ANNUAL REPORT

July 1, 2011 to June 30, 2012

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 that we have strong academic, research, and professional engineering programs. Our undergraduate and graduate 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 231 undergraduate (years 2, 3 and 4) and 113 graduate students (2011). We awarded 58 BESc degrees and 35 graduate 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. In 2011/2012, these projects included the design of an elbow motion simulator, HVAC systems, personal mobility systems, jet flaps, an electric race car, a toilet flush valve and a linear winch. Most of these designs have been further developed and implemented by the sponsoring companies. Such projects provide an excellent opportunity to experience real engineering work and to make contacts in industry. We encourage all the students 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 introduced a new 2nd year course that introduces students to the principles of experimentation. We have restructured those 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. Our laboratories are among the best in the country. We have expanded in the scope of our the 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.

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. We are finalizing an exchange program with the Tokyo Metropolitan University that includes students enrolled in graduate professional programs. This year we hosted 22 students from other countries, while we have also conducted an international project where our students worked together with those from the National University of Singapore on the design of a small hydroelectric power station.

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.

Almost all 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. They are very active in research and in generating new engineering knowledge. With annual externally funded research expenditures exceeding $10 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.

J.M.Floryan
Professor and Chair
ADMINISTRATION

Chair

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Graduate Research Programs Committee
2011-2012

C. Dunning
A.G. Straatman
R. Klassen
J. Yang, Associate Chair, Professional Programs
K. Siddiqui, Associate Chair, Research Programs

Graduate Professional Programs Committee
2011-2012

E. Savory
L. Jiang
K. Siddiqui, Associate Chair, Research Programs
J. Yang, Associate Chair, Professional Programs

Undergraduate Curriculum Committee
2011-2012

R.O. Buchal
L. Jiang
R. Khayat
S. Salisbury
J. Wood, Associate Chair, Undergraduate
AWARDS AND RECOGNITION

C.E. Dunning
Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering 2011-2012

J.M. Floryan
President, Canadian Congress of Applied Mechanics (CANAM) to be held in London in 2015
President, International Congress of Theoretical and Applied Mechanics to be held in Montreal in 2016

J. Johnson
Graham King Musculoskeletal Research Chair (2012-2016).

R. Klassen
Chair of the 24th Canadian Materials Science Conference (CMSC), London, Ontario, June 5-8, 2012

A. Straatman
President, CFD Society of Canada, 2012-2014

J. T. Wood
Leads the International Composites Research Centre (ICRC) established in 2012.
### FACULTY MEMBERS AND ADMINISTRATIVE STAFF

#### 1. FULL-TIME FACULTY MEMBERS

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Office</th>
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<th>Email</th>
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</table>

**Research Interests:**

- **Asokanthan, S.F.** Dynamics and Control; Inertial Sensing and Applications; Nonlinear and Stochastic Mechanics; Rotating Flexible Multi-body Systems
- **Buchal, R.O.** Design Methods and Tools; Design Education; Instructional Technology; Manufacturing Inspection Planning
- **Dryden, J.R.** Solid Mechanics; Elasticity; Heat Conduction
- **Dunning, C.E.** Human Orthopaedic Biomechanics; Joint Replacement (Implant) Design; Joint Kinematics; Impact Loading and Analysis
- **Ferreira, L.** Medical Mechatronics; Implantable Transducer Design; Biomechanics of Major Joints Computer-Aided Systems for Orthopaedic Surgery
### Research Interests:

- **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

- **Jenkin, 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., Assistant Prof., Ph.D., P.Eng.**
  - Office: SEB 3076
  - 519-661-2111, x 80422
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  - **Research Interests:** Nanostructured Materials; Nanomechanics; Piezoelectric Materials; Thin Film Materials; Fracture and Failure Analysis

- **Johnson, J., Professor, Ph.D., P.Eng.**
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  - 519-661-2111, x 88255
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  - **Research Interests - Orthopaedic Biomechanics; Implant Design and Analysis; Joint Motion and Load Transfer**

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  - 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
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  - **Research Interests - Micro-Mechanical Properties of Materials; Time-Dependent Deformation of Materials; Microstructure /Mechanical Property Relationships**
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<tr>
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<th>Office</th>
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<th>Research Interests</th>
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<td>Research Interests: Experimental Fluid Mechanics; Turbulence; Interfacial Fluid Dynamics and Heat Transfer; Alternative Energy Systems; Energy Conversion</td>
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**Research Interests:**

- **Singh, A.V.**
  - Computational Methods
  - Vibrations of Plates and Shells
  - Mechanics of Composite Materials
  - MEM and Nano Structures

- **Straatman, A.G.**
  - Computational Fluid Dynamics
  - Porous Materials
  - Convective Heat Transfer
  - Turbulence

- **Sun, X.A. (Andy)**
  - Nanotechnology
  - Nanomaterials
  - Clean Energy
  - Fuel Cells
  - Lithium Ion Batteries
  - Energetic Materials

- **Tutunea-Fatan, O.R.**
  - Multi-Axis CNC Machining
  - Computer-Aided Design and Manufacturing
  - Intelligent Machining Systems
  - Numerical Methods

- **Wood, J.T.**
  - Structure – Property Relationships
  - Lightweight Structural Materials for Automotive Applications
  - Magnesium Die-Casting
  - Composite Materials

- **Yang, J.**
  - 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
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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

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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.

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

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Turbulent and complex flows; Transport phenomena in biological flows; Experimental fluid dynamics.
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Composite materials, in-line compounding of long-fibre reinforced polymers, injection moulding, design and construction of composite parts.

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

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M. Sadayappany, Ph.D.
CANMET - Materials Technology Laboratory
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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
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. 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. 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. Lin Wang: Beijing Institute of Technology, P.R. China

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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

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 2299, 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/LLB 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 LLB 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/LLB 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
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

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 LLB:
- The two compulsory upper-year Law courses
- At least three Law core-group courses (must include Law 5220)
- Additional Law courses equaling at least 25 credit hours (must include one of the optional courses listed below under “The Impact of Technology on Society”)
- One Law course must have an essay requirement of at least two credit hours.

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:

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 & Materials Engineering Department

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.

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

Third Year Program

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

Third Year Program
Business Administration 3300, 3301, 3302Y, 3303, 3304, 3305Q/R/S/T, 3307, 3308A/B, 3316.

Fourth Year Program

Fifth Year Program
Mechanical & Materials Engineering Department

MME 4499, MME 4492A/B, ES 4498F/G
Two 0.5 technical electives
Business Administration 4415Q/R/S/T, 4505A/B, 4466A/B, three 4400 level Business half course equivalents.

Exchange Programs
Academic exchange opportunities are not available for the combined degree program because of the core and elective courses required in Years Four and Five.

2. UNDERGRADUATE ENROLLMENT

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3. DEGREES GRANTED

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<td></td>
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4. UNDERGRADUATE AWARDS

Recipients (Fall 2011) – 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: Mayank Sharma

**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: Rebecca Dean

**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: David Rozhko
**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: David Drysdale

**125th Anniversary Alumni Award in Engineering**
Awarded to a full-time undergraduate student in Year 2 or higher in the Faculty of Engineering based on academic achievements.

Awarded to: Daniel Rozhko

**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: Nathan Curiale

**Dr. Clement Bowman Award for Energy Innovation**
Awarded annually to a full-time student in the Faculty of Engineering who is in their final year of an undergraduate program, has achieved a minimum 76% average, and has worked on a project that is related to energy innovation.

Awarded to: Raphael Kopala

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

Awarded to: Daniel Rozhko

**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: Mayank Sharma

**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: Aaron Yurkewich

**Vladimir Stritesky Engineering Award**
Awarded annually to a full-time undergraduate student in any engineering program. Preference will be given to a student who has immigrated to Canada.

Awarded to: Mayank Sharma

**D. Carlton Williams Scholarship**
Awarded to: Lauren Cuthbertson
Mechanical & Materials Engineering Department

Four Year Continuing Admission Scholarship Program
Awarded to: Malcolm Chorel, Mehan; Patricia Clynick; Jacob Mckenzie Reeves; Daniel Rozhko

General Motors of Canada Limited Scholarship of Distinction in Engineering
Awarded to: Daniel Rozhko

T.R. Meighen Family Foundation
Awarded to: Sarah Goodridge

Walker Wood Foundation Continuing Scholarship
Awarded to: Jacob Reeves

Recipients (Spring 2012) Awards of the Graduating Class June 2012 – 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: Jacob Reeves

