ANNUAL REPORT

July 1, 2013 to June 30, 2014

Department of Mechanical and Materials Engineering

Western Engineering

Western University

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MESSAGE FROM THE DEPARTMENT CHAIR

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

The department had 227 full time and 37 part time undergraduate students (years 2, 3 and 4) and 107 graduate students. The Mechatronics Program offered jointly with the Department of Electrical and Computer Engineering exceeded planned enrolment by 100%. We awarded 79 BESc degrees, 22 MEng degrees, 8 MESc degrees and 13 PhD degrees this year. We think that we are the right size, where we are small enough to offer personal attention to our students and large enough to have broad, state-of-the-art technical expertise. Our numerous, high quality graduates are sought after by industrial employers from across the country, whilst many others continue on to graduate, medical, dental, business and law schools, all taking with them core skills in engineering design. Indeed, every year, our senior undergraduates work on “real world” design projects sponsored by a variety of companies.

In the past year, we have reviewed several aspects of our undergraduate curriculum and have continued to strengthen the experiential part of the program. We have restructured courses dealing with the fundamentals of electrical engineering in order to expose students to the use of sensors, actuators and controls, which are becoming essential elements of modern intelligent mechanical systems. We have created a new Controls Laboratory, 3D Printing Laboratory and expanded Dynamic and Vibrations Laboratory. We have completed renovations of the Gas Dynamics Laboratory, Hydraulics Laboratory and Sample Preparation Laboratory. Modernization of the MME Manufacturing and Design Studio are well advanced. Our laboratories are among the best in the country according to external reviewers. We have expanded the scope of our graduate professional programs in order to address society's needs. Enrolment in these programs has reached the planned capacity. Our program in Heating, Ventilation and Air Conditioning (HVAC) addresses the current preoccupation with energy and its efficient use. The program in Engineering and Medicine addresses the needs of our aging society and the opportunities associated with maintaining healthy life styles, while the program in Composite Materials focuses on the automotive as well as biomedical industries both of which require improved and lighter materials. We are working on the online versions of these programs. The Institutional Quality Assurance Process completed a review of our programs and concluded that they were all of high quality

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

Our department has several active student societies including the American Society of Mechanical Engineers (ASME), the Society of Automotive Engineering (SAE), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the Canadian Society for Mechanical Engineering (CSME). These student societies have regular meetings, field trips to companies who hire our students and they participate in regional competitions and meetings. We encourage them to participate in collegiate design competitions including the Formula SAE race car, the SAE Baja car, the solar car, the concrete toboggan, the SAE Aero remote-controlled aircraft and others.

Many or our faculty members are highly recognized in their field and have earned numerous honors and awards from different engineering societies. With annual externally funded research expenditures exceeding $2.5 million, research support is derived from major Federal research funding agencies, such as the Natural Sciences and Engineering Research Council, the Province of Ontario and industry. The Department has several large research laboratories in the areas of thermofluids, materials, biomechanics, dynamics, computational mechanics and mechatronics, among others. The major research areas include: (i) Heat transfer, (ii) Fluid mechanics, (iii) Composite materials, (iv) Biomechanics, (v) Micro-electro-mechanical systems (MEMS), (vi) Mechatronics, (vii) Computational mechanics and (viii) Design. Our research activities place us the third position in the country according to the ratings prepared by the University of Toronto.

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

J.M.Floryan
Professor and Chair

ADMINISTRATION

Chair

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

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Email: mfloryan@eng.uwo.ca

Associate Chair, Graduate Research Programs

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

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

Graduate Research Programs Committee 2013-2014

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

Associate Chair, Graduate Professional Programs

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

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Graduate Professional Programs Committee 2013-2014

J. Yang
T. Kuboki
P. Kurowski
K. Siddiqui, Associate Chair, Research Programs
R. Klassen, Associate Chair, Professional Programs

Associate Chair, Undergraduate Affairs

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

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

Undergraduate Curriculum Committee 2013-2014

R.O. Buchal
P. Kurowski
C. Zhang
O.R. Tutunea-Fatan
J. Wood, Associate Chair, Undergraduate

AWARDS AND RECOGNITION

J.M. Floryan

Received title “Professor” from the President of the Polish Republic. This is a personal title not a job title.

T. Jenkyn

NSERC Discovery Grant

A.G. Straatman

President of the Canadian Computational Fluid Mechanics Society
Terry Base Award for Outstanding Teaching in Mechanical and Materials Engineering
Nominated by the MME UG students

X. Sun

Engineering Prize for Achievement in Research

Faculty Research Award, Tier 1 Canada Research Chair in Development of Nanostructured Materials for Energy Storage and Conversion

NSERC Discovery Accelerator Supplement Award

C. Zhang

Elected Fellow of CSME (Canadian Society of Mechanical Engineers

FACULTY MEMBERS AND ADMINISTRATIVE STAFF

1. FULL-TIME FACULTY MEMBERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

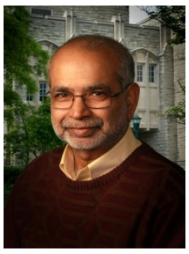
Research Interests: Piezoelectric Actuators; Real-Time Control; Dynamic Modelling and Analysis; Mechatronic System Integration

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. PROFESSOR EMERITI

J.R. Dryden, Professor, Ph.D. (Windsor)-Materials
J.D. Tarasuk, Professor; P. Eng.; Ph.D.-Mechanical

3. ADJUNCT ACADEMIC PROFESSORS

W. Altenhof, Ph.D.
Department of Mechanical, Automotive & Materials Engineering
University of Windsor
Windsor, Ontario N9B 3P4
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Experimental and numerical modeling of structures subjected to impact/dynamic and quasi-static loading; large deformation of materials; metallic and polymeric foams; crashworthiness evaluation; child safety in vehicles; durability of mining vehicle wheels

G. Avigad, Ph.D.
Mechanical Engineering
Braude College of Engineering
Karmiel, Israel
Email: gideona@braude.ac.il

Multi-objective and multi modal optimization, evolutionary algorithms, robotics, conceptual design, design for adaptability.

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

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

R. Canas, Ph.D.
Email: rcanas@uwo.ca

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

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

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

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

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

J. Johrendt, Ph.D.
Department of Mechanical, Automotive & Materials Engineering
University of Windsor
Windsor, Ontario N9B 3P4
519-253-3000, Ext. 2625
Email: Jennifer@uwindsor.ca

Materials and component characterization, neural networks, novel structural methods, vehicle durability, road test simulation, and driver modeling.

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

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

B. Minaker, Ph.D.
Department of Mechanical, Automotive & Materials Engineering
University of Windsor
Windsor, Ontario N9B 3P4
519-252-3000, Ext. 2621
Email: bminaker@uwindsor.ca

Modelling, simulation, and control of vehicle dynamics, multibody dynamics, finite element analysis, design of vehicle suspension systems.

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

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

C. Park, Ph.D.
Department of Mechanical and Industrial Engineering
University of Toronto
Toronto, Ontario M5S 3G8
416-978-3053
Email: park@mie.utoronto.ca

Foaming of Thermoplastics and Composites

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

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

M.R. Thompson, Ph.D.
Department of Chemical Engineering
McMaster University
Hamilton, Ontario L8S 4L7
Email: mthomps@mcmaster.ca
905-525-9140, Ext. 23213
Email: mthomps@mcmaster.ca

Polymer processing, extrusion machinery, composite materials, compounding technology, particle mechanics, foams.

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

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

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

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

4. VISITING PROFESSORS

Dr. Gideon Avigad, Ort Baude College of Engineering, Israel
Dr. Libo Fan, Xuchang University, China
Dr. Roderich Gross, The University of Sheffield, UK
Dr. Jian Gu, Hubei Institute of Aerospace Chemotechnology, China
Dr. Gui-Chuan Hu, Chongqing University of Science & Technology, China
Dr. Gang Li, Harbin Engineering University, China
Dr. Erella Matalon-Eisenstadt, Ort Braude College of Engineering, Israel
Dr. Botao Peng: Trojan UV Technologies, London, Ontario
Dr. Jack Polihronov, Sofia University, Soofia, Bulgaria

Dr. Eva Potyra, Fraunhofer Institute for Chemical Technology, Germany
Dr. Tobias Potyra, Fraunhofer Institute for Chemical Technology, Germany
Dr. Xiaolong Wang, The Hong Kong Polytechnic University, Hong Kong
Dr. Jianshe Wang, Zhengzhou University, China
Dr. Rong Xie, Dalian University of Technology, China
Dr. Fang Yuan, Henan University of Technology, China

5. ADMINISTRATIVE SUPPORT STAFF

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Joanna Blom
Graduate Coordinator
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Fax: 519-661-3020
Email: jblom@uwo.ca

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

6. TECHNICAL SUPPORT STAFF

Walid Altahan
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Dave Lunn
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Spencer Engineering Building, Room 1066
Telephone: 519-661-2111 Ext: 81516
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Adam Woodhouse
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Spencer Engineering Building, Room 1065
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Email: awoodhou@uwo.ca

UNDERGRADUATE EDUCATION

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

1. MECHANICAL ENGINEERING PROGRAM

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

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

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

Mechanical Engineering Option

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

Mechanical Engineering and Law Option

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

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

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

Failure to Meet Progression Standards
A student who fails to meet the combined program progression standards in any year will be required to withdraw from the combined program. However, a student who has met the progression standards of either the Engineering or LLB program, will be allowed to proceed to the next year of that program. If the progression standards of both individual programs have been satisfied, the student may continue in either program and may

petition the Faculty whose program was not selected for permission to complete that program at a later date. A student who is required to withdraw from the combined program and wishes to pursue either or both of the individual programs, must complete all the degree requirements of the individual program or programs in order to graduate from that program or those programs.

First Year Program
Common first year of Engineering.

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

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

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

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

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

Mechanical Engineering and Medicine Option

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

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

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

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

Concurrent Degree Program

First Year Program
Common first year of Engineering.

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

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

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

Fifth Year Program
Regular Year 2 of the MD program.

Sixth Year Program
Regular Year 3 of the MD program.

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

Mechanical Engineering and Business Option

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

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

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

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

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

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

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

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

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

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

Exchange Programs

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

2. UNDERGRADUATE ENROLLMENT

Full Time

	Year 1	Year 2	Year 3	Year 4	TOTAL
Mechanical	n/a	84	88	81	253

Part Time

	Year 1	Year 2	Year 3	Year 4	TOTAL
Mechanical	n/a	2	23	6	31

3. DEGREES GRANTED

Fall 2013	Spring 2014
3	79

4. UNDERGRADUATE AWARDS

Recipients (Fall 2013) – Students registered in the Department of Mechanical and Materials

ASHRAE Award

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

Awarded to: **Zain Quadri**

Andrea Bailey Memorial Award

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

Awarded to: **Mira Kim**

Ian Duerden Memorial Award

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

Awarded to: **Grant Warr**

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

Awarded to: **Doran Avivi**

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

Awarded to: **Alexis Chang-Powless; Chris Kornas**

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

Awarded to: **Jason Ng**
Bizmo Award for Volunteerism
Awarded to: **Lauren Cuthbertson**

Konrad and Ruth Plumpe Scholarship in Engineering
Awarded to: **Mitchell Dooreleyers**

Ontario Professional Engineers Scholarships
Awarded to: **Lauren Cuthbertson**

Tom NG Engineering Award
Awarded to: **Adonay Gebremariam**

UWOFA Scholarships
Awarded to: **James Crocker**

Vladimir Stritesky Engineering Award
Awarded to: **Luisa Valencia Vega**

Recipients (Spring 2014) Awards of the Graduating Class June 2014 – 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: **Lauren Rose Cuthbertson**

