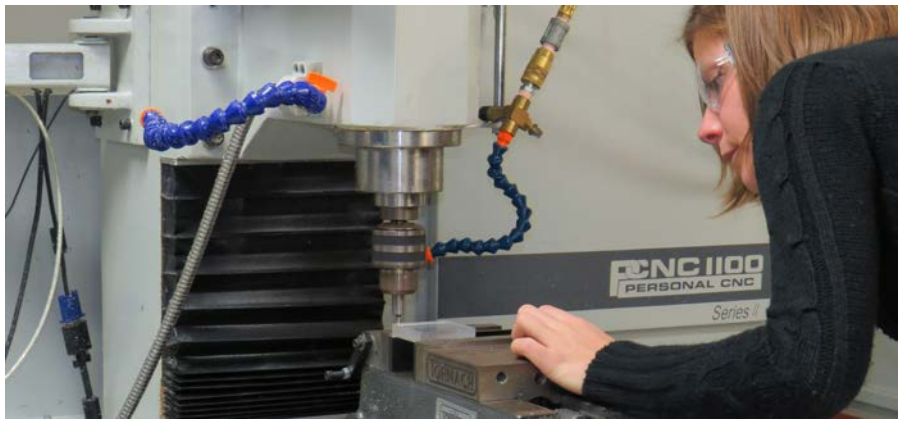
Department of Electrical & Computer Engineering – Research Facilities

Institute for Earth & Space Exploration (CPSX)

- Leading organization for Earth and space exploration research and training in Canada
- Seeks to understand Earth's formation, explore planets and apply technologies to mining, robotics, healthcare

Department of Mechanical & Materials Engineering – Areas of Research

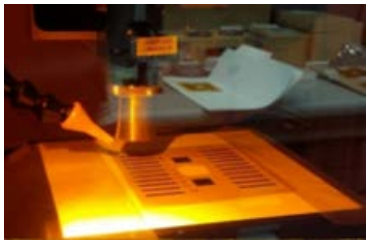
- Automation Technologies and Systems
- Biomechanics
- Design and Manufacturing
- Materials and Solid Mechanics
- Micro and Nano Systems
- Thermo-fluids

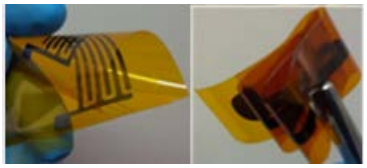


Automation Technologies and Systems

Research Focus:

- Mechatronic systems, nonlinear and stochastic mechanics
- Dynamics & control, intelligent machining systems
- Computer assisted and surgical robotics, implantable transducer design, geometric modelling
- Sensors and actuators, medical devices and wearable sensor systems





Flexible bio- and opto-electronics

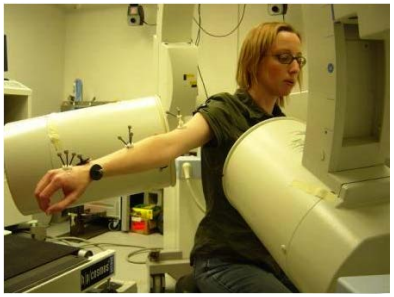
Wearable technology

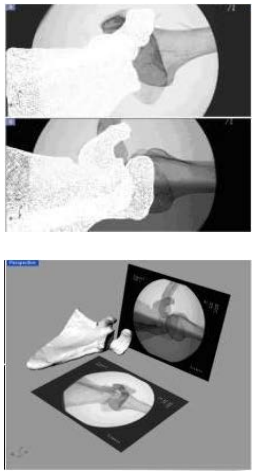
Faculty Members: S. Asokanthan, G. Knopf, M. Naish, A. Price, O.R. Tutunea-Fatan