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: Ethan Doan

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: Matthew De Jeu

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: Jacob Reeves

5. DESIGN PROJECTS

Projects at a Glance

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Student(s)</th>
<th>Faculty Advisor(s)</th>
</tr>
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<tbody>
<tr>
<td>Design of an Elbow Motion Simulator Team 1</td>
<td>Vanessa Brathwaite, Jennifer Ng, Tyler Orchard, Derek Wideman</td>
<td>L. Ferreira</td>
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<tr>
<td>Design of an Elbow Motion Simulator Team 2</td>
<td>Hussein Abushehada, Jacob Reeves, Kevin Samaranayake, Mayank Sharma</td>
<td>L. Ferreira</td>
</tr>
<tr>
<td>Hydro Generator for a Small Village</td>
<td>Daniel Bouillon, Malini Jhaver, Chris Kirk</td>
<td>J.M. Floryan</td>
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<tr>
<td>HVAC Design for the</td>
<td>Sarah Goodridge, Mike Knowlton, W. Altahan, R.O. Buchal</td>
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<tr>
<td>Project Title</td>
<td>Team Members</td>
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<tr>
<td>HVAC Design for the University of Chicago Library Team 2</td>
<td>Ethan Doan, Anne Engler, Laurie Klarner, Jonathan Ripley</td>
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<td>W. Altahan, R.O. Buchal</td>
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<td>Formula Electric Racecar</td>
<td>Vincen Chui, Andrew Kisielewski, Andrew McIlroy, Tyler Ouellet</td>
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<td></td>
<td>R.O. Buchal</td>
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<tr>
<td>Sustainable Personal Mobility System (SPMS) vehicle design team</td>
<td>Will Bonnycastle, Kelvin Kwok, Jay Pellerin</td>
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<td></td>
<td>R. O. Buchal</td>
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<td>SPMS vehicle layout and ergonomics team</td>
<td>Adam Lau, Kamil Omozik, Andrew Ravenhurst</td>
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<td>SPMS Business team</td>
<td>Reggie Adams, Chris Bacik, David Drysdale</td>
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<td></td>
<td>R.O. Buchal</td>
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<td>SPMS vehicle sharing system design team</td>
<td>Michael Bunt, Tom Kruk, Charles Vitanza</td>
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<td>R.O. Buchal</td>
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<td><strong>Industry-sponsored Projects</strong></td>
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<td>D-Jet Flap Design Team 1*</td>
<td>Scott Freeman, Alex MacKenzie, Owen Marble, Adam Shea</td>
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<td>R.O. Buchal</td>
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<td>Sponsor: Diamond Aircraft</td>
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<tr>
<td>D-Jet Flap Design Team 2</td>
<td>Joel Armstrong, Adam Spadotto, Justin Valenti</td>
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<td>Design of a Toilet Flush Valve Team 1</td>
<td>Richard Levick, Kevin Sin, Milan Tepavac, Zhao Wang</td>
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<td>P. Kurowski</td>
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<td>Design of a Toilet Flush Valve Team 2</td>
<td>Jeff Fox, Taylor Godbout, Alice Lok Donald Nickle</td>
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<td>Linear Winch Design Team 1</td>
<td>Joshua Fredlich, Branden Lomato, Brett Martin</td>
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<td>P. Kurowski</td>
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<td>Linear Winch Design Team 2</td>
<td>Matthew DeJeu, Kevin Graham, Peter Visser</td>
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<td>Linear Winch Design Team 3</td>
<td>Louis Kaptur, Raphael Kopala, Andrew Mitchell</td>
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*Best project

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<th>Supervisor</th>
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<tr>
<td>The Development of a Release Mechanism for Studying Downburst Flows</td>
<td>David Drysdale</td>
<td>E. Savory</td>
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<tr>
<td>Elbow Positioning and Muscle Activation on Radiocapitellar Joint Load</td>
<td>Jennifer Ng</td>
<td>J. Johnson</td>
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<tr>
<td>The Redesign of an Impact Loading Machine for Cadaveric Fracture Testing</td>
<td>Jacob Reeves</td>
<td>C. Dunning</td>
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<tr>
<td>Hemodynamic Forces on Monolayers of Endothelial Cells</td>
<td>Mayank Sharma</td>
<td>E. Savory</td>
</tr>
</tbody>
</table>
6. 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 2011-12.

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<tr>
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<th>Placement</th>
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<tr>
<td>Benacquista</td>
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<td>EVANTAGE</td>
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<td>Capitano</td>
<td>Kyle</td>
<td>GE Canada</td>
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<tr>
<td>Belanger</td>
<td>Alexandre</td>
<td>GM, CAMI Assembly</td>
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<tr>
<td>Ali</td>
<td>Faiz</td>
<td>GM Canada Ltd., CAMI assembly</td>
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<tr>
<td>Park</td>
<td>Daniel</td>
<td>LifeLike Bio Tissue Corporation</td>
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<td>J.D.</td>
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<td>Che</td>
<td>Nicole</td>
<td>Union Gas</td>
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<tr>
<td>Scalesse Lagendyk</td>
<td>Carlie</td>
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7. SUMMER ENGINEERING CO-OP PROGRAM

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<td>Chee</td>
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<td>*Chorel</td>
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<td>Hammerstone Corporation</td>
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<td>Fonseca</td>
<td>Graham</td>
<td>Crossey Engineering Ltd.</td>
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<tr>
<td>Freeman</td>
<td>Scott</td>
<td>Bell's Machining, Welding &amp; Hydraulics</td>
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<tr>
<td>Goodridge</td>
<td>Sarah</td>
<td>Imperial Oil (NFLD)</td>
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8. 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 2"rd or 3"rd 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.

Since the inaugural offering in 2010-2011, 24 Western engineering students have taken the PEME program. Graduates from the 2011-12 offering are:

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
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</thead>
<tbody>
<tr>
<td>Barnwell</td>
<td>Tyler</td>
</tr>
<tr>
<td>Fernandez</td>
<td>Jonathan</td>
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<td>Gibson</td>
<td>Philip</td>
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<tr>
<td>Lazo-Castro</td>
<td>Adelberto</td>
</tr>
<tr>
<td>Martinuzzi</td>
<td>Veronick</td>
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<tr>
<td>O’Gorman</td>
<td>Katelyn</td>
</tr>
<tr>
<td>Roddy</td>
<td>Matthew</td>
</tr>
<tr>
<td>Rodger</td>
<td>Cameron</td>
</tr>
<tr>
<td>Tsaltas</td>
<td>Julia</td>
</tr>
</tbody>
</table>

*1st year placements – went into Mechanical Program this year.*
9. EXCHANGE PROGRAMS AND INTERNATIONAL STUDENTS

MME is actively promoting international exchange programs as this enriches students' experience. Individual programs with the National University of Singapore and the University of Hong Kong have been established through direct department to department contacts, and an additional one is being established with the Tokyo Metropolitan University in Japan. In 2011/12 MME hosted 16 exchange students from 10 institutions located in Asia, Europe and Central America. One MME student completed an exchange year at Leeds University, UK.

MME has further established an exchange program with the Department of Mechanical Engineering at UBC in order to promote cross-country mobility, and is finalizing an program with the Tokyo Metropolitan University in Japan.

### Incoming students

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Home University</th>
<th>Home Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aranda</td>
<td>Hugo</td>
<td>Monterrey Institute of Technology and Higher Education</td>
<td>Mexico</td>
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<tr>
<td>Flores</td>
<td>Omar</td>
<td>Monterrey Institute of Technology and Higher Education</td>
<td>Mexico</td>
</tr>
<tr>
<td>Garcia Rodriguez</td>
<td>Jaime Arnoldo</td>
<td>Monterrey Institute of Technology and Higher Education</td>
<td>Mexico</td>
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<td>Guyoton</td>
<td>Alexis</td>
<td>Polytech Annecy-Chambery</td>
<td>France</td>
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<tr>
<td>Herrera</td>
<td>Duran</td>
<td>University of Costa Rica</td>
<td>Costa Rica</td>
</tr>
<tr>
<td>Huang</td>
<td>Huguang</td>
<td>National University of Singapore</td>
<td>Singapore</td>
</tr>
<tr>
<td>Joshi</td>
<td>Prachi</td>
<td>Vishwakarma Institute of Technology</td>
<td>India</td>
</tr>
<tr>
<td>Ng</td>
<td>Lay Hiong</td>
<td>Nanyang Technological University</td>
<td>Singapore</td>
</tr>
<tr>
<td>Nguyen</td>
<td>Thu Mai</td>
<td>INSA Toulouse</td>
<td>France</td>
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<tr>
<td>Omozik</td>
<td>Kamil</td>
<td>Stuttgart University</td>
<td>Germany</td>
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<tr>
<td>Padilla</td>
<td>Carolina</td>
<td>University of Costa Rica</td>
<td>Costa Rica</td>
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<tr>
<td>Vossing</td>
<td>Michael</td>
<td>Karlsruhe Institute of Technology</td>
<td>Germany</td>
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<tr>
<td>Wang</td>
<td>Kaidi</td>
<td>Jiangsu University</td>
<td>China</td>
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<tr>
<td>Yap</td>
<td>Hong Kai</td>
<td>National University of Singapore</td>
<td>Singapore</td>
</tr>
<tr>
<td>Yong</td>
<td>Cheng</td>
<td>Nanyang Technological University</td>
<td>Singapore</td>
</tr>
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### Outgoing students

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>University attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eden</td>
<td>Remy</td>
<td>University of Leeds</td>
</tr>
</tbody>
</table>

### Self-sponsored Incoming students

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Year</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkhamis</td>
<td>Ammar</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bilal</td>
<td>Muhammad</td>
<td>2</td>
<td>country ????</td>
</tr>
</tbody>
</table>
10. UNDERGRADUATE STORIES

Industry-sponsored undergraduate design projects
Several teams of undergraduate students worked with local companies on industry-sponsored capstone design projects. Three teams worked with Timberland Equipment Ltd. (Woodstock ON) on the design and analysis of a high capacity linear winch. Two teams worked with Diamond Aircraft (London ON) on the design of a wing flap actuation system for the new D-JET private jet being developed by Diamond. Two teams worked with Masco Canada (St. Thomas ON) on competing concepts for proportional control of flush valves. All of 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 2011, and further developed the course to be offered again 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 addition 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 Biomechanics

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
Mechanical & Materials Engineering Department

- 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

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 M.Eng. program is offered in the following subject areas:

1. Thermo-fluids,
2. Materials and Solid Mechanics,
3. Automation Technologies and Systems,
4. Mechanical Engineering with two options (i) General Mechanical Engineering and (ii) Engineering in Medicine.

Thermo-fluids

The program is comprised of the following:

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

B) 2 of the 4 core half courses in Professional Engineering (offered in Summer term); and

• 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.

For elective courses, students may take any graduate courses offered by the MME Department listed below. Courses marked in bold text with an asterisks (*) are recommended for those wishing to specialize in the Thermofluids area. Please note that the 95xx-level courses are combined courses accessible to the graduate and undergraduate students. However, the number of credits that graduate students can get for such courses cannot be greater than 30% of the degree requirement (i.e., maximum of 3 courses for M.Eng. degree):

• 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 for 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

Interested student may also be able to enroll in some 97xx-level courses offered by the MME Department with the approval of the course instructor and the MME Associate Chair Graduate. Courses may also be chosen from Electrical and Computer Engineering, Chemical and Biochemical Engineering, Civil & Environmental Engineering, Applied Math, and Physics & Astronomy with approval of the MME Associate Chair Graduate.

