ANNUAL REPORT

July 1, 2012 to June 30, 2013

Department of Mechanical and Materials Engineering

Faculty of Engineering

Western University

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MESSAGE FROM THE DEPARTMENT CHAIR

Welcome to Western's Department of Mechanical and Materials Engineering! As you browse this report, you'll discover a vibrant Department which offers strong academic, research and professional engineering programs. Our students are provided with an education that is solidly based in the fundamentals, infused with creativity and innovation, and geared to instill a strong ethical responsibility commensurate with the engineering profession. They are well prepared to take on leadership roles in industry and government when they leave our programs.

The department had 227 full time and 37 part time undergraduate students (years 2, 3 and 4) and 98 graduate students. We awarded 61 BESc degrees, 10 MEng degrees, 18 MSc degrees and 13 PhD degrees this year. We think that we are the right size, where we are small enough to offer personal attention to our students and large enough to have broad, state-of-the-art technical expertise. While we are pleased with the state of the department, we are continually working to improve our undergraduate and graduate programs. Our numerous, high quality graduates are sought after by industrial employers from across the country, whilst many others continue on to graduate, medical, dental, business and law school, all taking with them core skills in engineering design. Indeed, every year, our senior undergraduates work on “real world” design projects sponsored by a variety of companies. We encourage them to participate in collegiate design competitions including the Formula SAE race car, the SAE Baja car, the solar car, the concrete toboggan, the SAE Aero remote-controlled aircraft and others.

In the past year, we have reviewed several aspects of our undergraduate curriculum and have continued to strengthen the experiential part of the program. We have restructured courses dealing with the fundamentals of electrical engineering in order to expose students to the use of sensors, actuators and controls, which are becoming essential elements of modern intelligent mechanical systems. Obligatory course in control theory will start next year. Our laboratories are among the best in the country according to external reviewers. This year we have secured the longest possible accreditation of our program by the Canadian Engineering Accreditation Board and have successfully passed a review by the Institutional Quality Assurance Process, a process instituted by the Province of Ontario. We have re-structured our innovative PEME (Practical Elements of Mechanical Engineering) program offered jointly with the Fanshawe College so that students can acquire very practical skill by taking summer courses. We have expanded in the scope of our graduate professional programs in order to address society's needs. Our program in Heating, Ventilation and Air Conditioning (HVAC) addresses the current preoccupation with energy and its efficient use. The program in Engineering and Medicine addresses the needs of our aging society and the opportunities associated with maintaining healthy life styles, while the program in Composite Materials focuses on the automotive as well as biomedical industries both of which require improved and lighter materials. We are in the midst of preparations for the review of our graduate programs by the Institutional Quality Assurance Process.

Our students have the opportunity to participate in a variety of international experiences. We have an ongoing exchange program with the National University of Singapore and the University of Hong Kong. We have an exchange program with the University of British Columbia for students who want to experience other parts of Canada. This year we hosted 14 students from other countries, whilst 29 of our own students went into various Internships.

Our department has several active student societies including the American Society of Mechanical Engineers (ASME), the Society of Automotive Engineering (SAE), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the Canadian Society for Mechanical Engineering (CSME). These student societies have regular meetings, field trips to companies who hire our students and they participate in regional competitions and meetings.

Most of our faculty members are registered Professional Engineers and they come from all over the world. Many are highly recognized in their field and have earned numerous honors and awards from different engineering societies. With annual externally funded research expenditures exceeding $2.5 million, research support is derived from major Federal research funding agencies, such as the Natural Sciences and Engineering Research Council, the Province of Ontario and industry. The department has several large research laboratories in the areas of thermofluids, materials, biomechanics, dynamics, computational mechanics and mechatronics, among others. The major research areas include: (i) Heat transfer, (ii) Fluid mechanics, (iii) Composite materials, (iv) Biomechanics, (v) Micro-electro-mechanical systems (MEMS), (vi) Mechatronics, (vii) Computational mechanics and (viii) Design. As you look through our web site, you'll find information on our research programs and the faculty who work in these areas.

We look forward to our continued success in the years to come and we warmly welcome your involvement in ensuring a strong future for Mechanical and Materials Engineering at Western.

J.M.Floryan
Professor and Chair

ADMINISTRATION

Chair

J.M. Floryan, Ph.D., P.Eng.
Professor

519-661-2111, Ext: 88330
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Email: mfloryan@eng.uwo.ca

Associate Chair, Graduate Research Programs

K. Siddiqui, Ph.D., P.Eng
Associate Professor

519-661-2111, Ext: 88234
Office: SEB 3078
ksiddiqui@eng.uwo.ca

Graduate Research Programs Committee 2012-2013

A.G. Straatman
S. Asokanthan
R. Klassen, Associate Chair, Professional Programs
K. Siddiqui, Associate Chair, Research Programs

Associate Chair, Graduate Professional Programs

R. Klassen, Ph.D., P.Eng.
Associate Professor

519-661-2111, Ext: 88323
Office: SEB 3075
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Graduate Professional Programs Committee 2012-2013

E. Savory
T. Kuboki
L. Jiang (until December 31, 2012)
K. Siddiqui, Associate Chair, Research Programs
R. Klassen, Associate Chair, Professional Programs

Associate Chair, Undergraduate Affairs

J.T. Wood, Ph.D., P.Eng.
Associate Professor

519-661-3482
Office: SEB 3061
Email: jwood@eng.uwo.ca

Undergraduate Curriculum Committee 2012-2013

R.O. Buchal
P. Kurowski
S. Salisbury
O.R. Tutunea-Fatan
J. Wood, Associate Chair, Undergraduate

AWARDS AND RECOGNITION

J.M. Floryan

President, 25th Canadian Congress of Applied Mechanics, London, 2015
President, 24th International Congress of Theoretical and Applied Mechanics,Montreal, 2016

J.A. Johnson

Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering 2012-2103

R. Klassen

Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering 2012-2103

S. Salisbury

Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering 2012-2103

K. Siddiqui

Received “Best Paper Award” at the Canadian Congress of Applied Mechanics (CANCAM) held in Saskatoon, June 2013.

A. Straatman

President, CFD Society of Canada, 2012-2014

X. Sun

Renewed as a holder of Canada Research Chair (Tier 2) from October 1, 2012 to September 23, 2017

O.R. Tutunea-Fatan

The University Students Council 2011-2012 Teaching Honor Roll (awarded in 2013)

J. Yang

Faculty Scholar 2102-2014

FACULTY MEMBERS AND ADMINISTRATIVE STAFF

1. FULL-TIME FACULTY MEMBERS

Asokanthan, S.F., Professor, Ph.D. Office: SEB 2057A
519-661-2111, x 88907 sasokanthan@eng.uwo.ca

Research Interests: Dynamics and Control; Inertial Sensing and Applications; Nonlinear and Stochastic Mechanics; Rotating Flexible Multi-body Systems

Buchal, R.O., Associate Prof, Ph.D., P.Eng. Office: SEB 2069C
519-661-2111, x 88454 rbuchal@eng.uwo.ca

Research Interests: Design Methods and Tools; Design Education; Instructional Technology; Manufacturing Inspection Planning

Dryden, J.R., Professor, Ph.D., P.Eng., Office: SEB 3057
519-661-2111, x 88307 jdryden@eng.uwo.ca

Research Interests: Solid Mechanics; Elasticity; Heat Conduction

Dunning, C.E., Associate Prof, Ph.D., P.Eng. Office: SEB 2077
519-661-2111, x 88306 cdunning@eng.uwo.ca

Research Interests: Human Orthopaedic Biomechanics; Joint Replacement (Implant) Design; Joint Kinematics; Impact Loading and Analysis

Ferreira, L., Assistant Prof, Ph.D., P.Eng. Office: SEB 3024
519-661-2111, x 86124 lferreira@uwo.ca

Research Interests: Medical Mechatronics; Implantable Transducer Design; Biomechanics of Major Joints Computer-Aided Systems for Orthopaedic Surgery

Floryan, J.M., Professor, Ph.D., P.Eng. Office: SEB 2051
519-661-2111, x 88330 mfloryan@eng.uwo.ca

Research Interests: Fluid Mechanics; Hydrodynamic Stability; Flow Control; Numerical Algorithms; Moving Boundary Problems; Immersed Boundary Conditions Method

Jenkyn, T.R., Associate Prof, Ph.D., P.Eng. Office: SEB 2075
519-661-2111, x 88339 tjenkyn@eng.uwo.ca

Research Interests: Orthopaedic Biomechanics; Advanced Medical Imaging; Musculoskeletal Computational Modeling; Injury Causation Biomechanics; Sport Science

Jiang, L.Y., Associate Prof., Ph.D., P.Eng. Office: SEB 3076
519-661-2111, x 80422 lyjiang@eng.uwo.ca

Research Interests: Nanostructured Materials; Nanomechanics; Piezoelectric Materials; Thin Film Materials; Fracture and Failure Analysis

Johnson, J., Professor, Ph.D., P.Eng. Office: SEB 2076
519-661-2111, x 88255 jajohnso@eng.uwo.ca

Research Interests - Orthopaedic Biomechanics; Implant Design and Analysis; Joint Motion and Load Transfer

Khayat, R.E., Professor, Ph.D., P.Eng. Office: SEB 3086
519-661-2111, x 88253 rkhayat@eng.uwo.ca

Research Interests: Theoretical Fluid Dynamics; Free Surface and Interfacial Flows; Hydrodynamic Stability; Micro-Convective Heat Transfer; Newtonian and Complex Fluids

Klassen, R., Associate Prof, Ph.D., P.Eng. Office: SEB 3075
519-661-2111, x 88323 rklassen@eng.uwo.ca

Research Interests - Micro-Mechanical Properties of Materials; Time-Dependent Deformation of Materials; Microstructure /Mechanical Property Relationships

Knopf, G. K., Professor, Ph.D., P.Eng. Office: SEB 3087
519- 661-2111, x 88452 gknopf@eng.uwo.ca

Research Interests: Engineering Design; Geometric Modeling; Laser Micro-Fabrication; Optical Devices and Systems; Bioelectronics Biosensors

Kuboki, T., Assistant Prof, Ph.D. Office: CMLP 1306
519- 661-2111, x 88519 tkuboki@uwo.ca

Research Interests: Polymer Composites; Biocomposites, Nanocomposites; Polymer Blends; Bioplastics; Natural Fiber; Processing of Polymers and Composities; Plastic Foaming; Mechanical Properties of Polymers and Composites

Kurowski, P., Assistant Prof, Ph.D., P.Eng. Office: SEB 3077
519- 661-2111, x 80125 pkurowski@eng.uwo.ca

Teaching: Product Design, Finite Element Analysis, Mechanical Vibrations, Kinematics and Dynamics

Research Interests: Teaching Methods in Design and Design Analysis, Engineering Curriculum Development

Naish, M.D., Associate Prof, Ph.D. Office: SEB 2055
519-661-2111, x 88294 naish@eng.uwo.ca

Research Interests: Mechatronic Systems; Computer-Assisted Surgery and Therapy; Surgical Robotics; Sensing Systems; Surgical Training; Medical Devices; Robotics

Salisbury, S.P., Assistant Prof., Ph.D., P.Eng. Office: SEB 2053A
519-661-2111, x 8074 ssalisbury@eng.uwo.ca

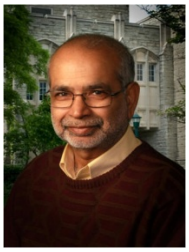
Research Interests: Piezoelectric Actuators; Real-Time Control; Dynamic Modelling and Analysis; Mechatronic System Integration

Savory, E., Associate Prof, Ph.D., P.Eng, C.Eng Office: 3085
519-661-2111, x 88256 esavory@eng.uwo.ca

Research Interests: Experimental Fluid Dynamics; Wind Engineering; Environmental Flows; Biological Fluid Mechanics

Siddiqui, K., Associate Prof, Ph.D., P.Eng. Office: SEB 3078
519-661-2111, x 88234 ksiddiqui@eng.uwo.ca

Research Interests: Experimental Fluid Mechanics; Turbulence; Interfacial Fluid Dynamics and Heat Transfer; Alternative Energy Systems; Energy Conversion



Singh, A.V., Professor, Ph.D., P.Eng. Office: SEB 2059A
519-661-2111, x 88321 avsingh@eng.uwo.ca

Research Interests: – Computational Methods; Vibrations of Plates and Shells; Mechanics of Composite Materials; MEM and Nano Structures

Straatman, A.G., Professor, Ph.D. P.Eng. Office: SEB 2069B
519-661-2111, x 88249 astraatman@eng.uwo.ca

Research Interests: Computational Fluid Dynamics; Porous Materials; Convective Heat Transfer; Turbulence

Sun, X.A. (Andy), Professor, Ph.D. Office: SEB 3059
519-661-2111, x 87759 xsun@eng.uwo.ca

Research Interests: Nanotechnology; Nanomaterials; Clean Energy Fuel Cells; Lithium Ion Batteries; Energetic Materials

Tutunea-Fatan, O.R., Assistant Prof, Ph.D Office: SEB 2063A
519-661-2111, x 88289 rtutunea@eng.uwo.ca

Research Interests: Multi-Axis CNC Machining; Computer-Aided Design and Manufacturing; Intelligent Machining Systems; Numerical Methods

Wood, J.T., Associate Prof, Ph.D., P.Eng. Office: SEB 3061
519-661-3482 jwood@eng.uwo.ca

Research Interests: Structure – Property Relationships; Lightweight Structural Materials for Automotive Applications; Magnesium Die-Casting; Composite Materials

Yang, J., Associate Prof, Ph.D., P.Eng. Office: SEB 3089
519-661-2111, x 80158 jyang@eng.uwo.ca

Research Interests: Nanofabrication; Atomic Force Microscopy (AFM); MEMS/NEMS; BioMEMS; Lab-on-a-chip; Microfluidics; Nanomaterials; Polymers; Biomedical Devices; Biophysics

Zhang, C., Professor, Ph.D., P.Eng. Office: SEB 2065
519-661-2111, x 88345 czhang@eng.uwo.ca

Research Interests - Computational Fluid Dynamics; Gas-Solid Two-Phase Flows; Vapor-Liquid Two-Phase Flows; Combustions and Emission Controls

2. PROFESSOR EMERITI

D.M. Shinozaki, Professor, D.Phil (Oxon)-Materials
J.D. Tarasuk, Professor; P. Eng.; Ph.D.-Mechanical

3. ADJUNCT ACADEMIC PROFESSORS

A Barari, Ph.D
Faculty of Engineering and Applied Science
UOIT
905-721-8666, x 2321
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Automotive Body and Structural Design and Analyses, Geometric Inspection and Coordinate Metrology, Tolerance Analyses, Computer-Aided Design, DFM

E. Bordatchev, Ph.D., Dr.Sc.(Eng)
National Research Council- IMTI
519-430-7107
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High-precision microfabrication; dynamics, monitoring, diagnostics, control and optimization of micromachining processes; micro molds/dies; micromechatronics; MEMS/MOEMS; micromechanisms; microsensors; micromanipulations.

R. Canas, Ph.D.
National Research Council-IMTI
519-430-7102
Email: Roberto.canas@nrc.gc.ca

Mathematics and physics modeling. Finites element, Computational Fluid Dynamics, Particle modeling, High performance computing and high performance graphic. Haptics and Virtual Environment. Non Destructive Testing. Application for Manufacturing, Automotive, Aerospace and Nuclear Energy.

H.Y. Feng, Ph.D.
Associate Professor, Dept of Mechanical Engineering
The University of British Columbia
6250 Applied Science Lane, Vancouver, B.C. V6T 1Z4
604-822-1366
Email: feng@mech.ubc.ca

Precision CNC Machining; Computer-Aided Design and Manufacturing; Precision Geometric Inspection.

R. Gurka, Ph.D.
Department of Chemical Engineering
Ben-Gurion University of the Negev
Beer Sheva, 84105, Israel
Email: gurka@bgu.ac.il

Turbulent and complex flows; Transport phenomena in biological flows; Experimental fluid dynamics.

F. Henning, Ph.D.
Fraunhofer Institute for
Chemical Technology, ICT,
Germany
490721-4640-420
Email: frank.henning@ict.fraunhofer.de

Composite materials, in-line compounding of long-fibre reinforced polymers, injection moulding,design and construction of composite parts.

N. Kaloni, M. Tech.,Ph.D.
Professor Emeritus, University of Windsor
519-253-3000, ext. 3024
E-mail: Kaloni@uwindsor.ca, Pkaloni@uwo.ca

Mathematical Modeling of Physical Problems in Fluid Mechanics; Non-Newtonian Fluids; Viscoelastic Fluids; Magnetic Fluids; Flow and Heat Transfer in Porous Media; Linear and Non-linear Stability of Convection Problems.

R. Martinuzzi, Ph.D., P.Eng.
Dept. of Mechanical & Manufacturing Engineering
University of Calgary, Calgary, Alberta
403-220-6627
Email: rmartuni@ucalgary.ca

Turbulence research; heat transfer in external, cross-flow heat exchanges and internal flows; three-dimensional anisotropic flow fields.

S. Nikumb, Ph.D.
National Research Council-IMTI
519-430-7058
Email: suwas.nikumb@nrc.gc.ca

Laser micro-processing of materials, high power laser development, photonic band gap materials, porous semiconductors, machine & process dynamics, micro-devices & sensor fabrication, micro-electro-mechanical-systems (MEMS), diode laser joining of materials and multi-kilowatt carbon di-oxide lasers.

M. Sadayappany, Ph.D.
CANMET - Materials Technology Laboratory
Natural Resources Canada, McMaster Innovation Park
289-922-8567
Email: Ksadayap@nrcan.gc.ca

Permanent mold casting of non-ferrous metals, development of lead-free copper alloys for plumbing applications, alloy development and solidification processing of light metals including aluminum and magnesium.

L. Wang, P.Eng., Ph.D.
Email: lwang35@uwo.ca

Distributed machining process planning; Adaptive assembly process planning; Web-based real-time monitoring and control of distributed machines; Function block-based integration of planning, scheduling, and execution monitoring.