Biomechanics

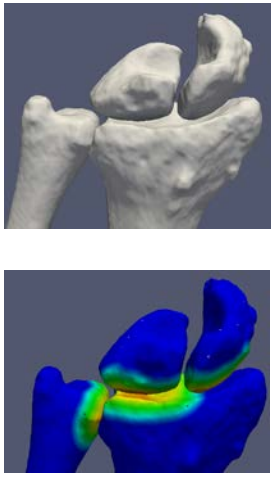
Research Focus:

- Orthopaedic biomechanics, impact biomechanics, rehabilitation sciences
- Joint replacement (implant) design and analysis, motion and load transfer
- Advanced medical imaging, electromagnetic tracking system to measure motion
- Sport science, injury causation, analysis of elite and recreational sport
- Head biomechanics, traumatic brain injury





Radiostereometric Analysis



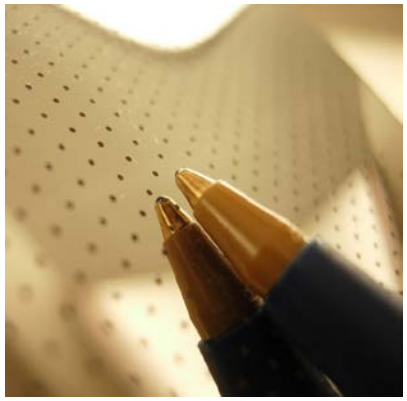
Imaging innovations

Faculty Members: L. Ferreira, J. Johnson, T. Jenkyn, G. Knopf, E. Lalone, D. Langohr, H. Mao, R. Willing

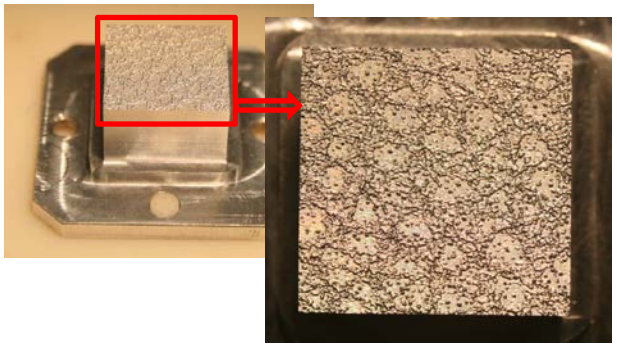
Design and Manufacturing

Research Focus:

- Design methodologies and tools, computer-aided design
- Multi-axis CNC machining, intelligent machining systems
- Ultra-precise single point cutting, micro-optics, laser polishing
- Additive manufacturing of advanced materials



Surface laser polishing



Organic (leather-like) surface

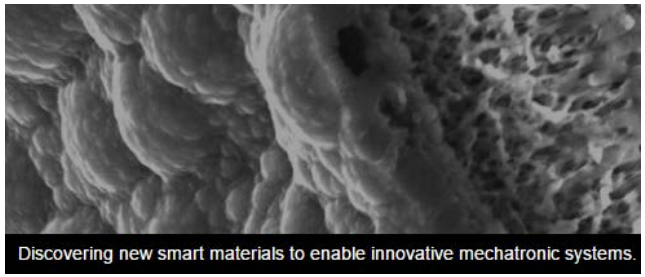
State-of-the-art equipment

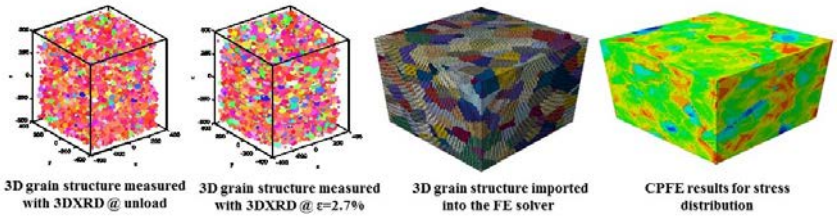
Faculty Members: G. Knopf, O.R. Tutunea-Fatan, A. Price