**Materials and Solid Mechanics**

The program is comprised of the following:
A) 4 of the 6 core half courses in Mechanical and Materials Engineering; and

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

B) 2 of the 4 core half courses in Professional Engineering (offered in Summer term); and

- 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.

For elective courses, students may take any graduate courses offered by the MME Department listed below. Courses marked in bold text with an asterisks (*) are recommended for those wishing to specialize in the Materials and Solid Mechanics area. Please note that the 95xx-level courses are combined courses accessible to the graduate and undergraduate students. However, the number of credits that graduate students can get for such courses cannot be greater than 30% of the degree requirement (i.e., maximum of 3 courses for M.Eng. degree):

- 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 for 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

Interested students may also be able to enroll in some 97xx-level courses offered by the MME Department with the approval of the course instructor and the MME Associate Chair Graduate. Courses may also be chosen from Electrical and Computer Engineering, Chemical and Biochemical Engineering, Civil & Environmental Engineering, Applied Math, and Physics & Astronomy with approval of the MME Associate Chair Graduate.
The program is comprised of the following:

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

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

B) 2 of the 4 core half courses in Professional Engineering (offered in Summer term); and

- 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.

For elective courses, students may take any graduate courses offered by the MME Department listed below. Courses marked in bold text with an asterisk (*) are recommended for those wishing to specialize in the Automation Technologies and Systems area. Please note that the 95xx-level courses are combined courses accessible to the graduate and undergraduate students. However, the number of credits that graduate students can get for such courses cannot be greater than 30% of the degree requirement (i.e., maximum of 3 courses for M.Eng. degree):

- 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 for 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
Interested student may also be able to enroll in some 97xx-level courses offered by the MME Department with the approval of the course instructor and the MME Associate Chair Graduate. Courses may also be chosen from Electrical and Computer Engineering

**Mechanical Engineering**

(i) General Mechanical Engineering Option

The program is comprised of the following:

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

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

B) 2 of the 4 core half courses in Professional Engineering (offered in Summer term); and

- 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.

For elective courses, students may take any graduate courses offered by the MME Department listed below. Please note that the 95xx-level courses are combined courses accessible to the graduate and undergraduate students. However, the number of credits that graduate students can get for such courses cannot be greater than 30% of the degree requirement (i.e., maximum of 3 courses for M.Eng. degree):

- 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 for 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
Mechanical & Materials Engineering Department

- 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

Interested students may also be able to enroll in some 97xx-level courses offered by the MME Department with the approval of the course instructor and the MME Associate Chair Graduate. Courses may also be chosen from Electrical and Computer Engineering, Chemical and Biochemical Engineering, Civil & Environmental Engineering, Applied Math, and Physics & Astronomy with approval of the MME Associate Chair Graduate.

(ii) Engineering in Medicine Option

The program is comprised of the following:

A) Two introductory half-courses on Engineering in Medicine

- MME 9550 Medical Device Design
- MME 9511 Biomechanics of the Musculoskeletal System
- BME 9502 Eng. Analysis of Physiological System
- BME 9520 Fundamentals of BioMEMS
- BME 9525 Introduction to Biomaterials Engineering

B) Two core half-courses in Mechanical and Materials Engineering; and

- MME 9610 Applied Measurements & Sensing Systems
- MME 9622 Advanced Dynamics and Kinematics

C) Four half-courses that cover advanced topics (or 2 courses plus an MEng project in related topic):

- 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 and Control (ECE 9509)
- MME 9724 Microfluidics and Lab-on-a-Chip
- MME 9728 Computer Aided Geometric Modeling
- MME 9729 Optomechatronic Systems
- BME 9509 Introduction to Digital Image Processing

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

- BME 9526 Tissue Engineering
- ECE 9200 Software Eng’g for Human-Computer Interface Design
- ECE 9202 Advanced Image Processing and Analysis
- ECE 9503 Robot Manipulators
- MME 9724 Microfluidics and Lab-on-a-Chip
- MME 9725 Piezoelectric Materials
- MME 9726 Advanced Nanomaterials
- MME 9732 Biotransport Phenomena
- MME 9733 Current Topics in Biomechanical Engineering

Interested students may also enroll in some advanced BME courses and 9xxx-level courses offered by the MME Department with the approval of both the course instructor and the MME Associate Chair-Graduate.

D) Two half-courses in Professional Engineering (offered in Summer term):
• CBE 9185  Risk Assessment and Management in Engineering Systems
• ECE 9010  Intellectual Property for Engineers

**HVAC Systems**

The program is comprised of the following:

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

• MME 9515  Fluid Machinery
• MME 9610  Applied Measurements & Sensing Systems
• MME 9612  Finite Element Methods Eng. Analysis of Physiological System
• MME 9614  Applied Computational Fluid Mechanics and Heat Transfer
• MME 9617  Energy Conversion
• MME 9621  Computational Methods in Engineering

B) 2 of the 4 core half-courses in Professional Engineering (offered in Summer term); and

• 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 Communications

C) Four half-courses in Mechanical Engineering (if not enrolling in a MEng Project), or 2 elective half courses with the MEng Project:

• MME 9517  HVAC I
• MME 9517  HVAC II
• MME 9641  Thermal Systems Engineering

The MEng project in the HVAC Systems option will be mainly industry sponsored project which will provide students a real working experience in the HVAC industry. The MEng project option will only be available to the students who have already completed HVAC I and HVAC II or equivalent courses in the previous degree.

### 3. GRADUATE ENROLLMENT

<table>
<thead>
<tr>
<th></th>
<th>M.Eng</th>
<th>M.E.Sc.</th>
<th>Ph.D.</th>
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<td><strong>Fall 2011</strong></td>
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### 4. GRADUATE DEGREES GRANTED

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<tr>
<th>Student name</th>
<th>Degree</th>
<th>Completion Date</th>
<th>Thesis Exam Date</th>
<th>Supervisor/Co-supervisor</th>
<th>THESIS TITLE</th>
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<tbody>
<tr>
<td>Basu, Indranil</td>
<td>MESc</td>
<td>June 17,</td>
<td>June 2,</td>
<td>Wood, J.</td>
<td>Solidification of Magnesium</td>
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## Mechanical & Materials Engineering Department

### Annual Report 2011-2012

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Degree</th>
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<th>Thesis Exam Date</th>
<th>Supervisor/Co-supervisor</th>
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<tr>
<td>Berta, Tesfaye</td>
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<td>n/a</td>
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<td>Chadi, Mounib</td>
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<td>Ehtesham, Mussayab</td>
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<td>Ma, Ji</td>
<td>PhD</td>
<td>Aug 29, 2011</td>
<td>Aug 18, 2011</td>
<td>Feng, S.</td>
<td>Surface Reconstruction from Unorganized Point Cloud Data via Progressive Local Mesh Matching</td>
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<td>Singh, Amandeep</td>
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<td>n/a</td>
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<td>Zhang, Limin</td>
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<td>May 3, 2011</td>
<td>Yang, J.</td>
<td>Effects of Multiple Reflections and Refractions at Interfaces and Water Temperature on Disinfection Efficiency in UV Reactors</td>
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### JUNE 2012 CONVOCATION – Mechanical and Materials Engineering

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<tr>
<td>Afrose Ronny, Rahima</td>
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<td>Dec 19, 2011</td>
<td>Dec 13, 2011</td>
<td>Knopf, G.</td>
<td>Design and Microfabrication of Edge-lit Curtains for Automotive Applications</td>
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<td>Jan 25, 2012</td>
<td>Jan 16, 2012</td>
<td>Asokanthan, S.</td>
<td>Experimental Model Analysis of Micron-Scale Structures</td>
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<td>Nov 18, 2011</td>
<td>Naish, M.D.</td>
<td>Design and Development of a Tele-Operated Surgical Simulation Environment</td>
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<td>Chen, Xin</td>
<td>MEng</td>
<td>Dec 31, 2011</td>
<td>n/a</td>
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## Mechanical & Materials Engineering Department

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<tr>
<th>Name</th>
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<td>Fan, Yaxi</td>
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<td>Sep 22, 2011</td>
<td>Sep 15, 2011</td>
<td>Yang, J.</td>
<td>Fast Prototyping and Small Volume Production of Micro-Devices by Hybrid Master Molds using Hot Embossing Lithography</td>
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<td>Floryan, J.M.</td>
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<td>Sun, Shuhui</td>
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## 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**

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<tr>
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</table>

**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: 2011-2012

<table>
<thead>
<tr>
<th>Name</th>
<th>Program</th>
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<td>Bashar, Mohammad</td>
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<td>DeGroot, Christopher</td>
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<td>NSERC-CGSD</td>
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<td>Elliott, Kevin</td>
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<td>Farrokhenjad Roudsari, Mehdi</td>
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<td>Johnson, Chelsea</td>
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<td>Khalaji, Iman</td>
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<td>McLachlin, Stewart</td>
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<td>Neuert, Mark</td>
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<td>Sept 2011 to May 2014</td>
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<td>Norouzi Banis, Mohammad</td>
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<td>Sept 2011 to May 2012</td>
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### 6. GRADUATE SEMINAR