L. Xue, Ph.D.
Group Leader, Material Addition Processes
National Research Council-IMTI
519-430-7059
Email: Lijue.Xue@nrc-cnrc.gc.ca

Development of laser and other materials processing technologies, new materials, metallurgical characterization and evaluation of material's properties and responses (including corrosion, wear, tensile, compression, fatigue, etc.).

4. VISITING PROFESSORS

Dr. Gideon Avigad, Ort Baude College of Engineering, Israel
Dr. Xiaobing Cai, Beijing Institute of Technology, P.R. China
Dr. Hong Chen: Chongqing University, P.R. China
Dr. Alberto Garcia Pinar, Universidad Politecnica de Cartagena, Spain
Dr. Ayumu Inasawa, Tokyo Metropolitan University, Tokyo, Japan
Dr. Erella Matalon-Eisenstadt, Ort Braude College of Engineering, Israel
Dr. WenPing Mou, Chengdu Aircraft Industrial Group Co.Ltd., P.R. China
Dr. Botao Peng: Trojan UV Technologies, London, Ontario
Dr. Eva Potyra, Fraunhofer Institute for Chemical Technology, Germany
Dr. Tobias Potyra, Fraunhofer Institute for Chemical Technology, German
Dr. Xiaolong Wang, The Hong Kong Polytechnic University, Hong Kong
Dr. Abraham Weiss, Ort Baude College of Engineering, Israel
Dr. Lin Wang: Beijing Institute of Technology, P.R. China

5. ADMINISTRATIVE SUPPORT STAFF

Chris Seres
Administrative Assistant
Telephone: 519-661-2136
Fax: 519-661-3020 Email: cseres@.uwo.ca

Joanna Blom
Graduate Coordinator
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Claire Naudi
Coordinator, Undergraduate and MEng Programs
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Fax: 519-661-3020 Email: cnaudi@uwo.ca

6. TECHNICAL SUPPORT STAFF

Walid Altahan
Laboratory Manager
Spencer Engineering Building, Room 1063
Telephone: 519-661-2111 Ext: 88293
Email: waltahan@eng.uwo.ca

Dave Lunn
Laboratory Supervisor
Spencer Engineering Building, Room 1066
Telephone: 519-661-2111 Ext: 81516
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Adam Woodhouse
Laboratory Supervisor
Spencer Engineering Building, Room 1065
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UNDERGRADUATE EDUCATION

The Department of Mechanical and Materials Engineering offers an accredited program in Mechanical Engineering. In preparation for a career in Mechanical Engineering, the program at Western endeavours to balance the theory and applications necessary for the spectrum of work situations. The first year courses are common with all other disciplines in Engineering. The second and third year courses focus on the fundamental areas of Mechanical Engineering. In the fourth year, students are given an opportunity to select electives in areas of interest or specialization. The program focuses on a broadly based Mechanical & Materials Engineering education that stresses: fundamental engineering concepts, contemporary design practices, development of interpersonal skills, and interaction with engineering practitioners.

1. MECHANICAL ENGINEERING PROGRAM

Second Year Program
Applied Mathematics 2413, ES 2211F/G, MME 2202A/B, MME 2204A/B, MME 2213A/B, MME 2259A/B, MME 2260A/B, MME 2273A/B, MME 2285A/B, Statistical Sciences 2143A/B, 0.5 non-technical elective*. *Selection of the non-technical elective must be approved by the Department Counselor to satisfy the CEAB requirements of subject matter that deals with central issues, methodologies, and thought processes of the humanities and social sciences. An approved list can be found on the Engineering website.

Third Year Program
Applied Mathematics 3413A/B, ECE 3373A/B, ECE 3374A/B MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B.

Fourth Year Program
There are four options: Mechanical Engineering Option; Mechanical Engineering and Law Option; Mechanical and Medicine Option; Mechanical Engineering and Business Option

Mechanical Engineering Option

Business Administration 2299E, ES 4498F/G, MME 4499. Six of the following technical electives: MME 4401Y, MME 4414A/B, MME 4422A/B, MME 4423A/B, MME 4424A/B, MME 4425A/B, MME 4427A/B, MME 4428A/B, MME 4429A/B, MME 4443A/B, MME 4445A/B, MME 4446A/B, MME 4450A/B, MME 4452A/B, MME 4453A/B, MME 4459A/B, MME 4460A/B, MME 4464A/B, MME 4469A/B, MME 4473A/B, MME 4474A/B, MME 4475A/B, MME 4479A/B, MME 4480A/B, MME 4481A/B, MME 4482A/B, MME 4483A/B, MME 4485A/B, MME 4486A/B, MME 4487A/B, MME 4491A/B, MME 4492A/B. Students may elect to substitute technical electives from other engineering disciplines or from the Faculty of Science, provided they have the required prerequisites, and provided at least half of their technical electives are chosen from the above list. A maximum of two 0.5 courses may be taken from the Faculty of Science and used towards the BESc degree. All courses outside of the MME list must be approved by the Department of Mechanical and Materials

Mechanical Engineering and Law Option

Admission
Before entering the combined BESc/JD degree program, students must have completed the first three years of the Mechanical Engineering program at Western (or equivalent). In addition to applying for the combined degree program through the Office of the Associate Dean - Academic of the Faculty of Engineering, students must also make a separate application to the Faculty of Law for admission into the JD program by the published deadline, May 1. In the application to the Law School, the applicant must indicate that he or she is applying to the combined BESc/JD program.

Admission Criteria
To be eligible for the combined degree program, students must have completed all the requirements of the first year curriculum in the Faculty of Engineering, and the second and third year program, Option B, in the Department of Mechanical Engineering with either a minimum cumulative weighted average (CWA) of 80% or stand in the top 10% of the class. In addition, the applicant must meet the minimum LSAT requirement established by the Law School Admission Committee for all combined degree programs. Entrance into the combined degree program is competitive and limited.

Progression Standards
Once admitted to the combined program, students are required to maintain a minimum year weighted average of 75% in their Engineering curriculum courses and a B average in their Law courses.

Failure to Meet Progression Standards
A student who fails to meet the combined program progression standards in any year will be required to withdraw from the combined program. However, a student who has met the progression standards of either the Engineering or LLB program, will be allowed to proceed to the next year of that program. If the progression standards of both individual programs have been satisfied, the student may continue in either program and may petition the Faculty whose program was not selected for permission to complete that program at a later date. A student who is required to withdraw from the combined program and wishes to pursue either or both of the individual programs, must complete all the degree requirements of the individual program or programs in order to graduate from that program or those programs.

First Year Program
Common first year of Engineering.

Second Year Program
Applied Mathematics 2413, ES 2211F/G, MME 2202A/B, MME 2204A/B, MME 2213A/B, MME 2259A/B, MME 2260A/B, MME 2273A/B, MME 2285A/B, Statistical Sciences 2143A/B, 0.5 non-technical elective*. *Selection of the non-technical elective must be approved by the Department Counsellor to satisfy the CEAB requirements of subject matter that deals with central issues, methodologies, and thought processes of the humanities and social sciences. An approved list can be found on the Engineering website.

Third Year Program
Applied Mathematics 3413A/B, ECE 3373A/B, ECE 3374A/B MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B

Fourth Year Program
First year Law curriculum. No courses outside Law may be taken during this year.

Fifth and Sixth Year Programs
MME 4450A/B, MME 4425A/B
MME 4499
In years five and six students must complete the following requirements for the JD:
1. The two compulsory upper-year Law courses
2. At least three Law core-group courses
3. Additional Law courses totalling at least 25 credit hours. One Law course must have an essay requirement of at least two credit hours.
Requirements 2 and 3 must include one of the courses listed below under “Economics” and one listed under “Impact of Technology on Society.”
Notes: Fulfillment of the Faculty of Engineering requirement of courses that expose students to the impact of technology on society, ethical issues, and economics must be taken as follows:
• Economics: One of Law 5220 Income Taxation, Law 5555 Corporate Finance, or an approved Law Selected Topics course.
• Ethical Issues: Law 5130 “Legal Ethics & Professionalism” – [part of the first year curriculum].
• Impact of Technology on Society: One of: Law 5615 “Biotechnology Law”, Law 5605 “Advanced Issues in Technology Law”, Law 5350 “Media Law”, Law 5600 “Advanced Intellectual Property”, Law 5620 “Information Law”, Law 5625 “Intellectual Property”, Law 5630 “International Protection of Intellectual Property”, Law 5610“Advanced Patent Law”, or an approved Law Selected Topics Course.

In addition, there may be a Selected Topics course offered which may be approved on an individual basis.
• Economics: Law 5220 “Income Taxation”.

Exchange Programs
Students enrolled in the combined program are not eligible for an exchange program with the Faculty of Engineering; however, they may be eligible for an exchange through the Faculty of Law in Year Five or Six. This will require advanced planning with both faculties.

Mechanical Engineering and Medicine Option

Admission
Before entering the concurrent BESc/MD degree program, students must have completed the first three years of the Mechanical Engineering program at Western, Option C (Mechanical Engineering and Medicine). In addition to applying for the concurrent degree program through the Office of the Associate Dean - Academic of the Faculty of Engineering, students must also make a separate application for admission into the MD program. As a part of the application process, students must write a letter to the Schulich School of Medicine & Dentistry (Admission Office) indicating their intent to proceed into the concurrent BESc/MD program.

Admission Criteria
To be eligible for the concurrent degree program, students must have completed all the requirements of the first year curriculum in the Faculty of Engineering with a minimum year weighted average (YWA) of 80%, and the second and third year program of Option C (Mechanical Engineering and Medicine), in the Department of Mechanical and Materials Engineering, with a minimum year weighted average (YWA) of 80% in each year. In addition, the applicant must meet the minimum performance standards in the MCAT and GPA, determined by the Schulich School of Medicine & Dentistry, and must be invited and attend a personal interview with the Schulich School of Medicine & Dentistry. A confidential assessment form, proficiency in English and Basic Life Support Training is also required. Entrance into the concurrent degree program is competitive and limited.

Admission Procedures
A student interested in the concurrent BESc/MD program will apply during the February registration period of the first common year of the Engineering program for admission to the Mechanical Engineering program, Option C (Mechanical Engineering and Medicine). The student must write the MCAT before the third year of the Mechanical Engineering and Medicine program, for the following year's admission into the MD program. Students must apply to the MD program by the deadline established (usually October) by the Ontario Medical School Application Service (OMSAS) during the third year of the Mechanical Engineering and Medicine program.
Admission to the BESc program does not guarantee admission to the MD program. Note: This program is only open to Canadian citizens or permanent residents.

Progression Requirements
A student enrolled in the concurrent BESc/MD degree program must satisfy the following progression requirements:
Year 2: a minimum YWA of 80% in courses taken as a part of Option C (Mechanical Engineering and Medicine)
Year 3: a minimum YWA of 80% in courses taken as a part of Option C (Mechanical Engineering and Medicine)
Year 4: progression requirements of the MD program and successful completion of Engineering courses.
Year 5: progression requirements of the MD program
Year 6: progression requirements of the MD program
Year 7: progression requirements of the MD program and successful completion of Engineering courses.
If the student fails to satisfy the conditions above, he or she will be required to withdraw from the concurrent program and will be required to transfer out of Option C into Option A of the Mechanical Engineering program.

Concurrent Degree Program

First Year Program
Common first year of Engineering.

Second Year Program
Applied Mathematics 2413, MME 2202A/B, MME 2204A/B, MME 2213A/B, MME 2259A/B, MME 2260A/B, MME 2273A/B, MME 2285A/B, Statistical Sciences 2143A/B, ES 2211F/G, Business Administration 2299E.

Third Year Program
Applied Mathematics 3413A/B, ECE 3373A/B, ECE 3374A/B, ES 4498F/G, MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B

Fourth Year Program
MME 4425A/B, MME 4450A/B.
Regular Year 1 of the MD program.

Fifth Year Program
Regular Year 2 of the MD program.

Sixth Year Program
Regular Year 3 of the MD program.

Seventh Year Program
Regular Year 4 of the MD program less the Advanced Communication Skills course.
MME 499 (will count as an "elective" credit in the fourth year of the MD program).

Mechanical Engineering and Business Option

Admission Requirements
Normally, students apply to the HBA program during their second year in Engineering by the published deadline. Application for the combined program is made during the first year in the HBA program. Students applying to the Ivey Business School's Academic Excellence Opportunity (AEO) are also eligible to be considered for the combined program. Admission to the program is competitive and limited. Upon completion of the program students will receive both an HBA and a BESc degree.

To be eligible for the combined program, all students, including those admitted via the AEO route, must have completed all the requirements of the first year curriculum in the Faculty of Engineering and the second year program in the Department of Mechanical and Materials Engineering. Students must obtain a weighted average (YWA) of 78% in each year. During the second year of the program students are required to complete Business Administration 2257 with a minimum grade of 70%. Demonstrated participation in extra curricular and/or community activities, leadership and work experience are also admission criteria.

Progression Standards
Students in this combined program must meet the following progression standards: Students enrolled in first year HBA (Year Three) must attain at least 78%.

In Years Four and Five, students must attain a minimum weighted average of 75% in their 4000 level HBA courses and a 75% average in their Engineering courses.

Failure to Meet Progression Standards
A student who fails to meet the progression standards in any year must withdraw from the combined program. However, a student who has met the progression standards of either the HBA or BESc program will be allowed to proceed to the next year of that program. If the progression standards of both individual programs have been satisfied, the student may continue in either program and may petition the School or Faculty whose program was not selected for permission to complete that program at a later date. A student who is required to withdraw from the combined program and wishes to pursue either or both of the individual programs, must complete all the degree requirements of the individual program or programs in order to graduate from that/those program(s).

First Year Program
Regular first year curriculum in the Engineering program.

Second Year Program
Applied Mathematics 2413, MME 2202A/B, MME 2204A/B, MME 2213A/B, MME 2259A/B, MME 2260A/B, MME 2273A/B, MME 2285A/B, Statistical Sciences 2143A/B, Business Administration 2257.

Third Year Program
Business Administration 3300K, 3301K, 3302K, 3303K, 3304k, 3307K, 3311K, 3316K, 3321K, 3322K, 3323K.

Fourth Year Program
Applied Mathematics 3413A/B, MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B, ECE 3373A/B, ECE 3374A/B Applied Project Requirement: At least one of Business Administration 4430 (1.0 course) or Business Administration 4410 (1.0 course)

Fifth Year Program
MME 4499, MME 4492A/B, ES 4498F/G
Two 0.5 technical electives
3.0 Business Administration courses: 0.5 course: International Perspective Requirement: Business Administration 4505A/B, 0.5 course: Corporations and Society Perspective Requirement: at least one 0.5 course from Business Administration 4521A/B, 4522A/B, 4523A/B or other business elective as determined and approved by the HBA Program Director to satisfy this requirement. 2.0 elective courses chosen from 4000 level Business courses.

Exchange Programs
Students enrolled in the combined program are not eligible for an exchange program with the Faculty of Engineering; however, they may be eligible for an exchange through the Richard Ivey School of Business in Year Five. This will require advanced planning and approval of both faculties.

2. UNDERGRADUATE ENROLLMENT

Full Time

	Year 1	Year 2	Year 3	Year 4	TOTAL
Mechanical	n/a	81	78	68	227

Part Time

	Year 1	Year 2	Year 3	Year 4	TOTAL
Mechanical	n/a	5	30	2	37

3. DEGREES GRANTED

Fall 2012	Spring 2013
2	59

4. UNDERGRADUATE AWARDS

Recipients (Fall 2012) – Students registered in the Department of Mechanical and Materials

ASHRAE Award
Awarded annually to a student in his/her fourth year in the Department of Mechanical and Materials Engineering based on academic achievement and the candidate's mark in Thermodynamics II, continuing educational studies, and career goals in the heating, refrigeration and air conditioning profession. This award is made possible by the generosity of ASHRAE, London Chapter, Canada.

Awarded To: Raed El-Khatib

Andrea Bailey Memorial Award
4th Year MME Awarded to a female student entering fourth year of Mechanical and Materials Engineering who demonstrates financial need, a minimum 75% academic average and involvement in extracurricular activities at the University and in the community. Preference will be given to a student meeting the stated criteria who is in a concurrent degree program. The recipient must not be in receipt of any other award in the Department of Mechanical and Materials Engineering. This award was established by friends and family in memory of Andrea Bailey.

Awarded to: no recipient awarded

Ian Duerden Memorial Award
3rd Year MME Awarded to a full-time undergraduate student in his or her third year of the Mechanical and Materials Engineering program who demonstrates financial need and achieves a minimum 75% academic average. This award was established through Foundation Western in memory of Ian Duerden, a former Associate Dean of the Faculty of Engineering.

Awarded to: Geoffrey Killing

Lynda Diane Shaw Memorial Award
4th Year MME Awarded to a student entering the fourth year of the Mechanical Engineering program in good standing. This student must have been active in community service activities, student clubs and extra-curricular activities and possess good interpersonal skills. Established by friends, colleagues and family in memory of Lynda Diane Shaw.

Awarded to: Gary Chan

Andrade Family Award in Engineering
Awarded annually to a full-time undergraduate student in 2nd or 3rd year of the Mechanical and Materials Engineering program, based on a minimum 75% average, and demonstrated volunteer and leadership skills through participation in university life.

Awarded to: Doran Avivi and Nathan Curiale

Lynn Fordham Awards in Science and Engineering
Awarded annual to students in Engineering who demonstrate academic excellence and possess leadership qualities.

Awarded to: Aaron Yurkewich

Donald P. Morris Engineering Award
Awarded to a full-time undergraduate student in year 2 or higher of any Engineering program based on academic achievement and involvement in extra-curricular activities that demonstrate leadership skills.

Awarded to: Geoffrey Killing

Craig O'Hagan Memorial Award
Awarded to a full-time undergraduate student in the third year of a program in Mechanical Engineering, Biochemical and Environmental Engineering or Civil and Environmental Engineering based on academic achievements.