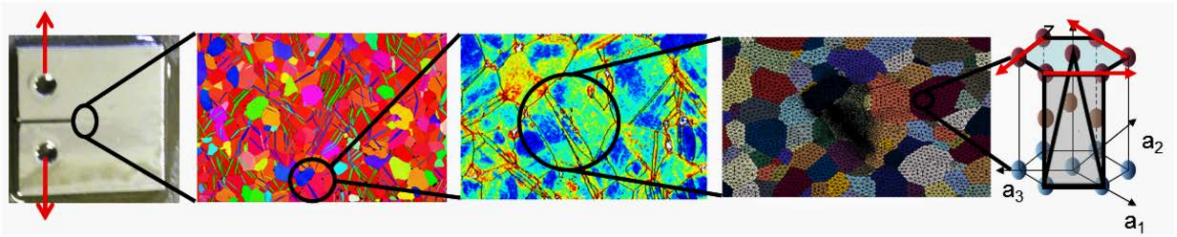
Materials and Solid Mechanics

Research Focus:

- Microstructure and properties of metals, polymers, composite materials, nanomaterials
- Energy materials, optoelectronics, smart materials for mechatronic systems
- Fracture and failure analysis, tribology, material processing







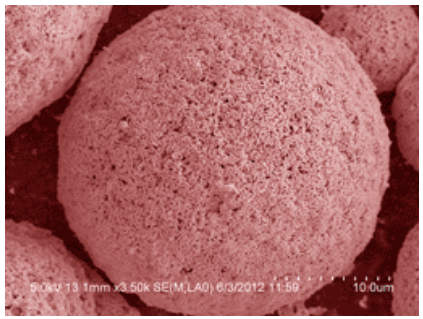
Multi-scale material characterization

Faculty Members: H. Abdolvand, S. Asokanthan, K. Coley, L. Jiang, E. Johlin, R. Klassen, D. Langohr, A. Price, X. Sun, J. Wood, Y. Zhao

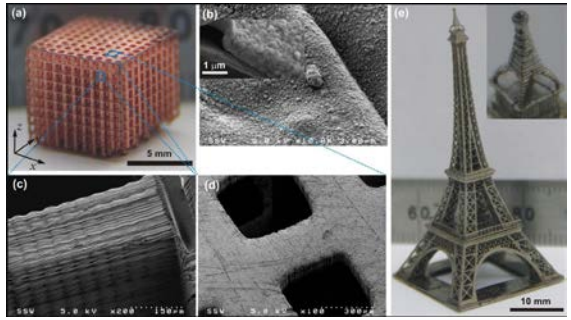
Micro and Nano Systems

Research Focus:

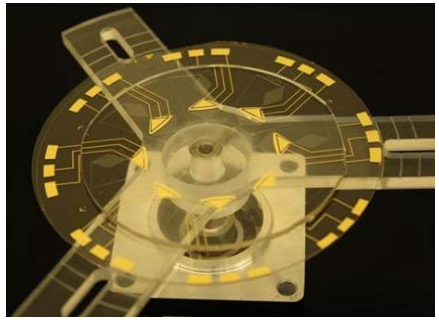
- Micro/nano-materials functionalization, characterization, and modeling
- Energy conversion, Fuel cells and Energy storage (Lithium-ion batteries)
- MEMS and NEMS, Additive micro/nano-engineering
- Micro-optics and Biotechnology, nanophotonics



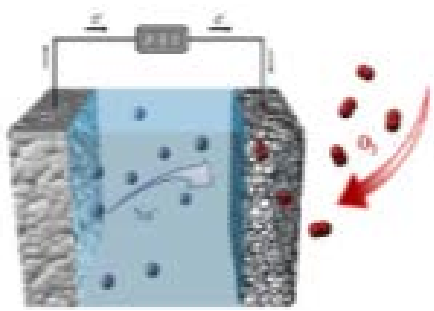
Nano-materials



Novel 3D printing technologies



Lab-on-the-chip



Batteries

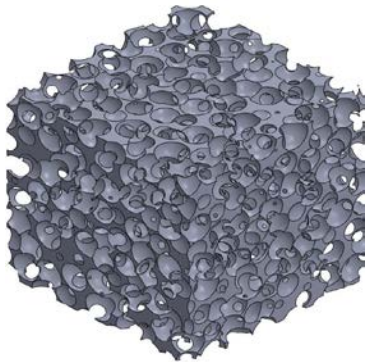
Faculty Members: H. Abdolvand, L. Jiang, E. Johlin, R. Klassen, G. Knopf, X. Sun, J. Wood, Y. Zhao