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

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

Awarded to: **David Nevin**

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: **Anthony Litrenta**

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: **Doran Avivi**

5. DESIGN PROJECTS

Projects at a Glance

Project Title	Student(s)	Faculty Advisor(s)
ASHRAE HVAC design competition	Muhammad Bilal;Simon Heathcote; James Kim; Kevin Lee; Zain Qadi	W. Altahan; R.O. Buchal
Redesign of condensate recovery system at Labatt brewery (Labatt)	Will Bonnycastle; Michelle Lyle; Dan Nevin	R.O. Buchal
Effects of environmental variation on evacuating and filling vehicle braking system (Honda Canada)	Daniel Arrunategui; Kyle Dobinson; Adalberto Lazo Castro; Veronick Martinuzzi	P. Kurowski
Exercise device for the elderly (ES 3399)	Michael Harvey; Brent Parsons	R.O. Buchal
Improved hand grips and shifters for a hand cycle used by quadriplegics.	Alex Balsdon; Tyler Barnwell; Kiefer Gunn; Ryan Kope; Nicholas Mendoza	L. Ferreira
Improved mobility aid for people with leg injuries (crutch). (**Confidential**)	Khaled Al Hourani; Omar Fayoumi; Tariq Ismail; Christian Lopez	P. Kurowski
Paralyzed patient transfer system.	Robert Green; Andrew Hudon; Natalie Martens;Allan McCulloch Lisa Sloan	P. Kurowski
Unicycle training device	Brian Scott; Kevin Titus	P. Kurowski
Failsafe braking system for trains	Nick Billingsley; Alex Bullock; Phil Poulin	R.O. Buchal
Design of a Safer Oil and Natural Gas Pipeline for River Crossings (**Confidential**)	Cristina Osorio; Michael Zawalski	R.O. Buchal
Sustainable Personal Mobility System (SPMS)	Joel Clifford; Remy Eden; Adam Saunders;Spencer Smith	R.O. Buchal
Bicycle Design for Sub-Saharan Africa	Chris Csernyei; Lauren Cuthbertson Ben Hamilton; Chris Oreskovic	R.O. Buchal
Space heating system for rural Malawi	Brendon Bain; Alexa Morin; Chloe Nicholson-Smith	R.O. Buchal

Large Square Bale Straw Processor to improve efficiency of bedding ginseng gardens.	Khalid Mahmoud; Joshua Miller; Nick Milliken	P. Kurowski
Mushroom picking robot team 1	Fahed Ahmed; Greg Inns; Eugene Li; Adam Orth	R.O. Buchal
Mushroom picking robot team 2	Najmalden Assaf; Mahmoud Safaan; Amir Safaei; Loabat Shojaei Kavan	R.O. Buchal
Portable camp wood stove	Jaryd Kilbride; Kris Lawrence; Patrick Rusyn	P. Kurowski
Wood burning stove	Marc-Andre Brooks;Emily Germann Hadley Jenkins-Giffen; Quinton Wilson	P. Kurowski
SAE Baja - CVT Tuning Mechanism	Doran Avivi	P. Kurowski
SAE Baja - Front suspension and steering	Kevin Acton; Peter Blokker; Anthony Litrenta; Carson Tarbutt	P. Kurowski
SAE Baja - Rear Suspension	Erica Kantor; Nathan Woodcock	P. Kurowski
Formula SAE racecar aerodynamic package	Issi-Rae George; Colton Harrison-Steel; Jeff Mock	R.O. Buchal
SAE Aero Design – Advanced Class - Model Aircraft Design and Fabrication	Mohamed Abbas; Clayson Colbran; Alex Fung; Drew Shaule; Matt Brezina; Dylan Fonger; Brady O'Sullivan; Blair Simpson;Justin Souter	R.O. Buchal
Western Engineering Toboggan Team (WETT) – Frame Design & Analysis	Scott Beaton; Eric Brooker; Adam Havord-Wier; David Johnson	P. Kurowski

MME 4401y Presentation

Characterization of influenza virus laden infectious bioaerosols	Lauren Cuthbertson	R. Tutunea-Fatan

5. EXCHANGE PROGRAMS

Incoming Exchange

LastName	FirstName	Home University	Home Country
Acuna Solis	Andres	University of Costa Rica	Costa Rica
Ludovic	Miranda	Ecole Polytechnique de l'universite de Nice	France
Delgado	Mauricio	Monterrey Institute of Technology	Mexico
Nemtsova	Marina	Saint-Petersburg State University	Russia
Lee	Jia Yao	Nanyang Technological University	Singapore
Tan	Qi Zhi (Joel)	Nanyang Technological University	Singapore
Yi	Fangchen	Nanyang Technological University	Singapore
Chen	Ziyue	National University of Singapore	Singapore

Khoo	Leonard	National University of Singapore	Singapore
Koh	He Xiang	National University of Singapore	Singapore
Dong	Yongsen	National University of Singapore	Singapore
Ghorpade	Guarav	Vishwakarma Institute of Technology, Pune	India
Liemajuntak	Grace	National University of Singapore	Singapore
Genari	Everton	Universidade Estadual de Campinas	Brazil

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 2013-14

Bell, Edward (Ted)	Formet Industries - Magna International
Bolton, Ryley	McCormick Canada
Cook, Jordan	Litens Automotive Group
Curiale, Nathanael (Nathan)	Schaeffler Group North America
Foster, Christopher	Labatt Breweries of Canada
Griffin, Graham	Callidus Engineering
Hockin, Geoffrey	Presstran Industries - Magna International Inc.
Johnson, Kevin	Labatt Breweries of Canada
Kasemphaibulsuk, Pibulchai (Pete)	BlackBerry
Khan, Awad	Toronto Hydro
Laing, Justin	Trudell Medical International
O'Gorman, Katelyn	Union Gas Limited
Ravi Shankar, Arun	Schaeffler Group North America
Rodger, Cameron	Trudell Medical International
Shariq, Mohammad	TransCanada Corporation
Sinclair, Marc	Presstran Industries - Magna International Inc.
Tsaltas, Julia	Schaeffler Group North America
Waters, Allison	Formet Industries - Magna International
West, Emily	Lanxess

8. SUMMER ENGINEERING CO-OP PROGRAM

Student	Company
Berkmortel, Luke	Attica Manufacturing Inc.
Brezina, Matthew	Caledon Tubing (Martinrea International Inc.)
Crocker, James	General Dynamics Land Systems - Canada

Fox, Elizabeth	Enwave Energy Corporation
Havord-Wier, Adam	H.H. Angus & Associates Limited
Mahaffy, Matthew	Xstrata Canada Corporation (Kidd Operations' Mine Site)
Milliken, Nicolas	RWF Industries
Simpson, Blair	Phil Mauer & Associates Inc.
Voorberg, Steven	HTS
Willett, Dustin	Imperial Oil Limited

9. PEME PROGRAM

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

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

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

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

10. UNDERGRADUATE STORIES

Southwestern Ontario Branch of the Canadian Manufacturers and Exporters (CME)

Each year the Southwestern Ontario Branch of the Canadian Manufacturers and Exporters (CME) provide 2 scholarships to Western Engineering students on Internship who have made a strong contribution to their internship company, and have a **demonstrated interest in manufacturing. This year, each student awarded this scholarship will receive $1,750**. This year Julia Tsaltas (intern at Schaeffler Group North America) and Geoff Hockin (intern at Presstran Industries - Magna International Inc.) have been chosen as the winners of these scholarships. It should be noted that Julia also completed the PEME program at Fanshawe College prior to participating in her current internship.

Industry-sponsored undergraduate design projects

Several teams of undergraduate students worked with local companies on industry-sponsored capstone design projects. One team worked with Labatt London Brewery on a condensate recovery system. Another team worked with Honda Canada Manufacturing to investigate vacuum pressure effects on a vehicle's brake system.

High School Outreach

MME offered a very successful Summer Academy course in the summer of 2013. The Summer Academy is a one-week camp offered to high-achieving high school students in grades 9 to 12. The one-week camp is offered twice, to twelve students at a time. The MME camps were fully subscribed, with students attending from all over Ontario.

11. VISITING STUDENTS

Henrique Brighenti, Universidade Federal de Minas Gerais – UFMG, Brazil
Damien Guivarch, INSA, France
Jean-Marie Marzin, ITII Pays de Loire, France
Pedro Mota, Universidade federal de Ouro Preto, Brazil
Jan-Michael Müller, Leibniz University of Hannover, Germany
Lucas Carneiro Novaes, São Carlos School of Engineering
Pedro Minoru Sakaguchi, Universidade Federal do ABC, São Paulo, Brazil
Mateus Pinheiro Camargo, University of Campinas (UNICAMP), Campinas, SP, Brazil
Nuanbang Zhong, Sun Yat-Sen University, China

GRADUATE EDUCATION

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

1. GRADUATE RESEARCH PROGRAMS

The M.E.Sc. program is structured to assist high achieving students in acquiring specialized knowledge and to train them in research and development techniques. The objective of this program of study is to introduce the student to research and to permit some modest degree of specialization in the chosen field. The requirements for completion of the program are four half courses, through specialist training by the thesis supervisor, by attendance at research seminars and through preparation and successful Master's thesis defense. Participation, where applicable, as a teaching assistant for the undergraduate courses adds further strength.

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

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

(1) Thermo-fluids,

(2) Materials and Solid Mechanics,

(3) Automation Technologies and Systems,

(4) Mechanical Engineering.

Thermo-fluids

The *Thermo-fluids Graduate Research Program* offers training in many areas of thermodynamics and fluid mechanics including: **theoretical fluid mechanics of Newtonian and non-Newtonian flows, hydrodynamic stability, Computational Fluid Dynamics (CFD), convective heat transfer, turbulence modeling, microfluidics, energy systems** and **experimental techniques**, in additional to applications in all of the mentioned areas. Students interested in the admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional

circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the admission to the Ph.D. program should have completed the M.E.Sc. degree. In exceptional circumstances, students can be transferred directly from the M.E.Sc. into the Ph.D. program without completing the M.E.Sc. program. All students admitted into the graduate research programs are offered full financial support.

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

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

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

Materials and Solid Mechanics

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

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

- MME 9611 Continuum Mechanics
- MME 9612 Finite Element Methods
- MME 9616 Composite Materials
- MME 9618 Fracture of Materials
- MME 9619 Fundamentals of MEMS and NEMS
- MME 9620 Nanomaterials and Nanotechnology
- MME 9624 Modelling and Interfacing of sensors and actuators
- MME 9716 Mechanics of Thin Films

- MME 9717 Deformation of Polymers
- MME 9719 Microstructure of Polymers
- MME 9720 Strengthening Methods in Materials
- MME 9721 X-ray Diffraction in Engineering
- MME 9722 Fuel Cell Science and Engineering
- MME 9725 Piezoelectric Materials
- MME 9726 Advanced Nanomaterials

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

Automation Technologies and Systems.

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

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

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

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

Mechanical Engineering

The General *Mechanical Engineering Program* offers students opportunity to follow personalized program within the general area of Mechanical Engineering. Course can be selected according to the needs of the individual program and within research areas of the Department. Three of the available research areas discussed above are complemented by **Biomechanics**, which exposes students with an opportunity for graduate level training in both

in the theory and application of mechanical engineering to primarily orthopaedic and cardiovascular medicine. Students interested in the admission to the M.E.Sc. program should have a Bachelor's degree in Engineering, or an equivalent degree, from an accredited University with a minimum A grade average. In some cases, students with a similar degree from another scientific discipline may be admitted. In exceptional circumstances, students in the final year of their undergraduate studies can be admitted into the accelerated M.E.Sc. program. Students interested in the admission to the Ph.D. program should have completed the M.E.Sc. degree. In exceptional circumstances, students can transfer directly from M.E.Sc. into Ph.D. program without completing M.E.Sc. degree. All students admitted into the graduate research program are offered full financial support.

2. PROFESSIONAL DEGREE PROGRAMS

Master of Engineering, Mechanical and Materials

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

The MME MEng program is structured into seven streams of specialization. The MEng student selects one area of specialization and takes either i) ten courses from a list specific to the area or ii) eight courses from the list along with completing an engineering project (MME 9500) which constitutes two courses. The lists of required courses (each is one term duration) for the seven areas of specialization are described below.

