

# **ANNUAL REPORT**

**July 1, 2010 to June 30, 2011**

Department of Mechanical and Materials Engineering

Faculty of Engineering

Western University

## TABLE OF CONTENTS

|                                                        |           |
|--------------------------------------------------------|-----------|
| <b>MESSAGE FROM THE DEPARTMENT CHAIR .....</b>         | <b>3</b>  |
| <b>ADMINISTRATION.....</b>                             | <b>4</b>  |
| <b>AWARDS AND RECOGNITION .....</b>                    | <b>5</b>  |
| <b>FACULTY MEMBERS AND ADMINISTRATIVE STAFF .....</b>  | <b>6</b>  |
| 1. FULL-TIME FACULTY MEMBERS.....                      | 6         |
| 2. SPECIAL APPOINTMENTS.....                           | 11        |
| 3. PROFESSORS EMERITI.....                             | 11        |
| 4. ADJUNCT ACADEMIC PROFESSORS .....                   | 11        |
| 5. VISITING PROFESSORS .....                           | 13        |
| 6. ADMINISTRATIVE SUPPORT STAFF .....                  | 13        |
| 7. TECHNICAL SUPPORT STAFF .....                       | 13        |
| <b>UNDERGRADUATE EDUCATION .....</b>                   | <b>14</b> |
| 1. MECHANICAL ENGINEERING PROGRAM.....                 | 14        |
| 2. UNDERGRADUATE ENROLLMENT .....                      | 18        |
| 3. DEGREES GRANTED .....                               | 18        |
| 4. UNDERGRADUATE AWARDS.....                           | 18        |
| 5. DESIGN PROJECTS .....                               | 21        |
| 6. EXCHANGE PROGRAMS .....                             | 23        |
| 7. INTERNSHIP PROGRAM.....                             | 23        |
| 8. SUMMER ENGINEERING CO-OP PROGRAM .....              | 24        |
| 9. INTERNATIONAL STUDENTS .....                        | 25        |
| 10. UNDERGRADUATE STORIES .....                        | 25        |
| <b>GRADUATE EDUCATION .....</b>                        | <b>25</b> |
| 1. GRADUATE RESEARCH PROGRAMS .....                    | 25        |
| 2. PROFESSIONAL DEGREE PROGRAMS .....                  | 28        |
| 3. GRADUATE ENROLLMENT.....                            | 34        |
| 4. GRADUATE DEGREE GRANTED .....                       | 34        |
| 5. GRADUATE AWARDS .....                               | 36        |
| 6. GRADUATE SEMINAR.....                               | 38        |
| 7. GRADUATE STORIES .....                              | 40        |
| <b>RESEARCH.....</b>                                   | <b>41</b> |
| 1. MAJOR RESEARCH AREAS .....                          | 41        |
| 2. FACILITIES .....                                    | 41        |
| 3. RESEARCH SUPPORT .....                              | 46        |
| 4. RESEARCH IN THE NEWS.....                           | 46        |
| 5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS ..... | 51        |
| <b>PUBLICATIONS.....</b>                               | <b>55</b> |
| 1. REFEREED JOURNAL ARTICLES .....                     | 55        |
| 2. REFEREED CONFERENCE PROCEEDINGS.....                | 64        |
| 3. ORAL AND POSTER PRESENTATIONS .....                 | 69        |
| 4. INVITED LECTURES.....                               | 73        |
| 5. TECHNICAL REPORTS .....                             | 75        |
| 6. BOOKS AND BOOK CHAPTERS.....                        | 75        |
| 7. PATENTS.....                                        | 75        |
| <b>PROFESSIONAL SERVICES .....</b>                     | <b>76</b> |
| 1. REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS ..... | 76        |
| 2. REVIEW OF GRANT APPLICATIONS .....                  | 79        |

## **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 service programs. Our undergraduate and graduate students are provided an education, 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 a leadership role in industry and government when they leave our program.

The department had 205 undergraduate (years 2, 3 and 4) and 126 graduate students (2011). We awarded 53 B.E.Sc degrees and 36 graduate degrees this year. We think that we are right size, where we are small enough to offer personal attention to our students and big enough to have state-of-the-art broad technical expertise. While we are pleased with the state of the department, we are continually working to improve our undergraduate and graduate programs. Our high quality and substantial numbers of graduates generate strong interest and support from industries and employers from around the country. Our graduates are hired by a wide range of industries. Besides careers in industry, a number of our students go on to graduate, medical, dental, business, and law school. The department offers a wide range of undergraduate and graduate courses. You can find listing of all of them in this report.

In the past year, we have reviewed experiential, information technology, design and control and dynamics tracks of our undergraduate curriculum and brought them to the current state-of-the-art. Our teaching laboratories are among the best in the country, according to external reviewers. We have significantly expanded our offerings in the graduate professional programs in order to address society's needs. Program in Heating, Ventilation and Air Conditioning (HVAC) addresses the current preoccupation with energy and its efficient use. Program in Engineering and Medicine addresses needs of the aging society and opportunities associated with maintaining healthy life styles. Program in Composite Materials will shortly address the needs of automotive as well as biomedical industries which require better and lighter materials.

Our students have an opportunity to participate in a variety of international experiences. We have an ongoing exchange program with the National University of Singapore and University of Hong Kong. We have exchange program with the University of British Columbia for students who want to experience other parts of Canada. This year we hosted almost 30 students from other countries. Every year, our senior students work on "real world" design projects sponsored by a variety of companies. In 2010/2011, these projects included design of a work-bike tool (RND Ltd.), design of a modular impinging jet heat tunnel test facility (STANMECH), design of a chunk ice dispenser (Cargill Canada), and design of a heat recovery system (Cargill Canada). Most of these designs are further developed and implemented by the sponsoring companies, and some lead to patents. The design projects provide excellent opportunity to experience real engineering work and to make contacts in the industry. We encourage all students to participate in collegiate design competitions including Formula SAE race car, SAE Baja car, solar car, concrete toboggan, SAE Aero remote-controlled aircraft, and others.

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

Almost all of our faculty are registered Professional Engineers. They come from all over the world. Many are highly recognized in their fields and have earned numerous honors and awards by different engineering societies. They are very active in research and generating new engineering knowledge. With annual externally funded research expenditures exceeding 2.5 million, research support is derived from major federal research funding agencies such as the National Science and Engineering Council, Province of Ontario, and industry. The department has several large research laboratories in the areas of thermofluids, materials, biomechanics, dynamics, computational mechanics, mechatronics, among others. The major research areas include: (i) Heat transfer, (ii) Fluid mechanics, (iii) Composite materials, (iv) Biomechanics, (v) MEMS, (vi) Mechatronics, (vii) Computational mechanics, (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



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

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### Associate Chair, Graduate Affairs



**A.G. Straatman**, Ph.D., P.Eng.  
Professor

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### Associate Chair, Undergraduate Affairs



**J.T. Wood**, Ph.D., P.Eng.  
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## **AWARDS AND RECOGNITION**

### **A.G. Straatman**

Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering  
University Student's Council Teaching Honor Roll 2010-2011

## FACULTY MEMBERS AND ADMINISTRATIVE STAFF

### 1. FULL-TIME FACULTY MEMBERS



Asokanathan, S.F., Professor, Ph.D. Office: SEB 2057A  
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**Research Interests:** Dynamics and Control; Inertial Sensing and Applications; Nonlinear and Stochastic Mechanics; Rotating Flexible Multi-body Systems



Buchal, R.O., Associate Prof, Ph.D., P.Eng. Office: SEB 2069C  
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**Research Interests:** Design Methods and Tools; Design Education; Instructional Technology; Manufacturing Inspection Planning



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

**Research Interests:** Solid Mechanics; Elasticity; Heat Conduction



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

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



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

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

*Mechanical & Materials Engineering Department*



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

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



Johnson, J., Professor, Ph.D., P.Eng. Office: SEB 2076  
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**Research Interests** - Orthopaedic Biomechanics; Implant Design and Analysis; Joint Motion and Load Transfer



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



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

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



Knopf, G. K., Professor, Ph.D., P.Eng. Office: SEB 3087  
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**Research Interests:** Engineering Design; Geometric Modeling; Laser Micro-Fabrication; Optical Devices and Systems; Bioelectronics Biosensors

*Mechanical & Materials Engineering Department*



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

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



**Naish, M.D.**, Assistant Prof, Ph.D. Office: SEB 2055  
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**Research Interests:** Mechatronic Systems; Computer-Assisted Surgery and Therapy; Surgical Robotics; Sensing Systems; Surgical Training; Medical Devices; Robotics



**Salisbury, S.P.**, Assistant Prof., Ph.D., P.Eng. Office: SEB 3035A  
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**Research Interests:** Piezoelectric Actuators; Real-Time Control; Dynamic Modelling and Analysis; Mechatronic System Integration



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

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



**Shinozaki, D.M.**, Professor, D. Phil., P.Eng. Office: SEB 3059  
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**Research Interests:** Microstructural Aspects of Deformation; Fracture of Polymers and Polymer; Composites; High Resolution Imaging

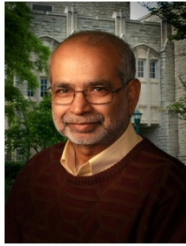


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**Research Interests:** Experimental Fluid Mechanics; Turbulence; Interfacial Fluid Dynamics and Heat Transfer; Alternative Energy Systems; Energy Conversion



*Mechanical & Materials Engineering Department*



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



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



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



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



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



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



Zhang, C., Professor, Ph.D., P.Eng.  
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**Research Interests** - Computational Fluid Dynamics; Gas-Solid Two-Phase Flows; Vapor-Liquid Two-Phase Flows; Combustions and Emission Controls

## 2. SPECIAL APPOINTMENTS

### **Honorary Professor**

Dr. Bjarni Tryggvason

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## 3. PROFESSOR EMERITI

J.D. Tarasuk, Professor; P. Eng.; Ph.D.

## 4. ADJUNCT ACADEMIC PROFESSORS

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Automotive Body and Structural Design and Analyses, Geometric Inspection and Coordinate Metrology, Tolerance Analyses, Computer-Aided Design, DFM

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

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

R. Gurka, Ph.D.

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

**F. Henning**, Ph.D.

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

**N. Kaloni**, M. Tech., Ph.D.

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519-253-3000, ext. 3024  
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Mathematical Modeling of Physical Problems in Fluid Mechanics; Non-Newtonian Fluids; Viscoelastic Fluids; Magnetic Fluids; Flow and Heat Transfer in Porous Media; Linear and Non-linear Stability of Convection Problems.

**R. Martinuzzi**, Ph.D., P.Eng.

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

**M. Sadayappany**, Ph.D.

CANMET - Materials Technology Laboratory  
Natural Resources Canada, McMaster Innovation Park  
289-922-8567  
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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.

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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.

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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.).

## **5. VISITING PROFESSORS**

Dr. Hong Chen: Chongqing University, P.R. China  
Dr. Jing-Zhong Chen: China University of Geosciences, P.R. China  
Dr. Alberto Garcia Pinar, Universidad Politecnica de Cartagena, Spain  
Dr. Aly Hafez Elsayed Gadallah: Tanta University, Egypt  
Dr. Botao Peng: Trojan UV Technologies, London, Ontario  
Dr. Lin Wang: Beijing Institute of Technology, P.R. China

## **6. ADMINISTRATIVE SUPPORT STAFF**

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## **7. TECHNICAL SUPPORT STAFF**

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**Adam Woodhouse**

Laboratory Supervisor  
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## **UNDERGRADUATE EDUCATION**

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

### **1. MECHANICAL ENGINEERING PROGRAM**

#### **Second Year Program**

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

#### **Third Year Program**

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

#### **Fourth Year Program**

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

#### **Mechanical Engineering Option**

Business Administration 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

## *Mechanical & Materials Engineering Department*

stand in the top 10% of the class. In addition, the applicant must meet the minimum LSAT requirement established by the Law School Admission Committee for all combined degree programs. Entrance into the combined degree program is competitive and limited.

### **Progression Standards**

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

### **Failure to Meet Progression Standards**

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

### **First Year Program**

Common first year of Engineering.

### **Second Year Program**

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

### **Third Year Program**

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

### **Fourth Year Program**

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

### **Fifth and Sixth Year Programs**

MME 4450A/B, MME 4425A/B  
MME 4499

In years five and six students must complete the following requirements for the 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:

- Ethical Issues: Law 5130 "Legal Ethics & Professionalism" – part of the first year Law curriculum.
- The Impact of Technology on Society: One of: Law 5615 "Biotechnology Law", Law 5605 "Advanced Issues in Technology Law", Law 5350 "Media Law", Law 5600 "Advanced Intellectual Property", Law 5620 "Information Law", the former Law 453 "Internet Law", Law 5625 "Intellectual Property", Law 5630 "International Protection of Intellectual Property", or Law 5610 "Advanced Patent Law".

In addition, there may be a Selected Topics course offered which may be approved on an individual basis.

- Economics: Law 5220 "Income Taxation".

### **Exchange Programs**

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

## **Mechanical Engineering and Medicine Option**

### **Admission**

Before entering the concurrent BSc/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 BSc/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 BSc/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 BSc program does not guarantee admission to the MD program.

### **Progression Requirements**

A student enrolled in the concurrent BSc/MD degree program must satisfy the following progression requirements:

**Year 2:** a minimum YWA of 80% in courses taken as a part of Option C (Mechanical Engineering and Medicine)

**Year 3:** a minimum YWA of 80% in courses taken as a part of Option C (Mechanical Engineering and Medicine)

**Year 4:** progression requirements of the MD program and successful completion of Engineering courses.

**Year 5:** progression requirements of the MD program

**Year 6:** progression requirements of the MD program

**Year 7:** progression requirements of the MD program and successful completion of Engineering courses.

If the student fails to satisfy the conditions above, he or she will be required to withdraw from the concurrent program and will be required to transfer out of Option C into Option A of the Mechanical Engineering program.

## **Concurrent Degree Program**

### **First Year Program**

Common first year of Engineering.

### **Second Year Program**

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

### **Third Year Program**

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

### **Fourth Year Program**



## *Mechanical & Materials Engineering Department*

MME 4425A/B, MME 4450A/B.

Regular Year 1 of the MD program.

### **Fifth Year Program**

Regular Year 2 of the MD program.

### **Sixth Year Program**

Regular Year 3 of the MD program.

### **Seventh Year Program**

Regular Year 4 of the MD program less the Advanced Communication Skills course.

MME 499 (will count as an "elective" credit in the fourth year of the MD program).

## **Mechanical Engineering and Business Option**

### **Admission Requirements**

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

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

### **Progression Standards**

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

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

### **Failure to Meet Progression Standards**

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

### **First Year Program**

Regular first year curriculum in the Engineering program.

### **Second Year Program**

[Applied Mathematics 2413](#), [MME 2202A/B](#), [MME 2204A/B](#), [MME 2213A/B](#), [MME 2259A/B](#), [MME 2260A/B](#), [MME 2273A/B](#), [MME 2285A/B](#), [Statistical Sciences 2143A/B](#), [Business Administration 2257](#).

### **Third Year Program**

[Business Administration 3300](#), [3301](#), [3302Y](#), [3303](#), [3304](#), [3305Q/R/S/T](#), [3307](#), [3308A/B](#), [3316](#).

### **Fourth Year Program**

## *Mechanical & Materials Engineering Department*

Applied Mathematics 3413A/B, MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B, MME 3385Y, ECE 3373A/B, ECE 3374A/B, Business Administration 4430.