Awarded to: Hadley Jenkins-Giffen

Chorley & Bisset Ltd., Consulting Engineers Award
Awarded to: Michael Schmitt

D. Carlton Williams President Entrance Scholarship
Awarded to: Lauren Cuthbertson

DELCAN Corporation Scholarship in Engineering Science
Awarded to: Aaron Yurkewich

Entrepreneurial Spirit Award
Awarded to: Matthew Stokes

E.V. Buchanan Faculty of Engineering Entrance Scholarship
Awarded to**:** Anne McDonald

Four Year Continuing Admission Scholarship Program
Awarded to: Alexander Balsdon; James Crocker; Mitchell Dooreleyers; Ryan Kope, Jordan Rose; Claire-Helene Sauve

Lorraine Ivey Shuttleworth Continuing Awards Program
Awarded to: Doran Avivi

Ontario Professional Engineers Foundation for Education Scholarships
Awarded to: Aaron Yurkewich

Recipients (Spring 2013) Awards of the Graduating Class June 2013 – Students registered in the Department of Mechanical and Materials

The John E.K. Foreman Gold Medal in Mechanical and Materials Engineering

This medal is named in honour of the late Dr. J.E.K. Foreman, the first Professor and Group Chair of Mechanical Engineering in the Faculty of Engineering. It is awarded to the fourth year engineering student in the Mechanical Engineering program with the highest aggregate final marks for the third and fourth years.

Awarded to: Aaron Yurkewich

The ASHRAE Award (1-$500.00 & One Year Membership/Fundamentals Handbook)

Awarded to the fourth-year engineering student in the Department of Mechanical and Materials Engineering, based on the candidate's marks in HVAC I and HVAC II. The student must have a minimum Year Weighted Average of 70

Awarded to: Kurtis Andrew Campbell, Aaron Yurkewich,

The Donald D.C. McGeachy Award for Materials Engineering

Awarded to the fourth-year engineering student in the Department of Mechanical and Materials Engineering, who in the opinion of the Faculty has the highest academic standing in Materials Engineering

Awarded to: Kyle Jordan Capitano

The Canadian Society for Mechanical Engineering Award

Sponsored by the Canadian Society for Mechanical Engineering, this award is given to a fourth-year engineering student in the Department of Mechanical and Materials Engineering, who demonstrated outstanding achievement.

Awarded to: Scott Steven Sinclair

5. DESIGN PROJECTS

Projects at a Glance

Project Title	Student(s)	Faculty Advisor(s)
Agro-robot Team 1	Rebecca Dean; Chris Deloyer; Geoff Killing; Alan Si	R.O. Buchal
Agro-robot Team 2	Katie Rinas; Matthew Roberto; Ruben Vanvaerenberg; James Viana	R.O. Buchal
Agro-robot Team 3	Allen Chee; Janathan Kusins; Anirudha Panditrao	R.O. Buchal
Avalon Renewable Energy Alternatives-Wind and Solar Energy	Brad Coutu; David McColl; Chris Sariyan; Michael Yeung	R.O. Buchal
Avalon Renewable Energy Alternatives-Energy Storage	Nicole Che; Andrew Dittmer; Dean Donovan	R.O. Buchal
Improved Wood Burning Stove*	Robert Costa; Jonathan Graham; Alana Khayat; Luke Psotka	P. Kurowski
ASHRAE HVAC competition Team 1	Jae Sun Jung; Hannah Keating; Dan Larkin; Carlie Scalesse	W. Altahan, R.O. Buchal
ASHRAE HVAC competition Team 2	Raed El-Khatib; Omar Gharib; Ismael Rajeh	W. Altahan, R.O. Buchal
Brain Injury and Craniofacial Fracture Test Chamber	Seung Baik; Ian Fan; David Rozhko; Zhao Wang	L. Ferreira
Hand Assistive Devices	Anthony Benaquista; Alexa Kopacz; Alex Motolko	P. Kurowski; R.O. Buchal
Design of a Novel Wrist Protective Device to Prevent Distal Radius Fractures in the Elderly Population	Gary Chan; Meghan Clynick; Scott Sinclair; Aaron Yurkewich	P. Kurowski
SAE Aero Aircraft Design	Faiz Ali; Jon Fernandes; Paul Lancelot; Richard Zimmer	R.O. Buchal
Wheelchair Anti-tipper	Alexandre Belanger; Evan Reinblatt; Matthew Roddy; Matthew Stokes	L. Ferreira
Wheelchair FreeWheel	Kurtis Campbell; Jesse Gaccione; Aaron Van Maanen; Graham Fonseca	L. Ferreira
Wheel Assemblies for Formula SAE Racing Vehicle	Adam Bezzina; Kyle Capitano	R.O. Buchal
SAE Baja Front Suspension	Phillip Gibson; Kent Mcphail; Dan Park; Joe Upsworth	P. Kurowski
SAE Baja Rear Suspension	J.D. Hartnagle; Bradyn Kelly; Michael Schmitt; Taylor Spurdza	P. Kurowski
Fibreglass Pipeline Installation Method	Harold Mutobola; Cole Peters; David Robertson; Sasha Tiwari	P. Kurowski
Design of a Safe Pipeline River Crossing	Mike Zawalski	

*best project

MME 4401y Presentations

Torsional Vibration Control of a Flexible Shaft System Driven by a Hooke's Joint	Seung Hoon Kevin Baik	S. Asokanthan
Development and Validation of a Virtual Elbow Joint	Jonathan Kusins	L. Ferreira

Model		
Optical Measurement of Tool Holder Profiles for Computer Aided Machining	Alexander Motolko	R. Tutunea-Fatan

6. EXCHANGE PROGRAMS

Incoming Exchange

LastName	FirstName	Home University	Home Country
Andrea	Andrea	National University of Singapore	Singapore
Bengtsson Ranneberg	Emil	Umea University	Sweden
Koh	Jia Kai	Nanyang Technological University	Singapore
Lancelot	Paul	University Francois Rabelais	France
Liu	Ruoxi	National University of Singapore	Singapore
Low	Zhi Wei Kelvin	Nanyang Technological University	Singapore
Patil	Abhishek Narendra	National University of Singapore	Singapore
Tan Qi Sheng	Jason	National University of Singapore	Singapore
Thatte	Suraj	Vishwakarma Institute of Technology	India
Wong	Kah Hwee	Nanyang Technological University	Singapore
Yap	Jeremy	National University of Singapore	Singapore
Yiew	Yu Rong Mindy	Nanyang Technological University	Singapore
Yuan	Shuai-Shuai	Jiangsu University	China
Zheng	Sicheng	National University of Singapore	Singapore

7. INTERNSHIP PROGRAM

The Faculty of Engineering offers an Internship Program for those students interested in gaining practical engineering employment experience in industry. In this program, students spend 12 to 16 consecutive months working in industry between their third and fourth years of the Bachelor of Engineering Science program. Time spent in internship may count as one-year of pre-graduation experience toward the four years experience required for licensing as a Professional Engineer in the Province of Ontario. Any engineering student who is completing third year, has at least a 65% average, is permitted to work in the country in which the job is located and who is in good academic standing may enroll in the program.

The following students from the MME Department completed an Internship in 2012-13.

Student	Company
Abbas, Mohamed	Union Gas Ltd.
Acton, Kevin	Alliance Fabricating Ltd.
Blokker, Peter	Trudell Medical International
Bullock, Graeme (Alex)	Union Gas Ltd.- London Location
Clifford, Joel	Schaeffler Canada Inc. & FAG Aerospace Inc.
Colbran, Clayson	Lincoln Electric Company of Canada
Dobinson, Kyle	Honda Canada Inc.

Fung, Alexander	Formet Industries - Magna International
George, Issi-Rae	Javelin Technologies Inc.
Green, Robert	Chrysler Canada Inc.
Harrison-Steel, Colton	Aerospace and Telecommunications Engineering Support Squadron (ATESS)
Heathcote, Simon	Boundary Layer Wind Tunnel Laboratory
Hudon, Andrew	Magna Closures
Ismail, Tariq	Research In Motion
Johnson, David	Trudell Medical International
Kantor, Erica	Armatec
Lazo Castro, Adalberto	Formet Industries - Magna International
Li, Man (Eugene)	Research In Motion
Litrenta, Anthony	NOVA Chemicals
Lyle, Michelle	Suncor Energy Inc.
Martens, Natalie	Callidus Engineering
Martinuzzi, Veronick	Honda Canada Inc.
Mock, Jeffrey	Multimatic Technical Centre
Nevin, Daniel	Labatt Breweries of Canada
Orth, Richard (Adam)	General Motors of Canada Limited, CAMI Assembly
Poulin, Philippe	General Motors of Canada Limited, CAMI Assembly
Saunders, Adam	Schaeffler Canada Inc. & FAG Aerospace Inc.
Shaule, Thomas (Drew)	Schaeffler Canada Inc. & FAG Aerospace Inc.
Sloan, Lisa	Celestica

8. SUMMER ENGINEERING CO-OP PROGRAM

Student	Company
Al Horani, Khaled	Diyar Consultants
Barnwell, Tyler	CUE Engineering Inc.
Chan, Gary	Kraft Canada Inc.
Chorel, Malcolm	Suncor Energy Inc.
Dean, Rebecca	Formet Industries
Deloyer, Christopher	Salford Farm Machinery Ltd.
Gibson, Phillip	Labatt Breweries of Canada
Graham, Jonathan (Kyle)	Formet Industries
Jung, Jae Sun	Qualtech Seating Systems
Milliken, Nicolas	TPI Enterprises Inc.
Psotka, Luke	Crossey Engineering Ltd.
Rajeh, Ismael	Hendrickson Canada ULC
Rozhko, David	Hendrickson Canada ULC
Schmitt, Michael	Schaeffler Canada Inc. & FAG Aerospace Inc.
Sinclair, Marc	Stackpole International
Stokes, Matthew	KnowRoaming Ltd.

9. PEME PROGRAM

Practical Elements in Mechanical Engineering is a certificate program developed by the MME Department at UWO in collaboration with Fanshawe College of Applied Arts and Technology. The PEME program is comprised of practical courses in machining, welding, metrology, etc. and was designed specifically to give university engineering students exposure to the practical side of their profession.

The PEME program was developed mainly in response to the changing backgrounds of students entering university engineering programs. PEME provides an opportunity for interested students to get exposure to some practical courses outside the traditional Mechanical engineering curriculum. The PEME program is thus a formal avenue whereby students have an opportunity to enrich their practical knowledge of their profession by taking specialized courses offered by experts.

Students in the Mechanical & Materials Engineering program at UWO who have at least a 60 percent yearly weighted average with no failures may apply for PEME following their 2nd or 3rd years of study. Since PEME is offered every year, students can combine PEME with a concurrent degree program, summer Co-op or Industry Internship; there are no limitations!

Our major industrial employers are thrilled with the introduction of PEME in the MME program at UWO. PEME gives our students incredible insight into how things are made and enables our graduates to have an immediate impact in industry.

10. UNDERGRADUATE STORIES

Industry-sponsored undergraduate design projects

Several teams of undergraduate students worked with local companies on industry-sponsored capstone design projects. Two teams worked with Avalon Rare Metals Inc. (Toronto ON) to investigate and evaluate renewable energy alternatives for a new mine site in Northwest Territories. Another team worked with WorleyParsons (Calgary AB) to design a method for installing pipelines using pipe made of composite materials. These projects were supported by the Ontario Centres of Excellence (OCE) Connections program.

High School Outreach

MME offered a very successful Summer Academy course in the summer of 2012. The Summer Academy is a one-week camp offered to high-achieving high school students in grades 9 to 12. The one-week camp is offered twice, to twelve students at a time. The MME camps were fully subscribed, with students attending from all over Ontario.

GRADUATE EDUCATION

The Department offers two types of graduate programs, i.e., research programs leading either to the Master of Engineering Science (M.E.Sc.) degree or to the Doctor of Philosophy degree (Ph.D.) and course-based Professional Degree Programs leading to the degree of Master of Engineering (M.Eng.) All programs are fully accredited by the Ontario Council of Graduate Studies.

1. GRADUATE RESEARCH PROGRAMS

The M.E.Sc. program is structured to assist high achieving students in acquiring specialized knowledge and to train them in research and development techniques. The objective of this program of study is to introduce the student to research and to permit some modest degree of specialization in the chosen field. The requirements for completion of the program are four half courses, through specialist training by the thesis supervisor, by

attendance at research seminars and through preparation and successful Master's thesis defense. Participation, where applicable, as a teaching assistant for the undergraduate courses adds further strength.

The Ph.D. program is structured to assist high achieving students in acquiring specialized, state-of-the-art knowledge and to train them in research and development techniques. The graduates should expect careers in academia as well as in industrial research and development organizations. Graduates are expected to develop the ability to undertake independent research, to prepare papers for publication, and to develop leading edge expertise in one specific sub discipline. Specialized training is undertaken by the professor supervising the research, in addition to other faculty members acting to advise the student. The requirements for completion of the program are a combination of formal course work (4 "half courses"), teaching assistantships, independent research, participation in research seminars, journal papers, and preparation and successful thesis defense.

The M.E.Sc. and Ph.D. programs are offered in the following subject areas:

(1) Thermo-fluids,

(2) Materials and Solid Mechanics,

(3) Automation Technologies and Systems,

(4) Mechanical Engineering.

Thermo-fluids

The *Thermo-fluids Graduate Research Program* offers training in many areas of thermodynamics and fluid mechanics including: **theoretical fluid mechanics of Newtonian and non-Newtonian flows, hydrodynamic stability, Computational Fluid Dynamics (CFD), convective heat transfer, turbulence modeling, microfluidics, energy systems** and **experimental techniques**, in additional to applications in all of the mentioned areas. Students interested in the admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the admission to the Ph.D. program should have completed the M.E.Sc. degree. In exceptional circumstances, students can be transferred directly from the M.E.Sc. into the Ph.D. program without completing the M.E.Sc. program. All students admitted into the graduate research programs are offered full financial support.

Students registered in the Thermo-fluids M.E.Sc. graduate program must complete four graduate-level half courses, and must prepare a research thesis. The program requires approximately two years for completion. The Ph.D. program requires four additional half courses and a research dissertation, and requires approximately four years to complete. Courses available in the Thermo-fluids area are:

- MME 9617 Energy Conversion
- MME 9611 Continuum Mechanics
- MME 9613 Aerodynamics for Engineers
- MME 9614 Applied Computational Fluid Dynamics and Heat Transfer
- MME 9710 Advanced Computational Fluid Dynamics
- MME 9711 Convection Heat Transfer
- MME 9712 Experimental Measurements in Fluid Mechanics
- MME 9713 Hydrodynamic Stability
- MME 9714 Introductory Computational Fluid Dynamics and Heat Transfer
- MME 9715 Mechanism and Theory of Turbulent Flow
- CEE 9639 Viscous and Boundary Layer Theory
- MME 9724 Microfluidics and Lab-on-a-Chip
- MME 9732 Biotransport Phenomena

Students may also select elective courses offered by other research groups from the Department of Mechanical and Materials Engineering, other Departments from the Faculty of Engineering and other Faculties from the University of Western Ontario upon consultation with the advisor and approval of the MME Associate Chair Graduate.

Materials and Solid Mechanics

Materials and Solid Mechanics offers advanced research in experimental and theoretical aspects of traditional materials engineering, with specific emphasis on: **mechanical properties, microstructural characterization, nano-structured materials, materials modeling, microfabrication methods, electroactive materials, MEMS, and mechanics at small scales**. Students interested in the admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the admission to the Ph.D. program should have completed the M.E.Sc. degree. In exceptional circumstances, students can be transferred directly from M.E.Sc. into Ph.D. program without completing the M.E.Sc. program. All students admitted into the graduate research programs are offered full financial support.

Students registered in the Materials and Solid Mechanics graduate program must complete four graduate-level half courses, and must prepare a research thesis. The program requires approximately two years for completion. The Ph.D. program requires four additional half courses and a research dissertation, and requires approximately four years to complete. Courses available in the Materials and Solid Mechanics areas are:

- MME 9611 Continuum Mechanics
- MME 9612 Finite Element Methods
- MME 9616 Composite Materials
- MME 9618 Fracture of Materials
- MME 9619 Fundamentals of MEMS and NEMS
- MME 9620 Nanomaterials and Nanotechnology
- MME 9624 Modelling and Interfacing of sensors and actuators
- MME 9716 Mechanics of Thin Films
- MME 9717 Deformation of Polymers
- MME 9719 Microstructure of Polymers
- MME 9720 Strengthening Methods in Materials
- MME 9721 X-ray Diffraction in Engineering
- MME 9722 Fuel Cell Science and Engineering
- MME 9725 Piezoelectric Materials
- MME 9726 Advanced Nanomaterials

Students may also select elective courses offered by other research groups from the Department of Mechanical and Materials Engineering, other Departments from the Faculty of Engineering and other Faculties from the University of Western Ontario upon consultation with the supervisor and approval of the MME Associate Chair Graduate.

Automation Technologies and Systems.

The *Automation Technologies and Systems Graduate Research Program* offers interested students the opportunity to investigate novel techniques, devices and systems to address challenging problems related to **automation technologies, inertial systems and control, machine vision, sensor development and micromachining**. Students interested in admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the Ph.D. program should have completed the M.E. Sc. degree. In

exceptional circumstances, students can be transferred directly from the M.E.Sc. into the Ph.D. programs without completing the M.E.Sc. degree. All students admitted into the graduate research program are offered full financial support.

Students registered in the M.E.Sc. program must take four half courses and complete a research thesis. This program of study takes approximately two years to complete. Registrants in the Ph.D. program must take an additional four half courses and complete a dissertation based on original research. A typical Ph.D. program will require four years to complete. Graduate Courses available for the Automation Technologies and Systems Program are:

- MME 9610 Applied Measurement and Sensing Systems
- MME 9612 Finite Element Methods
- MME 9619 Fundamentals of MEMS and NEMS
- MME 9622 Advanced Kinematics and Dynamics
- MME 9624 Actuator Principles, Integration and Control (ECE 9509)
- MME 9727 Computer-Aided Design and Manufacturing
- MME 9728 Computer-Aided Geometric Modelling
- MME 9729 Optomechatronic Systems: Techniques and Applications
- MME 9730 Principles and Applications of Neural Networks
- MME 9731 Stochastic Dynamics and Stability of Mechanical Systems

Students may also select elective courses offered by other research groups from the Department of Mechanical and Materials Engineering, other Departments from the Faculty of Engineering and other Faculties from the University of Western Ontario upon consultation with the advisor and approval of the MME Associate Chair Graduate.

