ANNUAL REPORT

July 1, 2009 to June 30, 2010

Department of Mechanical and Materials Engineering

Faculty of Engineering

The University of Western Ontario

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MESSAGE FROM THE DEPARTMENT CHAIR

The Department of Mechanical and Materials Engineering at the University of Western Ontario offers broadly based undergraduate and graduate programs that cultivate the learning, thinking and problem-solving abilities needed to adapt, to develop and to exercise responsible leadership through times of rapid change. Our undergraduate programs leading to the B.E.Sc. degree are markedly cross-disciplinary and offer students broad opportunity to match personal interests with career development. Our Professional Degree programs leading to the M.Eng degree offer opportunities for continuous education advancement for practicing engineers. Our research programs leading to M.E.Sc. and Ph.D. degree reflect a cross-disciplinary focus and wide range of inter-Faculty and international co-operations.

The Department currently has 24 full-time faculty members, 6 support staff members, a full-time undergraduate enrolment of 222 and a graduate enrolment of 131. In 2010, the Department graduated 76 undergraduate students and 56 graduate students.

From July 1, 2009 to June 30, 2010 the Department enjoyed success in research productivity with the publication of 108 journal papers, 5 book chapters, and 108 conference papers. In addition, 7 patents were issued.

Our faculty members were granted approximately $3 million in research funding from various agencies including NSERC, CFI, CIHR, and from industry.

We look forward to our continued success in the years to come.

J.M. Floryan, Ph.D., P.Eng., FASME, FCSME, FCASI, FJSPS, FEIC
Chair
Department of Mechanical and Materials Engineering

ADMINISTRATION

Chair

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

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

Associate Chair, Graduate Affairs

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

519-661-2111, Ext: 88249
Office: SEB 2069B
Email: astraatman@eng.uwo.ca

Associate Chair, Undergraduate Affairs

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

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

AWARDS AND RECOGNITION

W. Altahan

Terry E. Base Award for Outstanding Teaching in Mechanical and Materials Engineering
University of Western Ontario Students' Council Teaching Honors Roll

J.M. Floryan

CSME Robert W. Angus Medal
Canadian Pacific Railway Engineering Medal for 2010

L.Y. Jiang

NSERC University Faculty Award (2006-2011)

P. Kurowski

R. Mohan Mathur Award for Excellence in Teaching

E. Savory

Region Pays de la Loire (International Research Chair)

K. Siddiqui

CFI Leaders Opportunity Fund Award

A.G. Straatman

University of Western Ontario Students' Council Teaching Honors Roll

X.A. (Andy) Sun

Faculty Scholar

.

FACULTY MEMBERS AND ADMINISTRATIVE STAFF

1. FULL-TIME FACULTY MEMBERS

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

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

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

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

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

Research Interests: Solid Mechanics; Elasticity; Heat Conduction

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

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

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. Assistant 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, George 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

Kurowski, P., Assistant Prof, Ph.D., P.Eng. Office: SEB 3077
519- 661-2111, x 80125 kurowski@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., Assistant Prof, Ph.D. Office: SEB 2055
519-661-2111, x 88294 naish@eng.uwo.ca

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

Salisbury, S.P., Assistant Prof., Ph.D., P.Eng. Office: SEB 3035A
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

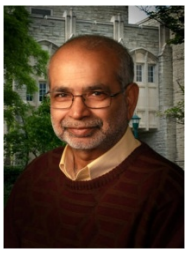
Research Interests: Experimental Fluid Dynamics; Wind Engineering; Environmental Flows; Biological Fluid Mechanics

Shinozaki, D.M. Professor, D. Phil., P.Eng. Office: SEB 3059
519-661-2111, x 88519 shinozaki@eng.uwo.ca

Research Interests: Microstructural Aspects of Deformation; Fracture of Polymers and Polymer; Composites; High Resolution Imaging

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., Associate Prof, 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), Associate Prof, Ph.D. Office: CMLP 1306
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., Assistant 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. SPECIAL APPOINTMENTS

Honorary Professor
Dr. Bjarni Tryggvason
Office: SEB 2053A
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3. PROFESSOR EMERITI

E.S. Nowak, Professor; Ph.D.

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

4. ADJUNCT ACADEMIC PROFESSORS

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

3-D forming of hydrogels for medical applications (polyvinyl alcohol cryogel, twin-screw extrusion process); Prosthetic implants (hip, knee, intervertebral disc, heart valve). Tissue-mimicking phantoms (morphology, biophysical properties, medical imaging).

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

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

H.Y. Feng, Ph.D.
Associate Professor, Dept of Mechanical Engineering
The University of British Columbia
6250 Applied Science Lane, Vancouver, B.C. V6T 1Z4
604-822-1366 Fax: 604-822-2403
Email: feng@mech.ubc.ca

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

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

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

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

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

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

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

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

E. Nowak, Ph.D., P.Eng.
Dept of Mechanical & Materials Eng,
University of Western Ontario
Co-director, Multi-disciplinary Accident Research Team
519-661-2127

Road safety, Canadian Motor Vehicle Safety Standards, Performance of vehicle safety features, Collision reconstruction, Bio-mechanics of injury related to crashes, Causes of collisions.

M.J. Shkrum, M.D., Ph.D.
Email: Mike.Shkrum@LHSC.ON.CA
Department of Pathology, UWO
Staff Pathologist - LHSC (University Hospital), London, Ont.

COPI and medical consultant with the Multi-Disciplinary Accident Research Team. Interest in trauma arising from motor vehicle collisions.

L. Wang, P.Eng., Ph.D.

Email: lwang35@uwo.ca

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

L. Xue, Ph.D.
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National Research Council-IMTI
519-430-7059

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

C. Zemach. Ph.D.
Los Alamos National Laboratory
New Mexico, U.S.A.
Fluid Dynamics

5. VISITING PROFESSORS

Dr. Roi Gurka – Ben-Gurion University, Beer-Sheva, Israel
Dr. Jung-Eui Hong, Chungju National University, South Korea
Dr. Qian Jing – Dalian Institute of Chemical Physics. CAS, China
Dr. Paul A. Meehan, University of Queensland, Brisbane, Australia
Dr. Yukitoshi Otani, Center for Optical Research and Education (CORE), Utsunomiya University, Tochigi, Japan
Dr. Huamin Zhang – Dalian Institute of Chemical Physics, CAS, China

6. ADMINISTRATIVE SUPPORT STAFF

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Belle Smaill
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7. TECHNICAL SUPPORT STAFF

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UNDERGRADUATE EDUCATION

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

1. MECHANICAL ENGINEERING PROGRAM

Second Year Program
Applied Mathematics 2413, ES 2211F/G, MME 2202A/B, MME 2204A/B, MME 2213A/B, MME 2259A/B, MME 2260A/B, MME 2273A/B, 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, MME 3385Y.