### **Fifth Year Program**

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**

| <b>FULL-TIME UNDERGRADUATE ENROLLMENT(2010-2011)</b>  |        |        |        |        |        |        |        |        |       |        |       |
|-------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|-------|
|                                                       | Year 1 |        | Year 2 |        | Year 3 |        | Year 4 |        | TOTAL |        | TOTAL |
|                                                       | Male   | Female | Male   | Female | Male   | Female | Male   | Female | Male  | Female |       |
| Mechanical                                            | n/a    | n/a    | 74     | 10     | 53     | 10     | 48     | 10     | 175   | 30     | 205   |
| <b>PART-TIME UNDERGRADUATE ENROLLMENT (2010-2011)</b> |        |        |        |        |        |        |        |        |       |        |       |
|                                                       | Year 1 |        | Year 2 |        | Year 3 |        | Year 4 |        | TOTAL |        | TOTAL |
|                                                       | Male   | Female | Male   | Female | Male   | Female | Male   | Female | Male  | Female |       |
| Mechanical                                            | n/a    | n/a    | 1      | 0      | 30     | 3      | 5      | 1      | 36    | 4      | 40    |

## **3. DEGREES GRANTED**

| <b>Fall 2010</b> | <b>Spring 2011</b> |
|------------------|--------------------|
| 4                | 49                 |

## **4. UNDERGRADUATE AWARDS**

### **Recipients (Fall 2010) – Students registered in the Department of Mechanical and Materials**

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

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: [Eric Lockett](#)

## *Mechanical & Materials Engineering Department*

### ***Andrea Bailey Memorial Award*** (1- \$1800.00)

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: [Claire Goulden](#)

### ***Ian Duerden Memorial Award*** (1-\$1000.00)

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: [Raed El-Khatib](#)

### ***Lynda Diane Shaw Memorial Award*** (1-\$900.00)

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: [Ryan Katchky](#)

### ***Donald P. Morris Engineering Award*** (1-\$1000.00)

Awarded to a full-time undergraduate student in Year 2 or higher of any Engineering Program based on academic achievement and involvement in extracurricular activities that demonstrate leadership skills. This award was established by Donald P. Morris, BESC '65.

Awarded to: [Eric Lockett](#)

### ***Bizmo Award for Volunteerism***

Awarded to a student in the third or fourth year of the Engineering Program who has demonstrated outstanding volunteer and leadership skills through participation in the Undergraduate Engineering Society and/or involvement in extracurricular activities that are focused on enhancing the Western Campus or the broader community. This award is made possible by a gift from Joseph & Janet Smolders, in recognition of their son, Bill Smolders, BESC '07 who was the 2006 UES President.

Awarded to: [Rachel Oosterhuis](#)

### ***DELSCAN Corporation Scholarship in Engineering***

Awarded annually to a full-time undergraduate student entering fourth year in the Faculty of Engineering based on academic achievement, demonstrated involvement in extra-curricular activities at the University or in the community. This scholarship is dedicated to James A. Main, Past President of Delcan Corporation.

Awarded to: [Rachel Brown](#)

### ***EMCO Scholarships*** (2-\$3600.00)

2nd Year ANY Awarded to students entering their second year of Engineering and preferably having a career objective in manufacturing or marketing. These students must have demonstrated leadership ability as well as involvement in outside activities. Scholarships are continuous into third and fourth year based on maintenance of at least an 80% average or standing in the top 25% of the class. Established through the generosity of EMCO Limited.

Awarded to: [Peter Blokker](#)

## *Mechanical & Materials Engineering Department*

### **Suncor Scholarships (3-\$5000.00)**

Awarded to fourth year students who have successfully completed the Industry Internship Program with Suncor. This award was established by Suncor Energy Foundation

Awarded to: [Jake Elliott](#)

### **Entrance Scholarships**

All students entering the Faculty of Engineering under the Engineering Excellence Admission Program will be offered a one year Western Academic Scholarship of Excellence (\$2,000) if their Grade 12 average is 90% or higher, or a one year Western Scholarship of Distinction (\$1,000) if their Grade 12 average is between 85.0 and 89.9%. These scholarships are offered during the admission process and are not conditional on the academic performance during the first year of studies.

Exceptional candidates may qualify for other entrance scholarships such as:

- **The President's Entrance Scholarships** - \$6,000 annually for four years, plus first year room and board.
- **The Faculty Entrance Scholarship** - \$4,000 annually for four years, plus first year residence room costs.
- **Continuing Admissions Scholarships** - \$2,000 annually for four years.

### **Walker Wood Foundation Continuing Scholarship**

Awarded to: [Jacob Mackenzie Reeves](#)

### **Four Year Continuing Admission Scholarship Program**

Awarded to: [Alexander James Balsdon](#); [Meghan Patricia Clynick](#); [Malini Jhaver](#); [Jacob Mackenzie Reeves](#); [Daniel Rozhko](#)

### **Scholarship of Distinction**

Awarded to: [David Alfonso Arrunategui](#)

### **A .I. Johnson Entrance Scholarship**

Awarded to: [Daniel Rozhko](#)

### **E.V. Buchanan Faculty of Entrance Scholarship**

Awarded to: [Paola Michelle Soriano](#)

### **Aiming for the Top Scholarships**

Awarded to: [Joel Armstrong](#); [Kurtis Andrew Campbell](#); [Kyle Jordan Capitano](#); [David Andrew Drysdale](#); [Tariq Ismail](#); [Natalie Johanna Martens](#); [Scott Steven Sinclair](#); [Ruben Michael Felix Vanvarerenbergh](#)

## **Recipients (Spring 2011) Awards of the Graduating Class June 2011 – 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: [Rachel Brown](#)

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

## *Mechanical & Materials Engineering Department*

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: [Scott Fulton](#), [Robert Maggio](#)

### *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: [Chelsea Erin Johnson](#)

### *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: [Joshua Hart Bernick](#)

## 5. DESIGN PROJECTS

### Projects at a Glance

#### Projects with a Biomedical Engineering Theme

| Project Title                                                                                 | Student(s)                                                     | Faculty Advisor(s)      |
|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------|
| Evaluation and Refinement of a Simulator Design for Laboratory Investigations of Spine Motion | Joshua Bernick, Alex Heroux, Tyler Moores, Paula Soriano       | C. Dunning              |
| Probe holding mechanism for ultrasound guided radiofrequency (RFA) ablation of liver tumors.  | Mark Cicero                                                    | R. Buchal<br>A. Fenster |
| Automated actuation system to quantify the stiffness of the shoulder.                         | Rachel Brown, Blake Griffiths, Chelsea Johnson, Allison Pellar | J. Johnson              |
|                                                                                               |                                                                |                         |

#### Projects with an Aerospace Theme

| Project Title                                                           | Student(s)                                | Faculty Advisor(s) |
|-------------------------------------------------------------------------|-------------------------------------------|--------------------|
| Engine Cowling Design for Minimum Drag                                  | Claire Goulden, Eric Lockett, Kris Newman | B. Tryggvason      |
| Design of an Ultralight Aircraft                                        | Jake Elliott, Quentin House               | B. Tryggvason      |
| Wing Tip Design for Minimizing Induced Drag for the Red Bull Race Plane | Greg Black                                | B. Tryggvason      |

#### Projects with an Automotive or Sustainable Transportation Theme

| Project Title                                                          | Student(s)                                                         | Faculty Advisor(s) |
|------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------|
| Sustainable personal transportation system                             | Jack Hansen, Riley Horne, Shane Parkhill, Cooper Robinson          | R.O. Buchal        |
| Single passenger ultralight battery electric vehicle conceptual design | Zach Chenier, Adam Day, Kyle Kirby, Scott Pressnail, John Vallance | R.O. Buchal        |

*Mechanical & Materials Engineering Department*

|                                                                     |                              |                                      |
|---------------------------------------------------------------------|------------------------------|--------------------------------------|
| Single passenger ultralight battery electric vehicle – Brake Design | Mark Greco, Matteo Maccario  | R.O. Buchal                          |
| The Design of a Solar Energy Management Software Tool               | Simone Pegus, Alex Spiro     | R.O. Buchal                          |
| Sunstang Suspension Design                                          | Ian Fan                      | R.O. Buchal                          |
| Formula SAE racecar cockpit and driver controls                     | Kurtis Gilbride, Pat Gribbon | R. Tutunea-Fatan<br>Sponsor: Armatec |

**Projects with a Mechanical Engineering Theme**

| Project Title                                 | Student(s)                                                          | Faculty Advisor(s)    |
|-----------------------------------------------|---------------------------------------------------------------------|-----------------------|
| Drake Well Museum HVAC System*                | Fady El-Koriny, Shahnawaz Lodhi, Mohammad Nizar Othman, Zach Swartz | W. Altahan            |
| Protective System for experimental drop tower | Ivan Leung, Anna Rozik, Lucas Walker                                | J. Wood               |
| Electro-active polymer gel robot              | Zain Hami, Monica Shade                                             | G. Knopf              |
| Design of a Vibration Experiment              | Kristen Kerwin, Rob Wakefiled                                       | L. Jiang, K. Siddiqui |

**Industry-sponsored projects**

| Project Title                                                                                     | Student(s)                                                | Faculty Advisor(s)                        |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------|
| Work bike Tool (confidential)                                                                     | Cao Thang, Bui, Aiden Amri,                               | L. Jiang<br>Sponsor: RND Ltd              |
| Micro-hydroelectric Generator                                                                     | Peter Bubar, Colin Gerber, Stavro Pantelakis              | S. Salisbury<br>Sponsor: Camille Energy   |
| A Modular Impinging Jet Heat Tunnel Test Facility                                                 | Casey Depoorter, Alex Hart, Chris Martin, Mario Morales   | E. Savory<br>Sponsor: Stanmech            |
| Chunk Ice Dispenser                                                                               | James Mann, Kevin O'Keefe-Harwood, Sean Stobbe, Kisung Um | P. Kurowski<br>Sponsor: Cargill Canada    |
| Cargill Heat Recovery Project                                                                     | Brad Barkauskas, Scott Fulton, Robert Maggio              | A.G. Straatman<br>Sponsor: Cargill Canada |
| The Design of a Hydraulic Lifting Platform to Work in Conjunction with a Biomedical Flow Facility | David Mimmagh, Kilsung Oh, Gregory Whitwham               | E. Savory                                 |

**MME 4401y Presentations**

| Project Title                                                          | Student(s)       | Faculty Advisor(s) |
|------------------------------------------------------------------------|------------------|--------------------|
| Pulmonary Gas Transport using a 3D Finite-Volume Numerical Method      | Chelsea Johnson  | A.G. Straatman     |
| A System for Measurement and Control of Laxity in the Human Knee Joint | Gregory Whitwham | J. Johnson         |

\*Best project

## 6. EXCHANGE PROGRAMS

| Last Name                | First Name       | Home University                        | Home Country |
|--------------------------|------------------|----------------------------------------|--------------|
| Ang                      | JunHuan          | Nanyang Technological University       | Singapore    |
| Bellemin                 | Dylan            | Universite Joseph Fournier - Grenoble  | France       |
| Brangier                 | Leonie           | Insa De Toulouse                       | France       |
| Chan                     | Zhi Wei          | National University of Singapore       | Singapore    |
| Dhouibi                  | Anouar           | Universite Joseph Fournier - Grenoble  | France       |
| Eng                      | Woon Chong Shawn | National University of Singapore       | Singapore    |
| Fei                      | Diqing           | City University of Hong Kong           | China        |
| Fesselier                | Emmanuel         | Universite Joseph Fournier - Grenoble  | France       |
| Fragoso Rubio            | Hector Fernando  | Instituto Tecnologico de Monterrey     | Mexico       |
| Gaitonde                 | Aalok            | Vishwakarma Institute of Technology    | India        |
| Gamiz Antunez            | Jorge Daniel     | Instituto Tecnologico de Monterrey     | Mexico       |
| Ganore                   | Bhagyashree      | Vishwakarma Institute of Technology    | India        |
| Garcia Gutierrez         | Manuel Alejandro | Instituto Tecnologico de Monterrey     | Mexico       |
| Gutierrez Pliego Crowley | Paulina          | Instituto Tecnologico de Monterrey     | Mexico       |
| Jin                      | Zhengan          | Yanzhou University                     | China        |
| Ku                       | Tsz Chung        | The University of Hong Kong            | China        |
| Lee                      | Wing Yiu         | The University of Hong Kong            | China        |
| Lehtinen                 | Tiia             | Mikkeli University of Applied Sciences | Finland      |
| Leong                    | Yurong Nelvin    | Nanyang Technological University       | Singapore    |
| Lopez de Leon            | Eduardo Manuel   | Instituto Tecnologico de Monterrey     | Mexico       |
| Maniar                   | Raj              | Vishwakarma Institute of Technology    | India        |
| Patil                    | Dhawal           | Vishwakarma Institute of Technology    | India        |
| Sebhat                   | Woldemichael     | Universite Joseph Fournier - Grenoble  | France       |
| Semat                    | Maxime           | Insa De Toulouse                       | France       |
| Suokas                   | Olli Tapio       | Mikkeli University of Applied Sciences | Finland      |
| Toh                      | Chin Wei         | Nanyang Technological University       | Singapore    |
| Yan                      | Liew Jia         | National University of Singapore       | Singapore    |
| Yip                      | Jing Ngei        | Nanyang Technological University       | Singapore    |
| Zheng                    | Lu               | National University of Singapore       | Singapore    |
| Ziyou                    | Lim              | Nanyang Technological University       | Singapore    |

## 7. INTERNSHIP PROGRAM

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

The following students from the MME Department completed an Internship in 2010-11.

*Mechanical & Materials Engineering Department*

| <b>Last Name</b> | <b>First Name</b> | <b>Placement</b>         |
|------------------|-------------------|--------------------------|
| Abushehada       | Hussein           | ArcelorMittal Dofasco    |
| Mcllroy          | Andrew            | Armaterc Survivability   |
| Kirk             | Chris             | CAMI Automotive          |
| Marble           | Owen              | CAMI Automotive          |
| Roddy            | Matt              | CAMI Automotive          |
| Tepavac          | Milan             | CAMI Automotive          |
| Kwok             | Kelvin            | Celestica                |
| Lau              | Adam              | Diamond Aircraft         |
| Ravenhurst       | Andrew            | Diamond Aircraft         |
| Shea             | Adam              | Diamond Aircraft         |
| Yeung            | Michael           | Diamond Aircraft         |
| Mitchell         | Andrew            | Evantage Industries      |
| Sivell           | Katie             | Lanxess                  |
| Wang             | Eric (Zhao)       | Litens Automotive        |
| Lok              | Alice             | Ontario Power Generation |
| Pellarin         | Jay               | Plan Group               |
| Ripley           | Jon               | Research In Motion       |
| Kaptur           | Louis             | Schaeffler               |
| Kopala           | Raphael           | Trudell Medical          |
| Ng               | Jennifer          | Trudell Medical          |
| Brathwaite       | Vanessa           | Union Gas                |

**8. SUMMER ENGINEERING CO-OP PROGRAM**

| <b>Last Name</b> | <b>First Name</b> | <b>Placement</b>                  |
|------------------|-------------------|-----------------------------------|
| Capitano         | Kyle              | Armaterc Survivability Corp.      |
| Kisielewski      | Andrew            | Automation System Corp.           |
| Walker           | Lucas             | Armaterc Survivability Corp.      |
| Spadotto         | Adam              | OES                               |
| De Jeu           | Matthew           | Armaterc Survivability Corp.      |
| Maggio           | Robert            | Magna Mississauga Seating Systems |
| Goulden          | Claire            | Syncrude                          |
| Wideman          | Derek             | General Electric                  |
| Kirby            | Kyle              | Brose Canada Inc.                 |



## 9. INTERNATIONAL STUDENTS

| Last Name       | First Name        | Year |
|-----------------|-------------------|------|
| Marinkovic      | Stefan            | 2    |
| Wickremesooriya | Suchiththa Joseph | 2    |
| Um              | Kisung            | 4    |

## 10. UNDERGRADUATE STORIES

There are no undergraduate stories to report

## 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 Biotransport Phenomena

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

### **Materials and Solid Mechanics**

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

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

## Mechanical & Materials Engineering Department

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

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

### Automation Technologies and Systems.

The *Automation Technologies and Systems Graduate Research Program* offers interested students the opportunity to investigate novel techniques, devices and systems to address challenging problems related to **automation technologies, inertial systems and control, machine vision, sensor development and micromachining**. Students interested in admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the Ph.D. program should have completed the M.E. Sc. degree. In exceptional circumstances, students can be transferred directly from the M.E.Sc. into the Ph.D. programs without completing the M.E.Sc. degree. All students admitted into the graduate research program are offered full financial support.

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

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

Students may also select elective courses offered by other research groups from the Department of Mechanical and Materials Engineering, other Departments from the Faculty of Engineering and other Faculties from the

## *Mechanical & Materials Engineering Department*

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

## *Mechanical & Materials Engineering Department*

- 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

## *Mechanical & Materials Engineering Department*

- 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.