Mechanical Engineering

The General *Mechanical Engineering Program* offers students opportunity to follow personalized program within the general area of Mechanical Engineering. Course can be selected according to the needs of the individual program and within research areas of the Department. Three of the available research areas discussed above are complemented by **Biomechanics**, which exposes students with an opportunity for graduate level training in both in the theory and application of mechanical engineering to primarily orthopaedic and cardiovascular medicine. Students interested in the admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the admission to the Ph.D. program should have completed the M.E.Sc. degree. In exceptional circumstances, students can transfer directly from M.E.Sc. into Ph.D. program without completing M.E.Sc. degree. All students admitted into the graduate research program are offered full financial support.

2. PROFESSIONAL DEGREE PROGRAMS

Master of Engineering, Mechanical and Materials

The M.Eng. program is specially structured to assist qualified engineers in the advancement of their professional careers and to provide students with the skills necessary to address key technological challenges. The program may be taken with or without an optional qualified work term component. If enrolled full-time, a student can complete the degree in one year. The M.Eng. program is focused to become an effective tool to address the significant need for education and integration of internationally trained engineers. It provides new Canadians who are trained further in engineering outside Canada, with a venue to update their knowledge in accordance with the needs of the Canadian technology sector. The requirement for completion of the program is ten half courses, or eight half courses and a project. Term start dates are September 1st, January 1st, and May 1st.

The MME MEng program is structured into seven streams of specialization. The MEng student selects one area of specialization and takes either i) ten courses from a list specific to the area or ii) eight courses from the list

along with completing an engineering project (MME 9500) which constitutes two courses. The lists of required courses (each is one term duration) for the seven areas of specialization are described below.

The MEng program in Mechanical Engineering-Thermofluids

The Thermofluids MEng degree stream is comprised of the following courses. The student must take:

A) 4 of the following 6 core courses in Mechanical and Materials Engineering

MME 9610 Applied Measurements & Sensing Systems
MME 9621 Computational Methods in Engineering
MME 9612 Finite Element Methods
MME 9622 Advanced Dynamics and Kinematics
MME 9617 Energy Conversion
MME 9623 Theory and Practice of Plasticity

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective courses (if not enrolling in a MEng Project), or 2 elective courses with the MEng Project

MME 9515 Fluid Machinery
MME 9516 HVAC I
MME 9517 HVAC II
MME 9522 Spacecraft System Design
MME 9523 Flight Dynamics
MME 9611 Continuum Mechanics
MME 9613 Aerodynamics for Engineers
MME 9614 Applied Computational Fluid Mechanics and Heat Transfer
MME 9639 Viscous Layer and Boundary Flow

The MEng program in Mechanical Engineering-Materials and Solid Mechanics

The Materials and Solid Mechanics MEng degree stream is comprised of the following courses. The student must take:

A) 4 of the 6 core courses in Mechanical and Materials Engineering

MME 9610 Applied Measurements & Sensing Systems
MME 9621 Computational Methods in Engineering
MME 9612 Finite Element Methods
MME 9622 Advanced Dynamics and Kinematics
MME 9617 Energy Conversion
MME 9623 Theory and Practice of Plasticity

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective courses (if not enrolling in a MEng Project), or 2 elective courses with the MEng Project

MME 9510 Advanced Vibration Analysis
MME 9514 Corrosion and Wear
MME 9518 Mechanical Properties of Materials
MME 9611 Continuum Mechanics
MME 9616 Composite Materials
MME 9618 Fracture of Materials
MME 9619 Fundamentals of MEMS and NEMS
MME 9620 Nanomaterials and Nanotechnology

The MEng program in Mechanical Engineering

The Mechanical Engineering MEng degree stream is comprised of the following courses. The student must take:

A) 4 of the 6 core courses in Mechanical and Materials Engineering

MME 9610 Applied Measurements & Sensing Systems
MME 9621 Computational Methods in Engineering
MME 9612 Finite Element Methods
MME 9622 Advanced Dynamics and Kinematics
MME 9617 Energy Conversion
MME 9623 Theory and Practice of Plasticity

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective courses (if not enrolling in a MEng Project), or 2 elective courses with the MEng Project

MME 9510 Advanced Vibration Analysis
MME 9511 Biomechanics of the Musculoskeletal System
MME 9512 Computer Integrated Manufacturing
MME 9513 Computer Numerically Controlled (CNC) Machining
MME 9514 Corrosion and Wear
MME 9515 Fluid Machinery
MME 9516 HVAC I
MME 9517 HVAC II
MME 9518 Mechanical Properties of Materials
MME 9519 Production Management of Engineers
MME 9520 Robotics and Manufacturing Automation
MME 9521 Systems and Control
MME 9522 Spacecraft System Design
MME 9523 Flight Dynamics
MME 9611 Continuum Mechanics
MME 9613 Aerodynamics for Engineers
MME 9614 Applied Computational Fluid Mechanics and Heat Transfer
MME 9615 Biomechanics of Human Joint Motion
MME 9616 Composite Materials
MME 9618 Fracture of Materials
MME 9619 Fundamentals of MEMS and NEMS
MME 9620 Nanomaterials and Nanotechnology
MME 9624 Actuator Principles, Integration and Control (ECE 9509)
MME 9639 Viscous Layer and Boundary Flow
MME 9640 Medical Devices

The MEng program in Mechanical Engineering-Automated Technologies and Systems

The Automated Technologies and Systems MEng degree stream is comprised of the following courses. The student must take:

A) 4 of the 6 core courses in Mechanical and Materials Engineering
MME 9610 Applied Measurements & Sensing Systems
MME 9621 Computational Methods in Engineering
MME 9612 Finite Element Methods
MME 9622 Advanced Dynamics and Kinematics
MME 9617 Energy Conversion
MME 9623 Theory and Practice of Plasticity

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective courses (if not enrolling in a MEng Project), or 2 elective courses with the MEng Project

MME 9510 Advanced Vibration Analysis
MME 9512 Computer Integrated Manufacturing
MME 9513 Computer Numerically Controlled (CNC) Machining
MME 9519 Production Management of Engineers
MME 9520 Robotics and Manufacturing Automation
MME 9521 Systems and Control
MME 9624 Actuator Principles, Integration and Control (ECE 9509)

The MEng program in Mechanical Engineering-Heating, Ventilating and Air Conditioning (HVAC) Systems

The HVAC systems MEng degree stream is comprised of the following courses. The student must take:

A) 4 mandatory half courses in Mechanical and Materials Engineering

MME 9516 HVAC I
MME 9517 HVAC II
MME 9641 Thermal Systems Engineering
MME 9642 Building Systems Engineering

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective courses (if not enrolling in a MEng Project), or 2 elective courses with the MEng Project

MME 9515 Fluid Machinery
MME 9610 Applied Measurements & Sensing Systems
MME 9612 Finite Element Methods
MME 9614 Applied Computational Fluid Mechanics and Heat Transfer
MME 9617 Energy Conversion

The MEng program in Mechanical Engineering-Composite Materials

The Composite Materials MEng degree stream is comprised of the following courses. The student must take:

A) 4 of the 6 core half courses in Mechanical and Materials Engineering

MME 9518 Mechanical Properties of Materials*
MME 9612 Finite Element Methods*
MME 9611 Continuum Mechanics
MME 9621 Computational Methods in Engineering
MME 9623 Theory and Practice of Plasticity

B) 2 of the 4 core courses in Professional Engineering

CBE 9185 Risk Assessment and Management in Engineering Systems
CEE 9510 Engineering Planning and Project Management
ECE 9010 Intellectual Property for Engineers
MME 9670 Engineering Communication

C) 4 elective half courses (if not enrolling in a MEng Project), or 2 elective half courses with the MEng Project

CBE 9455 Advanced Polymerization Engineering
MME 9614 Applied Computational Fluid Mechanics and Heat Transfer
MME 9616 Composite Materials (#)
MME 9618 Fracture of Materials
MME 9620 Nanomaterials and Nanotechnology
MME 9643 Composite Processing (#)

*Mandatory core courses
Mandatory technical courses

The MEng program in Mechanical Engineering Option in Engineering in Medicine

The Engineering in Medicine Option of the MME MEng degree stream is comprised of the following courses. The student must take:

A) 2 of the 6 introductory courses on Engineering in Medicine:

MME 9511 Biomechanics of the Musculoskeletal System
MME 9640 Medical Device Design
BME 9502 Engineering Analysis of Physiological Systems
BME 9520 Fundamentals of BioMEMS
BME 9525 Introduction to Biomaterials Engineering

B) 2 core courses in Mechanical and Materials Engineering:

MME 9610 Applied Measurement & Sensing Systems
MME 9622 Advanced Dynamics and Kinematics

C) 4 of the 12 advanced topics courses (or 2 courses plus a MEng. project in related topic):

BME 9509 Introduction to Digital Image Processing
BME 9526 Tissue Engineering
CBE 9160 Transport Processes
ECE 9992 Telerobotics
MME 9612 Finite Element Methods
MME 9615 Biomechanics of Human Joint Motion

MME 9620 Nanomaterials and Nanotechnology
MME 9621 Computational Methods in Engineering
MME 9624 Actuator Principles, Integration & Control
MME 9724 Microfluidics and Lab-on-a-Chip
MME 9728 Computer Aided Geometric Modeling
MME 9729 Optomechatronic Systems

Students who satisfy the course prerequisites, and obtain permission from both the instructor and MME Associate Chair, Graduate MEng Professional, may substitute up to 2 courses in category C with the following:

CBE 9544 Pharmaceuticals Manufacturing Processes
ECE 9200 Software Engineering for Human-Computer Interface Design
ECE 9022 Advanced Image Processing and Analysis
ECE 9023 Random Signals, Adaptive and Kalman Filtering
ECE 9053 Robot Manipulators

D) 2 courses in Professional Engineering (offered in Summer term):

CBE 9185 Risk Assessment & Management in Eng. Systems
ECE 9010 Intellectual Property for Engineers

3. GRADUATE ENROLLMENT

	M.Eng	M.E.Sc.	Ph.D.	Total
Summer 2012	13	27	46	86
Fall 2012	19	31	48	98
Winter 2013	21	29	43	93

4. GRADUATE DEGREES GRANTED

OCTOBER 2012 CONVOCATION – Mechanical and Materials Engineering Program					
Student name	**Degree**	**Completion Date**	**Thesis Exam Date**	**Supervisor/ Co-supervisor**	**THESIS TITLE**
Aghayan, Hamid	PhD	May 17, 2012	April 16, 2013	Yang, J.	On-line monitoring of engine health through the analysis of contaminants in engine lubricant
Baghaei, Hooman	MEng	August 30, 2012	n/a	n/a	n/a
Baldson, Megan	MESc	June 12, 2012	May 30, 2012	Jenkyn, T.	Investigation of in-vivo media longitudinal arch of the foot and orthotic interventions using bi-planar fluoroscopy
Bushey, Kristen	MESc	July 12, 2012	June 18, 2012	Jenkyn, T.	Investigation of in-vivo hind foot and orthotic interactions using bi-planar x-ray fluoroscopy
DeGroot, Christopher	PhD	August 3, 2012	July 16, 2012	Straatman, A.G.	Numerical modeling of transport in complex porous media: metal foams to the human lung
Elliott, Kevin	MESc	June 4, 2012	May 29, 2012	Zhang, C., Savory, E.	Numerical investigation of turbulent flows with high curvature in a simplified geometry and in centrifugal compressors
Fetterly, Sayward	MESc	August 30, 2012	August 24, 2012	Dunning, C.	Mechanical behavior of the cement mantel at and around the implant-

					cement interface
Hassan, Hassan	MESc	May 24, 2012	April 19, 2012	Siddiqui, K.	Development of novel solar tracking and heat extracting technologies
Irvine, Bryce	MEng	August 30, 2012	n/a	n/a	n/a
Kong, Lei	MESc	August 28, 2012	August 12, 2012	Zhang, C., Zhu, J.	Numerical simulations of catalytic ozone decomposition in circulating fluidized bed risers
Kuldeep, Sareen	PhD	July 6, 2012	June 22, 2012	Knopf, G.	Consistent density scanning and information extraction from point-clouds of building exteriors
Li, Tingjie	PhD	August 20, 2012	August 15, 2012	Yang, J.	An automated lab-on-a-CD system for parallel whole blood analyses
Mu, Haoming	MEng	August 30, 2012	n/a	n/a	n/a
Noroozi, Masoud	PhD	May 22, 2012	May 7, 2012	Jiang, L.	Mechanical instability of thin solid film structures
Norouzi Banis, Hamid	MESc	August 30, 2012	August 20, 2012	Sun, X.	Synthesis of silicide nonomaterials using chemical vapour deposition method
Pilli, Lilla	MEng	August 30, 2012	n/a	n/a	n/a
Sharifi, Pouya	MESc	August 31, 2012	August 13, 2012	Wood, J.	Structure property relationships of magnesium alloys
Wadker, Abhijeet	MEng	August 30, 2012	n/a	n/a	n/a
Yusuf, Omar	MESc	August 31, 2012	August 24, 2012	Khayat, R., Hrymak, A.	Nonlinear approach to coating floor of a thin film

JUNE 2013 CONVOCATION – Mechanical and Materials Engineering

Student Name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Abiola-Ogedengbe, Ayo	MESc	April 22, 2013	April 15, 2013	Siddiqui, K., Hangan, H.	Experimental investigation of wind effect on solar panel
Albarghot, Mohamed	MEng	April 30, 2013	n/a	n/a	n/a
Azimian, Hamidreza	PhD	August 12, 2012	August 22, 2012	Naish, M.D., Patel, R.	Optimal preoperative planning of robotics-assisted minimally cardiac surgery under uncertainty
Banerjee, Arindam	MESc	April 29, 2013	April 19, 2013	Wood, J.	Structure property relations for magnesium alloys
Cela, Ilir	MEng	April 30, 2013	n/a	n/a	n/a
Cheng, Yang	MESc	January 18, 2013	January 15, 2013	Yang, J.	Developing electrochemical biosensors for point-of-care diagnostics of cardiovascular biomarkers
ElBannon, Khaled	PhD	December 13, 2012	December 11, 2012	Salisbury, S.	Development of a compact piezoworm actuator for MR guided medical procedures
Faisal, Mahmudur Rahman	MESc	November 30, 2012	October 24, 2012	Khayat, R., Yanful, E.	Prediction of bottom stress in shallow mine tailings pond
Gangjee, Javed	MEng	April 30, 2013	n/a	n/a	n/a
Geng, Dongsheng	PhD	January 10,	January 8,	Sun, X.	Development of novel nano-

		2013	2013		structured materials with low-cost and high stability for PEM fuel cell
Gurveer, Sandhu	MESc	December 19, 2012	December 10, 2012	Siddiqui, K.	Study of thermal behaviour inside a flat plate solar collector and its performance with various insert devices and at different inclinations
Haghshenas, Meysam	PhD	April 25, 2013	April 19, 2013	Klassen, R.	Micro-mechanical assessment of the local plastic strain invoked during a splined mandrel flow forming operation
Johnson, Chelsea	MESc	April 15, 2013	April 11, 2013	Straatman, A.G.	Numerical modeling of species exchange in a 3D porous medium: modeling exchange with the human lung
Kamalizonouzi, Babak	MESc	December 18, 2012	December 12, 2012	Asokanthan, S.	Optimal inertial sensor placement and motion detection for epileptic patient monitoring
Kirchhefer, Adam	PhD	December 20, 2012	December 11, 2012	Kopp, G.	The near wake of a European starling
Liu, Xi	MEng	n/a	n/a	n/a	
Mahdavi, Mohammad Hadi	PhD	January 14, 2013	January 4, 2013	Jiang, L.	Vibration and buckling of carbon nanotube, grapheme and nanowire
McLachlin, Stewart	PhD	April 29, 2013	April 22, 2013	Dunning, C.	An investigation of cervical spine trauma and surgical treatment through biomechanical simulation and kinematic analysis
Norouzi Banis, Mohammad	PhD	December 17, 2012	December 5, 2012	Sun, X.	Controlled synthesis of one dimensional nanostructured materials and their applications as catalyst supports in proton exchange membrane fuel cells
Rustom, Ghaleb	MESc	January 23, 2013	December 12, 2012	Siddiqui, K.	Parametric study on a novel heat recovery system
Saini, Sumit	MEng	December 31, 2012	n/a	n/a	n/a
Selvaraju, Rajesh	MESc	October 23, 2012	October 16, 2012	Asokanthan, S.	Characterization of solar roadways via computational and experimental investigations

5. GRADUATE AWARDS

Qualified students in MESc and PhD programs have access to a financial support package, which may consist of a combination of program-based funding (e.g. from a supervisor's research grant or Graduate Research Assistantship), scholarships from the Faculty of Engineering (Western Engineering Scholarship), and income from employment (e.g. a Graduate Teaching Assistantship). This package is designed to cover a substantial portion of a student's expenses for the eligible period of funding in his/her program. To be eligible for this financial support, students must be registered full-time. Incoming students must have a minimum admission average of 78% as determined by the Faculty of Graduate Studies. Continuing students must meet the graduate program conditions for progression towards the degree, as well as a minimum requirement of 78% based on all graduate courses completed in the current program. Students in Master's Engineering (M.Eng.) program is expected to fund their own education, for example, through OSAP.

Minimum Support Level

May 2012	Tuition	TA/GRA	Total per term
Canadian/Permanent Resident	2438.15	4,000	6438.15
International	5615.49	4,000	9615.49

September 2012	Tuition	TA/GRA	Total per term
Canadian/Permanent Resident	2905.28	4,000	6905.28
International	6082.62	4,000	10,082.62

January 2013	Tuition	TA/GRA	Total per term
Canadian/Permanent Resident	2459.23	4,000	6459.23
International	5636.19	4,000	9636.19

External Scholarships

During their period of fundability, i.e., 6 terms for MESc, and 12 terms for PhD, students may apply for external scholarships for which they are eligible, such as National Sciences and Engineering Research Council (NSERC), Ontario Graduate Scholarship (OGS), and Ontario Graduate Scholarships in Science and Technology (OGSST).