<table>
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<tr>
<th>Date</th>
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<th>Supervisor/Co-Supervisor</th>
<th>Presentation Title</th>
<th>Seminar Facilitator</th>
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<tbody>
<tr>
<td>Sept. 19</td>
<td>Prof. Igor Bellow</td>
<td>City University, Hong Kong</td>
<td>Advances in Synthesis of Materials with Extreme Properties</td>
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<td></td>
<td>Ziad Boutanios</td>
<td>H. Hangan</td>
<td>Eulerian-Eulerian CFD Snowdrift Analysis</td>
<td>Rajeev Kumar</td>
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<td></td>
<td>Lingmin Shao</td>
<td>J. Yang</td>
<td>System Level Simulation Method of Automotive Sensor</td>
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<tr>
<td>Oct. 17</td>
<td>Mehdi Farrokhenjad</td>
<td>A.G. Straatman/J. Wood</td>
<td>Microporosity Modelling of Magnesium Die-Casting</td>
<td>Khaled Al-Arbi</td>
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<td></td>
<td>Dongniu Wang</td>
<td>X. Sun/T. Sham</td>
<td>Sn and Sn0&lt;sub&gt;2&lt;/sub&gt; based Graphene Nanocomposites with Enhanced Performance as Anodes for LIB</td>
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<td>Oct. 24</td>
<td>Prof. J. Peter King</td>
<td>BLWTL, UWO</td>
<td>The Boundary Layer Wind Tunnel 46 Years of Wind Engineering</td>
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<td>Oct. 31</td>
<td>Alireza Mohammadi</td>
<td>J.M. Floryan</td>
<td>Drag Reduction Potential of grooves due to Superhydrophobic Effect</td>
<td>Mona Hazzanzadeh</td>
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<td></td>
<td>Meysam Haghshenas</td>
<td>R. Klassen</td>
<td>Analysis of the Length Dependence and Strain Rate Sensitivity of the Indentation Stress of 6061 Aluminum Alloy</td>
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<td>Nov. 7</td>
<td>Jinli Yang</td>
<td>X. Sun</td>
<td>Synthesis of 3D Porous LiFeP0&lt;sub&gt;4&lt;/sub&gt; as Cathode Materials for Lithium Ion Batteries used in Electric Vehicles</td>
<td>Alireza Mohammadi</td>
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<tr>
<td>Date</td>
<td>Presenter/Title</td>
<td>Authors/Instructors</td>
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<td>Nov. 14</td>
<td>Mohammad Mahdavi: Mechanical Characterization of Nanomaterials</td>
<td>L. Jiang/X. Sun</td>
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<td>Mona Hazzanzadeh: Investigation of Two Phase Flow in an Effervescent Atomizer</td>
<td>K. Siddiqui</td>
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<td>Prof. P. Sullivan, Chair Mechanical and Mechatronics Engineering University</td>
<td>Mechanical Characterization of Nanomaterials</td>
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<td>of Waterloo: The Life of Shaped Polymers</td>
<td>Prof. P. Sullivan, Chair Mechanical and Mechatronics Engineering University of</td>
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<td>Kuldeep Sareen: Information Extraction from Point Clouds of Occupies Building</td>
<td>G. Knopf</td>
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<td>Interiors</td>
<td>Masoud Noroozi: The Instability of Thin Film Structures</td>
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<td>L. Jiang</td>
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<td>Dec. 5</td>
<td>Moradi Vafadar: Flow in Grooved Annuli</td>
<td>J.M. Floryan</td>
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<td>Iman Khalaji: Does Lung Cancer Treatment Path Pass through B-Splines?</td>
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<td>M.D. Naish</td>
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<td>Dec. 12</td>
<td>Yongliang Li: N-CNTs &amp; GNSs as Cathode Materials for Lithium-Air Batteries</td>
<td>X. Sun</td>
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<td>Stewart McLachlin: Cervical Spine Unilateral Facet Injuries: Simulation, Quantification,</td>
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<td>and Treatment</td>
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<td>Sina Arghavan: Vibration of carbon-based nanostructures</td>
<td>A.V. Singh</td>
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<td>Zhi Yan: Modelling and analysis of piezoelectric nanostructure with surface effects</td>
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<td>Jan. 23</td>
<td>Prof. Y. Sun, Department of Mechanical and Industrial Engineering, University</td>
<td>Manipulation and Characterization of Biological Cells: MEMS and Micro-Nanorobotics</td>
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<td>Approaches</td>
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<td>Bipasha Bose: Effect of Temperature on the Anistropic Deformation of Zr-2.5%</td>
<td>R. Klassen</td>
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<td>Nb Pressure Tube Material During Micro-Indentation</td>
<td>Richard Obiasuyi: Investigation of the use of Micro-Mechanical Testing to Analyze</td>
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<td>the Mechanical Anistropy of the Zr-2.5% Nb Pressure Tube Alloy</td>
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<td>Feb. 6</td>
<td>Tingjie Li: Lab-on-a-CD for parallel blood analysis</td>
<td>J. Yang</td>
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<td>Taravat Khadivi: Flow structures associated with yawned elliptical cavities</td>
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Winter 2012

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<tr>
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<td>Dr. B. Ashrafi, Institute for Aerospace National Research Council of Canada</td>
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<td>Maryam Refan H. Hangan</td>
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<td>Abdullah Hafiz R. Tutunea-Fatan/ E. Bordatchev</td>
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<td>Apr. 2</td>
<td>Khaled ElBannan S. Salisbury/ J.M. Floryan</td>
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<td>Rajeev Kumar C. Zhang/E. Savory</td>
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<td>Apr. 16</td>
<td>Prof. G. Bitsuamiak J. Wood</td>
<td>Mechanical and Mechatronics Engineering, University of Waterloo</td>
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<td>Apr. 23</td>
<td>Jamaloddin Jamali R. Khayat</td>
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<td>Apr. 30</td>
<td>Christopher DeGroot A.G. Straatman</td>
<td>Mechanical and Mechatronics Engineering, University of Waterloo</td>
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<tr>
<td>Apr. 30</td>
<td>Seyed Mostafavi Yazdi R. Tutunea-Fatan/ J. Johnson</td>
<td>Mechanical and Mechatronics Engineering, University of Waterloo</td>
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7. GRADUATE STORIES

C. Dunning

Stewart McLachlin – PhD Candidate, Jack McBain Biomechanical Testing Lab
At the 39th Annual Meeting of the Cervical Spine Research Society (Scottsdale, AZ; Dec. 2011), Stew received 2 honours. His podium presentation was awarded “1st Place Basic Science Paper”, and his poster was noted as a “Top 10 Poster”.

Tim Burkhart – Post-doctoral Fellow; Jack McBain Biomechanical Testing Lab
At the annual Symposium on Computational Methods in Orthopaedic Biomechanics (San Francisco, CA; Feb., 2012), Tim was awarded the “Best Paper” for the conference.

J.M.Floryan

Mr. Alireza Mohammadi, doctoral student working with Professor Floryan, received and CFD Society of Canada Graduate Scholarship Award for 2012. In addition, he has been awarded the Ontario Graduate Scholarship for 2012-2013 and the Queen Elizabeth II Graduate Scholarship in Science and Technology for 2012-2013.

L. Jiang

Zhi Yan was awarded the Ontario Graduate Scholarship for 2012-2013.

J. Johnson

Dan Langohr, a PhD student in BME under Jim Johnson’s supervision, received the prestigious Vanier Award for 2012-15.

X. Sun

Western Engineering alumnus Shuhui Sun has been honoured with the 2012 Governor General’s Gold Medal for graduate study at Western University. These medals recognize students who have completed their graduate studies at the highest level of academic standing.

Western’s School of Graduate and Postdoctoral Studies presents the award annually to two PhD graduates and one master’s graduate.

Sun, who completed his PhD in Mechanical and Materials Engineering in December 2011, came to Western University in 2008 after completing a master’s degree at China’s University of Science and Technology. Throughout his PhD coursework at Western, Shuhui was praised for his superior performance, which culminated in an outstanding graduating average of 94.5 per cent. In addition, his work was recognized through several competitive awards, including the prestigious doctoral-level NSERC Canada Graduate Scholarship.

“It is truly my great honour to receive this prestigious award,” said Sun. “This recognition reinforces my self-confidence and gives me greater resilience in the face of any future challenges to my research. I appreciate the support from my supervisor and from Western Engineering, without which it would have been impossible to achieve what I have so far.”

Shuhui’s research with Western Engineering’s Department of Mechanical and Materials Engineering has produced exemplary results, including two U.S. patents, and has been covered in several high-impact, peer-
reviewed industry journals. He is highly regarded as an innovator in his field, pioneering a new approach to the
design of electrocatalysts and, most recently, achieving a breakthrough in catalysis for fuel cells.

“Dr. Shuhui is a highly productive researcher who has demonstrated a progressive and creative approach to his
work with nanotechnology and clean energy,” said Andy Sun, professor and Sun’s PhD supervisor. “The
Governor General’s Gold Medal is only the latest addition to Shuhui’s growing collection of academic awards,
showcasing the valuable contribution that his research has already made to the field.”

Sun is continuing his research as an assistant professor at Institut National de la Recherche Scientifique in
Montreal.

J. Wood

Ian Swentek: Ian was funded by the OBW exchange program during the summer of 2011, which enabled him to
conduct research, take a course and experience working in a state-of-the-art polymer composite research facility
at the Karlsruhe Institute of Technology and the Fraunhofer Institute for Chemical Technology.

Mehdi Farrokhnejad: Mehdi is the recipient of the Ontario Graduate Scholarship both in 2011 and in 2012 and
has been elected Chair of the HQPAC for AUTO21 NCE. He was an invited as speaker to AUTO21 Conference
both in 2011 and 2012

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).