### **Automation Technologies and Systems**

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

## *Mechanical & Materials Engineering Department*

- 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 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
- 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



## *Mechanical & Materials Engineering Department*

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

### 3. GRADUATE ENROLLMENT

|             | M.Eng | M.E.Sc. | Ph.D. | PhD (BME)* | MESc (BME)* | Total |
|-------------|-------|---------|-------|------------|-------------|-------|
| Summer 2010 | 9     | 34      | 53    | 8          | 2           | 106   |
| Fall 2010   | 23    | 34      | 56    | 8          | 3           | 124   |
| Winter 2011 | 31    | 27      | 58    | 8          | 2           | 126   |

\*Students registered in the Biomedical Engineering program supervised or co-supervised by MME Faculty

### 4. GRADUATE DEGREES GRANTED

| OCTOBER 2010 CONVOCATION – Mechanical and Materials Engineering Program |        |                 |                  |                           |                                                                                                                                                 |
|-------------------------------------------------------------------------|--------|-----------------|------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Student name                                                            | Degree | Completion Date | Thesis Exam Date | Supervisor/ Co-supervisor | THESIS TITLE                                                                                                                                    |
| Estrada, Fabian                                                         | Meng   | Aug 24, 2010    | n/a              | n/a                       | n/a                                                                                                                                             |
| Fu, Jing                                                                | MESc   | Aug 26, 2010    | Aug 20, 2010     | Zhu, J.                   | Study on recyclability of powder coating particles and development of new powder coating                                                        |
| Hussain, Yahi                                                           | MESc   | Aug 18, 2010    | Aug 6, 2010      | Khayat, R.                | Flow a jet depositing on a moving wall near channel exit at moderate Reynolds number                                                            |
| Islam, Ariful AZM                                                       | MESc   | May 12, 2010    | April 29, 2010   | Klassen, R.               | Fe simulation and experimental validation of the plastic deformation and residual stress at grain boundaries in an indented A600 Ni-based alloy |
| Keshavarzmanesh, Shadi                                                  | PhD    | June 4, 2010    | May 21, 2010     | Wang, L.                  | Increasing adaptability of assembly process planning and control using function block methodology                                               |
| Latta, Steven                                                           | Meng   | May 11, 2010    | n/a              | n/a                       | n/a                                                                                                                                             |
| Liu, Hao                                                                | PhD    | June 24, 2010   | June 16, 2010    | Sun, X.                   | Controlled synthesis and characterization of one dimensional nanomaterials: carbon nanotubes and titanium oxide nanowires                       |
| Wang, Dong                                                              | PhD    | Aug 30, 2010    | Aug 26, 2010     | Zhang, C.                 | Development of heat-release rate-based emissions control models for a direct-injection diesel engine                                            |
| Zaman, Mostafa                                                          | MESc   | Aug 30, 2010    | Aug 18, 2010     | Jiang, L.                 | Thermo-electromechanical coupling behavior of curved functionally graded piezoelectric actuators                                                |

**JUNE 2011 CONVOCATION – Biomedical Engineering Program**

| Student Name    | Degree | Completion Date | Thesis Exam Date | Supervisor/ Co-supervisor | THESIS TITLE                                                                                                        |
|-----------------|--------|-----------------|------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------|
| Ferreira, Louis | PhD    | Jan 26, 2011    | Jan 26, 2011     | Johnson, J.; King, G.     | Development of an Active Elbow Motion Simulator and Coordinate Systems to Evaluate Kinematics in Multiple Positions |

**JUNE 2011 CONVOCATION – Mechanical and Materials Engineering**

| Student Name               | Degree | Completion Date | Thesis Exam Date | Supervisor/ Co-supervisor | THESIS TITLE                                                      |
|----------------------------|--------|-----------------|------------------|---------------------------|-------------------------------------------------------------------|
| Abolghasemi, Mohammadmehdi | MESc   | Dec 21, 2010    | Dec 13, 2010     | Tutunea-Fatan, R.         | Experimental Analysis of Titanium Foams Micromilling              |
| Ahmed, Moinuddin           | MESc   | Jan 20, 2011    | Jan 6, 2011      | Khayat, R.                | Steady Flow of a Thin Viscoelastic Jet                            |
| Albalbaki, Bashar          | PhD    | Sept 13, 2010   | Sept 7, 2010     | Khayat, R.                | Thermal Convection of Non-Newtonian Fluids                        |
| Amin, Rizwana              | MESc   | Jan 15, 2011    | Jan 11, 2011     | Khayat, R.                | Moving Wall Jet Flow at Moderate Reynold's Number                 |
| Asgarian, Ali              | MESc   | Dec 16, 2010    | Dec 2, 2010      | Floryan, J.M.             | Natural convection in a slot subject to a long wavelength heating |
| Azad, Md Abul Kalam        | MESc   | Jan 25, 2011    | Jan 11, 2011     | Khayat, R.                | Moderate Reynolds Number Pressure Driven Wall Jet                 |
| Banan, Roshanak            | MESc   | Sept 7, 2010    | Sept 2, 2010     | Singh, A.V.               | Vibrations of Rectangular and Circular Piezoelectric Plates       |
| Bhuiya, Md. Shafeyet H.    | MESc   | Dec 22, 2010    | Dec 10, 2010     | Tutunea-Fatan, R.         | Compensation of Geometry-Based Errors in Five-Axis Machining      |
| Chanda, Probal             | MESc   | Sept 8, 2010    | Sept 16, 2010    | Klassen, R.               | Numerical Analysis of Splined Mandrel Flow Forming                |
| Chen, Yougui               | PhD    | Dec 21, 2010    | Dec 13, 2010     | Sun, X.                   | PE and Their Supports for Low Temperature Fuel Cells              |
| Choi, Junghee              | Meng   | Dec 31, 2010    | n/a              | n/a                       | n/a                                                               |
| Chowdhury, Jubayer         | MESc   | Sept 21, 2010   | Sept 17, 2010    | Savory, E. Karava, P.     | Convective Heat Transfer from an Inclined Roof                    |
| Hong, Chan                 | Meng   | Apr 30, 2011    | n/a              | n/a                       | n/a                                                               |
| Ionescu, Mihnea            | PhD    | Feb 10, 2011    | Feb 7, 2011      | Sun, X.                   | Synthesis of 1D and 2D Carbon Based Nanomaterials                 |
| Khan, Fuqan                | MESc   | April 25, 2011  | April 15, 2011   | Siddiqui, K.              | Hydrogen Production through Thermo-Chemical Water Splitting       |
|                            |        |                 |                  |                           |                                                                   |

*Mechanical & Materials Engineering Department*

|                       |      |                |                |                 |                                                                |
|-----------------------|------|----------------|----------------|-----------------|----------------------------------------------------------------|
| Kurowski, Tomasz      | MESc | Feb 14, 2011   | Feb 8, 2011    | Naish, M.D.     | A Minimally Invasive Lung Tumor Localization Device            |
| Lee, Jehhwah          | Meng | April 30, 2011 | n/a            | n/a             | n/a                                                            |
| Li, Cheng             | Meng | Dec 31, 2010   | n/a            | n/a             | n/a                                                            |
| Liu, Yu               | PhD  | Oct 30, 2010   | Sept 20, 2010  | Yang, J.        | Atomic Force Microscopy for Better Probing                     |
| Lukas, Troy           | Meng | April 30, 2011 | n/a            | n/a             | n/a                                                            |
| McIntyre, Rory        | MESc | April 29, 2011 | April 21, 2011 | Savory, E.      | The effect of Inlet Geometry on the Development of a Wall Jet  |
| Moglan, Christian     | Meng | April 30, 2011 | n/a            | n/a             | n/a                                                            |
| Mohammad, Tarek       | MESc | Oct 12, 2010   | Oct 8, 2010    | Salisbury, S.   | A Novel Z-Axis Piezoworm Nanopositioner                        |
| Mohammadi, Mohsen     | PhD  | Dec 10, 2010   | Dec 1, 2010    | Dryden, J.      | Analysis of the elastic field in functionally graded materials |
| Nazari, Amir Mohammad | MESc | March 8, 2011  | March 2, 2011  | Shinozaki, D.M. | Flat Indentation of Filled and Unfilled PDMS                   |
| Pungotra, Harish      | PhD  | Nov 23, 2010   | Nov 12, 2010   | Knopf, G.       | Collision Detection and Merging of deformable....              |

## 5. GRADUATE AWARDS

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

### Minimum Support Level

|                             |                                        |                                        |
|-----------------------------|----------------------------------------|----------------------------------------|
| May 2010 term               | MESC                                   | PhD                                    |
| Canadian/Permanent Resident | Tuition + 12,000 (approx).<br>\$19,000 | Tuition + 12,000 (approx.)<br>\$19,000 |
| International               | Tuition + 12,000 (approx).<br>\$27,000 | Tuition + 12,000 (approx.)<br>\$27,000 |
| September 2010 term         | MESC                                   | PhD                                    |
| Canadian/Permanent Resident | Tuition + 12,000 (approx).<br>\$19,000 | Tuition + 12,000 (approx.)<br>\$19,000 |
| International               | Tuition + 12,000 (approx).<br>\$27,000 | Tuition + 12,000 (approx.)<br>\$27,000 |
| January 2011 term           | MESC                                   | PhD                                    |
| Canadian/Permanent Resident | Tuition + 12,000 (approx).<br>\$19,000 | Tuition + 12,000 (approx.)<br>\$19,000 |
| International               | Tuition + 12,000 (approx).<br>\$27,000 | Tuition + 12,000 (approx.)<br>\$27,000 |

## *Mechanical & Materials Engineering Department*

|                             |                                        |                                        |
|-----------------------------|----------------------------------------|----------------------------------------|
| May 2011 term               | MESc                                   | PhD                                    |
| Canadian/Permanent Resident | Tuition + 12,000 (approx).<br>\$19,000 | Tuition + 12,000 (approx.)<br>\$19,000 |
| International               | Tuition + 12,000 (approx).<br>\$27,000 | Tuition + 12,000 (approx.)<br>\$27,000 |

### 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:

| Name                         | Program | Award       | Award Duration        |
|------------------------------|---------|-------------|-----------------------|
| DeGroot, Christopher Thomas  | GMME    | NSERC-CGSD  | May 1/09-to-Jan 1/12  |
| Elliott, Kevin James         | GMME    | OGSST-OGS   | May 1/11-to-Jan 1/12  |
| Farrokhnejad Roudsari, Mehdi | GMME    | OGSST-OGSST | Sept 1/10-to-Jan 1/11 |
| Farrokhnejad Roudsari, Mehdi | GMME    | OGS-OGS     | May 1/11-to-Jan 1/12  |
| Fischer, Christian           | GMME    | OGGST-OGSST | Sept 1/10-to-Jan 1/11 |
| Johnson, Chelsea Erin        | GMME    | OGSST-OGS   | May 1/11-to-Jan 1/12  |
| McLachlin, Stewart           | GMME    | NSERC-CGSD  | Sept 1/09-to-May 1/12 |
| Neuert, Mark Alan Carmine    | GMME    | NSERC-CGSM  | May 1/10-to-Jan 1/11  |
| Neuert, Mark Alan Carmine    | GMME    | NSERC -PGSD | Sept 1/11-to-May 1/14 |
| Norouzi Banis, Mohammad      | GMME    | OGSST-OGSST | Sept 1/09-to-May 1/11 |
| Norouzi Banis, Mohammad      | GMME    | OGS-OGS     | Sept 1/10-to-May 1/12 |
| Sun, Shuhui                  | GMME    | NSERC-CGSD  | May 1/09-to-Jan 1/12  |
| Yan, Zhi                     | GMME    | OGS-OGS     | Sept 1/11-to-May 1/12 |

6. GRADUATE SEMINAR

| Fall 2010 |                                                          |                             |                                                                                                                         |                     |
|-----------|----------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|
| Date      | Student or Guest Lecturer Name                           | Supervisor/Co-Supervisor    | Presentation Title                                                                                                      | Seminar Facilitator |
| Sept 20   | Hadi Vafadar Moradi                                      | J.M. Floryan                | Effects of distributed surface roughness on the dynamics of pipe flow                                                   | Xiangbo Meng        |
|           | Richard Oviasuyi                                         | R. Klassen                  | Micro-Indentation based Investigation of the Anisotropy of Plastic Deformation in Select Zirconium Alloys               |                     |
| Sept 27   | Dr. Gideon Avigad, Broude College of Engineering, Israel |                             | Set Based Design and Evolution (SBDE)                                                                                   | J.M. Floryan        |
| Oct 4     | Shuhui Sun                                               | X. Sun                      | Synthesis of Highly Active and Stable Pt Nanowire-based Electrocatalyst for PEM Fuel Cell Applications                  | Chris DeGroot       |
|           | Mohsen Mohammadi                                         | J.R. Dryden                 | Stress Concentration around a Hole in a Radially Nonhomogenous Plate                                                    |                     |
| Oct 18    | Hamidreza Azimian                                        | M.D. Naish/<br>R. Patel     | Preoperative planning of robotics-assisted minimally invasive cardiac surgery under geometric uncertainty               | Alireza Mohammadi   |
|           | Xiangbo Meng                                             | X. Sun                      | Atomic Layer Deposition: A New Technique to Synthesize Nanocomposites for Renewable Clean Energy Conversion and Storage |                     |
| Oct 25    | Graham Hunt                                              | E. Savory/<br>R. Martinuzzi | Aerodynamics of Automotive Cooling Fan Modules                                                                          | Kar Man Leung       |
|           | Mihnea Ionescu                                           | X. Sun                      | Chemical vapor deposition of advanced carbon nanomaterials                                                              |                     |
| Nov 8     | Rory McIntrye                                            | E. Savory                   | A Parametric Study of a Confined Wall Jet                                                                               | Richard Oviasuyi    |
|           | Yu Zhong                                                 | X. Sun                      | Synthesis of 1-D Sn- / SnO <sub>2</sub> -based Nanomaterials with Novel Structures                                      |                     |
| Nov 15    | Hamid Aghayan                                            | E. Bordatchev/<br>J. Yang   | Two new methodologies for optical analysis of contaminated lubricants                                                   | Hadi Vafadar Moradi |
|           | Chris DeGroot                                            | A.G. Straatman              | A Numerical Model for Fluid Flow and Heat Transfer in Conjugate Fluid-Porous Domains                                    |                     |
| Nov 22    | Dr. Andrew Hrymak, Dean, Faculty of Engineering, UWO     |                             | Numerical Simulation of Impinging Slot Jets in Air Knife Coating                                                        | J.M. Floryan        |
| Nov 29    | Hadi Mahdavi                                             | L. Jiang                    | Mechanical characterization of one-dimensional nanomaterials                                                            | Meysam Haghshenas   |
|           | Mehdi Farroknejad                                        | A.G. Straatman              | Prediction of Local Mechanical Properties of Mg-casting                                                                 |                     |
| Dec 6     | Masoud Noroozi                                           | L. Jiang                    | Instability of thin film structures                                                                                     | Shuhui Sun          |
|           | Alireza Mohammadi                                        | J.M. Floryan                | Exploration of flow control strategies based on shape and orientation of grooves                                        |                     |
|           |                                                          |                             |                                                                                                                         |                     |