Ontario Graduate Scholarship (OGS):
The Ontario Graduate Scholarship (OGS) program is designed to encourage excellence in graduate studies at the master's and doctoral levels. Each award is tenable at the Ontario University of the student's choice. The value of the OGS is $5,000 per term to be held for two or three consecutive terms. One-term awards are not granted.

Ontario Graduate Scholarships in Science and Technology (OGSST):
Master's students can receive the scholarship for a maximum of two years and doctoral students for a maximum of four years, subject to a lifetime maximum of 4 years per student. The value of this scholarship is $5,000 per term, and may be held for either two or three full terms. One term awards are not allowed. OGSST awards must be held for at least 2 full consecutive terms and are paid monthly through Human Resources.

National Sciences and Engineering Research Council (NSERC):
NSERC is the national instrument for making strategic investments in Canada's capability in science and technology. NSERC's products are innovations, scientific discoveries, and highly qualified people. NSERC's unique Industrial Postgraduate Scholarship (IPS) provides financial support for highly qualified science and engineering graduates to gain research experience in industry while undertaking advanced studies in Canada. These scholarships are aimed at encouraging scholars to consider research careers in industry where they will be able to contribute to strengthening Canadian innovation.

External Scholarships Recipients: 2012-2013

Name	Program	Award	Award Duration
Blackman, Karin	GMME	OGS	May 2013 to April 2014
Farrokhnejad, Mehdi	GMME	OGS	May 2012 to April 2013
Khalaji, Iman	GMME	OGS	May 2012 to April 2013
Khan, Furquan	GMME	OGS	May 2013 to April 2014
Mohammadi, Alireza	GMME	OGS	May 2012 to April 2013
Mostafavi Yazdi, Seyed	GMME	OGS	May 2013 to April 2014
Neuert, Mark Alan Carmine	GMME	NSERC	Fall 2011 to August 2014
Ramadan, Abdelrahman	GMME	OGS	May 2012 to April 2013
Reeves, Jacob	GMME	OGS	May 2012 to April 2013

			September 2013 to August 2014
Refan, Maryam	GMME	NSERC Canada Graduate Scholarship-Doctoral	May 2012 to April 2014
Swentek, Ian Nathaniel	GMME	Queen Elizabeth II Graduate Scholarship in Science andTechnology	May 2012 to April 2013
Yan, Zhi	GMME	OGS	September 2012 to August 2013

6. GRADUATE SEMINAR

Fall 2013				
Date	**Student or Guest Lecturer Name**	**Supervisor/ Co-Supervisor**	**Presentation Title**	**Seminar Facilitator**
Sept. 10	Swentek, Ian	Wood, J.T.	Measuring Polymer Composite Interracial Strength	Islam, A.Z.M.
	Farrokhnejad, Mehdi	Straatman, A.G.	Simulation of Magnesium Casting Process on a General Unstructured Grid	
Sept. 17	Shao, Lingmin	Yang, J.	Miniaturized Inductive Position Sensor	Sinar, Dogan
Sept. 24	Lattimer, Derek/ Doucette, Lisa	The Writing Centre/Taylor Library, Western University		
Oct. 1	Mohammadi, Alireza	Floryan, J.M.	Groove Optimization for Drag Reduction	Geng, Dongsheng
	McLachlin, Stewart	Dunning, C.	Cervical Spine Unilateral Facet Injuries: Simulation, Quantification, and Visualization of Mechanisms and Treatment	
Oct. 15	Kumar, Rajeev	Zhang, C./ Savory, E.	Flow structures in the wakes of finite height square prisms	Bashar, Mohammad
Oct. 22	Geng, Dongsheng	Sun, X.	Bifunctional roles of nitrogen-doped graphene as electrocatalyst in fuel cells	Avari, Hamed
	Mahdavi, Hadi	Jiang, L./Sun, X.	Vibration and buckling of carbon nanotube, graphene, and nanowire	
Oct. 29	Vafadar, Hadi	Floryan, J.M.	Flows in Annuli with Longitudinal Grooves	Feng, Chuang

	Liu, Jian	Sun, X.	Atomic layer deposition: a unique technique to synthesize nanomaterials applied in lithium-ion batteries for EVs and HEVs	
Nov. 5	Refan, Maryam	Hangan, H.	Developing similarity analysis for laboratory simulated and field tornadoes	Stranges, Daniel
	Hafiz, Abdullah	Knopf, G./ Bordatchev, E.	Modeling and analysis of 5-axis Laser polishing process	
Nov. 19	Mohammadhasani, Rahim	Khayat, R.	Thermal convection of fluids with non-Fourier effect with spectral-perturbation approach	Hu, Yuhai
	Jamali, Jamaloddin	Wood, J.	Fracture of Polymer Matrix Composite	
Nov. 26	Zhi, Yan	Jiang, L.	Size-dependent Properties of Piezoelectric Nanostructures	Raj, Vijairaj
	Yang, Jinli	Sun, X.	Impact of Stacked Graphene and Unfolded Graphene on the Morphology of $LiFePO_4$ as a Superior Cathode Material for rechargeable Lithium Batteries	
Dec 3	Kuboki, Dr. T. MME Engineering, Western University		Manufacturing Technology and Properties Characterization of Natural	
Dec 12	Haghshenas, Meysam	Klassen, R.	Effect of strain-hardening rate on the grain-to-grain variability of local plastic strain in spin-formed fcc metals	Li, Yongliang
	Niknami, Mohammad	Khayat, R.	Energy growth of disturbances for a non-Fourier fluid	

Winter 2013				
Jan 7	Boutanios, Ziad	Hangan,H.	Euler-Euler Simulation of Drifting Snow	McLachlin, Stewart
	Islam, A.Z.M.	Klassen, R.	Study of the Size Dependence of Time-dependent Plastic Deformation of Gold Micro-pillars and Micro-spheres	
Jan 14	Prof. D. Sherry Dept. of Psychology, Western University		Memory and the Brain of Food-Storing Birds	
Jan 21	Khalaji, Iman	Naish, M.	Systematic Design of an Ultrasonic Horn Profile for High Displacement Amplification	Liu, Jian

	Hu, Yuhai	Sun, X.	Flexible Graphene based Hybrid Materials used as Anode for Lithium Ion Batteries	
Jan 28	Avari, Hamed	Savory, E.	Response of Endothelial Cells to Quantified Hemodynamic Shear Stresses	Jamali, Jamaloddin
	Wang, Dongniu	Sun, X.	Hierarchical SnO_2-Graphene Nanocomposites with Enhances Performances as Anodes for Lithium Ion Batteries applied in Electrical Vehicles	
Feb 4	Feng, Chuang	Jiang, L.	Modeling the Electrical Properties of Carbon Nanotube Based Polymer-Composites	Wang, Dongniu
	Mostafavi, Yazdi	Johnson, J./ Tutunea-Fatan, R.	Prediction of Interference Free Positions of the Humeral Implant in Preparation of Joint Replacement Procedures	
Feb 11	Prof. G. Osinski, Dept. of Earth Science Western University		To the Moon, Mars and Beyond: Planetary Science and Exploration Research at Western	
Feb 25	Li, Yongliang	Sun, X.	Heteroatom-doped Graphene as Cathode Materials for Lithium- Oxygen Batteries	Niknami, Mohammad
	Elatar, Ahmed	Siddiqui, K.	Three Dimensional Flow Structure during Low Reynolds Number Mixed Convection	
Mar 4	Prof. Ayumu Inasawa, Department of Aerospace Engineering Tokyo Metropolitan University		Suppression of Tonal Trailing-edge Noise from Airfoil using a Plasma Actuator	
Mar 11	Hassanzadeh, Mona	Siddiqui, K.	Improvement of Effervescent Atomization Process	Yang, Jinli
	Sinar, Dogan	Knopf, G.	Inkjet Printing and Functionalization of Graphene Oxide (GO) for Flexible Electronics	
Mar 18	Prof. D. Sinton, Dept. of Mechanical and Industrial Engineering, University of Toronto		Optofluidics for Energy Applications	
Apr 1	Bashar, Mohammad	Siddiqui, K.	Heat transfer process in PCM thermal storage	Hafiz, Abdullah
	Stranges, Daniel	Khayat, R.	Natural Convection of Non-Fourier Fluids and Relevance to Nanofluids	
Apr 8	Elizabeth Marshal Acting Director – C.B. “Bud” Johnston Library, Western University			
Apr 15	Paul Schmidt The Writing Support Centre, Western University			

Apr 22	Dadashi, Abbas	Zhang, C./ Zhu, J.	Numerical Simulation of Liquid-Solid Circulating Fluidized Beds Ion Exchange System for Continuous Protein Extraction	Yan, Zhi
	Raj,Vijairaj	Singh, A.V.	Vibration of Smart Structures using NURBS patches	

7. GRADUATE STORIES

C. Dunning

Jacob Reeves (MESc candidate) – OGS funding (May 2012 - April 2013)

Timothy Burkhart (Post-doctoral Fellow) – received a prestigious CIHR Bisby Fellowship Prize, which is awarded to the highest ranking candidate in each of the Fellowship Committees which comprise the annual CIHR fellowship competitions for 2012-2013

L. Jiang

Zhi Yan, a PhD student under Dr. Liying Jiang's supervision was awarded Ontario Graduate Scholarship for 2012-2013. In addition, she received the Chinese Government Award for Outstanding Self-financed Students Abroad in 2013.

R. Klassen

M.E. Sc. Thesis: Brandon Vriens; Effect of process parameters on splined mandrel flow forming. Started in September 2010. Completed in December 2012 (co-supervised with J.T. Wood).

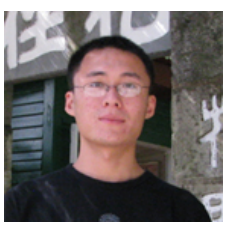
Ph.D. Thesis: Meysam Haghshenas; Local plastic strain resulting from splined mandrel flow forming. Started in January 2009, completed April 2013 (sole-supervisor).

A.G. Straatman

Mehdi Farrokhnejad completed his term as President of HQP in AUTO21. He served from June 2010 – May 2013 and was recognized recently at the annual AUTO21 Conference held in Toronto.

X. Sun

Ph.D students (Jian Liu – right and Jinli Yang-left) received “Outstanding Research Award” from Chinese Consulate in Toronto in Toronto. Each of them received $6000 in May 16, 2013.



J. Wood

Ian Swentek was nominated for the graduate student teaching award for the 2012-2013 school year, and he completed GS 9500, an elective course in the Theory and Practice of University Teaching, followed by teaching–ES 1021A Intersession.

This past year Ian sat on the Mechanical and Materials department council representing the department's graduate students. He is involved with the Graduate Engineering Society, and have been approached to consider running as president. Furthermore, Ian won the SAMPE Student Leadership award, which was presented at their annual conference in Long Beach, California.

RESEARCH

1. MAJOR RESEARCH AREAS

The current graduate program in the Faculty of Engineering is fully accredited by the Ontario Council of Graduate Studies. This brief seeks to further the decentralization of the program as recommended in the previous accreditation cycle by requesting the accreditation through the departmental graduate programs. Each Department has restructured the Graduate Research Programs by focusing on the individual areas of strength. In the case of the Department of Mechanical and Materials Engineering the Master's and PhD programs comprise the following fields:

- Mechanical Engineering
- Thermofluids
- Materials and Solid Mechanics
- Automation Technologies and Systems

2. FACILITIES

Laboratory Facilities

The description of laboratory facilities is divided into sections dealing separately with each of the four research groups. Note that there may be an overlap in the facilities listed as different groups may be using the same facilities, and the individuals may be contributing to different groups. There are in excess of 30,000 sq. ft. of laboratory and office spaces for the members of the program with state of the art research infrastructure and computing facilities (PCs and Workstations).

The description of laboratory facilities is divided into sections dealing separately with each of the four research groups. Note that there may be an overlap in the facilities listed as different groups may be using the same facilities, and the individuals may be contributing to different groups.

Thermofluids Group

Experimental facilities:

- Low-disturbance wind tunnel
- Hydraulic flume
- High speed imaging system
- Thermal imaging system
- Planer PIV and StereoPIV system
- Laser Induced Florescence system
- Unique small-scale downburst outflow simulator
- Automotive cooling fan module underhood rig simulator and plenum chamber
- Unique hemodynamic flow rig
- 3-component laser Doppler velocimetry system and additional lasers
- 2D wall jet wind tunnel
- Plenum chamber airflow facility for axial flow fan testing

Micro/Nano Fluids Laboratory facilities:

- OLYMPUS IX81 Inverted Fluorescence Microscopy
- Photometrics Cascade high speed Imaging system
- Patchman NP2 Micromanipulation system

Specialized computing resources:

- 4 SUN Blade 2000 workstations and 1 SUN Ultra 60 workstation and 12 high-end, single processor PCs.
- 4 dual core PCs with 4 Gb memory each, 2 dual core PCs each with 2Gb memory, 4 single core PCs each with 2 Gb memory each, one 4-processor Compaq machine (9Gb memory), one 2-processor Compaq machine (2 Gb memory), network and printing facilities.
- Server network (2 Tb, with additional 2 Tb back-up storage) and 5 PC workstations
- Commercial CFD codes, notably FLUENT and CFX
- Portal to Sharcnet

Materials and Solid Mechanics Group

Metal Forming Laboratory:

- Four combined bending and torsion test labs
- Four beam bending labs
- Four buckling test labs
- Four Asymmetric bending labs
- Two thick cylinders testing labs
- Eight P3 Vishay strain gauge indicators
- Five PCs with windows7 and data acquisition labs
- Five variable power supplies
- Various temperature and pressure sensors
- Thick Cylinder Apparatus (no. 1)
- Thick Cylinder Apparatus (no. 2)
- Unsymmetrical Bending Apparatus (no. 1)
- Unsymmetrical Bending Apparatus (no. 2)
- Column Buckling Apparatus (no. 1)
- Column Buckling Apparatus (no. 2)
- Combined Bending and Torsion Apparatus (no. 1)
- Combined Bending and Torsion Apparatus (no. 2)

Biotechnology Research Laboratory

- Three AFMs (Dimension, Multimode, CSPM 5500)
- Olympus 1X81 Inverted Fluorescence Microscope with environmental chamber, high-speed camera (Photometrics Cascade), Micro-manipulator (Patchman NP2)
- Three optical MIcroscopes
- Two laser systems including Micropoint laser
- Varian UV-Vis spectrophotometer
- Three Ocean Optics spectrometers
- Probe station for MEMS and Microelectronics
- Dimatix materials printer DMP-2800
- Acoustic Measurement System
- Hot-embossing lithography
- Spin coater
- Six high-precision multi-channel pumps
- High-speed centrifuge
- Electrochemistry station
- Furnace
- Oven
- Water bath and shaken water bath

- Fume hood
- Two Biological Safety Cabinets
- Cell culture room

Heat Treating Laboratory:

- Megatronic e42wri quartz quad elliptical radian heating furnace model 30393-2 with controller
- Lindberg blue box furnace maximum temperature 1100 degree centigrad serial no x01f313762xf
- Lindberg box furnace maximum temperature 1100 degree centigrad model no 59545
- Lindberg box furnace maximum temperature 1200 degree centigrad model no T51333
- Lindberg tube furnace maximum temperature 1200 degree centigrad
- 6 thermolyne tube furnaces model 21100 maximum temperature 1200 degree centigrad
- Lindberg tube furnaces model 55035a maximum temperature 1100 degree centigrad
- Hardness testing
- Vickers pyramid hardness tester serial no 255032
- Clark rockwell type hardness tester model c8a 50340
- Clark rockwell type hardness tester model c8a
- 3Macromet rockwell type hardness tester
- Satec Impact tester model Si-1B

Composite Fabrication Laboratory:

- Freezer
- oven,
- autoclave and heated platen press for two- and three-dimensional wet lay-up and prepreg processes.