Thermo-fluids

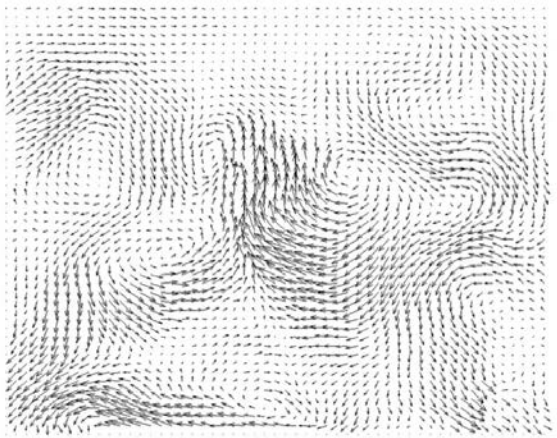
Research Focus:

- Renewable energy systems, thermal energy storage
- Biological and environmental flows, turbulence
- Porous media, combustion
- Two-phase flows, conjugate heat and mass transfer
- Theoretical and computational fluid mechanics, biofluid mechanics

Low disturbance wind tunnel



CFD Modelling



Flow Measurements

Faculty Members: C. DeGroot, J.M. Floryan, R. Khayat, K. Ogden, E. Savory, K. Siddiqui, A. Straatman, C. Zhang

Department of Mechanical & Materials Engineering – Research Facilities

Fraunhofer Project Centre for Composites Research

- A joint venture between Western University and the Fraunhofer Institute of Chemical Technology (ICT) in Germany
- Develops, tests validates and characterizes new lightweight materials & advanced manufacturing processes at industrial scale

School of Biomedical Engineering – Areas of Research

BME promotes the cooperative involvement of clinical and basic researchers in disciplines including four research pillars:

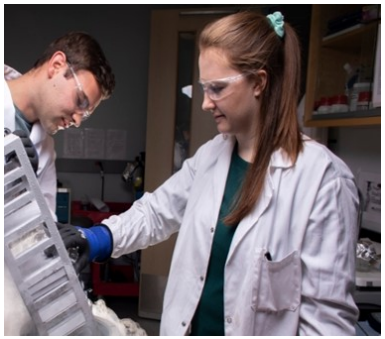
- Biomaterials
- Biomechanics
- Imaging
- Mechatronics

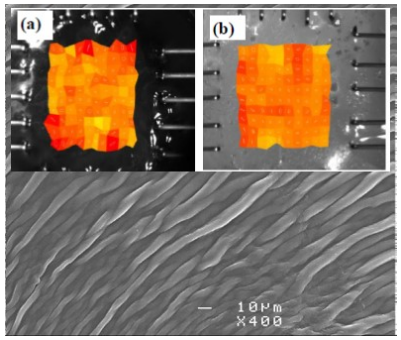



Biomaterials

Research Focus:

- **Tissue scaffolds** to support growth, differentiation, and regeneration of cells and tissues
- **Injectable hydrogels, nanoparticles** and **microparticles** for localized delivery and controlled release of therapeutic agents
- **Nanoparticles for use in biosensors**
- **Nanoparticle contrast media** for magnetic resonance and optical imaging
- **Smart materials** for biosensors
- Bioactive glasses and composites for use in **dental implants**