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

Mechanical Engineering Option

Business Administration 2299, ES 4498F/G, MME 4419 or 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 4443A/B, MME 4445A/B, MME 4446A/B, MME 4450A/B, MME 4452A/B, MME 4453A/B, MME 4459A/B, MME 4460A/B, MME 4464A/B, MME 4469A/B, MME 4473A/B, MME 4474A/B, MME 4475A/B, MME 4479A/B, MME 4480A/B, MME 4481A/B, MME 4482A/B, MME 4483A/B, MME 4485A/B, MME 4486A/B, MME 4487A/B, MME 4491A/B, MME 4492A/B. Students may elect to substitute technical electives from other engineering disciplines or from the Faculty of Science, provided they have the required prerequisites, and provided at least half of their technical electives are chosen from the above list. A maximum of two 0.5 courses may be taken from the Faculty of Science and used towards the BESc degree. All courses outside of the MME list must be approved by the Department of Mechanical and Materials

Mechanical Engineering and Law Option

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

Admission Criteria
To be eligible for the combined degree program, students must have completed all the requirements of the first year curriculum in the Faculty of Engineering, and the second and third year program, Option B, in the Department of Mechanical Engineering with either a minimum cumulative weighted average (CWA) of 80% or stand in the top 10% of the class. In addition, the applicant must meet the minimum LSAT requirement 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, 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, MME 3385Y.

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
One of: MME 4419 or MME 4499
In years five and six students must complete the following requirements for the LLB:
• The two compulsory upper-year Law courses
• At least three Law core-group courses (must include Law 5220)
• Additional Law courses equaling at least 25 credit hours (must include one of the optional courses listed below under “The Impact of Technology on Society”)
• One Law course must have an essay requirement of at least two credit hours.
Notes: Fulfillment of the Faculty of Engineering requirement of courses that expose students to the impact of technology on society, ethical issues, and economics must be taken as follows:
• Ethical Issues: Law 5130 “Legal Ethics & Professionalism” – part of the first year Law curriculum.
• The Impact of Technology on Society: One of: Law 5615 “Biotechnology Law”, Law 5605 “Advanced Issues in Technology Law”, Law 5350 “Media Law”, Law 5600 “Advanced Intellectual Property”, Law 5620 “Information Law”, the former Law 453 “Internet Law”, Law 5625 “Intellectual Property”, Law 5630 “International Protection of Intellectual Property”, or Law 5610“Advanced Patent Law”.
In addition, there may be a Selected Topics course offered which may be approved on an individual basis.
• Economics: Law 5220 “Income Taxation”.

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

Mechanical Engineering and Medicine Option

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

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

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

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

Concurrent Degree Program

First Year Program
Common first year of Engineering.

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

Third Year Program
Applied Mathematics 3413A/B, ECE 3373A/B, ECE 3374A/B, ES 4498F/G, MME 3303A/B, MME 3307A/B, MME 3334A/B, MME 3360A/B, MME 3379A/B, MME 3380A/B, MME 3381A/B, MME 3385Y.

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 4419 (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, Statistical Sciences 2143A/B, Business Administration 2257.

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

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

Fifth Year Program
MME 4419 or MME 4499, MME 4492A/B, ES 4498F/G
Two 0.5 technical electives
Business Administration 4415Q/R/S/T, 4428A/B, 4466A/B, three 4400 level Business half course equivalents.

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

2. UNDERGRADUATE ENROLLMENT

FULL-TIME UNDERGRADUATE ENROLLMENT(2009-2010)											
	Year 1		Year 2		Year 3		Year 4		TOTAL		TOTAL
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Mechanical	n/a	n/a	48	8	65	15	67	17	180	40	220
PART-TIME UNDERGRADUATE ENROLLMENT (2009-2010)											
	Year 1		Year 2		Year 3		Year 4		TOTAL		TOTAL
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Mechanical	n/a	n/a	1	0	15	1	4	1	20	2	22

3. DEGREES GRANTED

Fall 2009	Spring 2010
3	73

4. UNDERGRADUATE AWARDS

Recipients (Fall 2009) – Students registered in the Department of Mechanical and Materials

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

3rd Year MME Awarded annually to a student in his/her third year in the Department of Mechanical and Materials Engineering based on the candidate's mark in Thermodynamics II (MME 334a/b), financial need, continuing educational studies, and career goals in the heating, refrigeration and air conditioning profession. The student must have a minimum YWA of 70% and have taken five full courses during the year. Students repeating MME 334a/b or the former MME 258a/b do not qualify. This award is made possible by the generosity of ASHRAE, London Chapter, Canada.

Awarded to: Mohammad El-Makdah

Andrea Bailey Memorial Award (1- $1800.00)
4th Year MME Awarded to a female student entering fourth year of Mechanical and Materials Engineering who demonstrates financial need, a minimum 75% academic average and involvement in extracurricular activities at the University and in the community. Preference will be given to a student meeting the stated criteria who is in a concurrent degree program. The recipient must not be in receipt of any other award in the Department of Mechanical and Materials Engineering. This award was established by friends and family in memory of Andrea Bailey.

Awarded to: Bridget Heslin-Dasilva

Ian Duerden Memorial Award (1-$1000.00)
3rd Year MME Awarded to a full-time undergraduate student in his or her third year of the Mechanical and Materials Engineering program who demonstrates financial need and achieves a minimum 75% academic average. This award was established through Foundation Western in memory of Ian Duerden, a former Associate Dean of the Faculty of Engineering.

Awarded to: Anna Rozik

Lynda Diane Shaw Memorial Award (1-$900.00)
4th Year MME Awarded to a student entering the fourth year of the Mechanical Engineering program in good standing. This student must have been active in community service activities, student clubs and extra-curricular activities and possess good interpersonal skills. Established by friends, colleagues and family in memory of Lynda Diane Shaw.

Awarded to: Diane Davies

Donald P. Morris Engineering Award (1-$1000.00)
Awarded to a full-time undergraduate student in Year 2 or higher of any Engineering Program based on academic achievement and involvement in extracurricular activities that demonstrate leadership skills. This award was established by Donald P. Morris, BESc ’65.

Awarded to**:** Adam Bierylo

EMCO Scholarships (2-$3600.00)
2nd Year ANY Awarded to students entering their second year of Engineering and preferably having a career objective in manufacturing or marketing. These students must have demonstrated leadership ability as well as involvement in outside activities. Scholarships are continuous into third and fourth year based on maintenance of at least an 80% average or standing in the top 25% of the class. Established through the generosity of EMCO Limited.