Nanomaterials Fabrication and Characterization Laboratories:

- Chemical Vapour Deposition and sputtering facilities
- Inverted Fluorescence Microscopy
- NanoScope V MultiMode SPM
- Photometrics Cascade high speed Imaging system
- Patchman NP2 Micromanipulation system
- Cell Culture Room
- Photonic Instrument
- MicroPoint Laser System
- Fuel Cell station
- High-resolution scanning
- Electronic Microscope (Hitachi 4800)
- Environmental scanning
- Electronic Microscope(Hitachi 3400N)
- Transmission Electronic Microscope (Hitachi 7000)
- Raman Spectrometer (HORIBA)
- Scientific LabRam
- Micromeritics Tristar II
- Nicolet 380 FTR

Equipment for Electrochemical Characterization/Analysis

- Hot presser
- Potentiostat/Galvanostat (autolab)
- Electrochemical station (CHI)
- Fuel Cell test station
- Glove box
- Potentiostat/Galvanostat/EIS (VMP3)
- Batteries test station (Arbin BT2000)

Mechanical Testing Laboratories

- Mechanical and servohydraulic load frames ranging from 1kN to 500kN capacity
- Variety of fixtures for compression, flexure shear and mixed-mode bending
- Instron 9250HV instrumented drop tower for moderate rate impat testing up to 1600J
- Grindosonic ultrasonic modulus measurement device

Properties of Materials Laboratory

- Shopcraft bench grinder
- Unitek spot welder model 113203
- Atlas 6 inch lathe
- Drill press canadian blower co size 18
- Drill press rockwell beaver
- Oliver rolling mill
- Imptech C-10 Cut off Machine (5 year)
- Carver press model C-24,000 lbs, 11 metric tons

Polymer Engineering Laboratory

- FTIR, micro-indenter (DMTA, deep penetration)
- thin film tensile tester
- grad student desks

Tribology Laboratory

- A variety of wear testing machines including a Plinth and a Direct Observation Wear Machine.
- High-temperature nanodindentation testing machine (Micro Materials Ltd)

Materials Characterization Laboratories

- Optical and Electron microscopy
- X-ray diffractometer
- Differential scanning calorimeter
- Electrical resistivity (4-300K),
- “Grindosonic” ultrasonic probe
- High-temperature nanoindentation

Optical Microscopy Laboratory

- Buehler micromet automatic polishers 2
- Leitz stereo microscope
- Unitron stereo microscope
- Olympus stereo microscope
- Leitz aristophot
- Reichert bench type microscope with micro hardness tester 005 263
- Olympus bh2 microscope
- Sony monitor pvm 1340
- Sony video printer up850
- Microscope video black and white camera dage mti nc65
- Leitz laborlux microscope
- Fibre optics light source intralux 150 watt
- Technical copy stand TCI
- Clemex Vision Pe Image Analyzer
- Microscope xillix digital camera 0042
- Leitz microscope with discussion attachment model laborlux (2)
- Wild stereo microscopy with discussion attachment
- Unitron metallurgical inverted microscope model mec (2)
- Wild metallurgical inverted microscope model m50 (6)
- Microgram atic balance maximum 19 grams 5 decimal places resolution
- Sartorius digital micro balance maximum 120 grams 4 decimal places resolution
- Sartorius micro balance 160 grams maximum

- Metler micro balance model p1200n
- Leitz Laborlux Microscope

Polymer Engineering Laboratory

- DSC
- DMTA
- thin film/microprobe dielectric spectrometer
- Brabender high shear mixer
- Centrifuge
- annealing ovens
- thin film spinner
- grad student desks

Equipment for Synthesis of Nanomaterials

- Direct liquid injection CVD
- Aerosol-assisted CVD
- Rapid thermal CVD
- Joule-heating CVD
- Plasma-Enhanced CVD
- Microwave-assisted hydrothermal oven
- Atomoic layer depsotio (ALD)
- Ball milling machine
- Laboratory ovens

In addition to the departmental facilities, faculty and students in the Materials and Solid mechanics group have access to the following major equipment and common facilities:

Fraunhofer Project Centre

- 2500 tonnes press
- Direct SMC
- 2 extruder configuration (Dieffenbacher process)
- High pressure RTM

The Automation Technologies and Systems Group

Dynamic and Sensing Systems Laboratory

- Vibration transducers
- Micron-scale and macroscopic vibration transducers
- Electro-dynamic shakers
- Real-time signal analyzers and modal analysis software
- Real-time control hardware/software
- Accelerometers,
- Precision rate table and controller for angular rate characterization
- Power amplifiers/conditioners for structural vibration measurement

CNC Machining Laboratory

- The Fadal 4020-5 Axis CNC Machine with tooling package.
- Tormach three-axis compp0uter numerically controlled mills
- The “Swift” DEA-Coordinating Measuring machine with Controllers and PC-Pentium I-120 MHz and “Tutor” Software.
- PC-Pentium III-350 MHz with “Surfcam 99” CAD/CAM Package
- PC-Pentium II-233 MHz with “Surfcam 99” CAD/CAM Package

- Techno Isel, 3-Axis CNC Machine with Mac 200 Controller, connected to a Pentium 150 MHz Computer System
- Dyna Myte Model 2400, 3-Axis CNC machine with optional rotary axis, connected to a Pentium 150 MHz Computer System
- 40" LCD screen for demonstration and presentation purposes
- NextEngine 3D laser scanner (2)
- Makerbot Replicator 2 x 3D printer (2)

Geometric Modeling & Virtual Sculpting Laboratory

- Immersion MicroScribe G2 hardware/software
- PHANTOM Omni haptic device
- VRMesh 3.5 Studio software
- Claytools for Rhino modeling software
- Rhino3D NURBS modeling software
- Matlab tools

Bioelectronics and Biosensor Laboratory: (Note: This laboratory contains equipment not readily available elsewhere on campus)

- Optical Bench (2 types) – including various optical breadboards and plates
- Micralyne biochip toolkit
- Optikon High-Speed Sensicam VGA cooled color digital CCD camera
- Tunable ArKr laser system
- Argon-Ion laser (457nm)
- He-Ne yellow laser (594nm)
- Infiniium oscilloscope (2GSa/s)
- Wavestar U spectrometer
- Broadband amplitude modulator (3 units)
- Electro-optical modulator and drivers (2 units)
- Acousto-optic deflector and driver
- Radiometer ION 450
- Linear and rotational precision stages (multiple)

Visualization and Virtual Reality Laboratory:

- Cyberware 3D RGB head & shoulder scanner
- Fakespace Immersadesk R-2 virtual reality display

Sensing and Mechatronic Systems Laboratory:

- Active modular omnidirectional vision systems with multiple Firewire cameras
- Modular sensor/actuator building blocks

Biomechanics Group

The Jack McBain Biomechanical Testing Laboratory:

The Biomechanical Testing Laboratory primarily conducts experimental in vitro research related to orthopaedic biomechanics. The current lab (660 sq. ft) BioHazard Level 1 facility is equipped to conduct both experimental testing and computational modelling. The focus includes orthopaedic implant fixation and implant design for the upper limb and spine, as well as the assessment of lower limb impact injury. The primary equipment available includes two Instron materials testing machines, one of which is tension-compression and the other which has three actuators (tension-compression, as well as 2 torque axes). Data acquisition is achieved through National Instruments hardware and custom-written LabVIEW software, Solidworks, Mimics, FEA software (Abacus, Truegrid) LS-DYNA).

- Finite Element analysis workstations

- Strain gauges and circuitry
- IEEE 1394 (firewire) camera
- Digital microscribe

The Wolf Biomechanics and Imaging Laboratories:

The two facilities described below conduct basic and clinical biomechanics research into in vivo human motion in health, sport, disease (primarily osteoarthritis, ligament and other soft tissue injuries) and the result of surgery, bracing and other clinical interventions. Primarily studied is the lower limb, but research is being conducted on spine and upper limb biomechanics as well.

The Wolf Orthopaedic Biomechanics Lab (WOBL) is located adjacent to the Fowler-Kennedy Sports Medicine Clinic. Composed of an 8-camera motion analysis system (Motion Analysis Corp, Santa Rosa, CA, USA), a floor-mounted forceplate (AMTI, Amherst, NY, USA) and a telemetric electromyography system (Telemyo, Noraxon, MA, USA). This facility is one of only eight in Canada.

The Wolf Orthopaedic Quantitative Imaging Lab (WOQIL) is located immediately adjacent to WOBL. The WOQIL is equipped with 2 x-ray fluoroscopes (Siremobil Compact-L C-arm, Siemens Inc, Mississauga, ON), a 4-camera motion analysis system (Motion Analysis Corp, Santa Rosa, CA, USA) and a forceplate instrumented treadmill (Kistler Gaitway, Amherst, NY, USA). This facility is unique in Canada and one of only 3 worldwide. This facility is developing the technique of dynamic radiostereometric analysis (RSA).

Both of these facilities are located within the Fowler Kennedy Sport Medicine Clinic and tests clinical patients as part of their standard care by primary care physicians, orthopaedic surgeons and physiotherapists. This arrangement is unique in Canada.

The facilities have desktop computers for 8 graduate students or research assistants and are equipped with wireless networking for additional use of student laptops (table space is available for up to 3 laptops). This has been recently expanded with external funding from a national agency. There are no plans in the next 3 years to expand further, but expansion is possible in the longer term into the adjacent Zimmer Conference room (3M bldg).

The Bioengineering Research Laboratory

The Bioengineering Research Laboratory of the Hand and Upper Limb Centre is located in Lawson Health Research Institute of St. Joseph's Health Care London. The proximity of this laboratory to the outpatient clinics, therapy department and operating rooms allows a close interaction between researchers, clinicians and patients. This has resulted in a fertile environment for our graduate and medical students, and residents who have been stimulated by the clinical correlations of their research. All surgeries are conducted by Dr. King (PI) with surgical fellows and residents, and all engineering components are managed by Dr. Johnson (co-applicant), research engineers and graduate students.

The electromagnetic tracking device has six sensors and is linked to LabView on a personal computer. We have recently developed "Motion Station", a Lab View based program that provides a real-time graphical description of bone and joint motion. We have access to advanced imaging facilities in house.

A sample of equipment is as follows:

- Instron materials testing machine
- Elbow testing simulator
- Shoulder testing system
- Wrist testing system
- Data Aquisition Systems (HP)
- LabView virtual instruments (HP)
- 20 PTOtrack 3D tracking systems (Norther Digital)
- Flock of Birds Magnetic tracking system
- Tekscan pressure measurement system

Surgical Mechatronics

- 500 sq. ft. laboratory located in Lawson Health Research Institute
- 460 sq. ft surgical skills laboratory (adjacent to main lab) for cadaveric testing
- KUKA 4+ robot 7-axis (6+1 independent)
- Four PC workstations (4GB RAM0
- Two Optotrack Certus 6-degree-of-freedom optical motion tracking systems (NDI, Waterloo)

3. RESEARCH SUPPORT

Year 2012/2013		
Association/Institute/Societies		$565,804*
Foundations		$82,400
Government	Federal	$1,116,340
	Provincial-Ontario	$251,150
Industry		$358,123
*This includes $239,854 of internal Western Engineering funds.		

4. RESEARCH IN THE NEWS

L. Ferreira

Research conducted in the Surgical Mechatronics lab of the Hand and Upper Limb Centre has been the focus of a St. Joseph's Foundation public campaign.

K. Siddiqui

Novel Solar tracker technology featured in the 2012 Annual Report of Worldiscoveries

Following the Sun

Kamran Siddiqui, Associate Professor in the Department of Mechanical and Materials Engineering along with his graduate student, Hassan Hassan, has developed two new technologies that boost the efficiency of traditional solar panels and other solar energy applications. "Typically, panels face south, which makes sense if they are stationary," Siddiqui says. "But it means they are only aimed directly at the sun for a very short duration (solar noon) and for the rest of the day, the panel orientation with respect to the sun continuously changes, resulting in the lower output. If you move the panels as the sun moves across the sky, they are much more efficient."

In fact, studies show they are about 40% more efficient when aimed directly at the sun all day long. Unlike existing systems that rely on expensive microprocessors to calculate the sun's path, Siddiqui's solution tracks the sun with sensors and positions the panels accordingly.

If, however, the moving panels required large amounts of energy to remain in proper alignment the benefits would be reduced. That's where Siddiqui and his student's second innovation comes in.

A load compensator is a mechanical device that carries almost three-quarters of the weight of the solar panels making it easy for a small, energy-efficient motor to move the panels into perfect position.

The smaller motor is both energy efficient and less costly, making the entire system very cost-effective. Furthermore, the innovative "plug-n-play" design of the tracking system, reduces the installation cost by up to 75%.
Siddiqui and Hassan are now working with WORLDiscoveries® to patent and market their innovation through a spinoff company named "Grenetek Inc.".

X. Sun

Prof. Andy Sun's paper was highlighted in Back Cover of a journal: Batteries for Electric Vehicles, in "Energy & Environmental Science. 6 (2013) 1521-1528, a journal with impact factor of 11. Back Cover: *$LiFePO_4$–graphene as a superior cathode material for rechargeable lithium batteries: impact of stacked graphene and unfolded graphene. (Energy Environ. Sci. 6/2013) (Page 1521)*

$LiFePO_4$ nanoparticles are uniformly dispersed and tightly anchored to the unfolded graphene network, resulting in a high discharge capacity of 166.2 mA h g^{-1} (98% of the theoretical capacity) with low graphene content of 1.5 wt%. In their paper, X. Sun et al. presented a simple strategy for the synthesis of such $LiFePO_4$ nanoparticles attached on the 3D conducting network, which enables both Li ions and electrons to migrate and reach each active particle, then realizing the full potential of active materials.

This paper was further highlighted by "Green Car Congress" http://www.greencarcongress.com/2013/05/yang-20130502.html "Western University team boosts LiFePo4 to 98% of theroetical capacity with unfolded graphene" 2 May 2013

The research team from the Nanomaterials and Energy Group at the Western University led by Dr. Xueliang (Andy) Sun has reported that the specific capacity of $LiFePO_4$ can be greatly boosted to up to 168 mAh g^{-1}—98% of its theoretical capacity of 170 mAh g^{-1}—by using unfolded graphene as a three dimensional (3D) conducting network for $LiFePO_4$ nanoparticle growth. A paper on their work is published in the RSC journal Energy & Environmental Science.

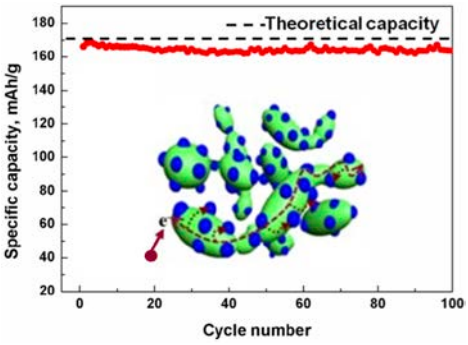
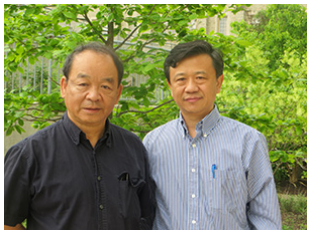


Image depicts the $LiFePO_4$ particles anchored to the crimped unfolded graphene. Source: Jinli Yang

Olivine-typed $LiFePO_4$ is considered to be an attractive cathode material for lithium-ion bateries (LIBs) applied in the new generation of hybrid electric vehicles (HEVs) and electric vehicles (EVs). Other work has shown that $LiFePO_4$ battery performance is strongly depended on the carbon coating, which can enhance the electronic conductivity of the electrodes. The Western University researchers found that the graphene with different thickness and morphology has a significant impact on the performance of $LiFePO_4$.

Prof. Andy Sun's paper about "*Single-atom Catalysis Using Pt/Graphene Achieved through Atomic Layer Deposition*" published in Scientific Report (a new Journal from Nature Group) was Highlighted by "Scientists



discover how to build cheaper, more efficient fuel cells".
http://www.lightsource.ca/news/media_release_20130523.php

http://fuelcellsworks.com/news/2013/05/24/scientists-discover-how-to-build-cheaper-more-efficient-fuel-cells/http://www.eng.uwo.ca/news/

Dr. Andy Sun's paper about **"**Understanding and recent development of carbon coating on LiFePO4 cathode materials for lithium-ion batteries" is one of 25 most read articles in 2012 in Energy & Environmental Science, a journal with impact factor of 11.

Dr. Andy Sun's paper about "Tin Oxide with Controlled Morphology and Crystallinity by Atomic Layer Deposition onto Graphene Nanosheets for Enhanced Lithium Storage" is the Most Accessed from 12/2011~11/2012 in Advanced Functional Materials**,** a journal of impact factor of over 10.

5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS

S. Asokanthan

Ministry of Transportation Ontario (MTO) -
An investigation into the feasibility of solar roadways considering sustainability while giving importance to safety and performance is carried out. Particular emphasis is placed on material characterization, mechanical strength of solar roadway panel systems, as well as development of an auxiliary vibration-based energy harvesting system for additional power generation. To this end, both experimental and analytical/numerical studies have been performed for the strength characterizations based on different vehicle categories, and effects such as fast moving shades and temperature on the power generation as well as optimal placement of mechanical energy harvesting systems have been investigated.

T. Jenkyn

Five students from my course MME9615a Biomechanics of Human Joint Motion worked with me on a class project sponsored by **3M Canada**. The project was testing the performance of a new grip tape for hockey sticks. The students designed the experiment and recruited 3 Mustangs players and one OHL player as test subjects. They tested them over at my lab in the Fowler Kennedy Sport Medicine Clinic. Two of the students are writing a paper for peer-review based on the project.
The students were: Rebecca Dean (undergrad MME), Ryan Frayne (grad Kinesiology), Jacob Reeves (grad MME), Najmeh Razfar (grad MME) and Javed Gangjee (MME MEng)

L. Jiang

Dr. Jiang is working on a collaborating project to develop new green chemistry and engineering methods for the fabrication of high-value-added polymer surface and devices. In particular, Dr. Jiang will contribute her modeling expertise to investigate the mechanical and electrical properties of conductive polymers nanocomposites. This work is in collaboration with Dr. Jun Yang (Department of Mechanical & Materials Engineering), Dr. John de Bruyn (Department of Physics and Astronomy), Dr. Gianluigi Botton (Department of Materials Science & Engineering, McMaster University) and researchers of **LANXESS**. This project is funded by ORF, OCE, LANXESS and NSERC.

R. Khayat

Sabbatical stay from January 1 to June 30, 2013 at the **Ecole des Mines Paristech** (Sophia-Antipolis, France). Collaborative research on reactive multi-layer flow in coestrusion.

G. Knopf

National Research Council of Canada
Collaborating Researchers: Drs. Suwas Nikumb and Evgueni Bordatchev (NRC, London Ont.)
Laser material processing and microfabrication
Laser material processing is a complex nonlinear process with numerous stochastic parameters related to the laser apparatus, optics and the material specimen. Researchers at Western and the National Research Council of Canada (NRCC) have developed nonlinear models to predict the level of pulse energy needed to create a dent with specific depth and diameter. Laser micromachining has also been used to rapidly construct mould masters for fabricating disposable polymeric micro-devices and laser micro-polishing (LμP) applications. More recent research involves the development of electrically conductive graphene-based inks and novel fabrication processes for printing bioelectronic circuitry on a variety of mechanically flexible surfaces (e.g. polymers, paper, and biocompatible silk). Laser microfabrication techniques are used for material removal and thermally reducing graphene-oxide (GO) films to produce conductive microcircuit features.

Ivey International Centre for Health Innovation
Collaborating Researcher: Dr. Anne Snowdon (Ivey School of Business, Western)
Intelligent wireless hand sanitizer technology
Infections acquired in hospital lead to significant health challenges for patients, and contribute to high healthcare costs. One of the most important strategies for mitigating hospital acquired infection (HAI) is the diligent use of hand washing to prevent cross-contamination among staff and patients. The Ivey led project is developing and implementing intelligent hand sanitization systems that track both compliance and unit maintenance using wireless RFID technology. The project involves the London Health Sciences Centre (LHSC) and industry partners (Pharmax, Thoughtspeed, S-Qube Wireless, Remington Medical Equip., CIO Resolve Inc.). Partial funding is provided through the Academic Medical Organization of Southwestern Ontario (AMOSO) Innovation Fund. A second complementary project involving monitoring compliance in a long-term healthcare facility (B'nai Brith Alzheimer Health Center, Toronto ON) is also being developed in collaboration with Western Engineering.