**Thermofluids Group**

**Aerodynamic testing facilities:**
- Two low-speed wind tunnels
- 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

**Micro/Nano Fluids Laboratory facilities:**
- OLYMPUS IX81 Inverted Fluorescence Microscopy
- Photometrics Cascade high speed Imaging system
- Patchman NP2 Micromanipulation system

**Access to other fluid dynamic related test facilities:**
- Boundary Layer Wind Tunnel Laboratory (four wind tunnels and a water tunnel)
- 3-component laser Doppler velocimetry system
- Stereoscopic particle image velocimetry system
- High-speed camera system for flow visualization
- Laser Scanning Confocal Microscope (Dept of Anatomy and Cell Biology)
- Insurance Research Lab for Better Homes (CFI Facility)

**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

**Materials and Solid Mechanics Group**

**Access to Nanofab and Surface Science Western:**
- Photolithography
- LEO 1530 E-beam Lithography
- LEO 1540XB FIB Lithography
- Plasma Enhanced Chemical Vapour Deposition (PECVD)
- Reactive Ion Etch - STS
- SIMS - Secondary Ion Mass Spectrometry
- ToF-SIMS - Time-of-Flight Secondary Ion Mass Spectrometry
- SEM-EDX - Scanning Electron Microscopy with Energy Dispersive X-ray analysis
- FESEM - Field Emission Scanning Electron Microscopy
- XPS - X-ray Photoelectron Spectroscopy
- Laser Raman Spectroscopy
- SAM/AES - Scanning Auger Microprobe/Auger Electron Spectroscopy
- AFM - Atomic Force Microscopy
- FTIR - Fourier Transform Infrared Spectroscopy

**Metal Forming Laboratory (SEB 24):**
- Four combined bending and torsion test labs
- Four beam bending labs
Mechanical & Materials Engineering Department

- 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)

Heat Treating Laboratory (SEB 3049):
- 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 (SEB 6):
- Freezer
- oven,
- autoclave and heated platen press for two- and three-dimensional wet lay-up and prepreg processes.

Nanomaterials Fabrication and Characterization Laboratories (SEB 3072, SEB 3074, TEB 324):
- 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

Mechanical Testing Laboratories (SEB 10)
- Mechanical and servohydraulic load frames ranging from 1kN to 500kN capacity

Properties of Materials Laboratory (SEB 3052)
- 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 (SEB 3055):**
- FTIR, micro-indententer (DMTA, deep penetration)
- thin film tensile tester
- grad student desks

**Tribology Laboratory (SEB 3064):**
- A variety of wear testing machines including a Plinth and a Direct Observation Wear Machine.

**Materials Characterization Laboratories (SEB 3045, 3047)**
- Optical and Electron microscopy
- X-ray diffractometer
- Differential scanning calorimeter
- Electrical resistivity (4-300K),
- “Grindosonic” ultrasonic probe
- High-temperature nanoindentation

**Optical Microscopy Laboratory (SEB 3051)**
- Buehler micromet automatic polishers 2
- Leitz stereo microscope
- Unitron stereo microscope
- Olympus stereo microscope
- Leitz aristrophot
- 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 microscope with discussion attachment
- Unitron metallurgical inverted microscope model mec (2)
- Wild metallurgical inverted microscope model m50 (6)
- Microgram atomic 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 (SEB 3068):**
- DSC
- DMTA
thin film/microprobe dielectric spectrometer
Brabender high shear mixer
Centrifuge
annealing ovens
thin film spinner
grad student desks

Dynamic and Sensing Systems Laboratory (SEB 3072):
- Vibration transducers
- Electrodynamic shakers
- Real-time signal and modal analysis software

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:

MME Undergraduate Teaching Laboratories: Metallographic preparation, Rockwell and Vickers hardness, Charpy impact pendulum

Surface Science Western and Nanofabrication Facility: A variety of state-of-the-art materials characterization tools including electron and atomic force microscopy and a wide variety of spectroscopic techniques, Photo-, E-beam and Focussed Ion Beam Lithography

Dept of Microbiology and Immunology: Transmission Electron Microscope

The Automation Technologies and Systems Group

Dynamic and Sensing Systems Laboratory (SEB 2070):
- Micron-scale and macroscopic vibration transducers
- Electro-dynamic shakers
- Real-time signal analyzers and modal analysis software
- Real-time control hardware/software

CNC Machining Laboratory (SEB 37/37A):
- The Fadal 4020-5 Axis CNC Machine with tooling package.
- 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

Geometric Modeling & Virtual Sculpting Laboratory (SEB 3025A):
- Immersion MicroScribe G2 hardware/software
- PHANTOM Omni haptic device
- VRMesh 3.5 Studio software
- Claytools for Rhino modeling software
- Rhino3D NURBS modeling software

Bioelectronics and Biosensor Laboratory: (TEB 18) (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:** (TEB 206)
- Cyberware 3D RGB head & shoulder scanner
- Fakespace Immersadesk R-2 virtual reality display

**Sensing and Mechatronic Systems Laboratory:** (SEB 2048)
- Active modular omnidirectional vision systems with multiple Firewire cameras
- Modular sensor/actuator building blocks

**Robotics and Automation Laboratory:** (SEB 1068)
- (21) Mini Desktop Computer with INTEL 2.8GHZ - Dual Core Processor, 1GB Ram, 256Mb PCI-E Video Card, 160GB HD, DVD+-RW, 17” LCD, Windows XP Pro.
- (15) Dell OptiPlex GX1p Computer, P3-550, 512MB Ram, 80GB HDD
- (20) Tektronix Oscilloscope, Model # TDS1002
- (10) Tektronix Oscilloscope, Model # TDS210
- (20) B&K PRECISION Power Supply
- (10) Global Series 12Vdc Power Supply
- (12) Fluke Digital Multimeter
- (10) General Purpose Multimeter
- (12) Fluke 3 MHz Sweep Function Generator
- (10) Hewlett Packard Function Generator
- (10) NI PCI-6221 M Series DAQ with SCB-68 Shielded I/O Connector Block
- (10) NI USB-6009 DAQ
- (3) PLC Controlled Industrial Workcells for Term Projects
  - (1) Motoman Robot with Controller - MRC II SV3
  - (1) GMFanuc S-110R Robot and Controller
  - (1) GMFanuc A-510 Robot and Controller
  - (1) CRS Plus M1A Robot and Controller
  - (1) 8-Axis Motion Control System with 4 Linear and 2 Rotary Stages
  - (5) Vision System, IEEE 1394 Firewire Colour Camera, IMAQ Advanced Vision software
  - (1) Vision Development System, IMAQ PCI-1408 (4 B&W Video Inputs)
  - (1) Omron F300 Vision System
  - (3) Vibratory Bowl Feeders
  - (9) Allen Bradley SLC 5/02 PLC - Basic Trainer
  - (10) Allen Bradley SLC 5/05 PLC - Advanced Trainer
  - (10) SMC Pneumatic Training Kits
  - (40) PIC16F877 Microcontrollers
  - (15) MPLAB-ICD (In-Circuit Debugger and Programmer)
  - (5) MPLAB PICDEM Training Boards
  - (1) PicStart Plus Programmer
  - (1) EEPROM Programmer and EEPROM Eraser
  - (20) Battery Chargers
  - (20) Stepper Motor Driver Board
Mechanical & Materials Engineering Department

- (20) DC Motor Driver Board
- (10) RC Servo Motors
- (2) Soldering Irons
- Various Electronic Components (555 Timers, Op-Amps, Logic Gates, motors, etc…)
- Various Mechanical Components (gears, castors, wheels, gearbox, springs etc…)
- Various Automation Related Equipment (i.e. sensors, valves, cylinders, motors, conveyors etc…)
- RSLogix 500 Programming Software, RSEmulate 500 PLC Emulation Software, RSLinx PLC Communication Software, RSView32 Visualization Software
- National Instruments Academic Site License - LabVIEW Professional Development System, Measurement Studio for Visual Studio .NET and many Advanced Toolkits

Research facilities available at National Research Council’s Integrated Manufacturing Technologies Institute (NRC-IMTI):
- 5 high precision laser micromachining systems with different lasers
- 2 high speed micromilling systems
- Micro-EDM
- Micro-welding system
- Micro/nano-injection moulding system
- Dynamic optical profilometer
- Scanning electron microscope
- 5-axis CNC milling machine
- ABB industrial robot
- Multi-camera motion tracking system
- FARO single-target laser tracker
- FARO laser scene scanner
- HYSCAN 3D laser scanning probe
- Equipment for virtual environment technologies
- Equipment for precision fabrication processes

Research facilities available at Canadian Surgical Technologies and Advanced Robotics (CSTAR):
- 2 Mitsubishi robots
- Zeus MIS system
- 3 Aesop arms
- 2 ultrasound machines
- Haptic input devices
- Electromagnetic and optical tracking systems

The Nanofabrication Laboratory: (Physics & Astronomy Room 10) – restricted fee access

Biomechanics Group

The Jack McBain Biomechanical Testing Laboratory: (Dr. Cynthia Dunning)

The Biomechanical Testing Laboratory primarily conducts experimental in vitro research related to orthopaedic biomechanics. The current lab 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.

The Wolf Biomechanics and Imaging Laboratories: (Dr. Tom Jenkyn)

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: (Dr. Graham King and Dr. James Johnson)

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.

3. RESEARCH SUPPORT

<table>
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<tr>
<th>Year</th>
<th>Granting Councils 2</th>
<th>Other Peer Adjudicated 3</th>
<th>Contracts 4</th>
<th>Others 5</th>
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<tr>
<td>2011</td>
<td>$5,194,907.83</td>
<td>$2,507,301.30</td>
<td>$3,229,293.84</td>
<td>$1,549,492.33</td>
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2NSERC Discovery Grants (this column does include equipment grants and conference grants)
3CFI grants, Centres of Excellence Grants (Federal and Provincial), Equipment Grants, Industrial Grants
4Industry grants
5University allocated grants (Academic Development Fund, UWO Internal Funding)
4. RESEARCH IN THE NEWS

C.E. Dunning

Dr. Dunning co-chaired the 2012 Ontario Biomechanics Conference, along with two other professors from Western’s Faculty of Health Sciences, Dr. Jeff Holmes (Occupational Therapy) and Dr. Jim Dickey (Kinesiology). The two meeting was held at the Kempenfelt Centre in Barrie, Ontario in March 2012, and attracted 150 participants from 12 Ontario universities.

L. Ferreira

Research conducted in the Hand and Upper Limb Centre Bioengineering and Surgical Mechatronics labs has been the focus of a St. Joseph’s Foundation public campaign. Mostly print and online news letters have been released. A media release went out August 29, 2012, directed to TV and radio.