The MEng program in Mechanical Engineering-Thermofluids

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

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

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

B) 2 of the 4 core courses in Professional Engineering

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

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

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

MME 9639 Viscous Layer and Boundary Flow

The MEng program in Mechanical Engineering-Materials and Solid Mechanics

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

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

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

B) 2 of the 4 core courses in Professional Engineering

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

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

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

The MEng program in Mechanical Engineering

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

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

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

B) 2 of the 4 core courses in Professional Engineering

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

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

MME 9510 Advanced Vibration Analysis
MME 9511 Biomechanics of the Musculoskeletal System
MME 9512 Computer Integrated Manufacturing

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

The MEng program in Mechanical Engineering-Automated Technologies and Systems

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

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

B) 2 of the 4 core courses in Professional Engineering

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

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

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

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

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

A) 4 mandatory half courses in Mechanical and Materials Engineering

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

B) 2 of the 4 core courses in Professional Engineering

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

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

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

The MEng program in Mechanical Engineering-Composite Materials

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

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

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

B) 2 of the 4 core courses in Professional Engineering

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

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

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

*Mandatory core courses
Mandatory technical courses

The MEng program in Mechanical Engineering Option in Engineering in Medicine

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

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

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

B) 2 core courses in Mechanical and Materials Engineering:

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

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

BME 9509 Introduction to Digital Image Processing
BME 9526 Tissue Engineering
CBE 9160 Transport Processes
ECE 9992 Telerobotics
MME 9612 Finite Element Methods
MME 9615 Biomechanics of Human Joint Motion
MME 9620 Nanomaterials and Nanotechnology
MME 9621 Computational Methods in Engineering
MME 9624 Actuator Principles, Integration & Control
MME 9724 Microfluidics and Lab-on-a-Chip
MME 9728 Computer Aided Geometric Modeling
MME 9729 Optomechatronic Systems

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

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

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

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

3. GRADUATE ENROLLMENT

	M.Eng	M.E.Sc.	Ph.D.	Total
Summer 2013	29	27	42	98
Fall 2013	40	30	37	107
Winter 2014	40	31	36	107

4. GRADUATE DEGREES GRANTED

OCTOBER 2013 CONVOCATION – Mechanical and Materials Engineering Program					
Student name	**Degree**	**Completion Date**	**Thesis Exam Date**	**Supervisor/ Co-supervisor**	**THESIS TITLE**
Azizoghly, Basil	MEng	August 31, 2013	n/a	n/a	n/a
Bracken, Tara	MESc	August 29, 2013	August 22, 2013	Naish, M.D.	Multi Modal Non Contact Track of Surgical Instruments

Buchanan, Susan	MEng	August 31, 2013	n/a	n/a	n/a
Farrokhenjad, Mehdi	PhD	August 22, 2013	August 19, 2013	Straatman, A.G. Wood, J.T.	Numerical Modeling of Solidification Process and Prediction of Mechanical Properties in Magnesium Alloys
Hafiz, Abdullah	PhD	August 28, 2013	August 20, 2013	Tutunea-Fatan, O.R.	Applicability of a Picosecond Laser Micro-Polishing of Metallic Surfaces
Kuppuswamy, Prasanna	MEng	August 31, 2013	n/a	n/a	n/a
Li, Yongliang	PhD	August 16, 2013	August 15, 2013	Sun, X.	Development of Novel Nanomaterials for Lithium-and Sodium-air Batteries
Liu, Jian	PhD	August 8, 2013	August 15, 2013	Sun, X.	Development of Advanced Nanomaterials for Potential Lithium-Ion Battery Applications
Menon, Anand	MEng	August 31, 2013	n/a	n/a	n/a
Nahum Leroy, Mauricio	MESc	August 20, 2013	August 15, 2013	Naish, M.D. Patel, R.	Design of Minimally Invasive Single Port HDR Brachytherapy Applicator for the Treatment of Lung Cancer
Oqab, Haroon	MEng	August 31, 2013	n/a	n/a	n/a
Reeves, Jake	MESc	August 27, 2013	August 26, 3013	Dunning, C. Johnson, J.	The Role of Static Muscle Loading on the Fracture Threshold of the Distal Radius
Saha, Rajib	MESc	August 23, 2013	August 15, 2013	Zhang, C. Ray, M.	Numerical Simulation of an Open Channel Ultra-Violet Waste-Water Disinfection Reactor
Salehi, Sina	MEng	August 31, 2013	n/a	Altahan, W.	n/a
Valiathan, Ajay	MEng	August 31, 2013	n/a	n/a	n/a
Wu, Tien-Tien	MEng	August 31, 2013	n/a	n/a	n/a
Yan, Zhi	PhD	June 26, 2013	June 24, 2013	Jiang, L.	Contiuum modeling on size properties of piezoelectric nanostructures.

JUNE 2014 CONVOCATION – Mechanical and Materials Engineering

Student Name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Aoudi, Mohamad	MEng	April 30, 2014	n/a	n/a	n/a
Dadashi, Abbas	MESc	January 27, 2014	January 16, 2014	Zhang, C. Zhu, J.	Numerical Simulation of Liquid-Solid Circulating Fluidized Beds
Desai, Jay	MEng	April 30, 2014	n/a	n/a	n/a

Doan, Ethan	MESc	April 28, 2014	April 22, 2014	Straatman, A.G.	Numerical Simulation of Dilute Phase Pneumatic Transport at St. Mary's Cement
Elatar, Ahmed	PhD	October 13, 2013	September 4, 2013	Straatman, A.G. Hangan, H.	Channel Flow Behaviour during Mixed Convection at Low Reynolds Numbers
Gaznai, Abdullah	MEng	December 31, 2013	n/a	n/a	n/a
Han, Xueguang	MESc	September 23, 2013	September 12, 2013	Yang, J.	Development of Microfabrication Process for Miniaturized Inductive Sensor
Hao, Deming	MEng	April 30, 2014	n/a	n/a	n/a
Harpreet, Gil	MEng	April 30, 2014	n/a	n/a	n/a
Hu, Yuhai	PhD	Sept 18, 2014	September 16, 2014	Sun, X.	Development of Novel Nanomaterials Based on Silicon and Graphene for Lithium Ion Battery Applications
Ismael, Rajeh	MEng	April 30, 2014	n/a	n/a	n/a
Jamaloddin, Jamali	PhD	June 9, 2014	June 9, 2014	Wood, J.	Mechanistic failure criterion for unidirectional and random fiber polymer composites
Mohammadi, Alireza	PhD	September 23, 2013	September 16, 2013	Floryan, J.M.	Flows in Grooved Channels
Mohammed, Al-Shehri	MEng	April 30, 2014	n/a	n/a	n/a
Mostafavi Yazdi, Seyed	PhD	April 30, 2014	April 23, 2014	Knopf, G. Jenkyn, T.	Computational Techniques to Predict Orthopaedic Implant Alignment and Fit in Bone
Peng, Dongzhe	MEng	December 31, 2013	n/a	n/a	n/a
Rajarajan, Deenathayalan	MEng	December 31, 2013	n/a	n/a	n/a
Refan, Maryam	PhD	April 2, 2014	March 27, 2014	Hangan, H.	Physical Simulation of Tornado-like Vortices
Sriram, Vijayaraghavan	MEng	April 30, 2014	n/a	n/a	n/a
Tian, Zhi	MEng	December 31, 2013	n/a	n/a	n/a
Vafadar Moradi, Hadi	PhD	January 29, 2014	January 10, 2014	Floryan, J.M.	Effects of Surface Topographies on Heat and Fluid Flows
Wang, Dongniu	PhD	September 18, 2013	September 17, 2013	Sun, X.	Nanostructured Tin-Based Anodes for Lithium Ion Batteries with X-Ray Absorption Fine Structure Studies
Wilson, Andrew	MEng	December 31, 2013	n/a	n/a	n/a
Xiaoyu, Wu	MEng	April 30, 2014	n/a	n/a	n/a
Yang, Jinli	PhD	September 6, 2013	September 5, 2013	Sun, X.	Development of Nanostructured LiMPO4(M=Fe,Mn) as Cathodes for High

					Performance Lithium-Ion Batteries
Yi, Mao	MEng	April 30, 2014	n/a	n/a	n/a
Zhang, Tengyuan	MESc	December 20, 2013	December 13, 2013	Knopf, G.	A method for Fabricating Printed Electronics with High Conductivity and High Resolution

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 1, 2013	Tuition	TA/GRA	Total/term
Canadian/Perm	2504.24	4000.00	6503.24
International	5842.00	4000.00	9842.00

September 1, 2013	Tuition	TA/GRA	Total/term
Canadian/Perm	2966.01	4000.00	6966.01
International	6304.57	4000.00	10304.57

January 1, 2014	Tuition	TA/GRA	Total/term
Canadian/Perm	2511.99	4000.00	6511.99
International	5850.00	4000.00	9850.00

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: 2013-2014

Name	Program	Award	Award Duration
Blackman, Karin	GMME	OGS	May 2013 to April 2014
Khan, Furquan	GMME	OGS	May 2013 to April 2014
Mostafavi Yazdi, Seyed	GMME	OGS	May 2013 to April 2014
Neuert, Mark Alan Carmine	GMME	NSERC	Fall 2011 to August 2014
Reeves, Jacob	GMME	OGS	May 2012 to April 2013 September 2013 to August 2014
Refan, Maryam	GMME	NSERC Canada Graduate Scholarship-Doctoral	May 2012 to April 2014

6. GRADUATE SEMINAR

Fall 2013				
Date	**Student or Guest Lecturer Name**	**Supervisor/ Co-Supervisor**	**Presentation Title**	**Seminar Facilitator**
Sept. 10	Swentek, Ian	Wood, J.T.	Measuring Polymer Composite Interracial Strength	Islam, A.Z.M.
	Farrokhnejad, Mehdi	Straatman, A.G.	Simulation of Magnesium Casting Process on a General Unstructured Grid	
Sept. 17	Shao, Lingmin	Yang, J.	Miniaturized Inductive Position Sensor	Sinar, Dogan
Sept. 24	Lattimer, Derek/ Doucette, Lisa	The Writing Centre/Taylor Library, Western University		
Oct. 1	Mohammadi, Alireza	Floryan, J.M.	Groove Optimization for Drag Reduction	Geng, Dongsheng
	McLachlin, Stewart	Dunning, C.	Cervical Spine Unilateral Facet Injuries: Simulation, Quantification, and Visualization of Mechanisms and Treatment	
Oct. 15	Kumar, Rajeev	Zhang, C./ Savory, E.	Flow structures in the wakes of finite height square prisms	Bashar, Mohammad

Oct. 22	Geng, Dongsheng	Sun, X.	Bifunctional roles of nitrogen-doped graphene as electrocatalyst in fuel cells	Avari, Hamed
	Mahdavi, Hadi	Jiang, L./Sun, X.	Vibration and buckling of carbon nanotube, graphene, and nanowire	
Oct. 29	Vafadar, Hadi	Floryan, J.M.	Flows in Annuli with Longitudinal Grooves	Feng, Chuang
	Liu, Jian	Sun, X.	Atomic layer deposition: a unique technique to synthesize nanomaterials applied in lithium-ion batteries for EVs and HEVs	
Nov. 5	Refan, Maryam	Hangan, H.	Developing similarity analysis for laboratory simulated and field tornadoes	Stranges, Daniel
	Hafiz, Abdullah	Knopf, G./ Bordatchev, E.	Modeling and analysis of 5-axis Laser polishing process	
Nov. 19	Mohammadhasani, Rahim	Khayat, R.	Thermal convection of fluids with non-Fourier effect with spectral-perturbation approach	Hu, Yuhai
	Jamali, Jamaloddin	Wood, J.	Fracture of Polymer Matrix Composite	
Nov. 26	Zhi, Yan	Jiang, L.	Size-dependent Properties of Piezoelectric Nanostructures	Raj, Vijairaj
	Yang, Jinli	Sun, X.	Impact of Stacked Graphene and Unfolded Graphene on the Morphology of $LiFePO_4$ as a Superior Cathode Material for rechargeable Lithium Batteries	
Dec 3	Kuboki, Dr. T. MME Engineering, Western University		Manufacturing Technology and Properties Characterization of Natural	
Dec 12	Haghshenas, Meysam	Klassen, R.	Effect of strain-hardening rate on the grain-to-grain variability of local plastic strain in spin-formed fcc metals	Li, Yongliang
	Niknami, Mohammad	Khayat, R.	Energy growth of disturbances for a non-Fourier fluid	

Winter 2014				
Jan 7	Boutanios, Ziad	Hangan,H.	Euler-Euler Simulation of Drifting Snow	McLachlin, Stewart
	Islam, A.Z.M.	Klassen, R.	Study of the Size Dependence of Time-dependent Plastic Deformation of Gold Micro-pillars and Micro-spheres	

Jan 14	Prof. D. Sherry Dept. of Psychology, Western University		Memory and the Brain of Food-Storing Birds	
Jan 21	Khalaji, Iman	Naish, M.	Systematic Design of an Ultrasonic Horn Profile for High Displacement Amplification	Liu, Jian
	Hu, Yuhai	Sun, X.	Flexible Graphene based Hybrid Materials used as Anode for Lithium Ion Batteries	
Jan 28	Avari, Hamed	Savory, E.	Response of Endothelial Cells to Quantified Hemodynamic Shear Stresses	Jamali, Jamaloddin
	Wang, Dongniu	Sun, X.	Hierarchical SnO_2-Graphene Nanocomposites with Enhances Performances as Anodes for Lithium Ion Batteries applied in Electrical Vehicles	
Feb 4	Feng, Chuang	Jiang, L.	Modeling the Electrical Properties of Carbon Nanotube Based Polymer-Composites	Wang, Dongniu
	Mostafavi, Yazdi	Johnson, J./ Tutunea-Fatan, R.	Prediction of Interference Free Positions of the Humeral Implant in Preparation of Joint Replacement Procedures	
Feb 11	Prof. G. Osinski, Dept. of Earth Science Western University		To the Moon, Mars and Beyond: Planetary Science and Exploration Research at Western	
Feb 25	Li, Yongliang	Sun, X.	Heteroatom-doped Graphene as Cathode Materials for Lithium- Oxygen Batteries	Niknami, Mohammad
	Elatar, Ahmed	Siddiqui, K.	Three Dimensional Flow Structure during Low Reynolds Number Mixed Convection	
Mar 4	Prof. Ayumu Inasawa, Department of Aerospace Engineering Tokyo Metropolitan University		Suppression of Tonal Trailing-edge Noise from Airfoil using a Plasma Actuator	
Mar 11	Hassanzadeh, Mona	Siddiqui, K.	Improvement of Effervescent Atomization Process	Yang, Jinli
	Sinar, Dogan	Knopf, G.	Inkjet Printing and Functionalization of Graphene Oxide (GO) for Flexible Electronics	
Mar 18	Prof. D. Sinton, Dept. of Mechanical and Industrial Engineering, University of Toronto		Optofluidics for Energy Applications	
Apr 1	Bashar, Mohammad	Siddiqui, K.	Heat transfer process in PCM thermal storage	Hafiz, Abdullah
	Stranges, Daniel	Khayat, R.	Natural Convection of Non-Fourier Fluids and Relevance to Nanofluids	

Apr 8	Elizabeth Marshal Acting Director – C.B. “Bud” Johnston Library, Western University			
Apr 15	Paul Schmidt The Writing Support Centre, Western University			
Apr 22	Dadashi, Abbas	Zhang, C./ Zhu, J.	Numerical Simulation of Liquid-Solid Circulating Fluidized Beds Ion Exchange System for Continuous Protein Extraction	Yan, Zhi
	Raj,Vijairaj	Singh, A.V.	Vibration of Smart Structures using NURBS patches	

7. GRADUATE STORIES

C. Dunning

Jacob Reeves – successfully defended MESc in August 2013; now a Research Engineer with the Hand and Upper Limb Centre, London.