*Mechanical & Materials Engineering Department*

**Winter 2011**

| <b>Date</b> | <b>Student's Name</b>            | <b>Supervisor/Co-Supervisor</b>                 | <b>Presentation</b>                                                                                                                | <b>Seminar Facilitator</b> |
|-------------|----------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Jan 10      | Bipasha Bose                     | R. Klassen                                      | Effect of Zr <sup>+</sup> Ion-Irradiation on the Anisotropy of Local Plastic Deformation of Zr-2.5%Nb CANDU Pressure Tube Material | Tingjie Li                 |
|             | Stewart McLachlan                | C. Dunning                                      | Cervical Spine Unilateral Facet Injuries: Simulation, Quantification, and Visualization of Mechanisms and Treatment                |                            |
| Jan 17      | Marian Vratonjic                 | E. Savory                                       | Development of a Novel Hemodynamic Flow Facility                                                                                   | Zhi Yan                    |
|             | Khaled El Bannan                 | S.Salisbury/J.M. Floryan                        | Development of a compact piezoelectric actuator for MRI guided procedures                                                          |                            |
| Jan 24      | Kar Man Leung                    | J. Yang/L. Lau                                  | Exploring the functions and properties of bacterial nanowires                                                                      | Hamid Aghayan              |
|             | Meysam Haghshenas                | R. Klassen                                      | Equivalent plastic strain during splined mandrel flow forming (Using micro-indentation and image analysis)                         |                            |
| Jan 31      | Adam Kirchhefer                  | R. Gurka/G. Kopp                                | A Case Study of Heaving, Pitching and Flapping Wings: The Wake of a European Starling ( <i>Sturnis Vulgaris</i> )                  | Jamaloddin Jamali          |
|             | Jian Liu                         | X. Sun                                          | Carbon Nanotubes (CNTs) and Lithium Titanate (LTO) as Advanced Anode Materials for Lithium Ion Batteries (LIBs)                    |                            |
| Feb 7       | Sina Arghavan                    | A.V. Singh                                      | Vibration of carbon-based nano-structures                                                                                          | Mohammad Norouzi Banis     |
| Feb 14      | Daniel Stranges                  | R. Khayat                                       | Linear stability analysis of non-Fourier thermal convection                                                                        | Dongniu Wang               |
|             | Jinli Yang                       | X. Sun                                          | Synthesis One-dimensional LiFePO <sub>4</sub> as Cathode Materials for High Performance Lithium Ion Batteries                      |                            |
| Feb 28      | Dongniu Wang                     | X. Sun/T.K. Sham                                | One-dimensional Tin-Based Nanomaterials and Their Nanocarbon Composites as Anodes for High Performance Lithium Ion Batteries       | Bipasha Bose               |
|             | Abdullah M. Khalid Hafiz         | R. Tutunea-Fatan/<br>E. Bordatchev/<br>G. Knopf | Modeling, analysis and optimization of 5-axis laser polishing process                                                              |                            |
| Mar 7       | Mr. Chris Ewald, Planit Software |                                                 | Staying Competitive in Today's Global Manufacturing Marketplace                                                                    | R. Tutunea-Fatan           |
| Mar 14      | Jamaloddin Jamali                | J. Wood                                         | PMCs fracture under tensile testing                                                                                                | Stewart McLachlan          |
|             | Tingjie Li                       | J. Yang                                         | Lab-on-a-CD for parallel blood analysis                                                                                            |                            |
| Mar 21      | Ahmed Elatar                     | K. Siddiqui                                     | Investigation of the Flow and Heat Transfer Behaviour in Low Reynolds Number Channel Flows                                         | Khaled El Bannan           |
|             | Yongliang Li                     | X. Sun                                          | Microwave-assisted hydrothermal                                                                                                    |                            |

|        |                        |          |                                                                                                    |              |
|--------|------------------------|----------|----------------------------------------------------------------------------------------------------|--------------|
|        |                        |          | synthesis of nanomaterials for lithium-air batteries                                               |              |
| Mar 28 | Mohammad Norouzi Banis | X. Sun   | Synthesis of Manganese Oxide One-Dimensional Nanostructures using Chemical Vapor Deposition Method | Ahmed Elatar |
|        | Zhi Yan                | L. Jiang | Continuum modeling of piezoelectric nanowires with surface effects                                 |              |
|        |                        |          |                                                                                                    |              |

## 7. GRADUATE STORIES

### J.R. Dryden

Dr. Mohsen Mohammadi successfully defended his Ph.D. thesis and is currently employed as a PDF at Canadian National Research Resources in Hamilton, Ontario. He is planning on going to the University of Waterloo as a PDF.

### L. Jiang

Zhi Yan was awarded the Ontario Graduate Scholarship for 2011-2012.

### A.G. Straatman

Dr. Lee Betchen has accepted a position with Maya Heat Transfer Technologies as a senior code developer. (June 1, 2011).

### X. Sun

Shuhui Sun received the International Society of Electrochemistry (ISE) Travel Award for Young Electrochemists, in recognition of the quality of his scientific research and contribution to the ISE Annual Meeting 2010 in Nice, France. There were total 5 recipients world-wide. The Award consists of the sum of 1000 Euros. Shuhui was invited to give a talk in the ISE Annual Meeting 2010 in Nice, France.

Henry (Xiangbo) Meng, a PhD student received the Student Award at the 11<sup>th</sup> International Conference on Atomic Layer Deposition (also called ALD 2011) was held at Cambridge, USA, in the past June 2011. Over 400 scientists gathered in that annual event across the world to discuss the progresses and opportunities of ALD. On that event, eight PhD students were announced as the winners of the Student Award. This award is to recognize the most outstanding worldwide research work conducted by graduate students in ALD. Among the winners, three were from US universities (including UIUC, UCLA, and Stanford), one from Canada (UWO), and four from Europe. Each winner received a certificate and US \$500. They were also invited to give a talk at that event. Henry as the awardee from Canada made a talk about fabrication of highly tunable nanostructured materials using ALD.

Xiang Bo Meng's received the Shuhui Travel award (\$500).

### J. Wood

Ian SWENTEK (PhD Candidate) was awarded a bursary under the Ontario / Baden-Wurtemberg Student Exchange Program. Aian spent four months at the Karlsruhe Institute of Technology and the Fraunhofer Institute for Chemical Technology in Pfinstal, Germany to advance his research in the field of composite materials.

### J. Yang

Yu Liu successfully defended his Ph.D thesis on Sep. 20, 2010, and then joined Xerox Canada. Limin Zhang successfully defended his MESC. thesis on May 3, 2011, and then joined Hatch.



## 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):**

- Rolling mill, wire
- drawing bench
- rotary swager
- 125kN SinTech tensile tester.

### **Metal Casting and Heat Treating Laboratory (SEB 3049):**

- furnaces

### **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, SEB 3052):**

- Mechanical and servohydraulic load frames ranging from 1kN to 500kN capacity

### **Polymer Engineering Laboratory (SEB 3055):**

- FTIR, micro-indenter (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, 3051):**

## *Mechanical & Materials Engineering Department*

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

### **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):**

- Fadal VMC 4020 vertical machining center with rotary table (A & B Axes)
- DEA *Swift* direct computer controlled coordinate measuring machine
- 2 Tormach PCNC 1100 Series II 3-axis CNC machines (with fourth axis and lathe options, respectively)

### **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)

- 2 Motoman and 1 Fanuc industrial manipulators
- 10 Allen Bradley PLC trainers
- Firewire cameras

**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

| Operating Research Funding by Source and year |                                |                                     |                        |                     |
|-----------------------------------------------|--------------------------------|-------------------------------------|------------------------|---------------------|
| Year                                          | Granting Councils <sup>2</sup> | Other Peer Adjudicated <sup>3</sup> | Contracts <sup>4</sup> | Others <sup>5</sup> |
| 2010                                          | 1,578,237                      | 581,282                             | 176,264                | 413,513             |

<sup>2</sup>NSERC Discovery Grants ( this column does include equipment grants and conference grants)

<sup>3</sup>CFI grants, Centres of Excellence Grants (Federal and Provincial), Equipment Grants, Industrial Grants

<sup>4</sup>Industry grants

<sup>5</sup>University allocated grants (Academic Development Fund, UWO Internal Funding)

### 4. RESEARCH IN THE NEWS

**T. Jenkyn - Sales of the Equalizer Curling Broom** continue to be strong.



Speaking of BalancePlus, their newfangled “EQ” curling brush head continues to sell like hotcakes. Using technology developed from Canada’s Own The Podium Olympic research initiative, studies show that the EQ head helps curlers improve their sweeping prowess by a minimum of 30% (for high-performance men) up to a stunning 105% for high-performance women. For Joe and Jane Average, ie. 90% of curlers, the results will be just as impressive ... and it will be fun to see last season’s naysayers using it, too.

**L. Jiang – Petro Canada Young Innovator Award for 2011-2012 and recipient of the NSERC University Faculty Award for 2006-2011.**



**A.G. Straatman, K. Siddiqui – Western Engineered Toilet Valve Now Saving Water**



By Communications Staff  
Tuesday, November 23, 2010

When Masco Canada was looking to expand one of its tried and true products with an environmental feature, the plumbing giant tagged a pair of engineers from The University of Western Ontario to flush its problem away.

Tony Straatman and Kamran Siddiqui, two Western Engineering professors who specialize in mechanical engineering, were asked to re-configure a mechanical valve known as the Teck® II that has been used in toilets for more than 80 years.

The goal was to add a dual flush function, allowing for both ‘short’ and ‘long’ flushes, but without changing the look or size of the valve assembly. Masco offers customers a dual flush system on electronic ‘flushometer’ products, but modifying the Teck® II will allow tens of thousands of manually operated toilets to save water too.



“Basically, Masco wanted to keep one of its bestsellers relevant while producing a more accurate flush system for water conservation,” says Straatman, who explained many competitors of Masco have faced problems with their mechanical dual flush models. If a user doesn’t hold or use the handle correctly, the water savings can be either reduced or entirely lost.

Straatman and Siddiqui started work immediately on the development of a novel secondary bleed valve that can be actuated to reduce the water use for a short flush, and then automatically reset itself prior to the next flush.

“The development of the valve required us to fill in some scientific voids; we were then able to come up with a very elegant solution to the problem”, says Straatman.

The pair worked with the team at Western’s University Machine Services to create some sample valves for testing (each one is only the size of a stack of six dimes).

A few minor modifications and 250,000 flushes later (the amount required to achieve certification), and the valve was approved by the Canadian Standards Association (CSA). It is already in hundreds of toilets across southwestern Ontario.

“Basically, the valves were typically set for six litres per flush and the change we made allows it to be set for four litres on a small flush and six litres on a big flush, so it’s big water savings in high-traffic lavatories,” Siddiqui says.

For a typical commercial toilet with five small flushes and five big flushes per day, a total of 3,650 litres (803 gallons) per year will be saved. For example, Western’s Spencer Engineering Building with 100 toilets could save 80,000 gallons of water per year.

“Not only did Tony and Kamran bring an expertise to solving this problem but when we were ready to cut prototypes, we could use University Machine Services to do the work. The team there is outstanding,” says Frank Stauder, Masco’s Director of Engineering. “They did a great job coming through on timelines and product.”

## X. Sun

Angew. Chem. Int. Ed.



**A New  
Cells: the**



50,422-426 (2011)

**Highly Durable Pt Nanocatalyst for PEM Fuel  
Multiarmed Star-like Nanowire Single Crystals**

Nature Nanotechnology, Vol 6/January 2011

### Fuel Cells: A Star Catalyst

Proton-exchange membrane fuel cells convert chemical energy into electricity using an electrochemical cell and could be used as portable power sources with high energy densities. At the anode of these devices, the fuel (usually hydrogen) is broken down into protons and electrons using a catalyst. The protons then travel through the membrane to the cathode, whereas the electrons are forced to travel round an external circuit to reach the cathode. At the cathode, the protons and electrons react with oxygen to produce water with the help of another

catalyst, which is typically composed of platinum nanoparticles dispersed across a carbon support. These nanoparticles can, however, degrade over time, compromising the performance of the fuel cell. Xueliang Sun and colleagues at the University of Western Ontario and General Motors Research and Design Center have now developed a fuel cell catalyst that is both active and durable. The catalyst is comprised of single-crystal platinum nanostructures that have a star-like shape, each with several nanowire arms. Compared with a commercial platinum nanoparticle catalyst, the new catalyst is three times more active for the oxygen reduction reaction (as occurs at the cathode of the fuel cell). Furthermore, in accelerated durability tests the nanoparticles of the commercial catalyst significantly increased in size, reducing the active surface area of the catalyst, whereas the star-shaped nanostructures were relatively unaffected.

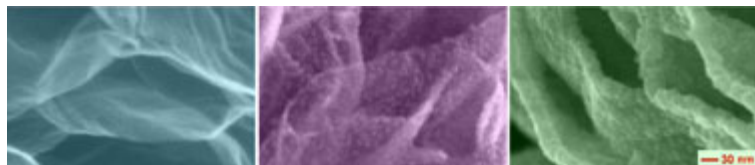
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## Lab Talk

Apr 12, 2011

### ALD cycling fine-tunes graphene-based nanocomposites

Metal oxides such as TiO<sub>2</sub> and SnO<sub>2</sub> are important candidates for many applications including fuel cells, lithium-ion batteries, solar cells, water splitting and gas sensing. By combining these materials with graphene, researchers from the Nanomaterials and Energy group at the University of Western Ontario, Canada, hope to create structures with exceptional properties. A recent success is the controlled synthesis of graphene-based TiO<sub>2</sub> nanocomposites with tunable structures by atomic layer deposition (ALD).



Metal oxide graphene nanocomposite

As shown in the figure, graphene-based crystalline anatase TiO<sub>2</sub> nanocomposites have been formed in a precise and well controlled manner by the group. The synthesized graphene displays a porous structure with very thin wrinkles. After several tens of ALD-cycles, TiO<sub>2</sub> nanoparticles of around 5 nm were uniformly deposited on both sides of the host material. Further ALD-cycles led to the formation of homogenous films.

Additionally, the team reported that the as-synthesized TiO<sub>2</sub>-graphene nanocomposites could be tuned in morphology as well as structure. A lower temperature (150 °C) contributed to amorphous TiO<sub>2</sub> while a higher temperature (250 °C) produced crystalline anatase TiO<sub>2</sub>. Thus, ALD as a deposition technique offers an elegant way of fine-tuning the synthesis of graphene-based nanocomposites.

Further details can be found in the journal *Nanotechnology*.

### About the author

Xiangbo Meng, PhD, is a research fellow in the Nanomaterials and Energy group at the University of Western Ontario, Canada. Currently he is using an ALD system to develop various advanced functional nanomaterials for energy-related applications. Prof. Xueliang (Andy) Sun is group leader and Canada Research Chair in Nanomaterials and Clean Energy. His research interests are associated with the synthesis of various nanomaterials for energy-related applications such as fuel cells and lithium-ion batteries.

**Univ. of Western Ontario researchers develop graphene nanosheet electrodes with high energy capacity for non-aqueous Li-air batteries**



10 August 2011

Researchers from the Nanomaterials and Energy Group at the University of Western Ontario, Canada, report the development of graphene nanosheet (GNS) cathode materials for non-aqueous lithium-oxygen (Li-air) batteries that show a capacity of  $8,705.9 \text{ mAh g}^{-1}$ —the highest capacity of any carbon-based materials in lithium-oxygen batteries reported so far, according to the team. Their paper appears in the RSC journal *Chemical Communications*.

Non-aqueous Li-air batteries are one of the promising systems being explored for “beyond Li-ion” energy storage solutions for electric vehicles (EVs) because of their extremely high theoretical energy density. The porosity of the air electrode is one of the critical factors in Li-air battery performance, because insoluble products are deposited in the electrode, which block  $\text{O}_2$  from diffusing to the reaction sites.

Other work, notes the team, also shows that the oxygen reduction reaction (ORR) in the carbon electrode significantly affects performance.

*Therefore, it is important to develop new carbon electrodes to improve the kinetics and enhance the energy capacity. Graphene nanosheets (GNSs) have attracted great attention for energy storage applications. Especially, they have been widely used as catalyst supports or non-noble catalysts for fuel cells.*

*Recently, Yoo and Zhou examined the GNSs as air electrodes in lithium-air batteries with a hybrid electrolyte and found that GNSs showed good electrocatalytic activity for ORR in an aqueous electrolyte, resulting in high performance. They also developed an idea of applying a graphene-like thin film on a ceramic state electrolyte in a lithium-air battery.*

*However, to the best of our knowledge, no research on GNSs as a cathode for nonaqueous lithium-oxygen batteries has been reported. Herein, for the first time, we employed GNSs as cathode active materials in nonaqueous lithium-oxygen batteries and found that GNSs delivered an extremely high discharge capacity.*

—Li et al.

The research team, led by Professor Xueliang (Andy) Sun, believes that the superior capacity is due to the unique structures of the synthesized GNSs, which provides ideal porosity suitable for the electrolyte wetting and  $\text{O}_2$  diffusion, thereby significantly improving the discharge capacity.