R. Klassen

The 24th Canadian Materials Science Conference (CMSC) was hosted at Western from 5-8 June, 2012. The department of Mechanical and Materials Engineering (MME) at Western was instrumental in organizing this conference: The conference chairman was Dr. R.J. Klassen (MME) and the organizing committee members were Drs. J.T. Wood (MME), X.A. Sun (MME), J. Yang (MME), A. Rizkalla (CBE), J.F Corrigan (Chem), and M.J. Gordon.

Two hundred and twenty people attended the conference. The conference had 133 oral presentations, presented in 4 concurrent sessions over 2.5 days, and 44 poster presentations. The conference was considerably larger than past CMSCs. Much of this expansion has resulted from the efforts of the organizing committee to expand the scope of the conference to include new, highly topical, areas of materials science. The conference therefore had concurrent technical sessions on Biomaterials, Composites, Materials for Energy Storage, Nuclear Materials, NEMS/MEMS, Nanomaterials, in addition to the conventional topics of Mechanical Metallurgy and Chemical Metallurgy.

The CMSC conference invited 21 Canadian materials scientists who were recognized leaders in their particular areas of materials research to deliver invited lectures to the various technical sessions. The keynote lecture of this conference was delivered by Dr. Carlos Tome of the Los Alamos Nuclear laboratories.

K. Siddiqui

Prof gets more from solar
ENERGY: Trackers move panels so they follow the sun all day
Call it a smarter take on solar energy.

Sun-powered electricity systems are becoming more popular than ever amid rising energy costs. Homes, businesses -- even farms now have them. Although some solar panels track the sun, many solar systems don't move, capturing only a fraction of the sun's energy over the course of a day. A University of Western Ontario mechanical engineering professor, Kamran Siddiqui, has come up with two new ways to squeeze more juice out of the sun's rays while lowering the operating costs for solar systems. Siddiqui's smart solar tracker moves solar panels that capture the sun's light so they follow the sunlight throughout the day, while a load compensator uses energy that's been collected -- along with small motors -- to help move the panels.
“The tracker is very accurate and the good thing is the overall cost is very low,” Siddiqui said. Both systems are add-ons that can be attached to solar panels. Because most solar panels are fixed, they can only collect sunlight when it hits them. "Typically, panels face south, so for only about two hours a day the panel is well aligned with the sun," Siddiqui said. He said that studies show efficiency goes up 40% when a panel tracks the sun, instead of staying in a fixed position. Siddiqui said that with the load compensator, only a small motor is needed to help move the panel since it carries between 60% and 75% of the panel's weight. "You're working against gravity, so you need extra power to lift the panel up," he said. "This mechanical system releases the energy to help push the system up, so you don't need a large motor." With the load compensator, there's a build-up of energy which is used to slow down the panel and operate as a braking system so the panel doesn't move too fast.

The prototype system is located on the roof of Western University's Claudette MacKay-Lassonde Pavilion building. Siddiqui has applied to patent the system and is trying to take the system to market through UWO's commercial arm for new technology. He estimates when the two add-ons go to market, the cost will likely start at $3,000.

Dr. Siddiqui also had radio interviews in The Biggs Show on CJBK and XFM Radio to explain the novel solar tracking technology

A.G. Straatman

Professor Straatman was elected President of the CFD Society of Canada

The goal of the CFD Society of Canada is to promote computational fluid dynamics and to provide a framework for communication and collaboration between researchers, developers and practitioners, in industry, government and academia. Since its founding in 1992, the CFD Society of Canada has been a vibrant society that has grown under the leadership of 11 different presidents and numerous board members from Canadian academia and industry. The Society provides a unique network for graduate students, professors and practitioners to discuss advancements, applications and issues in CFD.

The annual conferences held by the CFDSC draw together researchers to highlight recent advances and challenges encountered in a broad spectrum of application areas and to facilitate scientific and technical exchange. The conference is hosted annually in several different locations in Canada spanning from Vancouver to St. Johns and Halifax. Western University served as host of the 18th annual conference on May 17-19, 2010 under the coordination of professors Straatman and Siddiqui, and attracted more than 115 delegates from academia and industry. The conference comprised 84 technical presentations in four parallel sessions held over two full days, and included keynote lectures from Dr. Andrew Pollard, founding president of CFDSC, and Dr. Marian Nemec of Eloret Corp. (California).

Prof. Anthony Straatman of Western Engineering is serving as the current president of CFDSC for the term May 2012 – April 2014, with the mandate of enhancing the membership, sponsorship and visibility of the Society. Prof. Straatman has previously served on the CFDSC Board of Directors and brings with him the enthusiasm to grow the society.

X. Sun

Western Engineering researcher receives funding from the Canadian Foundation for Innovation (CFI) for the project "Facility for Applications of Advanced Nanomaterials in Energy Storage for Electric Vehicles."

Engineering News, January 24, 2012

Prof. Sun’s paper about Batteries for Electric Vehicles, was highlighted in “Advanced Functional. Materials”, a journal with Impact Factor of over 10.
Tin Oxide with Controlled Morphology and Crystallinity by Atomic Layer Deposition onto Graphene Nanosheets for Enhanced Lithium Storage (Advanced Function Materials 22 (2012), 1647-1654. Atomic layer deposition derived amorphous SnO\textsubscript{2} decorated on graphene nanosheets is demonstrated to be a very effective approach for addressing the challenges of electrochemical and mechanical degradation of SnO\textsubscript{2} anodes with high energy capacity for lithium ion batteries. As reported by Xueliang Sun and co-workers on page 1647, this important finding shows promise for the application of the composite in hybrid electric vehicles and plug-in hybrid electric vehicles.

Prof. Sun’s paper about “Lithium-Air Batteries” was Highlighted by “Green Car Congress”, “New Energy and Fuel” and “Materials Today”, One of ten most downloaded articles from Feb. to May. in 2012)
http://www.greencarcongress.com/2012/02/uwo-20120206.html

http://newenergyandfuel.com/http/newenergyandfuel/com/2012/02/08/the-best-lithium-air-batteries-get-a-33-boost/


U of Western Ontario researchers find nitrogen-doped graphene nanosheet cathodes significantly increase performance of Li-oxygen batteries; 11,660 mAh g\textsuperscript{-1} at 75 mA g\textsuperscript{-1}
6 February 2012
Researchers at the University of Western Ontario (Canada) report that using nitrogen-doped graphene nanosheets as cathode materials significantly increases the performance of a non-aqueous lithium-oxygen battery, even compared to the use of the high-performance pristine graphene nanosheets they had developed earlier. (Earlier post.)

In a paper accepted for publication in the journal Electrochemistry Communications, Yongliang Li and his colleagues found that their nitrogen-doped graphene nanosheet (N-GNS) cathode materials delivered a discharge capacity of up to 11,660 mAh g\textsuperscript{-1}; the pristine graphene nanosheets (GNSs) had shown a capacity of up to 8,706 mAh g\textsuperscript{-1}—at that time, the highest capacity of any carbon-based materials in lithium-oxygen batteries reported, according to the team.

In their new study, they found that the electrocatalytic activity of N-GNSs for oxygen reduction in the non-aqueous electrolyte is 2.5 times that of GNSs. They attributed the excellent electrochemical performance of N-GNSs to the defects and functional groups as active sites introduced by nitrogen doping.

Recent studies reported that nitrogen-doped carbon powder and carbon nanotubes showed higher discharge capacities than the pristine counterparts, however, there is no report on nitrogen-doped graphene nanosheets (N-GNSs) as cathode materials for lithium-oxygen batteries. In this study, for the first time, N-GNSs were employed in lithium-oxygen batteries, and it was found that they show excellent electrocatalytic activity for oxygen reduction, therefore, increasing about 40% of the discharge capacity compared to GNSs. This finding not only shows that N-GNSs are promising electrode materials, but also gives a rational direction to modify other carbon materials for application in lithium-oxygen batteries.

—Yi et al.

In the current study, Yi et al. prepared both GNS and N-GNS cathodes; findings included:

- The initial discharge capacity of the GNS electrode was 8,530 mAh g\textsuperscript{-1} at a current density of 75 mA g\textsuperscript{-1}, while the N-GNS electrode delivered 11,660 mAh g\textsuperscript{-1} for N-GNSs—about 37% higher.
As current densities increased, the discharge capacities of both samples decreased: 5,333 and 3,090 mAh g\(^{-1}\) for GNS and 6,640 and 3,960 mAh g\(^{-1}\) for N-GNS at current densities of 150 and 300 mA g\(^{-1}\), respectively.

The research was supported by Natural Sciences and Engineering Research Council of Canada, Canada Research Chair Program, Canada Foundation for Innovation, Ontario Early Researcher Award and the University of Western Ontario.

**Resources**


J.T. Wood

Western Engineering researcher receives funding through the AUTO21 Network of Centres of Excellence for the project “Computational Tools for Magnesium Die-Casting”

Western News, May 31, 2012

Fraunhofer Project Centre

Western University and the Fraunhofer Institute of Chemical Technology (ICT) in Pfinztal, Germany have launched a long-term research collaboration on composite technologies for weight reduction. This joint venture represents the first comprehensive initiative between a Canadian university and an institute of Fraunhofer. Together, Western and Fraunhofer will work on composite technologies adapted to the local demands of each region’s industry in the joint Fraunhofer Project Centre for Composites Research at Western (FPC) – focusing on the development of lightweight composites for the transportation and building materials sectors – set to open in November 2012.

Academic collaboration with the FPC is primarily through the International Composites Research Centre (ICRC) - a virtual research cluster hosted by Western and led by Prof. J. T. Wood of the Department of Mechanical & Materials Engineering. Formed as a result of a successful $7.2M Ontario Research Fund proposal, the ICRC embodies academic research expertise that spans the entire value-chain of the polymer composites industry. The mission of the ICRC is to train graduate and undergraduate engineers and scientists for maximum impact to the polymer composites industry.