Pharmax Research
Collaborating Researcher: Dr. Edward (Ted) Petroff (Pharmax Research)
Wireless biosensor for detecting sepsis in ICU catheter drainage systems
Most cases of urinary sepsis occur to patients in hospital intensive care units (ICU) or long-term care facilities. If detected early, mild forms of the bacterial sepsis can be treated with the administration of antibiotics and large amounts of intravenous fluids. However, untreated or severe sepsis has a mortality rate of nearly 50%. This collaborative research involves the design and manufacture of a novel wireless, printed bioelectronic sensor platform that is capable of detecting the early stages sepsis by monitoring the presence of bacteria in urinary catheter drainage systems. Western researchers are developing new low-cost conductive inks and inkjet printing technologies that permit the fabrication of wireless microcircuits on non-rigid substrates. Although at an early stage, this research may have a high impact on the quality of healthcare in Canada and around the world.

E. Savory

University of Toronto (J Scott) – Development and application of a mould sensor for use in housing wall assemblies and grain storage bins. Development of new standard testing methodologies for mould-resistant building materials.

University of Calgary (R Martinuzzi) – Experimental and numerical modeling of new jet engine compressor stages (**in collaboration with Pratt and Whitney Canada**).

Central Michigan University, **USA** (L Orf) – Large-scale numerical modeling of downburst-producing thunderstorm clouds.

Purdue University, USA (P Karava) – Wind-induced convective heat transfer from building-integrated photovoltaic systems and other solar collectors.

Ecole Centrale de Nantes, France (L Perret) – Experimental modeling of the dynamics of the wind flow in and above urban street canyons.

K. Siddiqui

Gas Turbine Laboratory, Institute of Aerospace Research, National Research Council, Ottawa
Project: Development of efficient effervescent fuel injector
Two of the most pressing challenges presently faced by the gas turbine industry are improvement in combustion efficiency and reduction in pollutant emissions. For gas turbines burning liquid fuels, the solution lies in the ability to improve and control spray atomization. Effervescent atomization has the potential to give the required spray quality for gas turbine combustion. This collaborative research work is focused on the development of efficient effervescent fuel injector for gas turbines.

Hydro One Networks
Project: Feasibility Study – MW Scale Liquid Air Energy Storage Technology
The introduction of intermittency due to high penetration of renewable energy (solar/wind) together with increasing limitations on easy transmission and distribution capacity additions has created an impetus on power distributors for understanding various energy storage technologies and their niche applications. This project was focused on studying the feasibility of the Liquid Air Energy Storage (LAES) and power generation system for potential installation in Ontario. In such system, electrical power (when it is cheap or surplus) is used to liquefy air and store it. When electricity demand is high, this liquid air is heated and converted into gaseous form at high pressure to derive turbine and generate electrical power.

Murray Power and Generation Inc, London
Project: Optimization of Concentrated Solar Power Components and System
Parabolic dish-type concentrated solar energy systems offer a great advantage due to their flexibility. They can be implemented in a wide range of scales and applications; from small-scale single-unit residential heating applications to medium-scale multiple-units for heating applications in the commercial sector (e.g. office buildings and factories), and agricultural sector (e.g. greenhouses and chicken barns) to large-scale parabolic dish farms for power generation. The project is focused on the development of a novel Parabolic Dish Concentrated Solar power (CSP) system to produce renewable thermal energy. A prototype unit has been developed, installed and tested.

Dyverga Energy Corporation, Waterloo, ON
Project: Thermo-fluid analysis of a novel waste heat to electricity conversion system
Dyverga Energy Corporation has developed a novel system to produce electricity from the waste heat. The Dyverga innovative turbine concept utilizes waste heat as the energy source and produces mechanical torque to drive a generator to produce electricity. A unique feature which distinguishes it from the conventional heat recovery systems, is its ability to extract heat at low temperature range (i.e. 10^{o}C to 90^{o}C) and generate electricity. This ongoing project is focused on the investigation of underlying thermo-fluid processes and a parametric study that will lead to an optimal design of the system.

A.G. Straatman

KMW Energy – a research project was conducted with KMW Energy to assess the levels of NOx and CO emitted from their recently developed biomass burner system. The study involved Computational Fluid Dynamics simulations of the burner system and considered various additives to mitigate exhaust pollutants.

St. Marys Cement – a project supported by MITACS accelerate funding was initiated with St. Marys Cement to reduce the pressure drop in their pneumatic transport cement conveying system. Preliminary results from the study have already been incorporated into the system and further enhancements are to be made in 2014 following the completion of the work.

X. Sun

General Motors of Canada (Fuel Cell and Li Ion Batteries for Electric Vehicles): Since 2005, we have been collaborating with GM scientists to develop one-dimensional nanomaterials in fuel cell applications. Our ideas are to integrate metal oxide and metal silicide nanowires into fuel cell electrodes through an NSERC CRD. In 2011, we are working on NSERC strategic project. We found that metal oxide nanowires as Pt-based catalyst supports for fuel cell electrodes have unique advantages compared with the carbon black supports used currently, to

reduce cost and improve durability of fuel cells. Also, we are also working on Sn-based anodes for Li Ion Batteries for electric vehicles through an NSERC CRD in 2011-2014.

Ballard Power Systems (Fuel cell studies): After an NSERC CRD on carbon nanotubes as Pt catalyst support for fuel cells, in 2011, we are working on graphene as Pt support for fuel cells through NSERC strategic project. This will significantly improve mass transport and utilization of expensive Pt electrocatalyst and therefore reduce fuel cell cost.

National Defense (Nanotechnology): Since 2005, we have been developing various methods to obtain mass production of nitrogen-doped carbon nanotubes (CNx) and their applications for Energetic Materials as defense application. Recently, we are also working on Nano photocatalysts for spliting water for hydrogen production through a research contract, in collaboration with Profs. Hong Guo and Zetian Mi in McGill University.

Lithium Phostech Inc.(Li Ion Batteries for Electric Vehicles): Over the past few years, there is a dramatic increase of interest in large scale batteries for energy storage, especially for the transportation sector and energy storage (smart grid). Lithium-ion battery (LIB) is one of the most promising power systems because it can offer a higher operative voltage and energy density. Recently, in collaboration with scientists in Phostech, we got involved in the development of novel nanomaterials as cathodes for LIB. We focus on understanding and synthesis of LiFePO4/carbon composites through an NSERC CRD (2010-2013).

O.R. Tutunea-Fatan

Work in collaboration with **National Research Council** (R. Tutunea-Fatan and E. Bordatchev): We are working in collaboration with researchers from the National Research Council's Centre for Automotive and Surface Transportation in London to investigate multi-axis CNC laser polishing operations, in an attempt to determine correlations between process parameters and quality of the surface produced, typically characterized by an average roughness in the nanometer domain. The applications of this technology span over a broad range of engineering applications, from mold and die to biomedical industries.

Work in collaboration with **Hand and Upper Limb Center from St. Joseph Hospital** (R. Tutunea-Fatan and J. Johnson)**:** We are working in collaboration with surgeons and researchers from the Hand and Upper Limb Centre from St. Joseph Hospital in London to develop computer assisted techniques capable to enhance the precision and efficiency of upper limb joint replacement procedures (*e.g.* elbow and shoulder). This work will translate into preoperative computer assisted software to be used for surgical simulation and training, as well as implant shape optimization purposes.

Work in collaboration **Lamko Tool and Mold. Inc.** (R. Tutunea-Fatan, S. Salisbury and A. Barari)**:** We are working on a project aiming to automate the process required to define tool holder profile within CAM software. The developed imaging-based technique is required to increase the overall efficiency and accuracy of the mold machining process.

J. Wood

Virtually all of my funded research is in collaboration with industrial partners. While the overarching theme of my research program is lightweight structural materials for the automotive industry, my research can be split into two sub-programs:

Magnesium Casting: The primary collaboration in this area began in 2001 with and AUTO21-funded project with **Meridian Lightweight Technologies Inc**. (Strathroy, ON) which continues to this day. Extensions of this work have led to a number of smaller contracts with CANMET Materials (Hamilton, ON). I also lead the Casting task of a larger Automotive Partnership Canada program led by colleagues at Waterloo involving Meridian, COSMA, 3M, and Huys and CANMET Materials.

Polymer Composites: My work in this area began under a collaboration with **General Dynamics Land Systems – Canada**. Since the end of that contract, however, the largest portion of this research is funded by a variety of agencies including the Ontario Research Fund, Ontario Centres of Excellence, and MITACs. The ($7.2M) ORF project includes industry partners: General Motors of Canada (Oshawa, ON), Ford Motor Company (Dearborn, MI), Dieffenbacher North America (Windsor, ON), and Continental Structural Plastics (Troy, MI) together with the

Fraunhofer Project Centre at Western. Other projects in the composites field involve collaboration with Hudson Boat Works (London, ON), and technical service contracts through FPC with Invista (Wichita, KS).

J. Yang

Dr. Jun Yang (Department of Mechanical and Materials Engineering), Dr. John de Bruyn (Department of Physics and Astronomy), Dr. Gianluigi Botton (Department of Materials Science & Engineering, McMaster University) and Dr. Liying Jiang (Department of Mechanical & Materials Engineering) have been collaborating with researchers of **LANXESS**, the world's second largest producer of butyl rubber, on developing new green chemistry and engineering methods for the fabrication of conductive polymers and self-cleaning polymer products. These projects have been funded by ORF-RE and LANXESS.

Dr. Jun Yang has been collaborating with R&D team of **KSR International Co.** to develop MEMS automotive sensors.

Dr. Jun Yang has been collaborating with R&D team of **Topnotch Building Maintenance Ltd.** to develop new UV technology for biomedical applications.

C. Zhang

Research project with **Renix Inc**. in London, Ontario
The objective of this project is to develop a comprehensive three-dimensional Computational Fluid Dynamics (CFD) model of a Liquid-Solid Circulating Fluidized Bed (LSCFB) ion-exchange system including the ion exchange adsorption and desorption models. The CFD model proposed in this study will be able to predict the overall efficiency of the ion exchange process and the production rate under different operating conditions. This project is expected to have important contribution to the development of LSCFB ion-exchange systems in Canada to conserve the limited natural resources. The proposed CFD model will be able to optimize the operating condition of the LSCFB ion-exchange systems, which can be applied for different types of chemical extraction processes to recover various functional materials such as proteins from large volume of industrial processes.

Research project with **Trojan Technologies** Inc. in London, Ontario
The objectives of this project are (a) to numerically model the UV disinfection occurring in a typical open-channel UV reactor using a two-phase approach, paying special attention to inlet and outlet 3D flow characteristics, hydraulic regimes and the microbial transport and inactivation occurring at the air-water interface (free surface phenomena) and (b) to investigate the effect of different configurations of the two flow banks in series, in order to determine the impact of decreasing water level from upstream to downstream. The work from this research will provide a better understanding of the detailed flow field in UV reactors, UV dose distribution and water level control for multiple flow banks. The CFD results will be used in optimizing the performance of UV systems in open channels, and developing more efficient UV systems.

Research project with **Biorem Technologies Inc**. in Guelph, Ontario
The objective of this project is to develop an advanced biofiltration system for large sewage plant odour control applications. Computational Fluid Dynamics (CFD) modeling will be carried out to visualize the air flow inside the biofilters on a computer. The design for inlet and outlet plenums and internal features will be optimized based on the CFD simulation results. Small prototype systems will be built and tested to validate CFD modeling. A final product will then be designed using the CFD tools followed by detailed engineering and costing. Benefits to the industrial partner include a better penetration of the municipal wastewater treatment market, creation of jobs in Ontario, and associated economic activity.

Research project with **Pratt and Whitney Canada** in Mississauga, Ontario
The objective of this project is to develop numerical models for the simulation of the flow field in the novel compact mixed flow compressor. To further improve the performance of aero engines, it is necessary to understand the flow fields in the compressor at both the design-point and at/near-stall and assess system behavior as the stall margin is approached. In this project, the computer simulation method will be used to predict the flow patterns in the compressor. The outcome of this project will be a computer simulation model that can be used by Pratt and Whitney Canada for designs of its advanced compressors. The computer simulations are expected to reduce the time and cost of new product development at Pratt and Whitney Canada, thereby helping the company maintain its competitiveness.

PUBLICATIONS

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3. Gideon, G, **Buchal, R.O.**, Fostering Teamwork Skills using Collaboration Software in Engineering Design Education, Proceedings of the 2013 Canadian Engineering Education Association (CEEA) Conference, Montreal, June 17-20, 2013.

4. Burkhart TA, **Dunning CE**, Andrews DM: Predicting Distal Radius Bone Strain and Injury in Response to Impacts to Failure Using Multi-Axial Accelerometers, 2012 Annual Meeting of the American Society of Biomechanics, University of Florida, Gainesville, FL, Aug 15-18, 2012. (podium)

5. McLachlin SD, Ferreira LM, **Dunning CE**: A Refined Technique to Calculate Joint Motion Helical Axes from Six-DOF Tracker Output, Ontario Biomechanics Conference, Barrie, Ontario, March 15-17, 2013. (podium)

6. Hosein YK, King GJW, **Dunning CE**: The Effect of Stem Surface Treatment and Material on Pistoning of Ulnar Components in Linked Cemented Elbow Prostheses, Ontario Biomechanics Conference, Barrie, Ontario, March 15-17, 2013. (podium)

7. Reeves J, Burkhart TA, McLachlin SD, **Dunning CE**: A Colour-Thresholding Technique to Quantify High-Speed Planar Motion of Isolated Distal Radius Specimens during Impact, Ontario Biomechanics Conference, Barrie, Ontario, March 15-17, 2013. (podium)

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9. "Channel Flow Modulated by Suction - Numerical Solution of the Linear Stability Equations" by H.V.Moradi and **J.M.Floryan**. Proceedings of the 21th Annual Conference of the CFD Society of Canada, May 6-9, 2013, Sherbrook, Quebec, Canada.

10. "Heat transfer intensification in micro-conduits" by H.V.Moradi and **J.M.Floryan**. Proceedings of CANCAM 2013, Saskatoon, June 2-6, 2013, Canada.

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13. "The Influence of the Pressure Gradient in the Görtler Vortices Development" by J. K. Rogenski, L. F. de Souza and **J.M.Floryan**, VIII Escola de Primavera de Transição e Turbulência, 24 a 28 de setembro de 2012, São Paulo – SP, Brazil.

14. "Natural Convection in a Periodically Heated Slot" by M.Z.Hossain and **J.M.Floryan**. Proceedings of the 18th Australasian Fluid Mechanics Conference (18AFMC), Dec. 3 – 7, 2012.

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55. Orf L G, Oreskovic C & **Savory E** (2013) "Circumferential analysis of simulated 3-D downburst-producing thunderstorm outflows", Proc 6th Euro African Conf on Wind Engineering, Cambridge, UK, July.

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68. Hafiz, A.K., Bordatchev, E., and **Tutunea-Fatan, R.**, "Application of Picosecond Laser for Polishing of AISI H13 Tool Steel Sample Prepared by Micro-milling," Technical Paper No. 1618, Transactions of 41st North American Manufacturing Research Conference (NAMRC41) held in Jun. 2013 in Madison, USA, xx pages.

69. Heroux, A., **Tutunea-Fatan, O.R.**, Salisbury, S.P., and Barari, A., 2013, "Minimization of Bone Removal Through Optimal Humeral Implant Alignment in Total Elbow Arthroplasty." Paper 72, USB Proceedings of the CAD'13 Conference held in Jun. 2013 in Bergamo, Italy, 19 pages.

70. Hafiz, A.M.K., Bordatchev, E.V., and **Tutunea-Fatan, O.R.**, "Micro-polishing of Inconel 718 by Picosecond Laser." Proceedings of the 8th International Conference on Micromanufacturing (ICOMM 2013), Mar. 2013, Victoria, Canada, pp. 219-225.

71. A.J. Gesing, J. H. Sokolowski, P. C. Marchwica, C Blawert, J. Jekl, M. Kozdras, M. Kasprzak, **J. Wood** (2013), "Cooling Curve and Microchemical Phase Analysis of Rapidly Quenched Magnesium AM60B and AE44 Alloys", Achievements in Mechanical and Materials Engineering (AMME 2013)", Poland.

72. R. Zhang, **C. Zhang** and J. Jiang, 2012, "CFD Assisted Control System Design for Chip Cooling," Proc. ASME Summer Heat Transfer Conference, Puerto Rico, July 8-12.

73. B Peng, **C Zhang** and J Zhu, 2012, "New Approaches to Improve the Uniformity of the Radial Solids Concentration Distribution in CFB Risers," Proc. ASME Fluids Engineering Division Summer Meeting, Puerto Rico, July 8-12.

3. ORAL AND POSTER PRESENTATIONS

1. **Buchal, R. O**., Which Type of Design Project is Best: Narrow and Detailed or Broad and Conceptual?, Proceedings of the 2013 Canadian Engineering Education Association (CEEA) Conference, Montreal, June 17-20, 2013.

2. Gideon, G, **Buchal, R.O**., Fostering Teamwork Skills using Collaboration Software in Engineering Design Education, Proceedings of the 2013 Canadian Engineering Education Association (CEEA) Conference, Montreal, June 17-20, 2013.

3. A.L. Trejos, R.V. Patel, **M.D. Naish**, R.A. Malthaner and C.M. Schlachta, "Force-based Assessment of Skill in Minimally Invasive Surgery," Oral presentation, 7th Minimally Invasive Robotic Association International Congress, Boston, MA, September 5–8, 2012.

4. A.L. Trejos, M. Dawson, S.M. Cristancho, R.V. Patel, **M.D. Naish**, R.A. Malthaner and C.M. Schlachta, "Validating Force-Based Metrics for Computer-Based Assessment of Technical Skills in Laparoscopic Surgery," Oral presentation, 2012 CERI Annual Research Conference, London, ON, October 9, 2012.

5. A. Jiang, S. Cristancho, **M.D. Naish** and R.V. Patel, "A Simulation-Based Mastery Learning Approach for Robotic Surgery," Oral presentation, 2012 CERI Annual Research Conference, London, ON, October 9, 2012.