Yara Hosein – successfully defended PhD in August 2013; now a post-doctoral fellow at the University of Western Ontario.

Kristyn Leitch (BME) – successfully defended PhD in April 2014; now a post-doctoral fellow at the University of Western Ontario.

L. Jiang

Zhi Yan, a former PhD student under Dr. Jiang's supervision was offered an associate professor position at Huazhong University of Science and Technology in China.

Chuang Feng, a PhD student under Dr. Jiang's supervision received the Chinese Government Award for Outstanding Self-financed Students Abroad in 2014. He was also awarded the Academic Achievement Scholarship from Western University.

R. Klassen

Meysam Haghshenas, PhD Graduate (MME) in April 2013, received a prestigious NSERC Postdoctoral research fellowship. He is planning to use it to study in the United States.

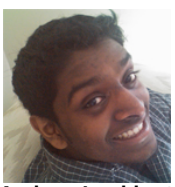
A.G. Straatman

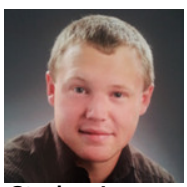
Ethan Doan, MESC graduate (April 2014) - currently employed at Chrysler Canada as CAE Engineer.

X. Sun


Jian Liu


Dongniu Wang


Andrew Lushington


Stephen Lawes

Jian Liu: previous Ph.D student graduated August 2013 received both NSERC PDF award and MITACS

Dongniu Wang: previous Ph.D student graduated Oct. 2013 received "Outstanding Research Award" from Chinese Consulate in Toronto in Toronto. Each of them received $6000 in May, 2014

Andrew Lushington: current Ph.D student received NSERC CGS, 2014

Stephen Lawes: current MESc. Student received OGS, 2014

J. Wood

Jamal Jamali successfully defended his Ph.D. thesis in June 2014

8. VISITING STUDENTS

Ding Bing, Nanjing University of Aeronautics and Astronautics, P.R. China
Shih Chia-Nan, Chung Cheng Institute of Techology, Taiwan
Wei Lei, The University of Sheffield, UK
Shaul Salomon, The University of Sheffield, UK
Syed Shah, Quaid-i-Azam University, Pakistan
Rizwan Ul-Haq, Quaid-i-Azam University, Pakistan

RESEARCH

1. MAJOR RESEARCH AREAS

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

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

2. FACILITIES

Laboratory Facilities

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

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

Thermofluids Group

Experimental facilities:

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

Micro/Nano Fluids Laboratory facilities:

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

Specialized computing resources:

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

Materials and Solid Mechanics Group

Metal Forming Laboratory:

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

Biotechnology Research Laboratory

- Three AFMs (Dimension, Multimode, CSPM 5500)
- Olympus 1X81 Inverted Fluorescence Microscope with environmental chamber, high-speed camera (Photometrics Cascade), Micro-manipulator (Patchman NP2)
- Three optical MIcroscopes
- Two laser systems including Micropoint laser
- Varian UV-Vis spectrophotometer
- Three Ocean Optics spectrometers

- Probe station for MEMS and Microelectronics
- Dimatix materials printer DMP-2800
- Acoustic Measurement System
- Hot-embossing lithography
- Spin coater
- Six high-precision multi-channel pumps
- High-speed centrifuge
- Electrochemistry station
- Furnace
- Oven
- Water bath and shaken water bath
- Fume hood
- Two Biological Safety Cabinets
- Cell culture room

Heat Treating Laboratory:

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

Composite Fabrication Laboratory:

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

Nanomaterials Fabrication and Characterization Laboratories:

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

Equipment for Electrochemical Characterization/Analysis

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

Mechanical Testing Laboratories

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

Properties of Materials Laboratory

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

Polymer Engineering Laboratory

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

Tribology Laboratory

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

Materials Characterization Laboratories

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

Optical Microscopy Laboratory

- Buehler micromet automatic polishers 2
- Leitz stereo microscope
- Unitron stereo microscope
- Olympus stereo microscope
- Leitz aristophot
- Reichert bench type microscope with micro hardness tester 005 263
- Olympus bh2 microscope
- Sony monitor pvm 1340
- Sony video printer up850
- Microscope video black and white camera dage mti nc65
- Leitz laborlux microscope
- Fibre optics light source intralux 150 watt
- Technical copy stand TCI
- Clemex Vision Pe Image Analyzer

- Microscope xillix digital camera 0042
- Leitz microscope with discussion attachment model laborlux (2)
- Wild stereo microscopy with discussion attachment
- Unitron metallurgical inverted microscope model mec (2)
- Wild metallurgical inverted microscope model m50 (6)
- Microgram atic balance maximum 19 grams 5 decimal places resolution
- Sartorius digital micro balance maximum 120 grams 4 decimal places resolution
- Sartorius micro balance 160 grams maximum
- Metler micro balance model p1200n
- Leitz Laborlux Microscope

Polymer Engineering Laboratory

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

Equipment for Synthesis of Nanomaterials

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

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

Fraunhofer Project Centre

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

The Automation Technologies and Systems Group

Dynamic and Sensing Systems Laboratory

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

CNC Machining Laboratory

- The Fadal 4020-5 Axis CNC Machine with tooling package.
- Tormach three-axis compp0uter numerically controlled mills
- The "Swift" DEA-Coordinating Measuring machine with Controllers and PC-Pentium I-120 MHz and "Tutor" Software.
- PC-Pentium III-350 MHz with "Surfcam 99" CAD/CAM Package
- PC-Pentium II-233 MHz with "Surfcam 99" CAD/CAM Package
- Techno Isel, 3-Axis CNC Machine with Mac 200 Controller, connected to a Pentium 150 MHz Computer System
- Dyna Myte Model 2400, 3-Axis CNC machine with optional rotary axis, connected to a Pentium 150 MHz Computer System
- 40" LCD screen for demonstration and presentation purposes
- NextEngine 3D laser scanner (2)
- Makerbot Replicator 2 x 3D printer (2)

Geometric Modeling & Virtual Sculpting Laboratory

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

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

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

Visualization and Virtual Reality Laboratory:

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

Sensing and Mechatronic Systems Laboratory:

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

Biomechanics Group

The Jack McBain Biomechanical Testing Laboratory:

The Biomechanical Testing Laboratory primarily conducts experimental in vitro research related to orthopaedic biomechanics. The current lab (660 sq. ft) BioHazard Level 1 facility is equipped to conduct both experimental testing and computational modelling. The focus includes orthopaedic implant fixation and implant design for the upper limb and spine, as well as the assessment of lower limb impact injury. The primary equipment available includes two Instron materials testing machines, one of which is tension-compression and the other which has

three actuators (tension-compression, as well as 2 torque axes). Data acquisition is achieved through National Instruments hardware and custom-written LabVIEW software, Solidworks, Mimics, FEA software (Abacus, Truegrid) LS-DYNA).

- Finite Element analysis workstations
- Strain gauges and circuitry
- IEEE 1394 (firewire) camera
- Digital microscribe

The Wolf Biomechanics and Imaging Laboratories:

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

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

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

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

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

The Bioengineering Research Laboratory

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

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

A sample of equipment is as follows:

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

Surgical Mechatronics

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

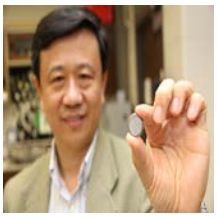
3. RESEARCH SUPPORT

Year 2013/2014		
Association/Institute/Societies		$602,110*
Foundations		0
Government	Federal	$1,770,175
	Provincial-Ontario	$181,756
Industry		$86,512
*This includes $58,819.05 of internal Western Engineering funds.		

4. RESEARCH IN THE NEWS

X. Sun

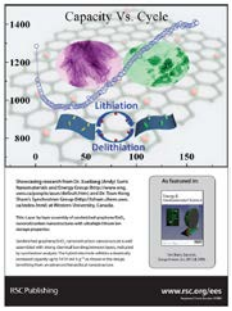
Western-led study reveals new surface chemistry in electric vehicle batteries
Paul Mayne, Western News
Western Engineering professor Andy Sun, Canada Research Chair in Development of Nanomaterials for Clean Energy, is working toward increasing the performance of electric cars, by using lithium iron phosphate batteries.



In the project with Phostech Lithium Inc., Dr. Sun and his team found a new nature - a new phase on very promising electrode materials ($LiFePO_4$) used in Li ion batteries for electric vehicles, which this new phase is directly related to properties of the electrode materials and performance of batteries. This significant finding results in re-designing the production process of the materials (2500 tons/year) in this company. The research results have recently been published in *Nature Communications* and it was reported by:

Western news on March 5, 2014 "Western-led study reveals new surface chemistry in electric vehicle
http://communications.uwo.ca/media/releases/2014/March/westernled_study_reveals_new_surface_chemistry_in_electric_vehicle_batteries.html

The Londoner Local News "Making a better battery". http://www.thelondoner.ca/2014/03/07/making-a-better-battery



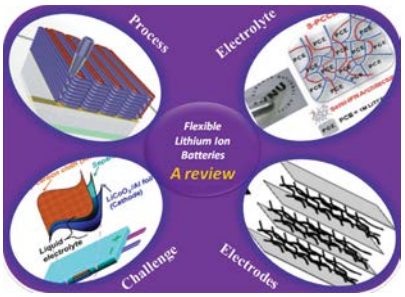
Back Cover: ***Layer by layer assembly of sandwiched graphene/SnO_2 nanorod/carbon nanostructures with ultrahigh lithium ion storage properties. (Energy Environ. Sci. 5/2013) (Page 2900).***

In this report, **Sandwiched graphene/SnO_2 nanorod/carbon nanostructures** is well assembled with strong chemical bonding between layers, indicated by synchrotron analysis. The hybrid electrode exhibits a drastically increased capacity up to 1419mAhg^{-1} as shown in the image, benefiting from an advanced hierarchical nanostructure. This new

electrode materials can be used as anode in Li ion batteries for Electric Vehicles.

Inside front cover: *Superior catalytic activity of nitrogen-doped graphene cathodes for high energy capacity sodium-air batteries. (Chem. Comm. 12/2013) (Page 11710)*

In this report, Nitrogen-doped graphene nanosheets (N-GNSs) displayed a discharge capacity two times greater than their pristine counterpart, as well as superior electrocatalytic activity as a cathode material for sodium–air batteries. The enhanced performance of N-GNSs is attributed to the active sites introduced by nitrogen doping. This is first report to use such graphene-based electrode and obtained high performance in this field.



Showcasing the review of flexible lithium ion batteries presented by Prof. Xueliang (Andy) Sun, Department of Mechanical and Materials Engineering, The University of Western University. The invited review published in Journal of Chemistry Materials was highlighted by Inside Back Cover.