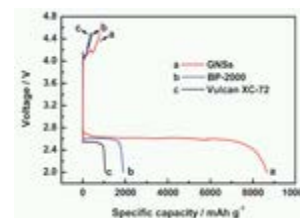
The team also pointed out that the edge sites of the GNSs which contained a large amount of unsaturated atoms were highly active in reaction with oxygen and form oxygen-containing groups, contributing to the battery performance.

*Although the detailed mechanism for the oxygen reduction reaction on GNSs in a nonaqueous electrolyte is unclear, it has [been] revealed that GNSs can deliver an extremely high discharge capacity, showing promising applications in lithium-oxygen batteries*

—Xueliang Sun

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



*Discharge-charge performance of lithium-oxygen batteries with (a) GNSs, (b) BP-2000, and (c) Vulcan XC-72 cathodes at a current density of  $75 \text{ mA g}^{-1}$ . Li et al. Click to enlarge.*

- Yongliang Li, Jiajun Wang, Xifei Li, Dongsheng Geng, Ruying Li and Xueling Sun (2011) Superior energy capacity of graphene nanosheets for a nonaqueous lithium-oxygen battery. *Chem. Commun.*, 47, 9438–9440 doi: [10.1039/c1cc13464g](https://doi.org/10.1039/c1cc13464g)

#### ev-olution.org

#### **Nitrogen-doped carbon nanotubes show high activity as cathode for lithium-air batteries**

Nitrogen-doped carbon nanotubes (N-CNTs) uses as cathode materials for lithium-air batteries show a specific discharge capacity of  $66 \text{ mAh g}^{-1}$ , which is about 1.5 times as that of CNTs, according to a new study by a team from the University of Western Ontario (Canada).

Their paper appears in the journal *Electrochemistry Communications*.

Li *et al.* synthesized the N-CNTs—which testing confirmed to incorporate 10.2 at.% nitrogen—by a floating catalyst chemical vapor deposition (FCCVD) method.

The team concluded that their results indicated that the N-CNTs electrode shows high electrocatalytic activities for the cathode reaction, thus improving lithium-air battery performance. The performance improvement of N-CNTs, they suggested, results from heteroatom nitrogen doping.

#### **Resources**

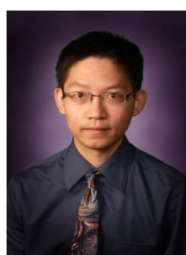
Yongliang Li, Jiajun Wang, Xifei Li, Jian Liu, Dongsheng Geng, Jinli Yang, Ruying Li and Xueliang Sun (2011) Nitrogen-doped carbon nanotubes as novel cathode for lithium-air batteries. *Electrochemistry Communications* doi: [10.1016/j.elecom.2011.04.004](https://doi.org/10.1016/j.elecom.2011.04.004)



**J. Wood**

#### **Western Engineering researcher receive Ontario Research Funding**

J.T. Wood is the Principal Investigator of a successful Ontario Research Fund application in the field of polymer composite materials and technologies. Provincial funding of \$2.4M is matched by five industry partners and five institutions (UWO, Windsor, McMaster, Toronto and Lambton College)

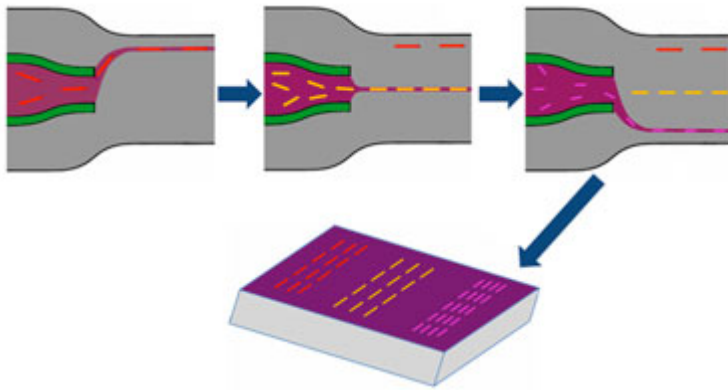


#### **J. Yang – Hydro-tweezers build nanodevices**

##### **Lab talk**

Mar 29, 2011

The assembly and alignment of nanowires or nanotubes is essential for building up nanodevices. However, manipulating nanowires in a controllable manner is still very challenging. To address the problem, a simple hydrodynamic focusing method has been developed to position and align nanowire arrays or single nanowires at specific locations. The team refers to the technique as "hydro-tweezers".



### Manipulating single nanowires

Researchers at the University of Western Ontario, Canada, are developing a bottom-up strategy for building nanosystems. The approach uses three flows, one sample flow in the middle of two sheath flows, to hydrodynamically focus nanocomponents ready for assembly.

The sample flow is clamped laterally by the two sheath flows, which act as a pair of hydro-tweezers. By adjusting the flow ratio of the sheath flow to the sample flow, it is possible to focus the sample flow and shift this stream over the entire flow field. If the sample flow contains suspended nanowires then these nanowires will deposit onto the surface beneath the sample flow.

The hydro-tweezers can be used to deliver nanowires to desired positions on a substrate and the approach could enable new applications in nanoelectronics, biosensors and materials science, with no material limitation.

More details, including images of deposited silver nanowires, can be found in the journal Nanotechnology.

### **About the author**

The study was conducted by Prof. Jun Yang's group and its collaborators at the University of Western Ontario, Canada. The first author, Dr Mei Liu, is now at the School of Mechatronics Engineering and Automation, Shanghai University, China.

## **5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS**

### **S. Asokanthan**

**Ministry of Transportation Ontario (MTO)** April 2011 –

An investigation into the feasibility of solar roadways considering sustainability while giving importance to safety and performance is being carried out. To this end, particular emphasis is placed on material characterization, mechanical strength of solar roadway panel systems, electrical power storage/transmission via smart grid and related power control.

**Nonlinear Systems Group, Department of Aerospace Engineering, University of Illinois, Urbana-Champaign, Illinois, USA** September 2011 - present

Non-linear filtering theory with applications to sensor networks and sensor fusion are being pursued. Particular emphasis is being placed on inertial sensor clusters that are being developed for predicting human body movements associated with patients suffering from epileptic seizures.

### **J.R. Dryden**

R. Bata at **Virginia Polytech** working on research concerned with Functionally Graded Material.

**J.M. Floryan**

Dr. Floryan is currently collaborating with the following:

Professors A. Inasawa and M. Asai, **Department of Aerospace Engineering, Tokyo Metropolitan Institute of Technology, Asahigaoka 6-6, Hino, Tokyo 191-0065, Japan.**

Dr. M. Debiasi, Senior Research Scientist, **Temasek Laboratories, National University of Singapore, Singapore.**

Professors Chew Yong Tian and Yeo Khoo Seng, **Department of Mechanical Engineering, National University of Singapore, Singapore.**

Professor Leandro Franco de Souza, **Laboratório de Computação de Alto Desempenho - LCAD/SME/ICMC-USP, São Carlos - SP - Brasil.**

**T. Jenkyn**

I am currently collaborating with a plastic surgeon from the **Dept. of Surgery** who has a busy practice at the LHSC Victoria Hospital. We are researching biomechanics of the craniofacial skeleton with a goal of improving facial protection in sport. This collaboration has been awarded a Dept. of Surgery Internal Research Grant in the amount of \$25,000 and a Lawson Internal Research Grant in the amount of \$13,000. We are applying to CIHR in the spring for an operating grant to support an expanded research program.

**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. Leo Lau (**Surface Science Western, Departments of Chemistry and Physics and Astronomy**), Dr. Jun Yang (**Department of Mechanical & Materials Engineering**), Dr. John de Bruyn (**Department of Physics and Astronomy**) and researchers of **LANXESS**. This project is funded by ORF, OCE, LANXESS and NSERC.

**R. Khayat**

Invited professor at the **Universite du Havre** (July 2010) for work on thermal convection of complex fluids.  
Invited professor at the **Universite de Nice** (June 2011) for work on lubrication flow.

**R. Klassen**

Ongoing collaborative research with **TransForm Automotive Ltd** (an automotive parts manufacturer based in Michigan but with a production facility in London ON).

Research with the **Atomic Energy of Canada Ltd** through a collaborative research grant held with the University Network of Excellence in Nuclear Engineering (UNENE).

**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 (L to reduce the surface roughness of micro-machined structures and parts.

(P) can be

### **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.

### **S. Salisbury**

NSERC Engage, “Optimization and Manufacturability Analysis of a Catheter Delivery System for Piezo-Resistive Pressure Sensor, (with **Curtiss Wright Controls Inc. in Stratford**)

NSERC Engage, “Investigation of the Suitability of Smart Material-Based Actuators for Aerospace Applications,” , (with **Scisense Inc. of London**)

### **E. Savory**

**University of Toronto** (J Scott) – Development and application of a mould sensor for use in housing wall assemblies and grain storage bins.

**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.

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

### **K. Siddiqui**

Dr. A. Pinar (**Technical University of Cartagena, Spain**). Research project: Design improvements of solar collectors

Dr. A. Gadallah (**Tanta University, Egypt**). Research project: Heat transfer enhancement using bubbly flows

Dr. W. Chishty (**National Research Council**). Research project: Development of Effervescent Injector

### **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. We found that metal oxide nanowires as Pt-based catalyst supports for fuel cell electrodes have unique advantages

## *Mechanical & Materials Engineering Department*

compared with the carbon black supports used currently, to reduce cost and improve durability of fuel cells. Recently, we are also working on Sn-based anodes for Li Ion Batteries for electric vehicles through an NSERC CRD.

**Ballard Power Systems (Fuel cell studies):** We are developing nitrogen-doped CNTs as Pt catalyst support for PEM fuel cells through an NSERC CRD. The advantages of this new technique are that integrating nanotubes into fuel cell backing (porous carbon paper) builds a three-dimensional (3D) electrode structure to allow hydrogen (or methanol in the case of Direct Methanol Fuel Cells) to reach all Pt nanoparticles on nanotubes. Recently, 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 LiFePO<sub>4</sub>/carbon composites through an NSERC CRD.

**Spring Power International. (Ontario) (Li Ion Batteries for Electric Vehicles):** We are concentrating on Si-based nanostructures as anodes for Li Ion Batteries through an NSERC Engage project. Silicon has the highest specific capacity, 4200 mAh/g, in known anode materials of lithium ion batteries (commercial graphite, 372 mAh/g). However, silicon anodes have seen very limited application to date due to its huge volume change in Li insertion and desorption. One way to overcome the problem is to utilize NANOsilicon such as nanotubes, nanowires and mesoporous silicon.

### **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 develop optimized micromilling strategies for porous titanium foams characterized by superior biocompatibility properties, which makes them suitable for biomedical applications. A second research stream aims 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.

### **J. Wood**

AUTO21-funded research in the field of magnesium die-casting is being carried out in co-operation with:

- **CANMET-MTL**
- **The University of Windsor**
- **Meridian Lightweight Technologies (Strathroy, ON)**

ORF-funded research in the field of polymer composite materials is being carried out in collaboration with:

- **Ford Motor Company**
- **General Motors**

- **Continental Structural Plastics**
- **DSM Composite Resins**
- **Zoltek Automotive**
- **Dieffenbacher GmbH**

### **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. The research is supported by Federal Economic Development Agency through ARCI program.

Since May 2010, Dr. Ajay K. Ray (**Departments of Chemical and Biochemical Engineering**), Dr. Keith Warriner (**Department: Food Science, University of Guelph**) and Dr. Jun Yang have collaborated with researchers of **Trojan Technologies**, one of the world's leading companies in water treatment, to develop a new generation Ultraviolet (UV) treatment technology for drinking water and wastewaters. This project is co-funded by a MITACS Accelerate Cluster program and Trojan Technologies.

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

### **C. Zhang**

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

**Pratt and Whitney Canada** - Numerical Investigation of the Flow Fields within Novel, Compact Compressors  
**BIOREM Technologies Inc., Guelph, ON** - Computational Flow Dynamic Analysis of Air Distribution in Biofilters and Biotrickling Filters

**Revolution Engine Corp., Listowel, ON** - CFD Modeling of Revolution Engine

**Prof. J. Zhu, Chemical and Biochemical Engineering, UWO** – Numerical Simulations of Two-phase Flows in Fluidized Beds

**Prof. M. Ray, Chemical and Biochemical Engineering, UWO** – Numerical Simulations of Two-phase Flows in Industrial Dryers

**Prof. J. Jiang, Electrical and Computer Engineering, UWO** – Numerical Simulations of Fluid Flow and Heat Transfer in Supercritical Water Cooled Reactor

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12. "Algorithm for Analysis of Flows in Ribbed Annuli" by H. Vafadar Moradi & **J.M. Floryan.** Int. J. Num. Methods Fluids, 2011, DOI: 10.1002/flid.2581
13. "Spectral Algorithm for Analysis of Flows in Grooved Channels " by A. Mohammadi & **J. M. Floryan.** Int. J. Num. Methods Fluids, 2011, DOI: 10.1002/flid.2577
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15. "Thermocapillary Effects in Liquid Systems of Variable Mass Confined in a Non-Isothermal Container" by M. El-Gammal and **J.M. Floryan.** CSME Transactions, v.34, 2010, pp.308-332.
16. "Immersed Boundary Conditions Method for Heat Conduction Problems in Slots with Time-Dependent Geometry" by David César Del Rey Fernandez, S.Z. Husain and **J.M. Floryan.** Int. J. Numer. Meth. Fluids (2010), DOI: 10.1002/flid.2363.
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143. Y. Zhang, **C. Zhang** and J. Jiang, 2011, "Numerical Simulation of Heat Transfer of Supercritical Fluids in Circular Tubes Using Different Turbulence Models," Journal of Nuclear Science and Technology, Vol. 48, No. 3, pp. 366–373.
144. J. A. Bourgeois, R. J. Martinuzzi, E. Savory, **C. Zhang** and D. A. Roberts, 2011, "Assessment of Turbulence Model Predictions for an Aero-Engine Centrifugal Compressor," ASME Trans. Journal of Turbomachinery, Vol. 133.
145. R. Zhang, **C. Zhang** and J. Jiang, 2011, "Determination of Applicable Input Range for Approximating a Nonlinear FGR Furnace around the Design Point," Combustion Theory and Modelling, Vol. 15, pp. 89-106.
146. B. Peng, J. Zhu and **C. Zhang**, 2010, "Numerical Study on the Effect of the Air Jets at the Inlet Distributor in the Gas-Solids Circulating Fluidized Bed Risers" Industrial and Engineering Chemistry Research, Vol. 49, No. 11, pp. 5310–5322.

## **2. REFEREED CONFERENCE PROCEEDINGS**

1. Book J M, **Asokanathan S.F**, Wang T (2010) Experimental Modal Characterization of MEMS Switches, proceedings of IEEE international Conference on MEMS, Nano, and Smart Systems, Changsha, China, December 2010.
2. Ma J, **Asokanathan S.F**, Jiang L (2010) Surface Effects Considerations for the Design of Casimir Actuated nanoswitches, proceedings of IEEE International Conference on Nano Science and Technology, Chengdu, China, Dec 2010, pp. 306-310.
3. **Buchal, R.O.**, Lu, H., Engineering Design Education and Practice as Collaborative Knowledge Building, Proceedings of the Canadian Engineering Education Association (CEEA) Second Annual Conference , St. John's, Newfoundland, June 6-8, 2011.
4. **Buchal, R.O.**, Day, A., Robinson, C., Design of a Sustainable Personal Mobility System (SPMS), Proceedings of the Canadian Engineering Education Association (CEEA) Second Annual Conference , St. John's, Newfoundland, June 6-8, 2011.
5. **Dryden, J.R.** "Effective Properties of Functionally Graded Cylinders", ACEX-11, Portugal, 2011.