6. A. Shamsil, R.V. Patel, **M.D. Naish** and R.A. Malthaner, "Lung Tumour Localization and Visualization via Multisensory Data Fusion in Minimally Invasive Surgery," Poster presentation, 2013 London Health Research Day, London, ON, March 19, 2013.

7. M. Dawson, A.L. Trejos, S.M. Cristancho, R.V. Patel, C.M. Schlachta, R.A. Malthaner and **M.D. Naish**, "Validating Force-based Metrics for Computerized Assessment of Technical Skills in Laparoscopic Surgery," Poster presentation, 2013 London Health Research Day, London, ON, March 19, 2013.

8. M. Hadavand, R.V. Patel and **M.D. Naish**, "Towards Precise Delivery of Needle/Probe-based Interventions for Lung Cancer Diagnosis and Treatment," Poster presentation, 2013 London Health Research Day, London, ON, March 19, 2013.

9. A. Jiang, K. Siroen, A.L. Trejos, R.V. Patel, **M.D. Naish**, C.M. Schlachta and S.M. Cristancho, "Application of Simulation Technology to Mastery Learning for da Vinci Robotic Surgical System Training," Poster presentation, 2013 London Health Research Day, London, ON, March 19, 2013.

10. A. Escoto, A.L. Trejos, **M.D. Naish**, R.V. Patel and M.-E. LeBel, "Force Sensing-based Simulator for Skills Assessment for Knee Arthroscopy," Poster presentation, 2013 London Health Research Day, London, ON, March 19, 2013.

11. A.L. Trejos, R.V. Patel, **M.D. Naish**, R.A. Malthaner and C.M. Schlachta, "The Effect of Visual Force Feedback on Applied Forces during a Complex Laparoscopic Procedure," Poster presentation, SAGES Annual Meeting, Baltimore, MD, April 17–20, 2013.

12. A. Jiang, K. Siroen, S.M. Cristancho, R.V. Patel, **M.D. Naish** and C.M Schlachta, "A Simulation-Based Mastery Learning Approach for Robotic Surgery," Poster presentation, Canadian Conference on Medical Education, Quebéc, QC, April 20–23, 2013.

13. A.L. Trejos, M. Dawson, S.M. Cristancho, R.V. Patel, **M.D. Naish**, C.M. Schlachta and R.A. Malthaner, "Validating Force-Based Metrics for Computer-Based Assessment of Technical Skills in Laparoscopic Surgery," Oral presentation, Canadian Conference on Medical Education, Quebéc, QC, April 20–23, 2013.

14. Alexander Heroux, O. Remus Tutunea-Fatan, **Shaun P. Salisbury** and Ahmad Barari, "Minimization of Bone Removal Through Optimal Humeral Implant Alignment in Total Elbow Arthroplasty," International CAD Conference and Exhibition, Bergamo, Italy, June 2013.

15. Bashar, M. and **Siddiqui, K.** "Heat transfer process in a phase-change thermal energy storage" 1000 Islands Energy Research Forum, Queens University, June 13-15, 2013.

16. A.Ramadan., **K. Siddiqui** and H. El Naggar, "Design improvement of the ground loop in a geo-source heat pump system", 1000 Islands Energy Research Forum, Queens University, June 13-15, 2013.

17. **Siddiqui, K.** "WindEEE Research Facility at the Western University", 1000 Islands Energy Research Forum, Queens University, June 13-15, 2013.

18. **Jun Yang**. "A Method for Fabrication of Unique High-performance Microfiltration Membranes", Beijing International Technology Transfer Congress 2013 (ITTC2013), April 26, 2013, Beijing, China.

19. **Jun Yang**. "A Lab-on-a-CD System for Point-of-care Diagnostics of Blood", Beijing International Technology Transfer Congress 2013 (ITTC2013), April 26, 2013, Beijing, China.

20. Qiuquan Guo and **Jun Yang**, "An innovative microfluidic cell culture platform for biomedical application", 96th Canadian Chemistry Conference, May 26-30, 2013, Québec City, Canada.

4. INVITED LECTURES/WORKSHOPS

L. Ferreira

June 2013	Surgical Mechatronics Laboratory: A Bench To Bedside Approach. CIBC St. Joseph's Foundation Luncheon. London, ON
May 2013	Surgical Mechatronics Laboratory: Research Update. Annual Bone & Joint Retreat. London, ON,
	Transitioning from Post Secondary Degrees to Academia (co-panelist). Annual Bone & Joint Retreat. London, ON,

J.M. Floryan

May 2013	Xian Jiao Tong University, Xian, China ("Use of Surface Corrugations for Passive Flow Control").
	Beijing University of Aeronautics and Astronautics, Beijing, China ("Effect of Surface Roughness on the Laminar-Turbulent Transition").
	Tsinghua University, Beijing, China ("Effect of Surface Roughness on the Laminar-Turbulent Transition").
	Beijing Institute of Technology, Beijing, China ("Certain aspects of Flows over Rough Walls").

April-May, 2013	Beijing Institute of Technology, Beijing, China (Lectures Series on Hydrodynamic Stability; 26 hrs).
March 2013	Workshop on the Laminar-Turbulent Transition organized by the University of Electro-Communications and JAXA, Tokyo, Japan, March 28-29, 2013 ("Development of Drag Reducing Strategies").
August 2012	Shanghai Jiao Tong University, Shanghai, People's Republic of China ("Dynamics of Droplets in Electric Fields").
	Shanghai Institute of Applied Mathematics and Mechanics, University of Shanghai, Shanghai, People's Republic of China ("Dynamics of Droplets in Electric Fields").
	Institute of Mechanics, Chinese Academy of Science, Beijing, People's Republic of China ("Dynamics of Droplets in Electric Fields").
	Beijing Institute of Technology, Beijing, People's Republic of China ("Dynamics of Droplets in Electric Fields").

L. Jiang

May 2013	Size-dependent properties of nanostructured piezoelectric materials. (Harbin Institute of Technology, China)
	Electromechanical coupling behavior of dielectric resonators and actuators. (Harbin Institute of Technology, China)
	Multi-scale modeling on mechanical and electrical properties of carbon nanotube-polymer nanocomposites. (Harbin Institute of Technology, China)
	Nonlinear instability of NEM electrostatic switches. (Harbin Institute of Technology, China)
	The fracture properties of functionally graded piezoelectric materials (FGPMs). (Harbin Institute of Technology, China)
April 2013	How nanostructured materials differ from their macroscale counterparts?—size-dependent properties. (Harbin University of Science and Technology, China, April 2013)

G. Knopf

August 2012	"Flexible bioelectronics: emerging technologies", Disease Diagnostic and Instrument Development Workshop**,** Edmonton AB

M.D. Naish

August 2012	"Force and Tactile Sensing for Minimally Invasive Surgery," 3rd North American Summer School on Image Guided Interventions, Surgical Robotics and Simulation, London, ON,

X. Sun

May 2013	"Nanostructured Materials for Energetic Applications", 96th Canadian Chemistry Society conference, Quebec (invited)
	"Nano Carbon-based Electrodes for Energy Storage and Conversion", for the 223rd meeting of The Electrochemical Society in Toronto, Ontario, Canada (invited)

April 2013	"Pt-based one-dimensional catalyst for Energy Storage and Conversion", a symposium entitled Catalysts for Energy Conversion and Storage on 245th ACS National Meeting & Exposition, New Orleans, Louisiana, USA. (invited)
January 2013	"Nanostructured Materials for Energy Storage and Conversion", University of Toronto (Departmental seminar) (invited)
November 2012	"Development of Nanostructured Materials for Fuel Cells and Li Batteries", Shanghai Tongji University (invited)
	"Nanomaterials for Fuel Cells and Batteries.", Shanghai Fuda University (invited)
	"How to Apply Nanomaterials in Li Ion Batteries and Fuel Cells.", Wuhan University of Technology (invited)

J. Yang

April 2013	"A Method for Fabrication of Unique High-performance Microfiltration Membranes", Beijing International Technology Transfer Congress 2013 (ITTC2013), Beijing, China.
	"A Lab-on-a-CD System for Point-of-care Diagnostics of Blood", Beijing International Technology Transfer Congress 2013 (ITTC2013),Beijing, China.
	"A Point-of-care Diagnostic System for Blood Analysis", Institute of Electronics, Chinese Academy of Sciences, Beijing, China.
November 2012	'Micro/Nanofabrication of Functional Materials, Surfaces and Devices", Xerox Research Centre of Canada
October 2012	"When Nanotechnology Meets Biology: from Fundamentals to Applications", MIE Distinguished Seminar Series 2012 – 2013, University of Toronto.
August 2012	"Mechanics in Micro, Nano and Bio Systems", Shanghai Institute of Applied Mathematics and Mechanics, Shanghai, China.
	"Non-silicon microfabrication techniques, devices and their applications", Institute of Geodesy and Geophysics (IGG), Chinese Academy of Sciences, Beijing, China.

5. TECHNICAL REPORTS

A.G. Straatman

Straatman, A. G., Farrokhnejad, M**.,** "Computational fluid dynamics modelling of reacting flow in a dual-silo system," Technical Report prepared for KMW Energy Ltd., London, Ontario, April 30, 2013.

X. Sun

8 reports for GM, Ballard, Phostech Lithium

6. BOOKS AND BOOK CHAPTERS

DeGroot, C. T**., Straatman, A. G.,** "Thermal dispersion in high conductivity porous media," in Numerical analysis of Heat and Mass Transfer in Porous Media, Edited by Joao Delgado, Springer, 2012

Knopf, G.K. and Otani, Y. (Eds.) (2013), Optical Nano and Micro Actuator Technology, CRC Press. [ISBN:978-1-4398-4053-5]

Kurowski, P. “Engineering Analysis with SolidWorks Simulation 2013” http://www.sdcpublications.com/Textbooks/Engineering-Analysis-SolidWorks-Simulation-2013/ISBN/978-1-58503-784-1/

Kurowski, P. “Thermal Analysis with SolidWorks Simulation 2013” http://www.sdcpublications.com/Textbooks/Thermal-Analysis-SolidWorks-Simulation-2013/ISBN/978-1-58503-785-8/

G. Zhang, S. Sun and **X. Sun**, "Atomic Layer Deposition of Metals and Metal Oxides for Fuel Cell Applications" in the book of "Advances in Fuel Cells". Ed by San Ping Jiang and Pei-Kang Shen, CRC Press/Taylor & Francis, (2012).

Y. Hu and **X. Sun**, "Chemically Functionalized Graphenes and their Applications in Electrochemical Energy Conversion and Storage" in the book of "Advances in Graphene Science", ISBN 980-953-307-981-8. InTech - open science, open minds. Website: http://www.intechopen.com/ (2013).

7. PATENTS

Jenkyn, T.R. Awarded a Canadian Patent #2728267 "Curling head for curling broom." The US patent is pending.

Polihronov, J. G., **Straatman, A. G.**, “Mechanism for enhanced energy extraction and cooling of pressurized gas,” PCT Patent, Application number: 1018P011US01, May 2013

Hassan, H**.** and **Siddiqui, K.,** “Solar Tracker” PCT International Patent Application, serial number PCT/CA2012/050664, 2012.

Sun, X., Abou-Rachid, H., Ionescu, M., “Controlled Synthesis Novel Class Carbon Nanostructures”, United States patent (filed) (2013).

Jun Yang, Tingjie Li, Natalie Suhan, et. al. , “Superoleophobic surfaces and methods of making same”, US provisional patent and PCT application

PROFESSIONAL SERVICES

1.REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS

R.O. Buchal

Journal of Engineering Manufacture
Journal of Mechanical Engineering Science
International Journal of Production Research

C. Dunning

Clinical Biomechanics
Proceedings of the Institution of Mechanical Engineers, Part H, Journal of Engineering in Medicine
Journal of Orthopaedic Trauma

L. Ferreira

Journal of Biomechanics (two manuscript reviews)

J.M. Floryan

Reviewed about 15 papers for journals like
Journal Fluid Mechanics
Physics of Fluids
European Journal of Mechanics
Fluid Dynamics Research
Archives of Mechanics, etc

Reviewed proposals for various NSERC Programs.

T.R. Jenkyn

Journal of Biomechanics (two submissions)

J. Johnson

The Journal of Shoulder and Elbow Surgery (Assistant Editor)
The Journal of Biomechanical Engineering
The Journal of Hand Surgery
The Journal of Orthopaedic Research
Clinical Orthopaedics and Related Research
Journal of Engineering in Medicine
Clinical Biomechanics
Journal of Biomechanics
Applied Physiology, Nutrition & Metabolism

L. Jiang

Journal of Applied Physic
ASME Journal of Applied Mechanics
Physica E: Low-dimensional Systems and Nanostructures
Engineering Fracture Mechanics
Composite Structures
The European Physical Journal
Advances in Materials Science and Engineering
Computational Materials Science
European Journal of Mechanics - A/Solids
Journal of Sound and Vibration
Journal of Nanomaterials
International Journal of Applied Mechanics
Acta Mechanica
Smart Materials and Structures
Mechanics Research Communications.

R. Klassen

Materials Science and Engineering A
Journal of Nuclear Materials
Reviewed Discovery Grant Applications for NSERC

Member of Senate (Western University)
Member of National Scholars Selection Committee (Western University)
Warden of Camp 11 of the Professional Engineers of Ontario 2013 - present.

G. Knopf

International Standards Organization (ISO) - Member of the Standards Council of Canada advisory committee (CAC) on Robots for Manufacturing Environment (TC184/SC2)

Natural Sciences and Engineering Research Council (NSERC) - Member of NSERC's Discovery Grant Evaluation Committee (1512)

Associate Editor of Refereed Journals:
International Journal of Control and Intelligent Systems (Editor: C. de Silva, UBC),
International Journal of Optomechatronics (Editor: H.-S. Cho, KIAST)

Reviewer of Refereed Journals
ASME Journal of Micro and Nano-Manufacturing
Biosensors and Bioelectronics
Computer-Aided Civil and Infrastructure Engineering
Computer Aided Design
Computers in Biology and Medicine
International Journal of Advanced Manufacturing Technology
Journal of Intelligent Material Systems and Structures
Measurement Science and Technology
Optical Engineering
Precision Engineering
Sensors and Actuators: B Chemical

T. Kuboki

Journal of Composite Materials (1 paper)
Journal of Materials Science (2 papers)

M.D. Naish

IEEE/ASME Transactions on Mechatronics
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Haptics
International Journal of Medical Robotics and Computer Assisted Surgery

K. Siddiqui

Int. Journal of Thermal Science

Technical Societies
Chair of Fluid Mechanical Technical Committee of the American Society of Mechanical Engineers (ASME) for a two-year term
Technical Editor, CSME Bulletin
Symposium organizer, ASME Fluid Engineering Summer Conferences

A.G. Straatman

CSME Journal (1)
Int. J. Thermal Sciences (3)
Physic of Fluids (1)
ASME Fluids Engineering Division (2)
J. Chemical Engineering Science (1)

X. Sun

Nature Nanotechnology
Nature Communications
Nature Materials
Journal of American Chemical Society
Adv. Materials
ACS Nano, *"Angewandte Chemie International Edition*
Nanotechnology
Materials of Chemistry
J. Phys. Chem.
Electrochemistry Communication
Electrochemical Solid-State Letter
Appl. Phys. Lett.
Carbon
Langumir, etc.

O. R. Tutunea-Fatan

Computer-Aided Design and Applications
Journal of Mechanical Engineering Science
Proceeding of the Journal of Engineering Manufacture
Measurement

J. Wood

Invista Engineering Polymers: Mechanical Testing of compression molded PMCs
Motion Industries (Canada) Ltd.: Mechanical Testing and Failure Analysis of Steel Chain.

J. Yang

Review about 15-20 research papers for these scientific journals:
Lab on a Chip,Applied Physics Letter, Nanotechnology, Journal of Micromechanics and Microengineering
IEEE Transactions on Industrial Electronics
IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency
IEEE Transactions on Nanotechnology
ACS Advances, Langmuir
The Journal of Physical Chemistry
Journal of Applied Physics; Sensors & Actuators: B. Chemical
Biomedical Materials
Soft Matter
Biomacromolecules
Journal of Biomechanics; Biomechanics and Modeling in Mechanobiology
Chemistry of Materials
Analytical Methods
Microsystem Technologies
Biotechnology Journal
Journal of Materials Processing Technologies

C. Zhang

Reviewer for Chemical Engineering Science
Reviewer for Computer and Fluids
Reviewer for CSME transaction

2. REVIEW OF GRANT APPLICATIONS

R.O. Buchal

Mitacs Accelerate internship proposal reviewer

C. Dunning

NSERC – Discovery Grants (3 applications)

L. Ferreira

Lawson Health Research Institute, Internal Research Fund (Spring 2012 Competition)

T.R. Jenkyn

NSERC Discovery Grant
CIHR Operating Grant (one application)

L. Jiang

NSERC Strategic Grant (one application)

J. Johnson

NSERC (external reviewer) 1998-present
Alberta Heritage Foundation for Medical Research (external reviewer) 2000-present
NSERC –Collaborative Health Research Partnerships (external reviewer) 2003-present

G. Knopf

Natural Sciences and Engineering Research Council (Strategic Grants) – **Canada** (2013)
Canada Research Chair (Tier II) – **Canada** (2012, 2013)
American Chemical Society – Petroleum Research Fund (ACS-PRF) – **United States** (2013)
IDEAS 2012 Exploratory Research Projects (PCE2012) **- Romania** (2012)

T. Kuboki

Agriculture and Agri-Food Canada (1 proposal)

M.D. Naish

NSERC Discovery Grants
NSERC Strategic Project Grants
NSERC/CIHR Collaborative Health Research Project Grants

A.G. Straatman

NSERC Discovery (2)
NSERC CRD (1)
Mitacs (2)

X. Sun

NSERC Discovery Committee Member (2011-2013)
NSERC Strategic
CRD
121
Discovery
CFI
OCE
ORF
NSF

J. Yang

NSERC Discovery grant applications
NSERC Strategic grant applications
NSERC CRD grant applications
NSERC I2I applications

C. Zhang

External Grant Reviewer: NSERC, MITACS