Title: Flexible Rechargeable Lithium Ion Batteries: Advances and Challenges in Materials and Process Technologies A comprehensive review of flexible lithium ion batteries is presented. The review proceeds in terms of the processes for making electrodes and full LIB cells so as to emphasize the materials and process technologies. The development of solid state electrolytes, the fundamental understanding and simulation of flexible LIBs are also addressed. The review concludes with an emphasis on the potential application of printing processes in f exible LIB fabrication

J. Yang

NSERC strategic project grants – Western News-January 2014
http://communications.uwo.ca/western_news/stories/2014/January/three_projects_tapped_for_nserc_strategic_project_grants.html
Developing robust, high-resolution, high-performance and low-cost printing technologies for making flexible and stretchable electronics and devices

Electronics or devices, which are flexible, wearable, rollable and/or foldable, will bring us completely different user experience and even change our way of life. Making flexible and stretchable electronics and devices has become an important direction of advanced manufacturing. Recent advances in materials and manufacturing processes have enabled many new applications of flexible electronics/devices, for example, electronic paper, curved screens, foldable or rollable displays, flexible solar cells, tunable lens, artificial muscles, skin sensors and wearable biomedical devices for health monitoring.

The market demand for flexible, printed and organic electronics has dramatically increased. Currently, the global market is more than $1 billion, and will grow to $45 billion by 2016.

Recently, material or inkjet printing has emerged as a very promising technique for mass production of large-area flexible and stretchable electronics at relatively low cost. Inkjet printing is a versatile technique that places conductive inorganic or organic materials in a direct-writing manner to designated locations on elastomeric substrates. In spite of its many advantages, current inkjet printing technology still faces a number of technical challenges such as low conductivity of printed metallic circuits, weak adhesion between conductive materials and the substrate, low resolution compared to the conventional IC processes, and limited choices of conductive materials and substrate materials.

Breakthrough adds a new dimension to printing
http://phys.org/news/2013-11-breakthrough-dimension.html

Mechanical and Materials Engineering professor Jun Yang said there's a Chinese saying that "people cannot use a basket to draw water."

But what if you could make a basket that can do just that – and with a 3-D printer, no less. Thanks to research being developed by Yang and his colleagues, it is indeed possible.

Yang has developed a process called i3DP (initiator integrated 3D printing), an approach to printing materials with easy-to-modify surfaces. Normally, different inks – and different layers – require multiple 3D printers. The development of this process, however, puts it all in one machine.

"When we prepare the printing ink with an initiator, it's like a tree," Yang said. "The tree grows and the branches appear and each can have a different function. If you want to make a 3D structure conductive, or you want to insulate it from electromagnetic waves, we can modify it in that way."

A bromine-containing acrylate is added to a 3D printing resin, which acts as an initiator to allow polymer brushes to grow on the printed surface. The printed 3D structures are then grafted into useful materials – anything from aircraft and auto parts to bio-medical devices and even human bones – all using what is called surface-initiated atom transfer radical polymerization (ATRP).

This process also allows the structures to achieve antimicrobial property, which inhibits the growth of bacteria on the surface, necessary for biomedical applications. In addition, since the whole structure, including the inner surface, is bonded with the initiator, surface damage can be easily 're-painted' with the ATRP process.

3D printing industry 2013/11/08-3D-Printed Reactionware Gives Objects new Properties
http://3dprintingindustry.com/2013/11/08/3d-printed-reactionware-gives-objects-new-properties/

One of the most interesting and, to me, most complicated fields of 3D printing research is that of 3D-printed reactionware. As someone who has only in my adult life learned to appreciate chemistry, the possibilities of 3D-printed mechanisms for controlling chemical reactions are hard to comprehend. Lee Cronin has probably attracted the most amount of attention on the subject, after 3D printing compartments for chemical catalysts on his lab's Fab@Home 3D printers. The idea is that, one can possibly 3D print a structure, injected with different chemicals, that, when a slot is opened here or a piece is turned there, the chemicals react to form a desired compound. More recently, Scientists Xiaolong Wang, at the Chinese Academy of Sciences in Lanzhou, China, and Jun Yang, of the University of Western Ontario in Canada, have explored methods for applying post-processing chemicals to change the surface properties of a 3D-print.

The researchers mixed bromine-containing acrylate to a UV-curable resin for 3D printing. After printing structures from the material, the objects were selectively coated with a reactive chemical, 3-sulfopropyl methacrylate potassium salt (SPMA), using a technique called atom transfer radical polymerization (ATRP). A reaction between the chemical and the acrylate caused the growth of polymer brushes onto the surface of the material. Depending on the application, these polymer brushes can be used to apply a variety of properties to a given object.

Wang, et al. tested the procedure with two different structures, a cube made up of lattices and a hollow, mesh ball. After initiating the growth of SPMA brushes using the ATRP procedure, the two structures took on superhydrophobic or superhydrophilic, water repelling or water retaining, characteristics. In the figures above, the SPMA prevented a droplet from entering the lattice cube and prevented liquid from leaving the mesh ball.

3D PrinterWorld article
http://www.3dprinterworld.com/article/holding-water-sieve-3d-printed-superhydrophobic-sphere

Contrary to a popularly held belief, it may well be about the surface of things and not what's inside.
A group of scientists, led by Xiaolong Wang at the Chinese Academy of Sciences and Jun Yang's team at the University of Western Ontario, have developed an approach which allows them to 3D print modular surfaces and thereby obviate the need for multiple 3D printers.

This versatile 3D printing process, which uses a bromine acrylate added to 3D printing resin, allows the acrylate to act as a spur for polymer brushes to "grow" on a printed surface.

They're calling it, "initiator integrated 3D printing" or "i3DP," and the process includes a vinyl-terminated initiator in UV curable resin to make functional structural materials which allow for genetic post-printing modifications.

They say "i3DP" makes 3D printing complex architectures possible for "nearly any desired surface modification for various applications."

As a test of their integrated printing method, the team fabricated lattices containing the polymer brushes, and then modified them to either act as superhydrophobic orsuperhydrophilic structures.

A cubic superhydrophobic lattice managed to repel a water droplet, and a superhydrophobic, hollow mesh ball with 1 mm pores contained fluid without leaking, even as it was shaken.

“The printed mesh ball held the water completely," said Wang. "There's a Chinese proverb that says 'pouring water into a sieve gets you nothing,' but now we've developed a way to make whatever functional complex structures we want. Even a sieve that can hold water."
The team are working on printing smaller structures with greater accuracy using different materials and processes.

New 3D printing technique to eliminate the need for multiple 3D printers
http://www.3ders.org/articles/20131030-new-3d-printing-technique-to-eliminate-the-need-for-multiple-3d-printers.html

3D printers can be used to create titanium aircraft parts, complex, nano-scale machines, or human bones. Depending on the material used, how many colors you want, the resolution you require, you need different printers to complete your design, which results in increasing fabrication costs. What if there is a printer that can print anything from aerospace parts to artificial bones?

First researchers added a bromine-containing acrylate into a UV curable 3D printing resin. To prepare the initiator contained resin, they simply added BrMA into the resin and mixed them. After degasing for 30 min in dark, customized resin was obtained and ready for 3D printing.

After the 3D printing process, 3D printed structures were "painted" with functional polymer brushes via atom transfer radical polymerization (ATRP) to achieve antimicrobial property for biomedical applications.
Since the initiator exists in the bulk material and thus in the entire printed structure, if needed, any damaged surface can be easily re-painted with single step of ATRP polymerization process.

To demonstrate the technique, 3-sulfopropyl methacrylate potassium salt (SPMA) was grafted on the surface and the adhesion of bacteria was significantly reduced. In addition, the functionalized surface can also inhibit the growth of bacteria on the surface.

In other tests, researchers fabricated lattices containing the polymer brushes and modified them to be either superhydrophobic or superhydrophilic. One cubic superhydrophobic lattice was shown to repel a water droplet. Another superhydrophobic structure was in the form as of 2.5 cm diameter hollow mesh ball with 1 mm pores. When filled with water, the hydrophobic ball effectively held the fluid without leakage, even when shaken.

We were stunned when we first found that the printed mesh ball held the water completely,' says Wang. 'There is Chinese proverb that says "pouring water into a sieve gets you nothing," but now we have developed a way to make whatever functional complex structures we want – even a sieve that can hold water.'

All-in-one 3D printing
http://www.rsc.org/chemistryworld/2013/09/3d-printing-ink-surface-modification

Imagine printing anything from electronic devices to artificial bones using the same 3D printer. Now, scientists have developed a universal approach for printing materials with easy-to-modify surfaces to eliminate the need for multiple 3D printers.

3D printing is a potentially powerful manufacturing tool. However, numerous printing technologies have had to be developed as several 3D printers with single-purpose inks are often needed for different uses, increasing fabrication costs. Finding one all-purpose ink or 3D printing process has proven elusive and nearly impossible, until now.

Xiaolong Wang at the Chinese Academy of Sciences in Lanzhou and co-workers in Jun Yang's group at the University of Western Ontario in Canada have developed a versatile 3D printing technique where a bromine-containing acrylate is added to a 3D printing resin. The acrylate acts as an initiator to allow polymer brushes to grow on the printed surface. Printed 3D structures are then grafted into useful materials by surface-initiated atom transfer radical polymerisation.

To test their integrated initiator approach, the group fabricated lattices containing the polymer brushes and modified them to be either superhydrophobic or superhydrophilic. One cubic superhydrophobic lattice was shown to repel a water droplet. Another superhydrophobic structure was in the form as of 2.5 cm diameter hollow mesh ball with 1 mm pores. When filled with water, the hydrophobic ball effectively held the fluid without leakage, even when shaken.

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Dr WANG Xiaolong at the Lanzhou Institute of Chemical Physics of the Chinese Academy of Sciences and co-workers in Jun Yang's group at the University of Western Ontario in Canada have developed an initiator integrated 3D printing approach (i3DP) to enable post-printing surface modifications for various applications.

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Breakthrough adds a new dimension to printing
http://communications.uwo.ca/western_news/stories/2013/November/breakthrough_adds_a_new_dimension_to_printing.html

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While 3D printing for industry is nothing new, up until now, several printers with single-purpose inks were needed for different uses, which increased fabrication. With Yang's all-purpose ink, or 3D printing process, that is no longer the case.

"We just don't want a structure, but instead bring a function to that structure," Yang said. "We are very excited about this because this can solve big problems in industry occurring with 3D printing. I don't think there is an end of the line for this. It is very versatile."

To test his approach, Yang fabricated two structures – a cube and a ball – each containing the polymer brushes and modified them to be either superhydrophobic (repels the water) or superhydrophilic (contains the water).
In testing the ball, the liquid was contained despite the 1.5mm pores in the mesh and despite even shaking the ball. In other words, the 'basket' held the water.

"If it were a regular ball, the water would leak out," Yang said. "But by modifying it, there is no leakage."
These applications could be used in something as simple as a shower curtain, allowing oxygen to pass through, but not water, or perhaps in industry, where windshields could be coated and potentially eliminating the need for wipers.

So far, the technique is only suitable for photopolymerization-based 3D printing, but Yang said he is working on printing smaller structures with greater accuracy.

“As engineers, we don’t like to do research to be surprised,” Yang said. “But there might be some things unexpectedly discovered along the way.”

5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS

L. Jiang

Dr. Jiang is collaborating with **Ford Motor Company** in USA to conduct computational mechanics modeling on the mechanical properties of fiber reinforced composites.

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

R. Klassen

Over the last year I have worked with the **Atomic Energy of Canada Ltd** and a consortium called the Candu Owners Group (COG) on a project to study the effect of ion irradiation and helium embrittlement on the indentation hardness of the Inconel X-750 alloy.

I have also had a research collaboration with **Nova Chemicals Inc (Calgary Alta)** to study the strength of specialized metal/polymer interfaces developed for oil/gas pipelines.

G. Knopf

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

Ivey International Centre for Health Innovation
Collaborating Researcher: Dr. Anne Snowdon (Ivey School of Business, Western)
Intelligent wireless hand sanitizer technology
Infections acquired in hospital lead to significant health challenges for patients, and contribute to high healthcare costs. One of the most important strategies for mitigating hospital acquired infection (HAI) is the diligent use of hand washing to prevent cross-contamination among staff and patients. The Ivey led project is developing and implementing intelligent hand sanitization systems that track both compliance and unit maintenance using wireless RFID technology. The project involves the London Health Sciences Centre (LHSC) and industry partners (Pharmax). Partial funding is provided through the Academic Medical Organization of Southwestern Ontario (AMOSO) Innovation Fund.

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

K. Siddiqui

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

Project: Development of an air-fuel control system for Effervescent Atomization Fuel Injector
The internal two-phase flow structure in an effervescent atomizer and hence the spray quality changes with the gas-to-liquid flow rates ratio (GLR). In a practical application of an aircraft gas turbine engine, the flow rate of liquid fuel changes during different stages of the flight and hence the GLR changes, which affects the spray quality and hence the combustion efficiency. In order to maintain the same spray quality during different flight stages, the air flow rate needs to be changed to maintain the same GLR. This work is focused on the development of a control mechanism to adjust the gas flow rate when the liquid flow rate is changed to meet the power demand.