### *Mechanical & Materials Engineering Department*

6. Neuert MAC, Austman RL, **Dunning CE**: Application of a Density-Elastic Modulus Equation Developed for the Distal Ulna to Multiple Forearm Positions: A Finite Element Study, 57th Annual Meeting of the Orthopaedic Research Society, Long Beach, California, Jan. 13-16, 2011. (poster)
7. Hosein YK, Clynick MP, Takaki SE, McLachlin SD, **Dunning CE**: The Effect of Intramedullary Stem Curvature on the Torsional Stability of Cemented Joint Replacement Systems, 57th Annual Meeting of the Orthopaedic Research Society, Long Beach, California, Jan. 13-16, 2011. (poster)
8. Rasoulinejad P, McLachlin SD, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: The Importance of the Posterior Osteoligamentous Complex to Sub-axial Cervical Spine Stability in Relation to a Unilateral Facet Injury, 57th Annual Meeting of the Orthopaedic Research Society, Long Beach, California, Jan. 13-16, 2011. (poster)
9. Nadeau M, McLachlin SD, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Qualitative and Quantitative Assessment of Soft Tissue Damage in the Cervical Spine following a Unilateral Facet Injury, 57th Annual Meeting of the Orthopaedic Research Society, Long Beach, California, Jan. 13-16, 2011. (poster)
10. McLachlin SD, Rasoulinejad P, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Anterior versus Posterior Fixation for an Isolated Posterior Facet Complex Injury in the Sub-axial Cervical Spine, 57th Annual Meeting of the Orthopaedic Research Society, Long Beach, California, Jan. 13-16, 2011. (poster)
11. Nadeau M, McLachlin SD, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Qualitative and Quantitative Assessment of Soft Tissue Damage in the Cervical Spine following a Unilateral Facet Injury, 11<sup>th</sup> Annual Scientific Conference of the Canadian Spine Society, Quebec City, PQ, March 9-12, 2011. (podium)
12. McLachlin SD, Rasoulinejad P, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Anterior versus Posterior Fixation for an Isolated Posterior Facet Complex Injury in the Sub-axial Cervical Spine, 11<sup>th</sup> Annual Scientific Conference of the Canadian Spine Society, Quebec City, PQ, March 9-12, 2011. (poster)
13. Neuert MAC, Austman RL, **Dunning CE**: Application of a Density-Elastic Modulus Equation Developed for the Distal Ulna to Multiple Forearm Positions: A Finite Element Study, ASME 2011 Summer Bioengineering Conference, Farmington, Pennsylvania, June 22-25, 2011. (poster)
14. Hosein YK, Clynick MP, Takaki SE, McLachlin SD, **Dunning CE**: The Effect of Intramedullary Stem Curvature on the Torsional Stability of Cemented Joint Replacement Systems, ASME 2011 Summer Bioengineering Conference, Farmington, Pennsylvania, June 22-25, 2011. (poster)
15. McLachlin SD, Rasoulinejad P, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Anterior versus Posterior Fixation for an Isolated Posterior Facet Complex Injury in the Sub-axial Cervical Spine, ASME 2011 Summer Bioengineering Conference, Farmington, Pennsylvania, June 22-25, 2011. (poster)
16. Quenneville CE, **Dunning CE**: Evaluation of the Biofidelity of the HIII and MIL-Lx Lower Leg Surrogates under Axial Impact Loading, ASME 2011 Summer Bioengineering Conference, Farmington, Pennsylvania, June 22-25, 2011. (podium)
17. Quenneville CE, **Dunning CE**: Evaluation of Energy Attenuating Floor Mats for Protection of Lower Limbs from Anti-vehicular Landmines, ASME 2011 Summer Bioengineering Conference, Farmington, Pennsylvania, June 22-25, 2011. (poster)
18. "Rayleigh-Benard Convection and Thermal Bifurcation in a Fluid Layer Subject to a Long Wavelength Heating", Asgarian, A., Hossain, M.Z. and **Floryan, J.M.** Proceedings of the 19th Annual Conference of the CFD Society of Canada, April 27-29, 2011, Montreal, Quebec, Canada.
19. "Control of Convective Rolls by Spatially Distributed Wall Heating" by M. Hossain and **J.M. Floryan**. Proceedings of the 17 the Australasian Fluid Mechanics Conference, Dec. 5-9, 2010, Auckland, New Zealand.
20. "Flow Control in Micro-channels using Groove Orientation" by A. Mohammadi and **J.M. Floryan**. Proceedings of the 17 the Australasian Fluid Mechanics Conference, Dec. 5-9, Auckland, 2010, New Zealand.

21. "Dynamics of water droplet distortion and break-up in a uniform electric field" by K. Adamiak and **J.M. Floryan**, IEEE Industry Applications Society Annual Meeting, Houston, Texas, October 2010, paper IAS11p01.
22. "Natural Convection in a Slot Subject to a Spatially Distributed Heating" by M. Hossain and **J.M. Floryan**, Bul. Amer. Phys. Soc., v. 55, No. 16, Nov.2010, p.127.
23. "Pressures Losses in Grooved Channels" by A. Mohammadi and **J.M. Floryan**, Bul. Amer. Phys. Soc., v.55, No.16, Nov.2010, p.300.
24. "The Influence of Change in Surface Geometry on the Stability of Flow in a Channel" by A. Inasawa, M. Asai and **J.M. Floryan**. Proceedings of the Eight European Fluid Mechanics Conference, Sept. 13-16, 2010, p. S1-40, Bad Reichenhall, Germany.
25. "Flow in Ribbed Annuli" by H. Moradi and **J.M. Floryan**, SHARCNET Research Day, Sheridan College, Oakville, Ontario, Canada, May 19, 2011.
26. "Flow in grooved micro channel" by A. Mohammadi and **J.M. Floryan**, SHARCNET Research Day, Sheridan College, Oakville, Ontario, Canada, May 19, 2011.
27. M. Noroozi, and **L.Y. Jiang**, Wrinkling around an inclusion line on thin film structures, 23rd Canadian Congress of Applied Mechanics, Vancouver, BC, Canada, June 5-9, 2011.
28. J. Ma, S.F. Asokanathan, and **L.Y. Jiang**, Surface effects considerations for the design of Casimir actuated nanoswitches, 2010 International Conference on Nano Science and Technology (ICNST), Chengdu, China, December 17-19, 2010.
29. M D Yahia Hossain, **Khayat, R.E.** Upstream flow near channel exit for free surface jet, Proceedings of the 18th Annual Conference of the CFD Society of Canada, London, Ontario, Canada, 2010
30. Albaalbaki, B. & **Khayat, R.E.** Pattern selection in thermal convection of non-Newtonian fluids. In Proceedings of Flow Instabilities and Turbulence in Viscoelastic Fluids. Workshop at the Lorentz Center, Leiden, Netherland (2010)
31. Moinuddin Ahmed, **Khayat, R.E.** 2010, A spectral approach to thin Newtonian jet, Proceedings of the 18th Annual Conference of the CFD Society of Canada, London, Ontario, Canada (2010)
32. Albaalbaki, B. & **Khayat, R.E.** 2010 On the comparison between low-order and amplitude equations approaches in thermal convection. In Proceedings of CFD Society of Canada Forum. The University of Western Ontario, London, ON (2010)
33. Albaalbaki, B. & **Khayat, R.E.** 2010 Non-Fourier conduction at the micro scale. In Proceedings of Ontario nanoscience and nanotechnology workshop. The University of Western Ontario, London, ON (2010)
34. Zahir U. Ahmed, **Roger E. Khayat**, "Role of inertia and gravity on three dimensional film casting and stability", 13<sup>th</sup> Asian Congr. of Fluid Mech., Dhaka, Bangladesh, pp 934-937, 2010.
35. Azad, M.A.K. and **Khayat, R.E.** 2010 A semi numerical approach to a wall jet flow near singularity. Computational Fluid Dynamics Conference (CFD), London, Ontario, Canada. **5**
36. Amin, R. & **Khayat, R.E.** 2010 A semi numerical approach for moving wall jet near singularity. Computational Fluid Dynamics Conference (CFD), London, Ontario, Canada. **6**
37. Zahir U. Ahmed, **R.E. Khayat**, "Axisymmetric annular curtain stability with viscous gas media", ICMIEE (Int. Conf. on Mech., Indust. and Energy Engg.), Khulna, Bangladesh, MIE10-153-1-4, 2010

*Mechanical & Materials Engineering Department*

38. Albaalbaki, B. & **Khayat, R.E.** Pattern selection in thermal convection of non-Newtonian fluids. In Proceedings of Flow Instabilities and Turbulence in Viscoelastic Fluids. Workshop at the Lorentz Center, Leiden, Netherland (2010)
39. M. Haghshenas, L. Wang, **R.J. Klassen**; Strain rate dependence of the indentation stress of heat-treated AA 6061 alloy over the indentation depth range from 50 nm to 10.0 mm. Symposium of Hardness across the multi-scales of structure and loading rate, Materials Science and Technology Conference, Editors: R. Armstrong, D. Bahr, N. Thadani, S. Walley, Cleveland Ohio, October 2011.
40. B. Bose, **R.J. Klassen**; "Assessment of the Effect of Irradiation Temperature on the Mechanical Anisotropy of the Zr Ion Irradiated Zr-2.5%Nb" Materials Research Society Fall Meeting (Symposium Q), Boston MA, November 29 - December 3, 2010.
41. B. Bose and **R.J. Klassen**; "Indentation Creep Studies of the Effect of Ion-Irradiation on the Mechanical Anisotropy of Zr-2.5Nb Pressure Tube Material at 25°C" NuMat Conference, Karlsruhe, Germany, August, 2010.
42. M. Haghshenas, **R.J. Klassen**, J.T. Wood; "Investigation of the equivalent plastic strain within a flow formed steel work piece determined by micro-indentation hardness and grain-shape analysis", IDDRG (International Deep Drawing Research Group) Annual International Conference, Graz, Austria, May 31 – June 2, 2010.
43. **R.J. Klassen**, Y. Liu; "The Role of Grain Boundaries in the Creep of Sub-micrometer Thick Cu and Cu/Si<sub>3</sub>N<sub>4</sub> Microbeams at 300K", Failure of Small-Scale Structures: Deformation and Failure Symposium TMS (The Minerals, Metals, and Materials Society) Annual Meeting, Seattle, WA, USA, February 2010.
44. Hafiz, A.M.K., Chow, M.T.C., Bordatchev, E.V., Tutunea-Fatan, O. R. and **Knopf, G.K.** (2011) "Integrated process planning for multi-axis laser polishing", 23rd Canadian Congress of Applied Mechanics **Vancouver, BC.**
45. Shiu, P.P., **Knopf, G.K.** and Ostojic, M. (2010) "Laser-assisted active microfluidic mixer", 2010 Intern. Symp. on Optomechatronic Technologies (ISOT), Toronto Ont., Oct 25-27, pp. 1-5 [DOI: 10.1109/ISOT.2010.5687346]
46. Sareen, K.K., **Knopf, G.K.** and Canas, R. (2010) "Rapid clustering of colorized 3D point cloud data for reconstructing building interiors", 2010 Intern. Symp. on Optomechatronic Technologies (ISOT), Toronto Ont., Oct. 25-27, 2010 pp. 1-6 [DOI: 10.1109/ISOT.2010.5687331].
47. Chow, M.T.C., Hafiz, A.M.K., Tutunea-Fatan, O. R., **Knopf, G.K.** and Bordatchev, E.V. (2010) "Experimental statistical analysis of laser micropolishing process", 2010 Intern. Symp. on Optomechatronic Technologies (ISOT), Toronto Ont., Oct. 25-27, pp.1-6 [DOI: 10.1109/ISOT.2010.5687316].
48. Sareen, K.K., **Knopf, G.K.** and Canas, R. (2010) "Point cloud simplification and civil building layout extraction from large data-set involving multiple objects", 2010 IASTED Modeling and Simulation, Banff, AB; July 15-17, 2010 (8 pages).
49. M.L. Guckert, **M.D. Naish** and R.V. Patel, "Position Control of a Spherical Joint using Feedback Linearization for SMA Wire Actuators," Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Montréal, Québec, pp. 1350–1355, July 6–9, 2010.
50. H. Azimian, R.V. Patel and **M.D. Naish**, "On Constrained Manipulation in Robotics-Assisted Minimally Invasive Surgery," Proceedings of the IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics, Tokyo, Japan, pp. 650–655, September 26–29, 2010.
51. **M.D. Naish**, M.T. Perri, D.A. Bottoni, A.L. Trejos, R.V. Patel and R.A. Malthaner, "Palpation System for Minimally Invasive Localization of Occult Tumors," Proceedings of the IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics, Tokyo, Japan, pp. 662–667, September 26–29, 2010.

*Mechanical & Materials Engineering Department*

52. H. Azimian, R.V. Patel, **M.D. Naish** and B. Kiaii, "A Framework for Preoperative Planning of Robotics-Assisted Minimally Invasive Cardiac Surgery (RAMICS) Under Geometric Uncertainty," Proceedings of the IEEE International Conference on Robotics and Automation, Shanghai, China, pp. 5018–5023, May 9–13, 2011.
53. H. Azimian, R.V. Patel and **M.D. Naish**, "A Chance-Constrained Approach to Preoperative Planning of Robotics-Assisted Interventions," accepted for publication at the 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Boston, MA, Aug. 30–Sept. 3, 2011.
54. T. Mohammad and **S. Salisbury**, "Design of a novel vertical motion piezoworm positioner," Proc. ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Philadelphia, PA, Sep. 2010.
55. Karava P, Chowdhury M J, & **Savory E** (2011) "Effect of terrain on the forced convective heat transfer from the inclined windward roof of a low-rise building", Proc 13th Int Conf on Wind Engineering, (ICWE13), Amsterdam, Netherlands, July.
56. Lin W E, **Savory E**, McIntyre R P, Vandelaar C & King J P C (2011) "A single-span aero-elastic model of an overhead electrical power transmission line with guyed lattice towers", Proc 13th Int Conf on Wind Engineering, (ICWE13), Amsterdam, Netherlands, July.
57. Orf L F & **Savory E** (2011) "Modeling of downburst-producing thunderstorms", Proc 13th Int Conf on Wind Engineering, (ICWE13), Amsterdam, Netherlands, July.
58. **Savory E**, Perret L & Rivet C (2011) "Modelling considerations for examining the mean and unsteady flow in a simple urban-type street canyon", Proc 13th Int Conf on Wind Engineering, (ICWE13), Amsterdam, Netherlands, July.
59. Perret L & **Savory E** (2011) "Dynamics of the large-scale structures over a street canyon in an urban-type boundary layer", Proc 7th Int Symp on Turbulence and Shear Flow Phenomena (TSFP-7), Ottawa, Canada, July.
60. Chowdhury M J, Karava P & **Savory E** (2010) "Building-integrated Photovoltaic/Thermal systems – numerical prediction of exterior convective heat transfer coefficients and parametric analysis", Proc Int High Performance Buildings Conf, Purdue Univ, USA, July.
61. Babaei, H. and **Siddiqui, K.**, "Investigation of streaming flow patterns in a thermoacoustic device using PIV" ASME Fluids Engineering Division Summer Conference, Montreal, Quebec, August 1-5, 2010.
62. **Siddiqui, K.** and Chishty, W.A., "The influence of channel orientation and flow rates on the bubble formation in a liquid cross-flow" ASME Fluids Engineering Division Summer Conference, Montreal, Quebec, August 1-5, 2010.
63. Lahouti, A.N., Doddipatla, L.S., Hangan, H. and **Siddiqui, K.** "Experimental and numerical study of the three-dimensional instabilities in the wake of a blunt trailing edge profiled body" ASME Fluids Engineering Division Summer Conference, Montreal, Quebec, August 1-5, 2010.
64. Doddipatla, L.S., Lahouti, A.N., Hangan, H. and **Siddiqui, K.** "Coherent structures in the near wake of a blunt trailing edge profiled body" Fluids Engineering Division Summer Conference, Montreal, Quebec, August 1-5, 2010.
65. DeGroot, C.T., **Straatman, A.G.**, "A comparison of thermal dispersion behavior in high-conductivity porous media of various pore geometries," DSL 2011, Vilemoura, Portugal, June 2011.
66. DeGroot, C.T., **Straatman, A G.**, "Interface conditions for finite-volume based models of flow in conjugate fluid-porous domains," The 19<sup>th</sup> Annual Conference of the CFD Society of Canada, Montreal Canada, April 2011.