Awarded to: Gary Chan

***Suncor Scholarships* (3-$5000.00)**
Awarded to fourth year students who have successfully completed the Industry Internship Program with Suncor. This award was established by Suncor Energy Foundation

Awarded to: Saeed Alsakka

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

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

Walker Wood Foundation Continuing Scholarship
Awarded to: Jacob Mackenzie Reeves

Four Year Continuing Admission Scholarship Program
Awarded to: Jacob Mackenzie Reeves

Recipients (Spring 2010) Awards of the Graduating Class June 2010 – 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: Kevin Elliott

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: Andrea Sylvester

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: Stephen Haley

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: Andrea Sylvester

5. DESIGN PROJECTS

Projects at a Glance

Project	Students	Faculty Advisor	Sponsor
Environmental Engineering			
HVAC System Design	Abdul Mooti, Ghaleb Rustom Abdul Sater, Mohammad Saqqa, Laith Issa	Walid Altahan	
Indirect Evaporative Cooling	Douglas Farough, Martin Hopgood	Walid Altahan Tony Straatman	
Improved Energy Efficiency for Residential Homes	Chris Anderson,Greg Hebb, Ian Kerwin and Charles Vladis	Kamran Siddiqui	
Design & Development of a Lab-Scale Parabolic Dish Concentrated Solar Energy System	Diane Davies, Ryan Theakson and Erik Williamson	Kamran Siddiqui	
Designing Dye-Sensitized Solar Cells (DSSC)	Thipphathong Vattaso	Jun Yang	
eBike Sharing Systems	Joshua Safer	Ralph Buchal	Fit-for-Life London
Improved Electric Bicycle	Darshanpreet Khosa, Heygaan Rajakumar and Johanna Sanchez	Ralph Buchal	Fit-for-Life London
Fryer Sanitation Water Recovery System	**Team 1**: Nick Oppedisano, Rob Hooper, Andrew Sellner, Alex Herold, Simon Lutz **Team 2**:Scott Cooper, Vinh Dinh and Vincey Chui	Paul Kurowski	Cargill Meats Canada
Biomedical Engineering			
Biomechanical Simulation: Mapping of a Golf Swing	Kevin Nasu, Brandon Vriens and Jimmy Tsu	Michael Naish Jeff Wood	
Design of an fRSA Validation Tool	Grace Lambert, Daniel Stranges, Catherine Thorn and Derek Gateman	Tom Jenkyn	
Wear Simulator for Soft Biomaterials	Kristin Bubnowizc, Andrew Fedorchuk and Andrew Romagnoli	Gordon Campbell (NRC)	
Design of a Stiffness Testing Mechanism for the TCu380A Intrauterine Contraceptive Device	Helen Brennek, Andrew Sylvester and Peter McIntosh	Paul Kurowski	Nazar Associates
Glucose Monitor: Interfaces for the Disabled	Ryan Abrams and Stephen Costella	Jun Yang	Tetra Society

Projects with an Entrepreneurial Theme			
Human-powered Workbike Tool	David Archer, Alex Burnet, Kevin Elliott and Vanessa Stadnyk	Liying Jiang	RND Limited
Customizable Carrying Case Solution	Stephen Haley	Ralph Buchal	
Alternative Designs for Pocket Billiard Tables	Matthew Logan, Ryan Hux and Adam Pidskalny	Liying Jiang	
Modular Multi-Tool	Nathaniel Dillon-Smith	Ralph Buchal	
Automotive Engineering			
Formula SAE Hub Assembly Design	Charles Dusustre	Remus Tutunea-Fatan	Armatec Survivability
Formula SAE ABS and ESM Systems	Qaid Damji	Shaun Salisbury	Armatec Survivability
Formula SAE Chassis*	Matthew Carroll and Matthew Ferguson	Anand Singh	Armatec Survivability
Formula SAE Suspension	Ryan Alexander, Greg Betteto, Casie Lang and Marc Pfister	Anand Singh	Armatec Survivability
Drivetrain for Western Baja Car	Saul Aginsky, Dan Currie, Sarah MacLellan and Michael Rubinger	Anand Singh	
Formula SAE Cooling	Michael Payne and Andrew West	Chao Zhang	Armatec Survivability
Sunstang Steering System	Geoff Gauthier	Shaun Salisbury	
Mechanical or Integrated Engineering			
Design Development of Spindle and Laser Head Attachments for a Desktop 8-axis Micromilling System	Bryce Irvine, Brian Chan, John Frydrychowicz and David Morrison	Remus Tutunea-Fatan	
Tillage Implements	Sarah Patterson, Nicole Feldmann and Kyle Ruttan	Ralph Buchal	David Baker
Integrated Pedestrian Traffic Signal – Team 1	Daniel Dean, Mohamad El-Makdah, David Tran and Saeed Alsakka	Paul Kurowski	
Portable Mechanical Test Frame	Brian Blumer and Emmanuel Ukposidolo	Jeff Wood	
Rapidly Variable Topography for WindEE	Lauren Blake, Brian Crook, Ryan McLachlan and Bridget Heslin-Dasilva	Jeff Wood and Horia Hangan	
Integrated Pedestrian Traffic Signal – Team 2	Zain Hami, Cimone Pegus and Monica Shade	Ralph Buchal	
Passive Greenhouse	Shane Parkhill and Cooper Robinson	Ralph Buchal	

Sunstang Brake System	Jeffrey Fox	Ralph Buchal	
SAE Baja Floatation System	David McColl	Ralph Buchal	

*Best project

6. EXCHANGE PROGRAMS

Last Name	First Name	Home University	Home Country
Castañeda	Manuel	Tecnologico de Monterrey	Mexico
Chapa Hernandez	Santiago	Tecnologico de Monterrey	Mexico
Elizalde García	René Eduardo	Tecnologico de Monterrey	México
Faber	Anne-Katrine	University of Copenhagen	Denmark
Gandhi	Rohan	Ontario/Maharashtra-Goa Exchange Program	India
González	Miguel Alejandro	Tecnologico de Monterrey	México
Herbert	Rémi Claude Antoine	Institut National des Sciences Appliquées de Toulouse (INSA Toulouse)	France
Kergrene	Erwan	Université de la Méditerranée (Aix-Marseille II)	France
Khatav	Prasad	Ontario/Maharashtra-Goa Exchange Program	India
Martel	Romain	Joseph Fourier University (Grenoble I)	France
Sahasrabudhe	Abhishek	Ontario/Maharashtra-Goa Exchange Program	India
Sauvage	Julien	Institut National des Sciences Appliquées de Toulouse (INSA Toulouse)	France
Wang	Yuxi	Nanyang Technological University	Singapore
Zewde	Kaleb	Joseph Fourier University	France
Baderulshah	Mohammad	National University of Singapore	Singapore
Carracedo	Rafael	Tecnologico de Monterrey	Mexico
Chen	Qing	Nanyang Technological University	Singapore
Xiao	Bing	National University of Singapore	Singapore
Tang	Ying	National University of Singapore	Singapore
Yak	Sin Wen	National University of Singapore	Singapore

7. INTERNSHIP PROGRAM

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

The following students from the MME Department completed an Internship in 2009-10.