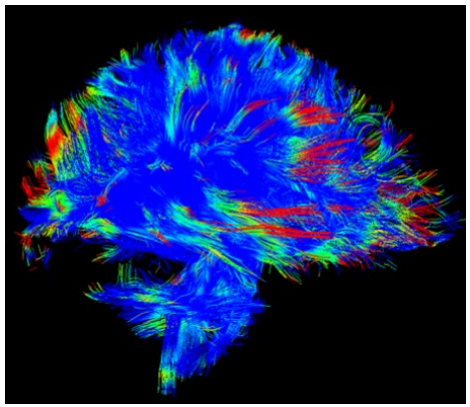
BME's biomaterials labs

Faculty Members: L. Briens, E. Chen, L. Flynn, E. Gillies, D. Hamilton, K. Hill, Y. Hosein, K. Mequanint, A. Price, A. Rizkalla, W. Siqueira, W. Wan, J. Zhang

Biomechanics

Research Focus:

- **Shoulder, elbow & hip implants** design with greater durability & biomechanical performance
- Development of **assistive technologies** to support patients during rehabilitation from stroke, musculoskeletal diseases, and sports injuries
- Investigation of the **biomechanics of impact and trauma**
- **Image-based computational modeling** of soft & hard tissues mechanical properties
- Investigation of the **fluid mechanics of blood flow & ventilation** to improve diagnosis and treatment of cardiovascular and respiratory diseases

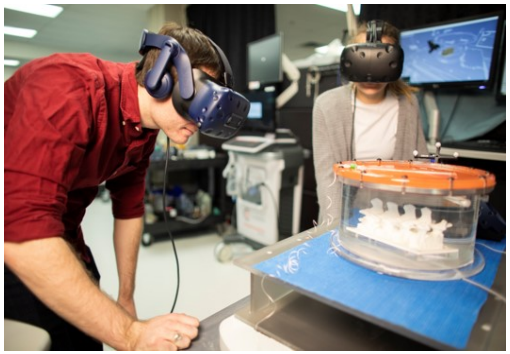


Faculty Members: J. Dickey, L. Ferreira, J.M. Floryan, D. Goldman, D. Holdsworth, Y. Hosein, T. Jenkyn, J. Johnson, H. Ladak, E. Lalone, H. Mao, G. Parraga, A. Price, R. Tutunea-Fatan, R. Willing

Imaging

Research Focus:

- Development of **image processing algorithms and software** with an emerging emphasis on **applications of machine learning** to medical image analysis.
- **Hardware, software, & virtual reality displays** development for image-guided interventions
- Design of **MRI pulse sequences and radio-frequency coils** for applications such as neuroimaging, cardiac imaging, cancer imaging, and respiratory imaging.
- Development of methods and systems for **quantitative perfusion imaging** for applications such as cancer imaging, musculoskeletal disease, heart failure, etc.

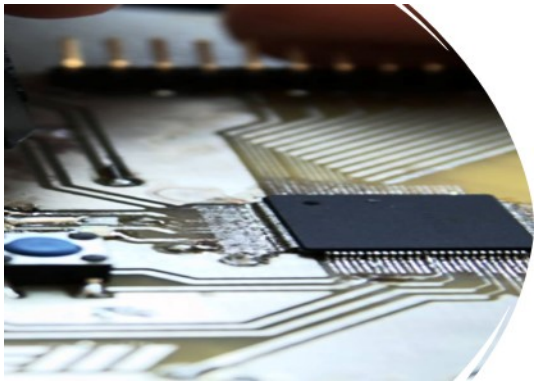


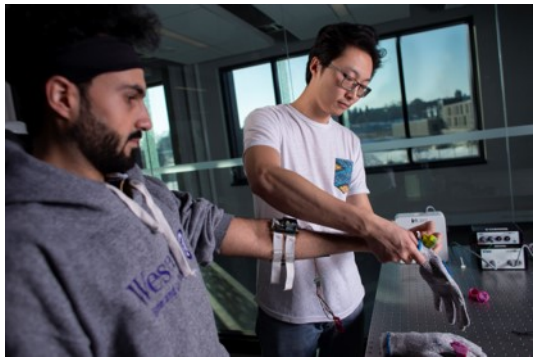
Faculty Members: C. Baron, J. Carson, E. Chen, S. de Ribaupierre, M. Diop, M. Dragnova, E. Duerden, R. Eagleson, A. Fenster, K. Hill, D. Holdsworth, A. Khan, J. Lacefield, H. Ladak, S. Li, C. McKenzie, R. Menon, G. Parraga, T. Peters, T. Poepping, A. Samani, J. Samarabandu, A. So, M. Teeter, A. Ward