### *Mechanical & Materials Engineering Department*

67. Bhuiya, M.S.H., and **Tutunea-Fatan, O.R.**, 2011, "An Interpolation Technique For Compensation Of Geometry-Based Errors." CDROM Proceedings of the 23<sup>rd</sup> Canadian Congress of Applied Mechanics (CANCAM 2011), Jun. 2011, Vancouver, Canada, pp. 743-746.
68. Hafiz, A.M.K., Chow, M., **Tutunea-Fatan, O.R.**, Bordatchev, E.V., and Knopf, G.K., 2011, "Integrated Process Planning For Multi-axis Laser Polishing.", CDROM Proceedings of the 23rd Canadian Congress of Applied Mechanics (CANCAM 2011), Jun. 2011, Vancouver, Canada, pp. 747-750.
69. Chow, M., Hafiz, A.M.K., **Tutunea-Fatan, O.R.**, Bordatchev, E.V., and Knopf, G.K., 2010, "Experimental Statistical Analysis of Laser Micropolishing Process." CDROM Proceedings of the International Symposium on Optomechatronic Technologies (ISOT 2010), Oct. 2010, Toronto, Canada, paper number LPTI-1 (6 p)
70. Xiangliang Jin, Zhibi Liu, Tingjie Li, Qiuquan Guo and **Jun Yang**, "A low cost CMOS sensor system of online monitoring and post image process for u-TAS applications", Proceeding of IEEE SOPO2010.
71. Xiangliang Jin, Zhibi Liu, Tingjie Li, Qiuquan Guo and **Jun Yang**, "Online Monitoring and Portable Analytical System with CMOS Sensor and Microfluidic Technology for Cell Cultivation Applications", Proceeding of IEEE SOPO2010.
72. Hamid Aghayan, **Jun Yang** and Evgueni Bordatchev, "Object shape-based methodology for optical analysis of contaminated engine lubricants", Proceeding of ISOT 2010.
73. Hamid Aghayan, Evgueni Bordatchev and **Jun Yang**, "Monitoring Of Contaminants In Engine Lubricants Using Surface Plasmon Resonance Measurement", Proceedings of the 23rd CANCAM, 2011.
74. Hamid Aghayan, Evgueni Bordatchev and **Jun Yang**, "Opto-microfluidic System For Analysis Of Contaminants In Engine Lubricants", Proceedings of the 23rd CANCAM, 2011.
75. D. Wang and **C. Zhang**, 2011, "Development of Diesel Engine Emissions Control Models Based on Heat Release Rate Analysis of Combustion," Proc. ASME/JSME 8th Thermal Engineering Joint Conference, Honolulu, Hawaii, March 13-17.

### **3. ORAL AND POSTER PRESENTATIONS**

1. Book J M, **Asokanthan S F**, Wang T (2010) Experimental Modal Characterization of MEMS Switches, proceedings of IEEE international Conference on MEMS, Nano, and Smart Systems, Changsha, China, December 2010. (ORAL)
2. Ma J, **Asokanthan S F**, Jiang L (2010) Surface Effects Considerations for the Design of Casimir Actuated nanoswitches, proceedings of IEEE International Conference on Nano Science and Technology, Chengdu, China, Dec 2010, pp. 306-310. (ORAL)
3. **Buchal, R. O.**, Lu, H., Engineering Design Education and Practice as Collaborative Knowledge Building, Proceedings of the Canadian Engineering Education Association (CEEA) Second Annual Conference , St. John's, Newfoundland, June 6-8, 2011.
4. **Buchal, R. O.**, Day, A., Robinson, C., Design of a Sustainable Personal Mobility System (SPMS), Proceedings of the Canadian Engineering Education Association (CEEA) Second Annual Conference , St. John's, Newfoundland, June 6-8, 2011.
5. Rasoulinejad P, McLachlin SD, Bailey SI, Gurr KR, **Dunning CE**, Bailey CS: Anterior versus Posterior Fixation for a Isolated Posterior Facet Complex Injury in the Sub-axial Cervical Spine, 38th Clinical Seminar in Orthopaedic Surgery, London, Ontario, October, 2010. (podium)
6. Nadeau M, McLachlin SD, Bailey SI, Gurr KR, **Dunning CE**, Bailey CS: Qualitative and Quantitative Assessment of Soft Tissue Damage in the Cervical Spine Following a Unilateral Facet Injury, 38th Clinical Seminar in Orthopaedic Surgery, London, Ontario, October, 2010. (podium)

7. "Flow in Ribbed Annuli" by H.Moradi and **J.M. Floryan**, presented at the SHARCNET Research Day, Sheridan College, Oakville, Ontario, Canada, May 19, 2011.
8. "Flow in grooved micro channel" by A.Mohammadi and **J.M. Floryan**, presented at the SHARCNET Research Day, Sheridan College, Oakville, Ontario, Canada, May 19, 2011.
9. "Rayleigh-Benard Convection and Thermal Bifurcation in a Fluid Layer Subject to a Long Wavelength Heating" by A. Asgarian, M. Z. Hossain, and **J.M. Floryan**, presented at the 19th Annual Conference of the CFD Society of Canada, April 27-29, 2011, Montreal, Canada.
10. "Control of Convective Rolls by Spatially Distributed Wall Heating" by M. Hossain and **J.M. Floryan**. Presented at the 17th Australasian Fluid Mechanics Conference, Dec. 5-9, 2010, Auckland, New Zealand. Speaker: J.M.Floryan
11. "Flow Control in Micro-channels using Groove Orientation" by A.Mohammadi and **J.M. Floryan**. Presented at the 17th Australasian Fluid Mechanics Conference, Dec. 5-9, Auckland, 2010, New Zealand. Speaker: J.M.Floryan
12. "Pressures Losses in Grooved Channels" by A. Mohammadi and **J.M. Floryan** , presented during the 63<sup>th</sup> Annual Meeting of the American Physical Society, Nov.21-23, 2010, Long Beach. Speaker: J.M.Floryan.
13. "Natural Convection in a Slot Subject to a Spatially Distributed Heating" by M .Zakir Hossain and **J.M. Floryan**, presented during the 63<sup>th</sup> Annual Meeting of the American Physical Society, Nov.21-23, 2010, Long Beach. Speaker: J.M.Floryan.
14. "The Influence of Change in Surface Geometry on the Stability of Flow in a Channel" by A. Inasawa, M. Asai and **J.M. Floryan**. Presented during the Eight European Fluid Mechanics Conference, Sept. 13-16, 2010, Bad Reichenhall, Germany. Speaker: A. Inasawa.
15. "Dynamics of water droplet distortion and break-up in a uniform electric field" by K. Adamiak and **J.M. Floryan**. Presented at the IEEE Industry Applications Society Annual Meeting, Houston, Texas, October 2010. Speaker: K.Adamiak.
16. Z. Yan, and **L.Y. Jiang**, Continuum modeling of piezoelectric nanobeams with surface effects, 2011 International Conference on Mechanical Properties of Materials (ICMPM), Zhejiang University, Hangzhou, China, June 12-15, 2011 (invited).
17. M.H. Mahdavi, **L.Y. Jiang**, and X. Sun, Nonlinear vibration of an embedded carbon nanotube in a polymer matrix, 47th Annual Technical Meeting, Society of Engineering Science, Iowa State University, October 3-6, 2010.
18. Alolabi B, Gray A, Ferreira LM, **Johnson JA**, Athwal GS, King GJW: Reconstruction of the Coronoid Using an Anatomical and Augmented Prosthesis: An In-Vitro Biomechanical Study. Meeting of the American Shoulder and Elbow Surgeons. San Diego, CA, October, 2010.
19. Sabo MT, McDonald CP, Ferriera LM, **Johnson JA**, King GJW: A Morphological Analysis of the Humeral Capitellum with and Interest in Prosthesis Design. 57<sup>th</sup> Annual Meeting Orthopaedic Research Society, Long Beach, CA, January 2011.
20. Deluce SR, Shannon H, Ferriera LM, King GJ, **Johnson JA**: The Development and Validation of a Laser Point Digitization System for Computer Assisted Orthopaedic Surgery. 57<sup>th</sup> Annual Meeting Orthopaedic Research Society, Long Beach, CA, January 2011.
21. Giles J, Boons H, Ferreira L, **Johnson J**, Athwal GS: The Effect of the Conjoined Tendon of the Short Head of the Biceps and Coracobrachialis on Shoulder Stability & Kinematics during In Vitro Simulation. 57<sup>th</sup> Annual Meeting Orthopaedic Research Society, Long Beach, CA, January 2011.

*Mechanical & Materials Engineering Department*

22. Giles J, Elkinson I, Ferreira LM, Boons H, **Johnson J**, Faber K, Athwal GS: Moderate to Large Hill-Sachs Defects: A Comparison of Remplissage, Allograft and Partial Resurfacing. 78<sup>th</sup> Annual American Academy of Orthopedic Surgeons Meeting, San Diego, CA, February 2011.
23. Alolabi B, Gray A, Ferreira LM, **Johnson JA**, Athwal GS, King GJW: Reconstruction of the Coronoid Using an Anatomic and Augmented Prosthesis: An In-Vitro Biomechanical Study. American Shoulder and Elbow Surgeons Annual Open Meeting, San Diego, CA, February 2011.
24. **R.J. Klassen**, J.S. Grewal, V. Bhakhri; The Analysis of Local Plasticity during Macro-indentation of the Nickel-based Alloy 600 Used in CANDU Steam Generator Tubing, presented at the 32<sup>nd</sup> Canadian Nuclear Society Conference, Niagra Falls ON, June 2011.
25. R. Oviasuyi and **R.J. Klassen**: Micro-Indentation based Investigation of the Anisotropy of Plastic Deformation in Select Zirconium Alloys, presented at the 22<sup>nd</sup> Canadian Materials Science Conference, Waterloo ON, June 2010.
26. M. Haghshenas and **R.J. Klassen**; An investigation of the effect of forming forces on the mandrel teeth during splined mandrel flow forming under different forming conditions, presented at the 22<sup>nd</sup> Canadian Materials Science Conference, Waterloo ON, June 2010.
27. A.Z.M. Islam and **R.J. Klassen**; FE Analysis of Residual Stress at Grain Boundaries That Undergo SCC in the A600 Ni-based Alloy, presented at the 22<sup>nd</sup> Canadian Materials Science Conference, Waterloo ON, June 2010.
28. B. Bose and **R.J. Klassen**: Effect of Ion-Irradiation on the Indentation Creep of Zr-2.5%Nb Pressure Tube Material at 298K, presented at the 22<sup>nd</sup> Canadian Materials Science Conference, Waterloo ON, June 2010.
29. M. Haghshenas, **R.J. Klassen**, J.T. Wood; "Strain Distribution During Splined-mandrel Flow Forming" presented at the 22<sup>nd</sup> Canadian Materials Science Conference, Waterloo ON, June 2010.
30. **R.J. Klassen**; "Mechanical Testing of Metallic Microsample", poster presentation at Nano-Ontario 2010 Ontario Nanoscience and Nanotechnology Workshop, London ON, May 16 – 18, 2010.
31. Al-Arife, K., **Knopf, G.K.** and Bassi, A.S. (2010) "bR based light activated proton pumps for a chemophotonic toxin sensor", 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem) Honolulu, Hawaii, USA, December 15-20, 2010.
32. K.J. Lumb, A.L. Trejos, C.D.W. Ward, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "A Hands-Free Pointer for Surgical Instruction in Minimally Invasive Surgery," Oral Presentation, Canadian Surgery Forum, Québec City, Québec, September 2–5, 2010, available in Canadian Journal of Surgery, vol. 53, no. 4, pp. S75–S76, August 2010.
33. M.-E. LeBel, A. Escoto, A.L. Trejos, **M.D. Naish** and R.V. Patel, "Initial Evaluation of a Force Sensing Simulator for Orthopaedic Knee Surgery," Oral Presentation, Centre for Education Research & Innovation Second Annual Research Symposium, London, Ontario, October 7, 2010.
34. G.R. Ozinski, N. Banerjee, P. Brown, R. Fleming, N. Ghafoor, K. Mclsaac, **M. Naish**, C. Ower, R. Patel, G. Southam, "Robotic Sample Curation, Handling, Manipulation, and Analysis: The Future of Sample Return Facilities?" Oral Presentation, The Importance of Solar System Sample Return Missions to the Future of Planetary Science, The Woodlands, TX, March 5–6, 2011
35. H. Azimian, R.V. Patel, **M.D. Naish**, B. Kiaii, "Increasing the Reliability of Preoperative Port Placement for Robotics-Assisted Minimally Invasive Cardiac Surgery," Poster Presentation, 14<sup>th</sup> Annual Scientific Meeting of the International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS), Washington, DC, June 8–11, 2011.

### *Mechanical & Materials Engineering Department*

36. **A.V. Singh**, S. Arghavan, Extensional and flexural modes of vibration of single layer graphene sheets by lattice structure and continuum plate theories, The 8<sup>th</sup> International Symposium on Vibrations of Continuous Systems Whistler BC, Canada, July 17 – 23, 2011. (Invited Paper).
37. **X. Sun**, Shuhui Sun, Ruying Li, Siyu Ye “Nanowires as a Novel Class of Catalyst Support for PEM Fuel Cells”. 218<sup>th</sup> Electrochemical Society Conference, Las Vegas, Oct.9-15. 2010 (oral)
38. Shuhui Sun, Gaixia Zhang, Ruying Li, **Andy Xueliang Sun**, and Mei Cai “Platinum Nanowire-Based Electrocatalyst for PEM Fuel Cells “. International Electrochemical Society Conference, Nice, France, Oct. 9-14, 2010. (oral)
39. Xifei Li, Xiangbo Meng, Dongsheng Geng, Jinli Yang, Jian Liu, Ruying Li, and **Andy Xueliang Sun**, “Crystalline and Amorphous SnO<sub>2</sub>/Graphene Nanosheet Composites with Superior Li<sup>+</sup> Storage as Anode Materials for High Performance Lithium Ion Battery Application”. Meet. Abstr. - Electrochem. Soc. 1101 276 (2011). 219<sup>th</sup> American Electrochemical Society Conference, Montreal, May 1-6, 2011. **(oral)**
40. Yongliang Li, Jian Liu, Xifei Li, Jiajun Wang, Ruying Li, and **Andy Xueliang Sun** “3-D Air Electrode of MnO<sub>2</sub> Nanoflakes Coated Nitrogen-Doped Carbon Nanotubes for Lithium/Air Batteries”. Meet. Abstr. - Electrochem. Soc. 1101 425 (2011). 219<sup>th</sup> American Electrochemical Society Conference, Montreal, May 1-6, 2011. (oral)
41. Shuhui Sun, Gaixia Zhang, Xiangbo Meng, Dongsheng Geng, Ruying Li, **Andy Xueliang Sun**, Siyu Ye, and Shanna Knights “Atomic Layer Deposition of Pt Nanocatalyst on Graphene Nanosheet for PEM Fuel Cell Applications” Meet. Abstr. - Electrochem. Soc. 1101 1862 (2011). 219<sup>th</sup> American Electrochemical Society Conference, Montreal, May 1-6, 2011. (oral)
42. Shuhui Sun, Gaixia Zhang, Ruying Li, **Andy Xueliang Sun**, and Mei Cai “Platinum Nanowire-Based Highly Active and Durable Electrocatalyst for PEM Fuel Cells “. Meet. Abstr. - Electrochem. Soc. 1101 1945 (2011). 219<sup>th</sup> American Electrochemical Society Conference, Montreal, May 1-6, 2011. (oral)
43. Xiangbo Meng, Dongsheng Geng, Ruying Li, Andy Xueliang Sun, “Atomic Layer Deposition of Various Nanostructures” International Atomic Layer Deposition Conference, Boston, USA, June 25-28, 2011. (oral)
44. “Enhanced Interpolation Techniques for Compensation of Geometry-Based Errors in Five-Axis Surface Machining” presented at 23<sup>rd</sup> Canadian Congress of Applied Mechanics (CANCAM 2011), Jun. 2011, Vancouver, Canada. **O.R. Tutunea-Fatan**
45. I.Basu, J.P. Weiler, **J.T. Wood**, "Process-structure relationships for cast magnesium alloys", Thermec' 2011, Quebec City, (2011). (Invited)
46. I. Basu, J.P. Weiler, J.T. Wood, “Study of Solidification of magnesium alloys during high-pressure die casting”, Thermec'2011, Quebec City (2011), (Invited).
47. Xiangliang Jin, Zhibi Liu, Tingjie Li, Qiuquan Guo and **Jun Yang**, “A low cost CMOS sensor system of online monitoring and post image process for u-TAS applications”, IEEE SOPO2010, July 19-21, 2010, Chengdu, China.
48. Xiangliang Jin, Zhibi Liu, Tingjie Li, Qiuquan Guo and **Jun Yang**, “Online Monitoring and Portable Analytical System with CMOS Sensor and Microfluidic Technology for Cell Cultivation Applications”, “”, IEEE SOPO2010, July 19-21, 2010, Chengdu, China.
49. Hamid Aghayan, **Jun Yang** and Evgueni Bordatchev, “Object shape-based methodology for optical analysis of contaminated engine lubricants”, ISOT 2010, Oct. 25-27, 2010, Toronto, Canada.
50. Tingjie Li and **Jun Yang**, “High performance blood separation on lab-on-a-CD: toward parallel and multiple lab-on-a-chip blood testing”, 2<sup>nd</sup> international conference on cellular and molecular bioengineering, Aug 2-4, 2010, Singapore.