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Last	First	Company
Bernick	Josh	Plan Group
Bui	Cao Thang	CAMI
Bunt	Michael	Canadian Tire
Depooter	Casey	Lanxess
El-Koriny	Fady	GABAE Development
Elliott	Jake	Suncor
Gilbride	Kurtis	Ontario Power Generation
Gribbon	Patrick	Union Gas
Hart	Alexander	Ontario Power Generation
House	Quentin	DFB Group
Lodhi	Shahnawaz	CAMI
Martin	Christopher	Trudell Medical
Morales	Mario	Trudell Medical
Ouellet	Tyler	Armatec Survivability Corp.
Soriano	Paola	Ontario Power Generation

8. SUMMER ENGINEERING CO-OP PROGRAM

Last Name	First name	Company
Elliott	Kevin	Sarnia Research Park
Goulden	Claire	W.R. Davis Engineering
Newman	Kris	Trow Associates Inc.
Rubinger	Michael	ARBO Engineering Inc.
Stadnyk	Vanessa	IWS Wood Products
Sylvester	Andrea	Bruce Power
Wideman	Derek	General Electric

9. INTERNATIONAL STUDENTS

Khosa, Darshanpreet	Year 4
Rustom Abdul Sater, Ghaleb	Year 4
Um, Kisung	Year 3

10. UNDERGRADUATE STORIES

Samir's Story

When Ottawa native Samir Raza arrived at Western as a National Scholar he had a talent for problem solving, a keen interest in technical innovation, and an appreciation for the power of education. Enrolled in Engineering, he had planned to apply his engineering skills in medical research.

But as he progressed and became immersed in “Canada’s best student experience,” his interests changed, and more importantly, he discovered his passion.

In first year, Samir ran an after school basketball program for elementary students. His extracurricular activities then expanded to include the roles of VP, Engineering Students Council and Alumni Relations Commissioner.

But the most defining experience for Samir was attending his first meeting of the Western chapter of Engineers Without Borders (EWB). Energized by the group’s mission to promote human development in impoverished communities, he was captivated and soon became EWB President. “As EWB Western President, I really developed as a leader and as a public speaker,” he reflects, “and I discovered my passion, which is International Development.”

Under Samir’s leadership, the group’s achievements included delivering a weekly lecture series on international development, integrating sustainable development topics into the core Engineering curriculum, lobbying MPs, and raising more than $40,000 for overseas projects – all while maintaining a 90 per cent average.

While his volunteer interests were changing, so too were his academic interests. Samir decided to follow his passion through a career in medicine. He’ll graduate in May with a concurrent degree in medicine and mechanical engineering.

“During my first four years, my aspirations shifted from using my engineering skills to solve technical medical problems, to using my knowledge of engineering and medicine to solve global health and development challenges, whether through overseas work, policy change or research.” It was a life-changing decision he didn’t take lightly.

“Western had a profound impact on my career choice and the individual I’ve become, teaching me the importance of innovation, effective problem solving, sharing knowledge and giving back to my community.”

Samir has carried these lessons from his first four years forward, establishing a one-on-one Clinical Mentorship Program as well as a Medicine and Law Interest Group. And during his upcoming residency in general internal medicine, he intends to “volunteer in under serviced areas, continue teaching medical students and expand my knowledge of international health and development.”

“My parents taught me early and often that someone can take away your possessions but they can’t take away your knowledge. They understood the transformational power of education. It’s a philosophy I’ve carried with me, and saw come to life at Western.”

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*
- *MME9712 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 Mechancial Systems*

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

Mechanical Engineering

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

2. PROFESSIONAL DEGREE PROGRAMS

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

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

(1) Thermo-fluids,

(2) Materials and Solid Mechanics,

(3) Automation Technologies and Systems,

(4) Mechanical Engineering with two options (i) General Mechanical Engineering and (ii) Engineering in Medicine.

Thermo-fluids

The program is comprised of the following:

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

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

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

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

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

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

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

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

Materials and Solid Mechanics

The program is comprised of the following:

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

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

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

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

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

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

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

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

Automation Technologies and Systems

The program is comprised of the following:

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

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

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

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

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

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

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

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

Mechanical Engineering

(i) General Mechanical Engineering Option

The program is comprised of the following:

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

- MME 9610 Applied Measurements & Sensing Systems
- MME 9612 Finite Element Methods
- MME 9617 Energy Conversion

- MME 9621 Computational Methods in Engineering
- MME 9622 Advanced Dynamics and Kinematics
- MME 9623 Theory and Practice of Plasticity

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

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

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

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

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

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

(ii) Engineering in Medicine Option

The program is comprised of the following:

A) Two introductory half-courses on Engineering in Medicine

- MME 9550 Medical Device Design
- MME 9511 Biomechanics of the Musculoskeletal System

- BME 9502 Eng. Analysis of Physiological System
- BME 9520 Fundamentals of BioMEMS
- BME 9525 Introduction to Biomaterials Engineering

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

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

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

- MME 9612 Finite Element Methods
- MME 9615 Biomechanics of Human Joint Motion
- MME 9620 Nanomaterials and Nanotechnology
- MME 9621 Computational Methods in Engineering
- MME 9624 Actuator Principles, Integration and Control (ECE 9509)
- MME 9724 Microfluidics and Lab-on-a-Chip
- MME 9728 Computer Aided Geometric Modeling
- MME 9729 Optomechatronic Systems

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

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

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

D) Two half-courses in Professional Engineering (offered in Summer term):

- CBE 9185 Risk Assessment and Management in Engineering Systems
- ECE 9010 Intellectual Property for Engineers

3. GRADUATE ENROLLMENT

	M.Eng	M.E.Sc.	M.E.Sc. (BME)*	Ph.D.	Ph.D. (BME)*	Total
Summer 2009	16	35	2	61	6	120
Fall 2009	28	46	3	57	8	142
Winter 2010	22	41	3	57	8	131

***Students registered in Biomedical Engineering program supervised or co-supervised by MME faculty**

4. GRADUATE DEGREE GRANTED

OCTOBER 2009 CONVOCATION – Biomedical Engineering Program

Student name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Fay, Katherine	MESc	30/08/2009		Johnson, J.A.	Development of a Ligament Tension Measurement System