The centrepiece of the FPC is a state-of-the-art, 2500 ton compression moulding press. Initially, this press is fed by two full-scale composite material production lines - a Direct, Long-Fibre Thermoplastic (LFT-D) and a Direct Sheet Moulding Compound (D-SMC) line. Future plans call for a third manufacturing technology - High-Pressure Resin Transfer Moulding (HP-RTM) and associated preform production equipment to be added to the suite of high-volume manufacturing technologies.

The activities of both research entities will utilize and increase the expertise to accelerate composite innovations as lightweight solutions for the transportation, construction, renewable energy and aerospace.

The activities of the Fraunhofer Project Centre at Western and the International Composites Research Centre were highlighted in Business London: (http://www.myvirtualpaper.com/doc/Business-London-Magazine/bl_june_2012/2012060601/#2)
J. Yang

Jun Yang, Department of Mechanical & Materials Engineering, Faculty of Engineering, received WIF funds for a project, A technique for fabrication of unique high-quality microfiltration membranes.

http://communications.uwo.ca/western_news/stories/2012/June/western_projects_get_internal_boosts.html
http://www.eng.uwo.ca/news/2012/Western_projects_get_internal_boost.htm

5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS

S. Asokanthan

Ministry of Transportation Ontario (MTO) - Feasibility of using solar roadways in place of conventional asphalt-based are studied considering material characterization, mechanical strength of solar roadway panel systems, electrical power storage/transmission via smart grid and innovative power control devices. Computational as well as experimental investigations are also carried out for the purpose of developing suitable vibration-based energy harvesting systems.

T. Jenkyn

Collaboration with the Division of Plastic and Reconstructive Surgery, Department of Surgery, Schulich School of Medicine and Dentistry. I am working with Dr. Arjang Yazdani, MD, FRCSC on the biomechanics of concussion and craniofacial skeleton fractures. This is funded by a Dept. of Surgery start-up grant and a Lawson Health Science Center research grant.

Collaboration with 3M Canada. I am working with the Research and Development Department at 3M to test a novel type of sport grip tape. There is an application for an NSERC Engage grant to support this work.

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. Klassen

On March 2012, R.J. Klassen was awarded a 4-year NSERC CRD grant to work with Natural Resources Canada (NRCan) and the Atomic Energy of Canada Ltd (AECL) to study “The effect of irradiation on the mechanical properties of nuclear fuel cladding and insulating materials for the Gen. IV pressure tube super critical water reactor”. This grant has a total value of $320,000.

G. Knopf

National Research Council of Canada – Industrial Materials Institute (NRC-IMI)
Collaborating Researchers: Drs. Suwas Nikumb and Evgueni Bordatchev (NRC-IMI, London)
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 UWO and NRC-IMI 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 large volumes of disposable polymeric micro-devices. More recent research explores how laser micro-polishing (LµP) can be used to reduce the surface roughness of micro-machined structures and parts.

**National Research Council of Canada – Institute for Research in Construction (NRC-IRC)**
**Collaborating Researchers: Dr. Roberto Canas (NRC-IRC, London)**
**Range sensing and geometric modeling for virtual reality environments**
Range scanners have become the primary tool for capturing arbitrary surface geometry of pre-existing objects or large civil structures and spaces. However, the digitization process generates an immense cloud of 3D coordinate data that exhibit significant measurement errors due to scanner noise, partial or missing information, and data density variations. Researchers at UWO and NRC-IRC are developing new methods to reduce scanning errors and improve spatial accuracy by exploiting redundant data in multiple partial scans. The captured data is used to create 3D virtual reality models of buildings and structures. Another collaborative project involves the development of a computational framework for manipulating deformable free-form objects in virtual environments. The core algorithms for haptic rendering, collision detection and physics-based modeling assume that all deformable objects can be represented as parametric B-spline surfaces.

**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.

**Lor-don Limited/Team Enterprise, London**
**Project: Solar assisted Geo-Exchange system**
Geothermal heat pumps provide heating and cooling by utilizing clean, reliable and continuous thermal energy of Earth as a source and sink, respectively. The system cost and the degradation of its heating performance in the winter season are major obstacles in the wide scale utilization of this clean energy system. This research project was focused on the development of a novel hybrid solar-geothermal system to enhance the overall performance of the system and to reduce the overall cost. A prototype system has been developed and installed at a residential site and the performance evaluation is currently underway.

**EnerMotion Inc. Bolton, ON**
**Project: Thermodynamic Improvement and Operational Efficiencies to Hybrid Auxiliary Power Unit Harnessing Waste Exhaust Energy from a Heavy Truck**
Heavy trucks consume additional power during driving and operator’s rest/idle time to provide necessary heating/cooling to the cab/sleeper. During driving, this additional power requirement is provided by the truck engine resulting in increased fuel consumption and corresponding emissions as well as extra load on the truck engine. During the rest time, the power for the heating/cooling is either provided by idling the main engine or by operating a diesel-based auxiliary power unit which also leads to increased fuel consumption and gas emissions. EnerMotion has developed a novel Hybrid Auxiliary Power Unit that recovers waste engine heat, and converts it to a usable energy form by storing and releasing thermal energy. This project was focused on an in-depth analysis of the underlying thermodynamic processes and the associated design improvements to enhance heat transfer and thermal storage.

**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°C to 90°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

MITACS Accelerate application was approved for collaboration with St. Mary's Cement. The work involves a study of the pressure drop in a pneumatic transport system that moves cement powder from the milling to the filtration station. St. Mary's Cement/MITACS is supporting Ethan Doan (MESc) to conduct the work under my supervision.

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.

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 splitting 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): We are working in collaboration with researchers from the Centre for Automotive Materials and Manufacturing at the National Research Council’s Institute for Industrial Materials (NRC-IMI) located 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 optimize the insertion trajectory of the implant within the medullary canal of the targeted bone. 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 Scisense Inc. (R. Tutunea-Fatan and S. Salisbury): We are working in collaboration with industrial partner’s R&D staff to develop precise manufacturing strategies capable to produce miniaturized housings to encapsulate the MEMS sensor used in circulatory pressure and volume measurements. These blood flow parameters have clinical significance during the animal testing phase of the new experimental drugs with action on the cardiovascular system. The proposed hot-embossed housing will be integrated in a new generation of catheterized devices to be developed by the industrial partner for large-sized mammals.

J. Wood

Research funded by AUTO21 in the field of magnesium-based automotive structures continues with Meridian Lightweight Technologies (Strathroy, ON). Related research, funded by the Automotive Partnership Canada program includes Meridian, COSMA, 3M, Huys Industries, CANMET-MTL and researchers from McMaster and Waterloo and is part of the three-country (Canada, US, China) Magnesium Front-End Research and Development project.

In the field of composite materials, industrial partners include Ford Motor Company, General Motors, Continental Structural Plastics, DSM Composite Resins and Dieffenbacher North America.

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 researchers of Rosstech Signals Incorporation, Orillia, Ontario to develop multifunctional solar systems.

Dr. Jun Yang has been collaborating with Oxygon Technologies Inc. to develop a new design of spray bottles.

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
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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

1. REFEREED JOURNAL ARTICLES


32. Shultz, R., Birmingham, TB, Jenkyn R Differences in neutral foot positions when measured barefoot compared to in shoes with varying stiffness. Medical engineering and physics. December 2011.


64. R. Oviasuyi and R.J. Klassen; “Deducing the stress-strain response of anisotropic Zr-2.5%Nb pressure tubing by spherical indentation testing” Accepted, Journal of Nuclear Materials, June 22, 2012.


96. J. Yang, J. Wang, D. Wang, X. Li, D. Geng, G. Liang, M. Gauthier, R. Li, X. Sun, 3D Porous LiFePO4-graphene Hybrid Electrodes with Enhanced Performance for Li-ion Batteries. J. Power Sources 208 (2012) 340-344.


2. REFEREED CONFERENCE PROCEEDINGS


28. Neuert MAC, **Dunning CE**: Development of Strain Adaptive Finite Element Model for the Ulna, Annual Meeting of the Canadian Orthopaedic Research Society, Ottawa, ON, June 8-10, 2012. (poster)


33. "Natural Convection Due to a Long Wavelength Heating" by A. Asgarian and J.M. Floryan, Bul. Amer. Phys. Soc., v. 56, No. 15, Nov.2011, p.120.


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77. Mohammad Niknami, Kamran Siddiqui, Khayat, R.E. 2011, Economic and environmental analyses of Nanofluid based solar water heaters, 4th Annual Symposium of the Particle Technology Research Center, London, Ontario, Canada (October 2011)


111. Xiaobing Cai, Qiuquan Guo, Gengkai Hu and Jun Yang, “Particle trapping and focusing in liquid based on acoustic metamaterials”, Proceeding of SPIE Smart Structures/NDE 2012.


3. OTHER (Editor Reviewed Article)


4. OTHER (Research Laboratory Reports)


5. ORAL AND POSTER PRESENTATIONS


14. Ferreira, L. The Effect of Radial Head Excision and Arthroplasty on Medial Collateral Ligament Tension. CIHR Young Investigators Meeting, King City, ON June 12, 2012.


40. Jian Liu, Xifei Li, Xiangbo Meng, Dongsheng Geng, Mohammad N. Banis, Yuhai Hu, Ruying Li, Xueliang Sun. "Atomic-layer-deposition synthesis of energy nanomaterials and their applications in lithium-ion batteries". 12th International Conference on Atomic Layer Deposition, Dresden, Germany, June 17-20, 2012 (oral).


46. Jian Liu, Xifei Li, Liang Li, Ruying Li, Mei Cai, Xueliang Sun. Novel nanostructured Li4Ti5O12 as anode materials for lithium-ion battery applications. 16th International Meeting on Lithium Batteries, Republic of Korea, June 17-22, 2012 (poster).


48. Xifei Li, Xiangbo Meng, Ruying Li, Xueliang Sun, Mei Cai and Mark W. Verbrugge “Atomic Layer Deposition Derived Metal Oxides with Controlled Morphology and Crystallinity onto Graphene Nanosheets For Lithium Storage”. 16th International Meeting on Lithium Batteries, Republic of Korea, June 17-22, 2012 (poster).