Technical University of Denmark
Project: Characterization of the near-surface flow field over Boland Island
Boland Island is located off the cost of Denmark. The island is considered as a test side for field measurements focusing on the investigation of the near-surface flow produced by the wind approaching the island from the sea. This collaborative project with the Wind Engineering Group at the Technical University of Denmark is focused on the near-surface flow characterization over a 1/100th scaled model of the island in the lab using Particle Image Velocimetry (PIV).

S2E Technologies, Waterloo
Project: Study of potential technologies for Net-Zero Housing
S2E Technologies has conducted a Net Zero Housing study in collaboration with the Ministry of Energy. This project was geared towards supporting the efforts to achieve the objective of the Net Zero Housing study of S2E Technologies. Two specific areas were considered which are, thermal energy storage and off-grid water system.

A.G. Straatman

St. Mary's Cement - MITACS: Initiated a project in May 2014 to conduct a complete energy audit of the St. Mary's facility.

GDLS - MITACS: Initiated a project in May 2014 to analyze the heat load on a Light-armored vehicle with the goal of improving interior climate control

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. Recently, through Automobile Partnership of Canada (APC), we are working on “In Situ Studies of Electrochemical

Processes in Automotive Materials" involving five research teams from McMaster University, McGill University, University of Quebec and Western, supported by GM.

Ballard Power Systems (Fuel cell studies): After an NSERC CRD and NSERC Strategic grants on carbon nanotubes as Pt catalyst support for fuel cells, recently, working on "Low Pt catalysts for PEM fuel cells research network" – through Automobile Partnership of Canada (APC), involving 20 research teams from seven universities and NRC supported by several industrial partners such as Ballard Power Systems.

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 are working on another project titled "Scale-up of a novel melt synthesis process for manufacturing of C-$LiFePO_4$ for automotive applications' from Automobile Partnership of Canada. It deals with five research teams from University Polytechnique Montreal, University of Montreal, Western and CANMET national lab supported by Phostech Lithium Inc.

O.R. Tutunea-Fatan

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

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

J. Wood

Between July 1, 2013 and June 30, 2014 I have continued my research collaboration with a number of industrial partners, primarily in the areas of properties and applications of polymer composites, funded by ORF. These partners are **General Motors, BASF, Toho Tanax, Dieffenbacher North-America, Ford Motor Company**, and **Hudson Boatworks**.

I have during the same period continued my research on structure property relationships from magnesium alloys in collaboration with **Meridian Technologies** and **CANMET-Materials**.

J. Yang

Dr. Jun Yang has been collaborating with R&D teams of **Rosstech inc**. and **Topnotch Building Maintenance Ltd**. to develop new technologies of printable electronics.

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

Dr Jun Yang has been collaborating with R&D team of **Mixshop Inc.** to develop new 3D printing materials and 3D printers.

Dr. Jun Yang has been collaborating with R&D team of **Marwood Metal Fabrication** to develop new coating technology.

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

C. Zhang

Research project with **OMTEC**, Ridgetown, Ontario

The objectives of this study are (1) to develop a computational fluid dynamics (CFD) model which could be used to predict important process parameters, such as the pressure drop due to the porous filter, at different operating conditions and (2) to investigate the effect of the geometric parameters of the coalescer and separator on the pressure drop and filtration efficacy..

Research project with **Trojan Technologies Inc.** in London, Ontario

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

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2. REFEREED CONFERENCE PROCEEDINGS

1. Ma, J, **Asokanthan S. F**, and Jiang L.Y (2013) Nonlinear instability of NEM Electrostatic switches with the consideration of surface effects, 4th Canadian Conference on Nonlinear Solid Mechanics (CanCNSM2013), Montreal, Canada, July 23-26, 2013.

2. Orr, V., Barhi, S., **Buchal, R.,** Process Safety Management Learning Module, Proceedings of the 2014 Canadian Engineering Education Association (CEEA) Conference, Canmore AB, June 8-11, 2014.

3. Burkhart TA, **Dunning CE**. The Effect of Material Model, Element Formulation and Bone Marrow Inclusion on the Accuracy of an Explicit Finite Element Model of the Distal Radius, 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, Sept 4-7, 2013. (podium)

4. McLachlin SD, Ferreira LM, **Dunning CE**. A Refined Technique to Calculate Joint Motion Helical Axes from Six-DOF Tracker Output, 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, Sept 4-7, 2013. (poster)

5. Burkhart TA, Asa B, **Dunning CE**, Payne M, Wilson TD. The Effect of Amputation Length and Interosseous Membrane Viability on Fibular Migration in Below Knee Amputations, 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, Sept 4-7, 2013. (podium)

6. Hosein YK, King GJW, **Dunning CE**. The Effect of Stem Circumferential Grooves on the Stability at the Implant-Cement Interface, Novel Therapies: Components and Implants Section, Bone and Joint Injury & Repair Conference. London, ON. Jan 16-17, 2014. (podium)

7. Reeves JM, Burkhart TA, **Dunning CE**. The Effect of Static Forearm Muscle-Loads on the Fracture Threshold of the Distal Radius: A Cadaveric Study, Trauma Section, Bone and Joint Injury & Repair Conference. London, ON. Jan 16-17, 2014. (poster)

8. McLachlin SD, Ferreira LM, **Dunning CE**: A Refined Technique To Calculate Helical Axes From Six-DOF Tracker Output, 60th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, March 2014. (poster)

9. Yao R, McLachlin SD, Rasoulinejad P, Gurr KR, Siddiqui F, **Dunning CE**, Bailey CS. Influence Of Graft Size On Spinal Instability With Anterior Cervical Plate Fixation Following In Vitro Flexion-Distraction Injuries, 60th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, March 2014. (poster)

10. "Stability of Flow in a Channel with Longitudinal Grooves" by H. V. Moradi and **J.M.Floryan**. Proceedings of the Canadian Society for Mechanical Engineering International Congress 2014 CSME International Congress 2014, June 1-4, 2014, Toronto, Ontario, Canada.

11. "Effects of Longitudinal Grooves on the Kinematically/Pressure-Driven Laminar Flows" by A. Mohammadi and **J. M. Floryan**. Proceedings of the Canadian Society for Mechanical Engineering International Congress 2014 CSME International Congress 2014, June 1-4, 2014, Toronto, Ontario, Canada.

12. "Use of Distributed Heating for Drag Reduction" by Daniel Floryan and **J.M.Floryan**. Proceedings of the 1000 Islands Fluid Mechanics Meeting, May 30-June 1, 2014, Kingston, Ontario, Canada.

13. "Pressure Losses In Heated Channels" by Daniel Floryan and **J.M.Floryan**. Proceedings of the 2014 Canadian Society for Mechanical Engineering International Congress, June 1-4, 2014, Toronto, Ontario, Canada.

14. "On the Intensification of the Super-ThermoHydrophobic Effect" by **J.M.Floryan** and Daniel Floryan. Proceedings of the 14th Pan-American Congress of Applied Mechanics, March 24-28, Santiago, Chile.

15. "Drag Reduction due to Spatial Thermal Modulations" by **J.M.Floryan** and D. Floryan, Bul. Amer. Phys. Soc., v.58, #8, 2013.

16. "Groove Optimization for Drag Reduction" by A .Mohammadi and **J.M.Floryan**, Bul. Amer. Phys. Soc., v.58, #18, 2013.

17. "Instabilities of Natural Convection in a Periodically Heated Layer" by M.Z. Hossain and **J.M.Floryan**, Bul. Amer. Phys. Soc., v.58, #18, 2013.

18. "The influence of the pressure gradient on the Görtler vortices" by J. K. Rogenski, L. F. de Souza and **J.M.Floryan**, Bul. Amer. Phys. Soc., v.58, #18, 2013.

19. "On the Super-Thermohydrophobic Effect" by **J.M.Floryan**. Proceeding of the 11th International Conference on Numerical Analysis and Applied Mathematics, Sept.21-27, 2013, Rhodes, Greece (AIP Proceedings, v.1558, Editor: T.Simos, Co-Editors: G.Psihoyios, C.Tsotouras).

20. Ma, J., Asokanthan, S. F., and **Jiang, L.Y.**, Nonlinear instability of NEM Electrostatic switches with the consideration of surface effects, the 4th Canadian Conference on Nonlinear Solid Mechanics (CanCNSM2013), Montreal, Canada, July 23-26, 2013.

21. Mahdavi, M.H., **Jiang, L.Y.**, and Sun, X., Nonlinear vibration of a graphene sheet embedded in a polymer matrix, the 4th Canadian Conference on Nonlinear Solid Mechanics (CanCNSM2013), Montreal, Canada, July 23-25, 2013.

22. Yan, Z., and **Jiang, L.Y.**, The influence of flexoelectricity on the electromechanical coupling of piezoelectric nanobeams,17th U.S. National Congress on Theoretical & Applied Mechanics, East Lansing, USA, June 15-20, 2014.

23. Zhou, J., **Jiang, L.Y.**, and R. E. Khayat, Frequency tuning of a viscoelastic dielectric elastomer (DE) membrane resonator, 17th U.S. National Congress on Theoretical & Applied Mechanics, East Lansing, USA, June 15-20, 2014.

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25. Zhou, J., **Jiang, L.Y.**, and Khayat, R. E., Electromechanical response and instability of dielectric elastomer actuators, Proceedings of The Canadian Society for Mechanical Engineering International Congress 2014, Toronto, Canada, June 1-4, 2014.

26. H. Rajakumar, **R.J. Klassen**; "Effect of Temperature and Ion Irradiation on the Mechanical Properties of Material for the Gen. IV Super Critical Water Reactor", Symposium "Materials Development and Degradation and Management for Nuclear Applications", 2013 Materials Science and Technology Conference, Oct. 27-31, 2013, Montreal, Quebec.

27. M. Haghshenas, V. Bhakhri, **R.J. Klassen**; "Creep of Pure Mg during High-Temperature Microindentation", Symposium "Magnesium Technology- Deformation I", 2013 Materials Science and Technology Conference, Oct. 27-31, 2013, Montreal, Quebec.

28. A.Z.M. Islam and **R.J. Klassen**; "Study of the Size Dependence of Time-dependent Plastic Deformation of Gold Micro-pillars and Micro-spheres", Proceeding of Seminar BBB of the 2013 MRS Spring Meeting, April 1-5, 2013, San-Francisco, California. Available in the MRS Online Proceedings Library, hosted by Cambridge Journals.

29. M. Haghshenas and **R.J. Klassen**; "Microindentation-based Assessment of the Dependence of the Geometrically Necessary Dislocation Upon Depth and Strain Rate", 2013 MRS Spring Meeting, April 1-5, 2013, San-Francisco, California

30. Sinar, D., **Knopf, G. K**., and Nikumb, S. (2014). Microfabrication of passive electronic components with printed graphene-oxide deposition. In SPIE MOEMS-MEMS (pp. 89730H-89730H). International Society for Optics and Photonics.

31. Sinar, D., **Knopf, G. K**., Nikumb, S., and Andrushchenko, A. (2014). Laser micromachining of oxygen reduced graphene-oxide films. In SPIE MOEMS-MEMS (pp. 89730K-89730K). International Society for Optics and Photonics.

32. A. Escoto, F. LeBer, A.L. Trejos, **M.D. Naish**, R.V. Patel and M.-E. LeBel, "A Knee Arthroscopy Simulator: Design and Validation," 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 5715–5718, July 3–7, 2013.

33. I. Khalaji, M. Hadavand, A. Asadian, R.V. Patel and **M.D. Naish**, "Analysis of Needle–Tissue Friction during Vibration-Assisted Needle Insertion," IEEE/RSJ International Conference on Intelligent Robots and Systems, Tokyo Big Sight, Japan, pp. 4099–4104, November 3–7, 2013.

34. Scott J A, Motavaze K, Summerbell R C, Lin W E, Spiler K, Dooreleyers M, **Savory E** & Pogacar J (2014) "Improved biodeterioration resistance tests for building materials", Proc Indoor Air 2014, Hong Kong, July.

35. Roberto M C & **Savory E** (2014) "Experimental simulation of thunderstorm downbursts", Proc CSME Int Congress 2014, June, Toronto, Ontario, Canada. [Best paper prize winner]

36. **Savory E,** Dooreleyers M, Spiler K, Li E, Sabarinathan J & Scott J (2014) "Performance of an optoelectronic mould sensor", Proc CSME Int Congress 2014, June, Toronto, Ontario, Canada.