OCTOBER 2009 CONVOCATION – Mechanical and Materials Engineering Program

Student name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Haj Mohammad Jafar, Reza	MESc	8/28/2009	8/24/2009	Dryden, J	Electric flow across a circular spot between parallel plates
Austman, Rebecca	PhD	5/21/2009	5/5/2009	Dunning, C	The effect of distal ulnar implant design characteristics on load transfer: an experimental and finite element analysis
Barakchi Fard, Mohammad Javad	PhD	8/19/2009	8/7/2009	Feng, S	Optimal tool orientation in five-axis surface machining using flat-end mills
Kalyna, Iryna	MESc	8/24/2009	8/19/2009	Tryggvason, B	Control for the microgravity vibration isolation mount-3
Sinar, Dogan	MEng	8/27/2009	N/A		
Weiler, Jonathan	PhD	8/21/2009	8/17/2009	Wood, J	AM60B structure-property relationships
Zhu, Zuohua	MEng	7/22/2009	N/A		
Yan, Zhi	MESc	8/12/2009	8/6/2009	Jiang, L	Fracture properties of FGPMS

JUNE 2010 CONVOCATION – Biomedical Engineering Program

Student Name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Allen, Anne-Marie	MESc	12/21/2009		Jenkyn, T.R.	Development and validation of a markerless radiostereometric analysis (RSA) system

JUNE 2010 CONVOCATION – Mechanical and Materials Engineering

Student Name	Degree	Completion Date	Thesis Exam Date	Supervisor/ Co-supervisor	THESIS TITLE
Ahmed, Zahir	MESc	12/21/2009	12/11/2009	Khayat, R	Axisymmetric and Non-axisymmetric annular jet stability
Babaei, Hadi	PhD	12/18/2009	11/26/2009	Siddiqui, K	Theoretical and experimental investigation of thermoacoustic process
Bashar, Mohammad	MEng	12/31/2009		N/A	N/A

Betchen, Lee J	PhD	2/18/2010	1/19/2010	Straatman, A.G.	Entropy-based analysis and optimization of the pore-level geometry of high-conductivity foams for use in enhanced heat transfer
Bhakhri, Vineet	PhD	9/21/2009	9/15/2009	Klassen, R	A study of deformation kinetics of gold using high-temperature and nano-indentation technique
Brown, David	MESc	4/30/2010	4/16/2010	Zhang, C	Control and Optimization of Laminar Incompressible Fluid Flow
Carreau, Adam	MEng	4/30/2010	N/A	N/A	N/A
Cepek, Jeremy	MESc	12/18/2009	12/15/2009	Straatman, AG	Turbulent convection in graphitic foams
Choy, Kane	MEng	4/30/2010	N/A	N/A	N/A
Del Rey Fernandez, David	MESc	9/29/2008	9/24/2009	Floryan, JM	Spectral Method in Heat Conduction
Ghafouri, Behzad	MESc	11/2/2009	9/22/2009	Savory, E/Zhang, C	Numerical simulation of flow over stators and support arms
Guckert, Mark	MESc	10/6/2009	9/21/2009	Naish, M/Patel R (ECE)	Design and Control of a miniature robotic manipulator
Harris, Jacob	MEng	12/31/2009		N/A	N/A
Hashemi Karuie, Seyed Md.	MEng	12/31/2009		N/A	N/A
Hodis, Viorel	MESc	12/9/2009	12/3/2009	Shinozaki, DM	Polyvinylidenefluoride nanocomposites
Horie, Miho	MESc	9/30/2009	9/22/2009	Savory, E	A hemodynamic flow facility for endothelial cell response
Huard, Martin	MESc	12/21/2009	12/11/2009	Briens C/Berruti F	A novel gas-solid separator for Downer reactors
Husain, Syed Zahid	PhD	10/8/2009	9/29/2009	Floryan, JM	Immersed boundary conditions method for computational fluid dynamics problems
Hussain, Ijlal	MEng	4/30/2010	N/A	N/A	N/A
Islam, S.M. Nazrul	MEng	4/30/2010	N/A	N/A	N/A
Jayed, Ali Ashraf	MEng	12/31/2009		N/A	N/A
Jupalli, Murali	MEng	4/30/2010	N/A	N/A	N/A
Kedgley, Angela	PhD	12/17/2009	12/11/2009	Johnson J Dunning C Jenkyn T	Development and application of a fluoroscopic RSA system
Keikhaee, Aidin	MESc	9/29/2009	9/18/2009	Floryan, JM	Spectral methods in fluid flow
Khanal, Yadav	PhD	4/23/2010	4/19/2010	Buchal, R.O.	Object-oriented design methods
Li, Jianling	MEng	12/31/2009		N/A	N/A
Lin, William	PhD	4/29/2010	4/19/2010	Savory, E	Validation of a Novel Downdraft Outflow Simulator

Liu, Mei	PhD		4/7/2010	Yang, J	Self-Assembly of Nanowires and Microparts for Integration of NEMS/MEMS
Mokal, Jaspreet	MEng	4/30/2010	N/A	N/A	N/A
Moloodi, Soheil	MESc	10/13/2009	9/21/2009	Shinozaki, DM	Processing dependant properties of polydimethylsiloxane nanocomposites
Peng, Botao	PhD	12/22/2009	12/15/2009	Zhang, C	Study on the hydrodynamics and flow mechanisms in CFB risers
Quenneville, Cheryl	PhD	12/21/2009	12/14/2009	Dunning, C	Experimental and numerical assessments of injury criteria for short-duration, high-force impact loading of the tibia
Refan, Maryam	MESc	11/24/2009	11/12/2009	Hangan, H	Aerodynamic performance of a small wind turbine
Shademan, Mehrdad	MESc	4/29/2010	4/21/2010	Hangan, H	CFD Simulations of Wind Loading on Solar Panels
Shaikh, Suhail	MEng	12/31/2009		N/A	N/A
Shui, Punpang	PhD	12/18/2009	12/4/2009	Knopf, G/ Nikumb S	Rapid fabrication of micromold masters for the replication of polymer microfluidic devices
Swentek, Ian	MEng	4/30/2010	N/A	N/A	N/A
Thirugnanavel, Arumugam	MEng	12/31/2009		N/A	N/A
Tran, Ly	MEng	12/31/2009		N/A	N/A
Vermeire, Brian	MESc		4/19/2010	Savory, E	Numerical modeling of thunderstorm downbursts and downburst lines
Villada-Gomez, Jorge	MEng	12/31/2009		N/A	N/A
Wang, Mo	MESc	10/8/2009	9/30/2009	Siddiqui, K	Investigation of a Dish-Type Solar Thermal Energy System
Wang, Wei	MESc	4/19/2010	4/14/2010	Buchal, R.O.	Decision Making in Conceptual Design
Yang, Chi	MEng	12/31/2009		N/A	N/A
Zhang, Rong	PhD	11/26/2009	11/20/2009	Zhang, C	CFD Assisted Control System Design

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

Winter 2007 to Winter 2009:	MESc	PhD
Canadian/Perm. Residents	$16,000/yr	$18,000/yr
International	$23,000/yr	$25,000/yr