## *Mechanical & Materials Engineering Department*

51. Hamid Aghayan, Evgueni Bordatchev and **Jun Yang**, "Monitoring Of Contaminants In Engine Lubricants Using Surface Plasmon Resonance Measurement", The 23rd CANSAM, June5-9, 2011, Vancouver, BC, Canada.
52. Hamid Aghayan, Evgueni Bordatchev and **Jun Yang**, "Opto-microfluidic System For Analysis Of Contaminants In Engine Lubricants", The 23rd CANSAM, June5-9, 2011, Vancouver, BC, Canada.
53. Qiuquan Guo, Tingjie Li and **Jun Yang**, "Design of Enhancing Acoustic Focusing Metamaterials in Conjunction with Tissue Structures for Ultrasound Therapy", ISAM 2011, May 23-25, Beijing, China.

## **4. INVITED LECTURES**

### **R.O. Buchal**

November 2010            Presentation on "Designing the Car of the Future", as invited speaker at workshop on Math, Science, Technology, and the Arts related to Society and the Environment at the Faculty of Education, University of Western Ontario.

### **J.M. Floryan**

June 2011                Department of Mechanical Engineering, Bandung Institute of Technology, Bandung, Indonesia ("Research at the University of Western Ontario and Student Exchange Programs" –informal presentation and discussion).

June 2011                Faculty of Engineering, Maranatha University, Bandung, Indonesia ("Spray Control through Utilization of Electric Fields")

June 2011                Department of Mechanical Engineering, University of Indonesia, Jakarta, Indonesia ("Use of Electric Fields in the Dynamic of Droplets")

June 2011                Department of Mechanical and Industrial Engineering, Universitas Gadjah Mada, Yogyakarta, Indonesia ("Induced Polarization Effects in Liquid Droplets").

May 2011                 Dept. of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore ("Effect of Distributed Surface Roughness on Stability on Shear Layer").

May 2011                 Centre for Water Research, University of Western Australia, Perth, Australia ("Induced Polarization Effects in Liquid Droplets and Rain Formation").

April 2011                Department of Mechanical Engineering, University of Hong Kong, Hong Kong ("Effect of Distributed Surface Roughness of the Stability of Shear Layers").

April 2011                Institute of High Performance Computing, Singapore ("Immersed Boundary Conditions Methods in Fluid Mechanics").

April 2011                Department of Mechanical Engineering, National University of Singapore, Singapore ("Induced Polarization Effects in Liquid Droplets")

February 2011            Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai Johor, Malaysia ("Effects of Distributed Surface Roughness Dynamics on the Laminar-Turbulent Transition")

February 2011            Department of Physics, Nanyang Technological University, Singapore ("Dynamics of Droplets Driven by Induced Polarization Effect")

February 2011            Department of Mechanical Engineering, National University of Singapore ("Dynamics of Shear Layers in the Presence of Distributed Surface Roughness")

## *Mechanical & Materials Engineering Department*

- December 2010 Department of Mechanical Engineering, University of Canterbury, Christchurch, New Zealand ("Effect of Distributed Surface Roughness on the Laminar-Turbulent Transition")
- C. Dunning**
- November 2010 Laboratory Investigations in Orthopaedic Biomechanics: Research Directions of the Jack McBain Biomechanical Testing Lab, Invited Seminar Presentation, Seminar of the Joint Motion Program, CIHR Strategic Training in Health Research program, University of Western Ontario.
- R.E. Khayat**
- July 2010 Pattern Selection in Thermal Convection of Non-Newtonian Fluids. In Proceedings of Flow Instabilities and Turbulence in Viscoelastic Fluids. Workshop at the Lorentz Center, Netherland.
- M.D. Naish**
- May 2011 "Robotics and Mechatronics for Clinical Applications." Shanghai University, Department of Mechatronics and Automation Engineering, Shanghai, China.
- K. Siddiqui**
- November 2010 Flow Structure Above Wavy Water and Solid Surface. ASME International Mechanical Engineering Congress & Exposition. Vancouver, B.C.
- X. Sun**
- July 2010 One-dimensional Nanomaterials for fuel cells, 8<sup>th</sup> international conference on New materials for Electrochemical Systems, Shanghai, China
- October 2010 Nanomaterials for Energy Conversion and Storage, University of Saskatchewan,  
Development of Nanomaterials for Energy Conversion and Storage, Canadian Light Sources, Saskatchewan.
- November 2010 Nanomaterials for Energy Conversion and Storage, Brookhaven National Laboratory, New York, USA.
- May 2011 Development of Nanomaterials for Clean Energy, University of Toronto.
- June 2011 Graphene Composites as Anode for Li-Ion Batteries, Canadian Chemistry Society Conference, Montreal.  
Pt Nanowires Electrocatalysts for PENM Fuel Cells, Canadian Chemistry Society Conference, Montreal.
- J. Yang**
- June 2011 Nanotechnology: An Enabling Tool for Biology, Schulich Dentistry Research Seminar Series.

## 5. TECHNICAL REPORTS

1. "Mechanism of drag generation by surface corrugation" by A. Mohammadi and **J.M. Floryan**. Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-1/2011, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2011.
2. "Spectral Method for Analyzing Motions of Ellis Fluid over Corrugated Boundaries" by M. Fazel Bakhsheshi, **J.M. Floryan** & P.N. Kaloni, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-8/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
3. "Cross Roll Instability in a Periodically Heated Fluid Layer" by M.Z. Hossain and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-7/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
4. "Dynamics of water droplet distortion and break-up in a uniform electric field" by K. Adamiak and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-6/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
5. "Algorithm for Analysis of Flows in Ribbed Annuli" by H. Moradi and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-5/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
6. "Thermocapillary Effects in Liquid Systems of Variable Mass Confined in a Non-Isothermal Container" by M. El-Gammal and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-4/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
7. "On the transition between distributed and isolated surface roughness and its effect on the stability of channel flow" by **J.M. Floryan** and M. Asai, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-3/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.
8. **Savory E**, El Damatty A, Hangan H, Miller C & Galsworthy J (2011) "Modeling and prediction of failure of transmission lines due to high intensity winds (HIW) - Phase 2 (Validation and Implementation)" CEATI WISMIG Project 3323, Final Report, March, pp 284.

## 6. BOOKS AND BOOK CHAPTERS

1. Engineering Analysis with SolidWorks Simulation 2011. **P. Kurowski**, Schroff Development Corporation (ISBN 978-1-58503-632-5)
2. **M.D. Naish**, R.V. Patel, A.L. Trejos, M.T. Perri, R.A. Malthaner, "Robotic Techniques for Minimally Invasive Tumor Localization," Surgical Robotics—Systems Applications and Visions (J. Rosen, B. Hannaford, R. Satava, eds.), Springer: New York, pp. 469–496, 2011, ISBN 9781441911254.
3. **Straatman, A.G.**, "Heat Transfer in graphitic foams," in Heat Transfer in multiphase materials, Edited by Andreas Oschner, Springer, 2010.

## 7. PATENTS

1. R.V. Patel, A.L. Trejos, M. Tavakoli and **M.D. Naish**, "Sensorized Medical Instrument," United States Patent Application 13/141,065, filed June 20, 2011.

## *Mechanical & Materials Engineering Department*

2. **Straatman, A.G.**, Fisher, B. T., **Siddiqui, K.**, Stauder, F., "Secondary Bleed valve for dual flush valve," North American Patent, Patent Application number: 123-3-26-U; 60137-668PUS1, 2010.
3. **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, Filed, January, 2011.
4. **Sun, X.**, Yang, H., Li, X., Geng, D. "Secondary Lithium Batteries Having Novel Anodes Field of The Invention", US patent, pending. Dec., 2010
5. **Jun Yang**, Zhifeng Ding and Leo Lau, "Hybrid Solar Energy Conversion System with Photocatalytic Disinfectant Layer", Provisional US patent and PCT application filed.
6. Leo W. M. Lau, Zhifeng Ding, **Jun Yang**, David Love, Mohammad Harati, "Electrochemical Method of Producing CIGS Solar Cell", US patent and PCT application filed.

## PROFESSIONAL SERVICES

### 1. REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS

#### **S. Asokanthan**

Review of Refereed Journals and Book Chapters  
ASME Journal of Applied Mechanics  
Review of Grant Applications  
NSERC Discovery Grant

#### **R.O. Buchal**

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

#### **J.R. Dryden**

Reviewer for Journal of Materials Science

#### **C. Dunning**

Proceedings of the Institution of Mechanical Engineers, Part H, Journal of Engineering in Medicine  
Journal of Orthopaedic Trauma  
Journal of Biomechanics  
Medical Engineering & Physics  
Computer Methods in Biomechanics and Biomedical Engineering

#### **J.M. Floryan**

#### **Editor**

Member, Editorial Board of Canadian Society for Mechanical Engineering (CSME) Transactions ;  
Member, Editorial Board of Archives of Mechanics.

#### **Professional Commitments**

The Canadian Society of Mechanical Engineering, Vice President, Ontario Region, 2009-2010.  
Secretary of the Canadian National Mechanics Committee (IUTAM), Canadian representative for the International Union of Theoretical and Applied Mechanics;

## *Mechanical & Materials Engineering Department*

Chair of the Organizing Committee for the 24<sup>th</sup> IUTAM (International Union for Theoretical and Applied Mechanics) Congress, Montreal 2016.

Member of the CANCAM Central Committee (since 2010)

Member of the College of Reviewers for the Canada Research Chair Program and the Canada Foundation for Innovation.

Member of the Selection Panel for the Canada Research Chair Program.

Member of the Executive Committee for the Turbulence and Shear Flow Phenomena Symposium (Ottawa 2011)

### **Reviewer of Refereed Journals**

Archives of Mechanics

Journal of Fluid Mechanics

Journal of Computational Physics

Proceedings of the Royal Society

Fluid Dynamics Research

Physics of Fluids.

### **L. Jiang**

Journal of Micromechanics and Microengineering

Physica E: Low-dimensional Systems and Nanostructures

Mechanics of Advanced Materials and Structures

Theoretical and Applied Mechanics Letters

International Journal of Applied Mechanics

Acta Astronautica Carbon; Applied Mathematics and Computation

Journal of Physics D: Applied Physics

Journal of Physics: Condensed Matter.

### **R.E. Khayat**

Physical Review

Journal of Fluid Mechanics

International Journal for Numerical Methods in Fluids

### **R. Klassen**

Canadian Metallurgical Quarterly

Journal of Nuclear Materials

### **G. Knopf**

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

**Natural Sciences and Engineering Research Council (NSERC)**

Member of NSERC's Discovery Grant Evaluation Committee (1512)

**Associate Editor of Refereed Journals:**

International Journal of Control and Intelligent Systems (Editor: C. de Silva, UBC),

International Journal of Optomechatronics (Editor: H.-S. Cho, KIAST)

**Reviewer of Book Manuscripts** (Technical reviewer for publisher)

Smaili, A. and Mrad, F. (2011) *Applied Mechatronics*, Oxford University Press, Canada.

### **Reviewer of Refereed Journals**

Applied Optics

Biosensors and Bioelectronics

## *Mechanical & Materials Engineering Department*

Computer Aided Design  
Computer Methods and Programs in BioMedicine  
Control and Intelligent Systems (Associate Editor)  
Optical Engineering  
IEICE Transactions on Electronics  
International Journal of Advanced Manufacturing Technology  
International Journal of Optomechatronics (Associate Editor)  
Journal of Intelligent Manufacturing  
Journal of Optics  
Measurement Science and Technology  
Sensors  
Sensors and Actuators: B Chemical

### **M.D. Naish**

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

### **S. Salisbury**

IEEE/ASME Transactions on Mechatronics

### **E. Savory**

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

### **Other**

Organizing Committee for PHYSMOD 2011, "International Workshop on Physical Modelling of Flow and Dispersion Phenomena" to be held 22<sup>nd</sup> – 25<sup>th</sup> August 2011, Meteorological Institute of Hamburg University, Germany.

### **K. Siddiqui**

Heat Transfer Engineering  
International Journal of Hydrogen Energy  
Journal of Fluids Engineering  
International Journal of Thermal Sciences  
Computers and Fluids  
Canadian Journal of Civil Engineering

### **A.G. Straatman**

International Journal of Computational Fluid Dynamics (November 2010)  
International Journal of Heat and Mass Transfer, 2 articles (March 2011, April 2011)  
International Journal of Thermal Sciences, 1 article (May 2011)  
Journal of Fluid Mechanics, 1 article (June 2011)  
Carbon, 1 article (July 2011)

### **X. Sun**

Nature Nanotechnology  
Journal of American Chemical Society  
Advanced Materials

## *Mechanical & Materials Engineering Department*

ACS Nano, "Angewandte Chemie International Edition"  
Nanotechnology  
Materials of Chemistry  
J. Phys. Chem.  
Electrochemistry Communication  
Electrochemical Solid-State Letter  
Appl. Phys. Lett.,  
Carbon,  
Langumir

### **O.R. Tutunea-Fatan**

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

### **J. Yang**

Lab on a Chip  
Applied Physics Letter  
Nanotechnology  
Journal of Micromechanics and Microengineering  
IEEE Transactions on Industrial Electronics  
IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency  
IEEE Transactions on Nanotechnology Langmui  
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**

Reviewer for Computers and Mathematics with Applications  
Reviewer for Combustion Theory and Modelling  
Reviewer for Proceedings of the Institution of Mechanical Engineers, Part A, Journal of Power and Energy

### **Professional Commitments**

Member of International Scientific and Advisory Committee for 2011 International Workshop on Heat Transfer Advances for Energy Conservation and Pollution Control  
Session Co-Organizer for 2011 ASME-JSME Thermal Engineering Joint Conference  
Member of Organizing Committee for CFD Annual Conference 2010  
MITACS Elevate Review Subcommittee

## **2. REVIEW OF GRANT APPLICATIONS**

### **R.O. Buchal**

NSERC Strategic Grants Program  
NSERC Collaborative Research and Development Grant

**C. Dunning**

Health Technology Exchange – Health Technology Commercialization  
NSERC – Discovery Grants

**J.M. Floryan**

U.S. National Science Foundation  
NASA - Dynamics and Stability Panel  
Office of Microgravity Research (Member of the Review Panel)  
NSERC Strategic Grants  
NSERC Operating Grant Proposals  
AGARD-NATO  
Soros Foundation  
US Civilian Research and Development Agency  
Office of Scientific Research, Ministry of Education, Saudi Arabia  
SHARCNET Grant Review Board  
CFI  
Ontario Ministry of Research  
CRC Program – member of the College of Reviewers  
Ministry of Science and Higher Education, Poland.

**R.E. Khayat**

NSERC  
ANR (France)

**R. Klassen**

CRC Chair Renewal Application  
NSERC Discovery Grant  
NSERC Collaborative Research and Development

**G. Knopf**

NSERC (Discovery Grants)

**M.D. Naish**

NSERC Idea to Innovation Grants  
NSERC Discovery Grants

**S. Salisbury**

NSERC Discovery Grant

**E. Savory**

Czech Academy of Sciences

**K. Siddiqui**

NSERC (Strategic, CRD, Discovery)



**X.Sun**

NSERC Discovery Committee member  
NSERC Strategic  
CRD  
12  
Discovery  
CFI  
OCE  
ORF  
NSF

**J. Yang**

NSERC Strategic grant applications  
NSERC 121

**C. Zhang**

NSERC  
OCE  
MITACS