37. Avari H, **Savory E** & Rogers K A (2014) "A novel hemodynamic facility for studying the effects of shear stresses on endothelial cells", Proc CSME Int Congress 2014, June, Toronto, Ontario, Canada.

38. Blackman K, **Savory E** & Perret L (2014) "Wind tunnel modelling of upstream roughness arrays for street canyon flow studies", Proc CSME Int Congress 2014, June, Toronto, Ontario, Canada.

39. **Savory E**, Lin W E, Blackman K, Roberto M C, Cuthbertson L R, Scott J & Mubareka S (2014) "Western Cold and Flu (WeCoF) aerosol study - preliminary results", Proc CSME Int Congress 2014, June, Toronto, Ontario, Canada.

40. Perret L, Blackman K & **Savory E** (2013) "Effect of upstream flow regime on street canyon flow dynamics", Proc PHYSMOD 2013, Univ Surrey, Guildford, UK, Sept.

41. Bashar, M. and **Siddiqui, K**., "Investigation of the melting process in a phase-change material", CSME International Congress, Toronto, June 1-4, 2014.

42. Jobehdar, M.H. Gadallah, A.H., **Siddiqui, K.**, and Chishty, W.A. "Investigation of Internal and External Flow in an Effervescent Atomizer", CSME International Congress, Toronto, June 1-4, 2014.

43. Ramadan, A., **Siddiqui, K**., El-Naggar, H., "Parametric Study of Veritcal Ground Loop Heat Exchangers for Ground Source Heat Pump Systems", CSME International Congress, Toronto, June 1-4, 2014.

44. Gadallah, A. and **Siddiqui, K.,** "Bubble size reduction using honeycomb monlith breaker in co-current upward flowing liquid", CSME International Congress, Toronto, June 1-4, 2014.

45. Elatar, A. and **Siddiqui, K**., "Effect of low Reynolds number mixed convection on the flow development inside channel", ASME Fluids Engineering Summer Conference, Incline Village, Nevada, July 7-11, 2013.

46. Jobehdar, M.H. Gadallah, A.H., **Siddiqui, K.**, and Chishty, W.A. "Investigation of the bubble formation in liquid cross-flow using a novel nozzle design", ASME Fluids Engineering Summer Conference, Incline Village, Nevada, July 7-11, 2013.

47. Gadallah, A. and **Siddiqui, K.,** "A Novel Nozzle Design for Reducing Bubble Size Generated in Stagnant Liquid", ASME Fluids Engineering Summer Conference, Incline Village, Nevada, July 7-11, 2013.

48. P. Mirzabeygi and **C. Zhang**, 2014, "Computational Fluid Dynamics Modeling of Laminar Film Condensation on a Horizontal Tube," 22nd Annual Conference of the CFD Society of Canada, Toronto, Canada, June 1 to 4,

49. P. Mirzabeygi and **C. Zhang**, 2014, "Computational Fluid Dynamic Analysis of Two Phase Flow and Heat Transfer in Condensers," Proc. CSME International Congress, Toronto, Canada, June 1-4, 2014.

50. G. Dutta, R. V. Maitri, **C. Zhang** and J. Jiang, 2014, "Numerical Analysis of Heat Transfer for Supercritical Water Flow in Circular Tubes Using a Newly Developed Thermal Hydraulic Model," Proc. CSME International Congress, Toronto, Canada, June 1-4, 2014.

51. R. V. Maitri, G. Dutta, **C. Zhang** and J. Jiang, 2014, "Numerical Analysis of the Deterioration of Heat Transfer Phenomenon in Supercritical Water Flow in Circular Tubes Using Different Turbulence Models," Proc. CSME International Congress, Toronto, Canada, June 1-4, 2014.

52. R. K. Saha, **C. Zhang** and M. B. Ray, 2013, "Scalability Analysis of an Open Channel UV Wastewater Disinfection Reactor using CFD simulation," Annual AIChE Meeting, November 3-8, San Francisco, CA, USA.

53 R. K. Saha, M. B. Ray and **C. Zhang**, 2013, "CFD Modeling of an Open Channel UV Wastewater Disinfection Reactor." Proc. 2nd International Conference on Mechanical Engineering and Mechatronics, Toronto, Canada, August 8-9.

3. ORAL AND POSTER PRESENTATIONS

1. Orr, V., Barhi, S., **Buchal, R**., Process Safety Management Learning Module, Presented at the 2014 Canadian Engineering Education Association (CEEA) Conference, Canmore AB, June 8-11, 2014.

2. **Buchal, R.O.,** Billingsley, N., Bullock, A., Poulin, P., The Lac-Megantic Train Disaster as a Basis for a Design Project that Emphasizes Safety, Presented at the 2014 Canadian Engineering Education Association (CEEA) Conference, Canmore AB, June 8-11, 2014.

3. "Effects of Longitudinal Grooves on the Kinematically/Pressure-Driven Laminar Flows" by A. Mohammadi and **J. M. Floryan**. Presented during the 2014 Canadian Society for Mechanical Engineering International Congress, June 1-4, 2014, Toronto, Ontario, Canada.

4. "Pressure Losses In Heated Channels" by Daniel Floryan and **J.M.Floryan**. Presented during the 2014 Canadian Society for Mechanical Engineering International Congress, June 1-4, 2014, Toronto, Ontario, Canada.

5. "Stability of Flow in a Channel with Longitudinal Grooves" by H. V. Moradi and **J.M.Floryan**. Presented during the 2014 Canadian Society for Mechanical Engineering International Congress, June 1-4, 2014, Toronto, Ontario, Canada.

6. "Use of Distributed Heating for Drag Reduction" by Daniel Floryan and **J.M.Floryan**. Presented during the 1000 Islands Fluid Mechanics Meeting, May 30-June 1, 2014, Kingston, Ontario, Canada.

7. "On the Intensification of the Super-ThermoHydrophobic Effect" by **J.M.Floryan** and Daniel Floryan. Presented during the 14th Pan-American Congress of Applied Mechanics, March 24-28, Santiago, Chile.

8. "Drag Reduction due to Spatial Thermal Modulations" by **J.M.Floryan** and D. Floryan. Presented during the 66th Annual Meeting of the American Physical Society, Pittsburg, Nov. 24-26, 2013.

9. "Groove Optimization for Drag Reduction" by A .Mohammadi and **J.M.Floryan**. Presented during the 66th Annual Meeting of the American Physical Society, Pittsburg, Nov .24-26, 2013.

10. "Instabilities of Natural Convection in a Periodically Heated Layer" by M.Z. Hossain and **J.M.Floryan**. Presented during the 66th Annual Meeting of the American Physical Society, Pittsburg, Nov. 24-26, 2013.

11. "The influence of the pressure gradient on the Görtler vortices" by J. K. Rogenski, L. F. de Souza and **J.M.Floryan**. Presented during the 66th Annual Meeting of the American Physical Society, Pittsburg, Nov. 24-26, 2013.

12. "On the Super-Thermohydrophobic Effect" by **J.M.Floryan**. Presented during the 12th International Conference on Numerical Analysis and Applied Mathematics, Sept.21-27, 2013, Rhodes, Greece.

13. Zhao, N., **Kuboki, T.,** Mark, L.H., Park, C.B., and Li, Q. Foaming of Microfibrillated Cellulose Reinforced Polyvinyl Alcohol Biocomposites. 4th International Conference on Biofoams, August 27-29, 2013, Toronto, Ontario, Canada.

14. M. Dawson, A.L. Trejos, R.V. Patel, C.M. Schlachta, R.A. Malthaner, **M.D. Naish** and S.M. Cristancho, "Validating Force-based Metrics for Computerized Assessment of Technical Skills in Laparoscopic Surgery," Poster presentation, Association for Medical Education in Europe (AMEE) 2013 Annual Conference, Prague, Czech Republic, August 24–28, 2013.

15. L. McCracken, A. Escoto, A.L. Trejos, **M.D. Naish**, R.V. Patel and M.-E. LeBel, "Developing Performance Metrics for a Knee Arthroscopy Simulator," Poster presentation, 2014 London Health Research Day, London, ON, March 18, 2014.

16. M. Dawson, A.L. Trejos, S. Cristancho, R.V. Patel, **M.D. Naish**, C.M. Schlachta and R.A. Malthaner "Validating Computer-based Metrics of Technical Skills in Laparoscopic Surgery," Poster presentation, 2014 London Health Research Day, London, ON, March 18, 2014.

17. M.P. Guttman, A.L. Trejos, **M.D. Naish**, R.V. Patel, C.M. Schlachta and R.A. Malthaner, "Returning an Operator's Sense of Touch in Minimally Invasive Surgery," Poster presentation, 2014 London Health Research Day, London, ON, March 18, 2014.

18. S. Hossain, K.L. Siroen, C.D.W. Ward, A.L. Trejos, R.V. Patel, **M.D. Naish** and C.M. Schlachta, "Evaluation of a Hands-Free Pointer for Surgical Instruction in Minimally Invasive Surgery," Poster presentation, 2014 London Health Research Day, London, ON, March 18, 2014.

19. A. Shamsil, **M.D. Naish**, R.V. Patel and R.A. Malthaner, "Lung Tumour Localization and Visualization via Multisensory Data Fusion in Minimally Invasive Surgery (MIS)," Poster presentation, 2014 London Health Research Day, London, ON, March 18, 2014.

20. K.L. Siroen, S.H. Hossain, C.D.W. Ward, A.L. Trejos, R.V. Patel, **M.D. Naish** and C.M. Schlachta, "Evaluation of a Hands-Free Pointer for Surgical Instruction in Minimally Invasive Surgery," Poster presentation, SAGES Annual Meeting, Emerging Technologies Session, Salt Lake City, UT, April 2–5, 2014.

21. K.L. Siroen, S.H. Hossain, C.D.W. Ward, A.L. Trejos, R.V. Patel, **M.D. Naish** and C.M. Schlachta, "Evaluation of a Hands-Free Pointer for Surgical Instruction in Minimally Invasive Surgery," Oral presentation, 14th World Congress of Endoscopic Surgery, Paris, France, June 25–28, 2014.

22. Bordatchev, E.V., Hafiz, A.M.K., and **Tutunea-Fatan, O.R.,** 2014, "Comparative Analysis of Laser Polishing Technology Implementations," presented at the 1st Conference on Laser Polishing (LaP 2014), May 2014,Aachen, Germany.

23. **Andy X. Sun**, Jiajun Wang, Jinli Yang, Interactions of Carbon/$LiFePO_4$, International conference on Olivines for Rechargeable Batteries, May 25-28, 2014, May 25-28, 2014,Montreal, Canada

24. Andrew Lushington, J. Liu, Y. Tang, R. Li, **Xueliang (Andy) Sun** Unexpected Formation of Nanopores on Nitrogen Doped Carbon Nanotubes by Atomic Layer Deposition, International conference of Atomic Layer Deposition 2014 Tyoto Japan, June 16-18, 2014

25. Jian Liu, Xifei Li, Andrew Lushington, Ruying Li, and **Xueliang (Andy) Sun**, Superior High-Voltage Cycling Behavior of Cathode Materials Coated with Solid-State Electrolyte by Atomic Layer Deposition International conference of Atomic Layer Deposition 2014 Tyoto Japan, June 16-18, 2014

26. Jian Liu, **Andy X. Sun**-Atomic Layer Deposition for Li ion batteries".-One-day Workshop of "Nanostructured Materials for Energy Conversion and Storage" -at Western (organized by Andy X. Sun), May 1, 2014

27. Niancai Cheng, Shuhui Sun, Nicolas Gauquelin, Sam Stambula, Jian Liu, Mohammad Norouzi Banis, Gaixia Zhang, Ning Chen, Jigang, **Xueliang Sun** Single-atom Pt Catalysts through Atomic Layer Deposition and Application in PEM Fuel Cells -2013 Centre for Advanced Materials and Biomaterials Research (CAMBR) Conference-Nov 1, 2013 UWO, London, CA. (Poster)

28. Mohammad Norouzi Banis, S. Sun , G. Zhang, N. Gauquelin, N. Chen, J. Zhou, S. Yang, W. Chen, X. Meng, D. Geng, M. Banis, R. Li, S. Ye, S. Knights, G. Botton, T.-K. Sham, **X. Sun** Atomic-layer-deposition synthesis of energy nanomaterials and their applications in lithium-ion batteries-2013 Centre for Advanced Materials and Biomaterials Research (CAMBR) Conference-November 1st, 2013, London, Canada (oral)

29. Xifei Li, Jian Liu, Dongniu Wang, Jinli Yang, Yuhai Hu, Ruying Li, Mei Cai, **Xueliang Sun** ALD Technique Increasing LiCoO2 Cathodes Performance for Lithium Ion Batteries-2013 Centre for Advanced Materials and Biomaterials Research (CAMBR) Conference-Nov. 1, 2013. London, Canada (Poster)

30. **Jun Yang** "i3DP, an enabling approach adds a new dimension to 3D printing",The 7th World Congress on Particle Technology May 18-22, 2014, Beijing China.