Fall 2009 to Winter 2010:	MESc and PhD
Canadian/Perm. Residents	$19,000/yr
International	$27,000/yr

May 2010 to date:	MESc and PhD
Canadian/Perm. Residents	$19,000/yr or tuition + $12K
International	$19,000/yr or tuition + $12K

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. There are three

External Scholarships Recipients: 2009-2010 Competitions

Name	Program	Award	Award Duration
DeGroot,Christopher Thomas	PhD	NSERC CGSD	2009/05/01 to 2012/04/30
Sun,Shuhui	PhD	NSERC CGSD	2009/05/01 to 2012/04/30
McLachlin,Stewart	PhD	NSERC CGSD	2009/09/01 to 2012/08/31
Fischer,Christian	MESc	NSERC CGSM	2009/09/01 to 2010/08/31
Neuert,Mark Alan Carmine	MESc	NSERC CGSM	2010/05/01 to 2011/04/30
Vermeire,Brian	MESc	NSERC CGSM	2009/05/01 to 2010/04/30
Cepek,Jeremy	MESc	NSERC PGSM	2008/05/01 to 2010/04/30
Lin, William	PhD	NSERC PGSD	2008/05/01 to 2010/04/30
Hossain,Mohammad Zakir	PhD	OGS	2009/09/01 to 2010/08/31
Liu,Yu	PhD	OGS	2010/01/01 to 2010/12/31
Ionescu,Mihnea Ioan	PhD	OGS	2010/05/01 to 2011/04/30
El Bannan,Khaled Mohamed	PhD	OGSST	2009/09/01 to 2010/08/31
Norouzi Banis,Mohammad	PhD	OGSST	2009/09/01 to 2010/08/31

6. GRADUATE SEMINAR

Fall 2009				
Date	**Student or Guest Lecturer Name**	**Supervisor/Co-Supervisor**	**Presentation Title**	**Seminar Facilitator**
Sep-21	Hamid Reza Aghayan	E. Bordatchev/J. Yang	Engine Lubricant Condition Monitoring for Engine Performance Evaluation	Yu Zhong
	Bashar Albaalbaki	R. Khayat	Rayleigh-Bénard Convection of Non-Newtonian Fluids	
Sep-28	Shuhui Sun	X.A. (Andy) Sun	Development of Novel Nanomaterials for High-Performance and Low-Cost Fuel Cell Applicationn – Nanowire-Based Electrodes for Fuel Cells	Harish Pungotra
	Mei Liu	J. Yang	Microfluidics Based Tuneable Assembly of Nanowires into Functional Nanodevices	
Oct-05	Andreas Mandelis, Ph.D.		Diffusion-Waves and Applications: Unconventional Diagnostic Techniques go where no light has gone before!	Maciej Floryan
Oct-19	Graham Hunt	E. Savory	An Evaluation of Axial Fan Modelling Methods	Bashar Albaalbaki
	Mohsen Mohammadi	J. Dryden	Stress Concentration Factor around a Circular Hole in an Inhomogenous Infinite Plate under Uniaxial Tension	
Oct-26	Khaled El-Bannan	S. Salisbury	Compact Piezoworm Actuator for MR-Guided Surgical Needed Procedures	Hamid Aghayan
	Yu Zhong	X.A. (Andy) Sun	Synthesis and Characterization of 1-D and 2-D Nanomaterials	
Nov-02	M. Michael Yovanovich		Models for Friction Factors for Laminar and Turbulent Flows in Short and Long Microchannels of Noncircular Cross Sections	Maciej Floryan
Nov-09	William Lin	E. Savory	Length Scaling of a Downdraft Outflow Model	Mei Liu
	Mohammad Zakir Hossain	J.M. Floryan	Flow Instability Due to Presence of Distributing Wall Heating: Effect of Prandl Number	

Nov-16	Hamidreza Azimian	M.D. Naish/R. Patel	Preoperative Planning of Robotics-Assisted Minimally-Invasive Cardiac Surgery	Shuhui Sun
	Harish Pungotra	G.K. Knopf	Collision Detection and Merging of the Deformable Multi B-Spline Surface Patches in VR Environment	
Nov-23	Maciej Floryan, Ph.D.		Induced Polarization Effects in Liquid Droplets	
Nov-30	Richard Oviasuyi	R. Klassen	Micro-Indentation based Investigation of th Anisotropy of Plastic Deformation in Select Zirconium Alloys	Bipasha Bose
	Mihnea Ionescu	X.A. (Andy) Sun	Synthesis of Carbon Nanotubes by Plasma-Assisted Chemical Vapor Deposition	
Dec-07	Amir Khajepour, Ph.D.		New Emissions Standards for the Automotive Industry: Threat or Opportunity?	

Winter 2010

Date	Student's Name	Supervisor/Co-Supervisor	Presentation	Seminar Facilitator
Jan-11	Hao Liu	X.A. (Andy) Sun	Synthesis of Aligned Carbon Nanotubes via Chemical Vapor Deposition	Jamal Jamali
	Kar Man (Edmond) Leung	J. Yang	Nanotechnology meets microbiology: a study of electrical transport of bacteria nanowires	
Jan-18	Dong Wang	C. Zhang	A Numerical and Experimental Approach to Develop Diesel Engine Emissions Control Models	Kuldeep Sareen
	Thomas Bruce	J. Wood	Mixed Mode Delamination Failure Criterion for Polymer Composites	
Jan-25	William Schutz, Ph.D.		U.S. National Science Foundation Priorities in Cyber, Interdisciplinary and Engineering Activities: A Personal Objective	Maciej Floryan
Feb-01	Adam Kirchhefer	R. Gurka/G.A. Kopp	Sparrow Aerodynamics: Preliminary Results and Live Bird Experiment Preparation	Shadi Keshavarzmanesh
	Marin Vratonjic	J. Yang	Micro-Traversing Laser Velocimetry for Near-Wall Flow Measurements in the Hemodynamic Flow Channel: A Study of Pulsating Flow over Endothelial Cells	