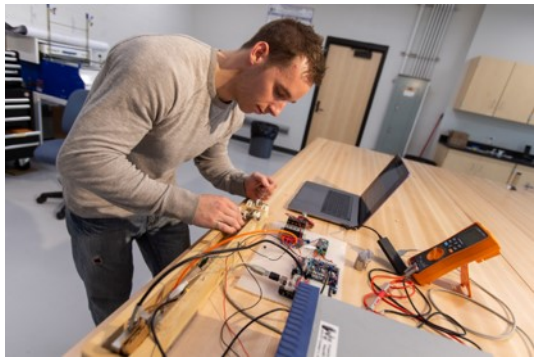
Mechatronics

Research Focus:

- Development of control methods and haptic feedback to the clinician for **surgical robotic systems**.
- Design of **actuators** & **wearable devices** for rehabilitation & tremor suppression.
- Development of **signal processing** and **machine learning methods** to use EEG and EMG feedback for control of assistive devices.
- Development of systems combining **virtual** or **augmented reality** and **haptic feedback** to train clinicians in surgical procedures such as minimally invasive cardiac valve repair, placement of cochlear or joint implants, and neurological ablation.







Faculty Members: M. Naish, R. Patel, A. L. Trejos

School of Biomedical Engineering – Research Facilities and Partnerships

As a School encompassing four faculties, BME promotes collaborative, multi-disciplinary research. BME thrives on the driven students and faculty at various research facilities in London.

Labs

- Canadian Surgical Technologies & Advanced Robotics (CSTAR)
- Centre for Functional and Metabolic Mapping (CFMM)
- Hand and Upper Limb Centre (HULC)
- Wolf Orthopaedic Biomechanics Laboratory (WOBL)

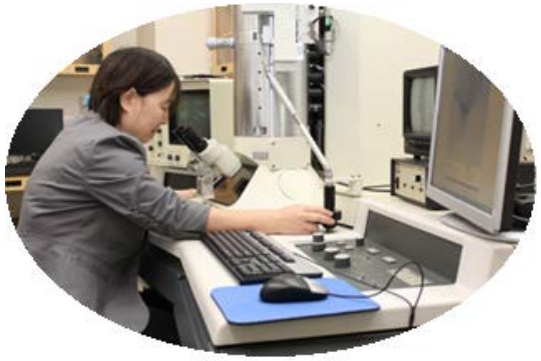
Institutes and Centres

- Biomedical Imaging Research Centre
- Bone and Joint Institute
- The Brain and Mind Institute
- BrainSCAN
- Centre for Advanced Materials and Biomaterials Research
- Lawson Imaging
- London Regional Cancer Program (LRCP)
- Robarts Imaging

Other Engineering Research Facilities

Labs

- Insurance Research Lab for Better Homes
- Robotics and Real-Time Systems
- Visualization and Virtual Reality
- Distributed Intelligent Systems
- Mobile Robotics and Computer Vision
- Control, Instrumentation and Electrical Systems
- Sensing and Mechatronic Systems
- Geometric Modeling and Virtual Sculpting
- Fuel Cell
- Nanomaterials and Clean Energy
- Access to Nanofab and Surface Science Western



Research Centres

- Institute for Catastrophic Loss Reduction (ICLR)
- The Particle Technology Research Centre (PTRC)
- Centre for Environment and Sustainability
- Geotechnical Research Centre

Questions?

Email: weresgrd@uwo.ca

Western

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