31. **Jun Yang** "Plasmonic optical fibers with periodic nanostructures for lab-on-a-tip sensing applications", International Conference on Optoelectronic Technology and Application 2014 (IPTA 2014) 13-15 May 2014, Beijing, China.

32. **Jun Yang** 'Acoustic metamaterials assisted ultrasound focusing and its applications", International symposium on the theory andapplication of artificial periodic structures (phononic crystals, acoustic metamaterials, Changsha, Hunan, China, October 18-20, 2013.

33. **Jun Yang** "Fabrication of copper nano-particle based functional patterns on photopaper" Nano Ontario 2013, Kingston, Ontario, November 7-8, 2013.

34. **Jun Yang** "Fabrication of copper nano-particle based functional patterns on photopaper" CAMBR Day 2013, London, Ontario, November 1, 2013.

35. **Jun Yang** " A Lab-on-a-CD System for Point-of-care Testing of Whole Blood Sample",The 5th Sino-American Workshop on Biomedical Engineering and China-Oversea Joint Workshop on Biomechanics, August 1–5, 2013, Beijing, China

4. INVITED LECTURES/WORKSHOPS

L. Ferreira

January 2014 — Surgical Mechatronics. McMaster University Biomedical Engineering Symposium

J.M. Floryan

August 2013 — 2nd International Conference on Mechanical Engineering and Mechatronics, Toronto, Canada, (Plenary speaker: "Development of Drag Reducing Strategies").

X. Sun

June 2014 — "Design of electrodes by atomic layer deposition for Li ion batteries", International conference of Atomic Layer Deposition 2014, Tyoto Japan (session Chair)

"Atomic layer deposition for Li ion batteries and fuel cells", Workshop in International conference of Atomic Layer Deposition 2014, Tyoto Japan

"Nanostructured Materials for Fuel Cell Applications", 97th Canadian Chemistry Society conference, Vancouver

	"Atomic Layer Deposition for Li battery Applications", 97th Canadian Chemistry Society conference, Vancouver
	"Nanostructured Materials for Fuel Cell Applications", AFCC (company), Vancouver
May 2014	"Design of surface and interface by atomic layer deposition for energy conversion and storage", Baltic International conference of Atomic Layer Deposition 2014, Finland (session Chair)
	"Synchrotron application for Li ion batteries ", Workshop in Synchrotron Applications 2014, Soochow University, China
	"Surface and Interface of LiFePO4 cathode for Li ion batteries". One-day Workshop of "Nanostructured Materials for Energy Conversion and Storage" at Western (organized by Andy X. Sun)
April 2013	"Atomic layer deposition for Li ion batteries and fuel cells", 6th International conference of Atomic Layer Deposition user 2014, Stanford University
March 2014	"Nanostructured Materials for Li ion Batteries, Lishen battery company, Tianjin, China.
	"Nanostructured Materials for Li ion Batteries and Fuel Cell Applications", 18th Institute, Tianjin, China
	"Nanostructured Materials for Li ion Batteries", Nankai University, Tianjin, China
	"Nanostructured coating s for Li ion batteries ", TMS International conference - 2014 Symposium: Nanostructured Materials for Rechargeable Batteries and for Supercapacitors II
December 2013	"Design of surface and interface by atomic layer deposition for energy storage", Asian Pacific Conference on Chemistry of Materials - Advanced materials for energy generation, saving and storage, 3-6 December 2013 City University of Hong Kong, Hong Kong.
November 2013	"Nanostructured Materials for Energy Storage and Conversion", Berkeley National Lab, (Departmental seminar)
October 2013	"Nanostructured Materials for Energy Storage and Conversion", University of Calgary, (Departmental seminar)
July 2013	"Development of nano-based Electrodes for Energy Storage and Conversion", International Conference on Electrochemical Materials and Technologies for Clean Sustainable Energy, Guangzhou, China, (organiser-vice Chairman, Session Chair). (Keynote talk)

J. Yang

May 2014	"i3DP, an enabling approach adds a new dimension to 3D printing",The 7th World Congress on Particle Technology , Beijing China.
	"Engineering Micro and Nanostructured Functional Materials, Coatings and Devices", Beihang University.
	"Plasmonic optical fibers with periodic nanostructures for lab-on-a-tip sensing applications", International Conference on Optoelectronic Technology and Application 2014 (IPTA 2014) , Beijing, China.

	"Engineering Micro and Nanostructured Functional Materials, Surfaces and Devices", Tianjing University.
	"Engineering Micro-Nanostructured Hierarchical and Functional Materials, Surfaces and Devices", Lanzhou institute of chemical physics, Chinese Academy of Sciences.
October 2013	'Acoustic metamaterials assisted ultrasound focusing and its applications", International symposium on the theory andapplication of artificial periodic structures (phononic crystals, acoustic metamaterials, Changsha, Hunan, China.
	"Bacteria Can Grow Conductive and Semiconductive Nanowires: Potential Applications in Environment, Energy and Bioelectronics", Xiangtan university, Xiangtan, Hunan, China.
	"Engineering Micro/Nanostructured Functional Materials, Surfaces and Devices", Queen's University.
September 2013	"Bacterial nanowires exhibit conductive and semi-conductive behaviour: applications for environment, energy and bioelectronics or biosensing", Shanxi University, Taiyuan, Shanxi, China.
August 2013	"A merge between top-down and bottom-up approaches for fabrication of functional materials, surfaces and devices", Xuchang University, Xuchang, HeNan, China.
	"Highly Integrated Multi-functional Solar Systems", International Workshop of Thin Film Solar Cell Innovation and Commercialization, Chengdu, Sichuan, China.
	"Study of conductive and semi-conductive bacterial nanowires towards applications for environment, energy and bioelectronics", Xinan University, Chongqing, China.
	"A Lab-on-a-CD System for Point-of-care Testing of Whole Blood Sample",The 5th Sino-American Workshop on Biomedical Engineering and China-Oversea Joint Workshop on Biomechanics, Beijing, China.

5. TECHNICAL REPORTS

J. Yang

A number of technical reports about collaborative projects have been submitted to supporting companies.

6. BOOKS AND BOOK CHAPTERS

Kuboki, T. and Park, C. B. Chapter 13: Foaming Technology of Wood Fiber/Plastic Composites. Volume 4: Biobased Composite Materials, their Processing Properties and Industrial Applications, Handbook of Green Materials, Oksman, K., Mathew, A.P., Bismarck, A., Rojas, O., Sain M. eds., World Scientific Publishers, 197–218, June 2014.

Kurowski, P. Engineering Analysis with SolidWorks Simulation 2014. ISBN 978-1-58503-858-9

Kurowski, P. Thermal Analysis with SolidWorks Simulation 2014. ISBN 978-1-58503-862-6

B. Xiao and **X. Sun** "Recent Progress of Graphene Nanoribbons Derived from Unzipped Carbon Nanotubes and the Application in Lithium Ion Batteries" in the book of "Graphene Oxide: Synthesis, Mechanical Properties and Application", Nova Sciences, USA, (2014).

7. PATENTS

C.M. Schlachta, R.V. Patel, A.L. Trejos and **M.D. Naish,** "Hands-Free Pointer System," China Patent 10671348.1, awarded April 30, 2014.

Hassan, H. and **Siddiqui, K**., "Receiver for use with parabolic solar concentrator" US Provisional Patent application #1018P012US01, 2013.

Jun Yang, Xiaolong Wang, Xiaobing Cai, Qiuquan Guo, "Surface modification of printed objects", US provisional patent.

PROFESSIONAL SERVICES

1.REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS

S. Asokanthan

Journal of Sound and Vibration

R.O. Buchal

Robotics and Computer Integrated Manufacturing
Journal of Engineering Manufacture
Journal of Mechanical Engineering Science

L. Ferreira

Journal of Biomechanics (2 manuscript reviews)

L. Jiang

Composites Part B
Engineering Fracture Mechanics
European Journal of Mechanics - A/Solids
International Journal of Applied Mechanics
Physica E: Low-dimensional Systems and Nanostructures
Computational Materials Science
IEEE Transactions on Nanotechnology
Acta Astronautica
ASME Journal of Engineering Materials and Technology
Journal of Intelligent Material Systems and Structures
Materials and Design
The Transactions of the Canadian Society for Mechanical Engineering.

G. Knopf

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

NSERC Research Tools and Instruments (RTI) Grants – Committee member (2014)

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

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

T. Kuboki

Polymer Composites
Journal of Cellular Plastics

M.D. Naish

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

A.G. Straatman

Journal of Fluid Mechanics
Int. J. Heat and Mass Transfer
Int. J. Numerical Methods in Fluids
Thermal Sciences, Physics of Fluids
Fluids and Structures

K.Siddiqui

Int. Journal of Thermal Science

Technical Societies

Chair of Fluid Mechanical Technical Committee of the American Society of Mechanical Engineers (ASME) for a two-year term

Technical Editor, CSME Bulletin

Organizer of the Symposium of Turbulent Flows at the ASME Fluids Engineering Summer Conference, Incline Village, Nevada, July 7-11, 2013

X. Sun

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

Appl. Phys. Lett.
Carbon
Langumir, etc.

Associate editor, Editorial Board of Journal of Frontier on Energy Storage, 2013-
Member, Editorial Board of Journal of ISRN Nanomaterials, 2012-
Member, Editorial Board, Journal of Material Sciences & Engineering, 2011-present

O.R. Tutunea-Fatan

Machining Science and Technology
Computer-Aided Design
Computer-Aided Design and Applications
Medical and Biological Engineering and Computing
International Journal of Production Research
Mechanics and Industry
International Journal of Advanced Manufacturing Technology
International Journal of Machine Tools and Manufacture
Proceeding of the Journal of Engineering Manufacture

J. Yang

Review more than 20 research papers per year for these scientific journals:
Nature Nanotechnology
Advanced Materials
Lab on a Chip
Applied Physics Letter
Nanotechnology
Journal of Micromechanics and Microengineering
IEEE Transactions on Industrial Electronics
IEEE Transactions on Nanotechnology
ACS Advances
Langmuir
The Journal of Physical Chemistry
Journal of Applied Physics: Sensors & Actuators: B. Chemical
Biomedical Materials
Soft Matter
Chemical Communications
Organic Electronics
Chemistry of Materials
Environmental Science & Technology

C. Zhang

Reviewer for Engineering Computations
Reviewer for Computer and Fluids
Reviewer for Powder Technology

2. REVIEW OF GRANT APPLICATIONS

L. Ferreira

Lawson Health Research Institute, Internal Research Fund (Fall 2013 Competition) Nov 25, 2013. Primary reviewer for two applications and secondary reviewer for two applications.

Lawson Health Research Institute, Internal Research Fund (Fall 2013 Competition) June 9, 2014. Primary reviewer for three applications.

Joint Motion Program: CIHR Training Program in Musculoskeletal Health and Leadership. Summer Studentship Funding applications review committee. April 2013.

Joint Motion Program: CIHR Training Program in Musculoskeletal Health and Leadership. Summer Studentship Funding applications review committee. Primary reviewer for one application and secondary reviewer for three applications. April 2014.

L. Jiang

Proposal review for:
Mitacs Accelerate Internship (1 application)
2013 State Natural Science Award of the People's Republic of China (2 applications)

G. Knopf

Natural Sciences and Engineering Research Council (Strategic Grants) – Canada (2013, 2014)
Canada Research Chair (Tier II, Tier I) – Canada (2013, 2014)
NSERC Discovery Grant – Canada (2014)
IDEAS 2012 Exploratory Research Projects (PCE2012) - Romania (2013, 2014)
Translational-Research Programme (TRP) – Austria (2014)

M.D. Naish

NSERC Strategic Grants

A.G. Straatman

NSERC Discovery
MITACS
IMIA

X. Sun

NSERC Strategic
CRD
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Discovery
CFI
OCE
ORF

J. Wood

Dr. T. P. Bruce: Tensile and Twisted bridge cable testing.
Armatec Survivability Corporation: Materials testing.
Henkel Corporation: Materials testing.

J. Yang

NSERC Discovery grant applications
NSERC Strategic grant applications
NSERC CRD grant applications
NSERC I2I applications
NSERC-CIHR CHRP applications
Swiss National Science Foundation (SNSF)

The Terry Fox Foundation
National Council for Research and Development-Joint Applied Research Projects – PCCA (Romania)
Austrian Science Fund (FWF)
Khalifa University Internal Research Fund

C. Zhang

External Grant Reviewer - MITACS