Feb-08	Bipasha Bose	R. Klassen	Assessment of the Kinetics of Local Plastic Deformation of Zr-2.5%Nb CANDU Pressure Tubes	Mohammad Norouzi Banis
	Yu Liu	J. Yang	A Fast Method for Nanoscale Friction Measurement based on Atomic Force Microscopy	
Feb-22	Javad Mostaghimi, Ph.D .		Plasma Spray Forming of Heat Exchangers and Combustors from Metallic Foams	
Mar-01	Rajeev Kumar	C. Zhang/E. Savory	Numerical Analysis of Vortex Shredding from a Surface-Mounted Square Prism	Edmond Leung
	Taravat Khadivi	E. Savory	Flow over low aspect ratio elliptical cavities	
Mar-08	Mohammad Norouzi Banis	X.A. (Andy) Sun	Development of Novel Catalyst Supports for High Performance and Low Cost Fuel Cell Applications	
Mar. 15	Chul Park, Ph.D.		Current Trends in Industrial Applications of Functional Foams	Maciej Floryan
Mar-22	Joel Book	S. Asokanthan	Modal Characteristics of Micro-Cantilevers via Output-Only Identification	Rajeev Kumar
	Kuldeep Sareen	G.K. Knopf	Accurate Information Extraction from Large and Partially Spurious Point Cloud Data Sets	
Mar-23	Kuldeep Sareen	G.K. Knopf	Accurate Surface Reconstruction from Large and Partially-Spurious Point Cloud Data	Yu Liu
	Shadi Keshavarzmanesh	L. Wang	Adaptive Assembly Process Planning & Control	
Mar-29	Jamal Jamali	J. Wood	Fracture of Polymer Matrix Composites (PMCs)	Marin Vratonjic
	Tingjie Li	J. Yang	Portable Lab-on-CD Device for Parallel Blood Analysis	
Apr-5	George Raithby, Ph.D.		Direct Design of Surface Shape	Maciej Floryan

7. GRADUATE STORIES

Finding mistakes to set them right

By Paul Mayne
Thursday, April 22, 2010 Western News
For Mechanical & Material Engineering PhD student Mehdi Farrokhnejad, his research is all about finding mistakes.

Mechanical & Material Engineering PhD student Mehdi Farrokhnejad is generating research on magnesium alloys and its potential benefits in the auto sector.

Having finished his master's last year under the supervision of Engineering professors Tony Straatman and Jeff Wood, Farrokhnejad is delving into the use of magnesium alloys in the auto sector.

Since 2001, a partnership between Meridian Lightweight Technologies Inc. and a research team supported by the AUTO21 Network of Centres of Excellence, has been exploring how to resolve magnesium defects.

AUTO21 is a national research initiative supported by the federal government that brings together more than 220 Canadian researchers at 45 universities with more than 200 industry and government partners. The annual research budget is about $11 million.

The team's first project, led by Wood, investigated how to improve magnesium die-casting. Magnesium is attractive because it is substantially lighter than conventional materials used to build cars and trucks. Lighter materials add to fuel efficiency and reduce emissions.

By 2004, approval was received for the second phase of the project, and this past year additional funding added another three years to the research project.

"Magnesium is light and has the potential for part consolidation, so it's a good candidate for this purpose," says Farrokhnejad.

The safety challenge, however, is to build structural components that bend, deform or break in a predictable way, instead of breaking suddenly. Currently, it is not possible with magnesium to predict the size and exact location where this will occur.

"Understanding the location and size is crucial because for some applications small pores within the interior of a part may not interfere with part's function, but in some could result in unexpected fracture of the part," says Farrokhnejad.

By working with castings, Farrokhnejad is trying to predict the location of critical casting defects such as microporosity and gas porosity, as well as the mechanical properties.

"Knowing that, it may be possible to move these spots to areas within the casting that do not compromise the part's integrity," says Farrokhnejad, whose work is focusing on the instrument panel beams of vehicles.

"I would personally love to solve the problem and I hope at least I can take a few steps further in solving it in the next three years of my PhD work."

Farrokhnejad's work toward a solution may be closer than he thinks. He recently competed in a national competition called AUTO21 TestDRIVE, where his research was ranked as one of the top seven brilliant ideas that could help the auto industry.

As a result, he moved to the second round of this competition (this past February in Ottawa), where he made a presentation to top business people to assess the market value of his research.

While he didn't garner one of the two scholarships, the experience was priceless.

"I was honored to meet the most successful people in industry and politics, including the Minister of Industry, and create a good network for my project and future works," he says. "Every moment of this competition was a learning experience."

Farrokhnejad's research has also landed him a story in the upcoming issue of Canadian Die Caster magazine.

RESEARCH

1. MAJOR RESEARCH AREAS

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

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

2. FACILITIES

Laboratory Facilities

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

Thermofluids Group

Aerodynamic testing facilities:

- Two low-speed wind tunnels
- Unique small-scale downburst outflow simulator
- Automotive cooling fan module underhood rig simulator and plenum chamber
- Unique hemodynamic flow rig
- 3-component laser Doppler velocimetry system and additional lasers

Micro/Nano Fluids Laboratory facilities:

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

Access to other fluid dynamic related test facilities:

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

Specialized computing resources:

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

Materials and Solid Mechanics Group

Access to Nanofab and Surface Science Western:

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

Metal Forming Laboratory (SEB 24):

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

Metal Casting and Heat Treating Laboratory (SEB 3049):

- furnaces

Composite Fabrication Laboratory (SEB 6):

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

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

- Chemical Vapour Deposition and sputtering facilities
- Inverted Fluorescence Microscopy
- NanoScope V MultiMode SPM
- Photometrics Cascade high speed Imaging system
- Patchman NP2 Micromanipulation system
- Cell Culture Room
- Photonic Instrument
- MicroPoint Laser System
- Fuel Cell station

Mechanical Testing Laboratories (SEB 10, SEB 3052):

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

Polymer Engineering Laboratory (SEB 3055):

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

Tribology Laboratory (SEB 3064):

- A variety of wear testing machines including a Plinth and a Direct Observation Wear Machine.

Materials Characterization Laboratories (SEB 3045, 3047, 3051):

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

Polymer Engineering Laboratory (SEB 3068):

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

Dynamic and Sensing Systems Laboratory (SEB 3072):

- Vibration transducers
- electrodynamic shakers
- real-time signal and modal analysis software

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

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

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

Dept of Microbiology and Immunology: Transmission Electron Microscope

The Automation Technologies and Systems Group

Dynamic and Sensing Systems Laboratory (SEB 2070):

- Micron-scale and macroscopic vibration transducers
- Electro-dynamic shakers
- Real-time signal analyzers and modal analysis software
- Real-time control hardware/software

CNC Machining Laboratory (SEB 37/37A):

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

Geometric Modeling & Virtual Sculpting Laboratory (SEB 3025A):

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

Bioelectronics and Biosensor Laboratory: (TEB 18) (Note: This laboratory contains equipment not readily available elsewhere on campus)

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

Visualization and Virtual Reality Laboratory: (TEB 206)

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

Sensing and Mechatronic Systems Laboratory: (SEB 2048)

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

Robotics and Automation Laboratory: (SEB 1068)

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

Research facilities available at National Research Council's Integrated Manufacturing Technologies Institute (NRC-IMTI):

- 5 high precision laser micromachining systems with different lasers
- 2 high speed micromilling systems
- Micro-EDM
- Micro-welding system
- Micro/nano-injection moulding system
- Dynamic optical profilometer
- Scanning electron microscope
- 5-axis CNC milling machine
- ABB industrial robot
- Multi-camera motion tracking system
- FARO single-target laser tracker
- FARO laser scene scanner
- HYSCAN 3D laser scanning probe
- Equipment for virtual environment technologies
- Equipment for precision fabrication processes

Research facilities available at Canadian Surgical Technologies and Advanced Robotics (CSTAR):

- 2 Mitsubishi robots
- Zeus MIS system
- 3 Aesop arms
- 2 ultrasound machines
- Haptic input devices
- Electromagnetic and optical tracking systems

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

Biomechanics Group

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

The Biomechanical Testing Laboratory primarily conducts experimental in vitro research related to orthopaedic biomechanics. The current lab focus includes orthopaedic implant fixation and implant design for the upper limb and spine, as well as the assessment of lower limb impact injury. The primary equipment available includes two Instron materials testing machines, one of which is tension-compression and the other which has three actuators (tension-compression, as well as 2 torque axes). Data acquisition is achieved through National Instruments hardware and custom-written LabVIEW software.