49. Yongliang Li, Jiajun Wang, Xifei Li, Dongsheng Geng, Mohammad N. Banis, Ruying Li and Xueliang Sun “Graphene and N-doped Graphene as Cathodes for Li-Air Batteries”. 16th International Meeting on Lithium Batteries, Republic of Korea, June 17-22, 2012 (poster).

50. Yongliang Li, Jiajun Wang, Xifei Li, Dongsheng Geng, Mohammad N. Banis, Ruying Li and Andy Xueliang Sun “Graphene and N-doped graphene as cathodes for Li-Air Batteries”. Canadian Materials Science Conference, London, ON, Canada June 5-8, 2012 (oral).


58. Xiaobing Cai, Qiuquan Guo, Gengkai Hu and Jun Yang, “Particle trapping and focusing in liquid based on acoustic metamaterials”, SPIE Smart Structures/NDE 2012, March 11-15, 2012, San Diego, California, USA.

6. INVITED LECTURES

C. Dunning
September 2011 Investigations in Orthopaedic Biomechanics from Western’s Jack McBain Biomechanical Testing Lab, Dr. Sandy Kirkley Musculoskeletal Research Symposium, Western University

L. Ferreira
June 2012 The roles Mechatronics can play in orthopaedic procedures and surgical training. Schulich Department of Surgery Research Day. St. Joseph’s Health Care, Surgical Mechatronics Laboratory: A Bench To Bedside Approach. CIBC St. Joseph’s Foundation Luncheon. London, ON,

J.M. Floryan
September 2011 Certain Aspects of Flows over Rough Surfaces. National Institute of Aerospace, Hampton, VA,USA

M.D. Naish
September 2011 Devices to Enhance the Practice of Minimally Invasive Surgery,” 5th Seminario International Ingenería Electrónica, Bucaramanga, Columbia.

A.V. Singh
July 2011 Extensional and flexural modes of vibration of single layer graphene sheets by lattice structure and continuum plate theories, The 8th International Symposium on Vibrations of Continuous Systems, Whisler BC
X. Sun


Atomic Layer Deposition: Synthesis and Energy Applications of Nanostructured Materials. 95th Canadian Chemistry Society conference, Calgary, (invited)

April 2012  Graphene-based Electrodes for Fuel Cells and Li Batteries, Electrochemical Society Canadian Conference (ECS Canadian), Montreal. (invited)

February 2012  Development of Nanostructured Materials for Fuel Cells and Li Batteries, University of International Florida, Miami, USA

June 2012  Advanced Nanomaterials for Fuel Cells and Batteries”, University of Tsinghua University, Beijing, China

Energy Materials for Fuel Cells and Batteries, University of Soochow, Soochow, China

Energy Materials for Fuel Cells and Batteries, Institute of Physics, Academy of Sciences, China


Pt Nanwire-based Electrodes for Fuel Cells, Low Carbon EarthSummit-2011, Dalian, China

Nanomaterials for Fuel Cells and Batteries”, University of Zhongshan, Guangzhou, China

Nanomaterials and Clean Energy, Dalian Institute of Chemical Physics Chinese, Academy of Sciences, China

August 2011  Fuel Cells and Batteries: Role of Nanomaterials, University of Waterloo, Ontario

July 2011  Li Ion Batteries and Li-Air Batteries: Role of Nanomaterials, University of Shenzhen

Development of Li Ion Batteries and Li-Air Batteries”, Wuhan University of Technology

J. Yang

April 2012  Nanotechnology: from nanofabrication to nanomanipulation to application, Shanghai Jiaotong University

January 2012  A Method for Fabrication of Well-defined Microfiltration Membranes with Uniform Pore Size and Distribution, Trojan Technologies

December 2011  When Nanotechnology Meets Biology: from Fundamentals to Applications, Shanghai University
7. TECHNICAL REPORTS

S. Salisbury


E. Savory


X. Sun

8 reports for GM, Ballard, Phostech Lithium

8. BOOKS AND BOOK CHAPTERS


9. PATENTS

Kofman, J. and Knopf, G.K. entitled “Method and apparatus for three-dimensional shape measurement with unconstrained object and sensor motion” [US 6542249; CA 2278108] sold to Align Technology Inc., San Jose California, in June 2012. Align Technology Inc. is a global medical device company that develops 3D scanning solutions for orthodontics and dentistry.


Sun, X., Zhang, G., Sun, S., Li, R. Cai, M. “A General Strategy for the Kilogram-Scale Production of Various Metal and Bimetallic-Composite Nanostructures”, US patent,
**PROFESSIONAL SERVICES**

1. REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS

**S. Asokanthan**

Journal of Sound and Vibration  
ASME Journal of Applied Mechanics

**R.O. Buchal**

Journal of Mechanical Engineering Science  
Journal of Computing and Information Science in Engineering (JCISE)

**J.R. Dryden**

Journal of Materials Science

**C. Dunning**

Clinical Biomechanics  
International Journal for Numerical Methods in Biomedical Engineering  
Journal of Orthopaedic Trauma  
Journal of Biomechanics

**L. Ferreira**

ASME Journal of Biomechanical Engineering (1 review)  
Medical Engineering & Physics (1 review)  
Journal of Biomechanics (two reviews)

**J.M. Floryan**

Reviewing for 32 journal titles  
Member of Editorial Board of the Canadian Society for Mechanical Engineering (CSME) Transactions  
Archives of Mechanics  
The Archive of Mechanical Engineering  
Journal of Flow Control, Measurement and Visualization.
T. Jenkyn

Journal of Biomechanics
Journal of Orthopaedic and Related Research
Physics in Medicine and Biology

L. Jiang

Mathematics and Mechanics of Solids
Physica E: Low-dimensional Systems and Nanostructures
Smart Materials and Structures
Mechanics of Materials
Mechanics Research Communications
Proceedings of the Royal Society A
Theoretical & Applied Mechanics Letters
Journal of Physics D: Applied Physics
Journal of Engineering Materials and Technology
International Journal of Applied Mechanics
Journal of Applied Physics

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

R. Klassen

The Journal of Mechanical Engineering Science
Journal of Nuclear Medicine

G. Knopf

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

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
Applied Optics
Biosensors and Bioelectronics
Computer-Aided Civil and Infrastructure Engineering
Computer Aided Design
Control and Intelligent Systems (Associate Editor)
Optical Engineering
International Journal of Advanced Manufacturing Technology
International Journal of Optomechatronics (Associate Editor)
M.D. Naish

IEEE Transactions on Haptics
IEEE Transactions on Medical Imaging
IEEE Transactions on Biomedical Engineering
International Journal of Medical Robotics and Computer Assisted Surgery

E. Savory

J Wind Engineering and Industrial Aerodynamics
Wind and Structures
Experimental Thermal Fluid Sciences
J Automobile Engineering

Other

K. Siddiqui

Journal of Fluids Engineering
Solar Energy

Other
Elected as the 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

International J. Computer Mathematics (2)
Journal of Thermal Sciences (1)
International J. Heat and Mass Transfer (1)
Carbon (1)
International Conference on Heat Exchanger Fouling and Cleaning (3).

X. Sun

Nature Nanotechnology
Nature Communications
Nature Materials
Journal of American Chemical Society
Adv. Materials
Nanotechnology
Materials of Chemistry
J. Phys. Chem.
Electrochemistry Communication
O.R. Tutunea-Fatan

Computer-Aided Design
Journal of Engineering Manufacture
International Journal of Advanced Manufacturing Technology
Journal of Mechanical Engineering Science
Journal of Machining Science and Technology
International Journal of Machine Tools and Manufacture

J. Wood

Canadian Metallurgical Quarterly

J. Yang

IEEE Transactions on Industrial Electronics
IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency
IEEE Transactions on Nanotechnology, Langmuir
The Journal of Physical Chemistry
Journal of Applied Physics
Sensors & Actuators: B. Chemical
Biomedical Materials
Biomacromolecules; Microsystem Technologies
Biotechnology Journal
Journal of Materials Processing Technologies

C. Zhang

Chemical Engineering Science
International Journal of Heat and Mass Transfer

2. REVIEW OF GRANT APPLICATIONS

S. Asokanthan

NSERC Discovery Grants
NSERC CREATE Grant

R.O. Buchal

NSERC Strategic Grants
NSERC Collaborative Research and Development Grant

C. Dunning

NSERC – Discovery Grants (three applications)

J.M.Floryan

NSERC, NSF
L. Ferreira
Internal Grant Competition (Lawson Health Research Institute) (one application)

T. Jenkyn
NSERC Discovery
CFI Leading Edge Funds
CIHR Operating Grants

L. Jiang
American Chemistry Society – Petroleum Research Fund (Proposal Review)

J. Johnson
Canadian Institute of Health Research (CIHR)
Catalyst Grant- Bone Health Committee (Scientific Chair, attendee, 2012)
2012 Canadian Institute of Health Research (CIHR)
Biomedical Engineering Committee (Scientific officer, attendee, 2012)

R. Klassen
NSERC – CRD Grants (two applications)
NSERC – Discovery Grants (two applications)

G. Knopf
Member of NSERC's Discovery Grant Evaluation Committee (1512)
Natural Sciences and Engineering Research Council (Discovery Grant)
Austrian Science Fund (FWF) - Translational Research Program (TRP)
Romanian National Council for Scientific Research - Exploratory Research Projects

M.D. Naish
NSERC Strategic Grants
NSERC Discovery Grants

E. Savory
Czech Academy of Sciences

K. Siddiqui
NSERC Discovery Grants

A.G. Straatman
NSERC – CRD Grants (two applications)
NSERC – Discovery Grant (one application)
Nazarbeyez University Review (one application)

Elected President of CFD Society of Canada  2012-2014

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

J. Yang
NSERC – Discovery Grant
NSERC – Strategic Grant
NSERC – 121

C. Zhang
NSERC
MITACS