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

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

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

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

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

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

The Bioengineering Research Laboratory: (Dr. Graham King and Dr. James Johnson)

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

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

3. RESEARCH SUPPORT

Operating Research Funding by Source and year				
Year	**Granting Councils [2]**	**Other Peer Adjudicated [3]**	**Contracts[4]**	**Others [5]**
2009	1,715,475	651,366	687,173	118,113

[2]NSERC Discovery Grants (this column does include equipment grants and conference grants)
[3]CFI grants, Centres of Excellence Grants (Federal and Provincial), Equipment Grants, Industrial Grants
[4]Industry grants
[5]University allocated grants (Academic Development Fund, UWO Internal Funding)

4. RESEARCH IN THE NEWS

J.M. Floryan – **Robert W. Angus Medal**

The Canadian Society for Mechanical Engineering (CSME) has recently recognized Mechanical & Materials Engineering professor and Department Chair J.M. Floryan with the Robert W. Angus Medal. Floryan received this prestigious award for outstanding contributions to the management and practice of mechanical engineering. Floryan has been honored by EIC with the 2010 Canadian Pacific Railway Engineering Medal for years of leadership and service to the Institute at the regional branch and section levels.

Since joining Western Engineering in 1982, Floryan has served as Associate Dean (Academic) from 1996 – 2001, and Department Chair of Mechanical and Materials Engineering from April 30, 2005 – present.

His life-time contributions to fluid mechanics are at the highest possible rank. He is a well-known expert in his field, receiving worldwide recognition in the form of various awards, fellowships and visiting professorships. These awards have come from three continents and a number of countries, including Europe (France, Germany), North America (USA, Canada) and Asia (Japan).

T.R. Jenkyn – **Secret Curling Broom Olympics Bound**

By Paul Mayne (Western News)
Thursday, January 21, 2010

'Sweeep!' This simple word echoes across curling rinks nation-wide.

And University of Western Ontario professor Tom Jenkyn has discovered there's a lot more to the perfect sweep than anyone had imagined.

For the past two years, Jenkyn has played a part in the Canadian Olympic Committee's Own The Podium Top Secret Fund - a five-year, $8-million sports arms race, so to speak, designed to provide Canadian athletes with an edge in equipment and technique in a variety of sports.

If the curling team makes the podium next month, his work will have played a part in that success.

With backing from the Canadian Curling Association, and the assistance of Olympic-level curling coach Scott Arnold, Jenkyn began research in 2007 into what takes place when curlers sweep in front of a stone on its way down the ice. Sweeping has long been used to fine-tune movement of a stone.

With the use of infrared cameras, he was able to debunk one long-standing myth.

While sweeping will momentarily raise the ice temperature by one or two degrees, it's not enough to convert ice to water.

"No one is melting anything," says Jenkyn, associate professor of Human Biomechanics in the Department of Mechanical and Materials Engineering, with a cross-appointment in the School of Kinesiology.

"No one is getting the ice up to the freezing point. Minus two is the highest you'll ever see the ice temperature get."

So if ice melting is not assisting the rock into the house, what is? That's where the biomechanics angle comes in.

Jenkyn says with a turning rock - as it moves down the ice - one side will be moving faster than average. The slower side moves with respect to the pebbled ice surface, creating greater friction between the two surfaces.

"Therefore the slower side has more grab on the ice and tends to curl the rock toward the slower moving side," says Jenkyn.

"By sweeping, the surface of the ice over which the rock travels is warmed and the friction decreases overall."

Sweeping also tends to reduce the difference in friction between the faster and slower sides of the rock, therefore the rock curls less and runs straighter.

Working closely with Canada's Olympic curling team coaches, Jenkyn says the athletes have been "buying into" the research to improve their game. And Jenkyn has found sweeping technique can make the difference between gold and silver.

"It's all about subtleties," says Jenkyn, noting positioning of the feet, angle of attack, strength and conditioning and even how one holds the broom can change a shot. "There is a lot that can be gained, even at the elite level, by proper positioning of the broom and the body."

This curling query also spawned a connected research project for Jenkyn, who recently received $18,640 from the Western Innovation Fund to examine a novel re-design of the curling broom to significantly improve effectiveness.

In collaboration with Mechanical and Materials Engineering professor Jeff Wood, they have optimized the new design for mass production and will bring this product to the Canadian marketplace for the next curling season.

"It's the kind of broom for the Joe Schmoes in the recreation leagues to help improve their performance," he says.

February 4, 2010 Western News

Secret Curling Broom Research Olympics Bound

A Health Sciences and Engineering professor, Jenkyn was commissioned by the Canadian Olympic Committee (COC) to conduct research for the Own The Podium initiative, studies that were veiled by its five-year, $8-million 'Top Secret' Fund. When Jenkyn was finally allowed to pull back the curtain (after some results were revealed in Maclean's) on his research which dealt primarily with sweeping and ice temperature, the national media descended on Highland Curling Club for the news. Local outlets, Rogers TV, A News, the London Free Press and XFM were joined in London by Global National, CTV National, CBC News: The National and CHCH. National Post and Canadian Press also covered the research.

By KELLY PEDRO, THE LONDON FREE PRESS
7th January 2010

If the Shoe Fits

Tom Jenkyn, an associate professor at the University of Western Ontario, says a lot of the information people get about running shoes and about the type of shoe they require, can't be simply diagnosed by casual observation in a store. (MIKE HENSEN, The London Free Press)

Tom Jenkyn is helping Londoners to put their best foot forward.

The University of Western Ontario researcher is looking at how the joints in our feet move when we walk.

His work is being used by footwear giants, such as Nike, to study their own shoes. Jenkyn also is looking at whether people who wear orthotics can benefit from his research.

"There's a huge industry out there not just for running shoes, but also for orthotics, but there's not a lot of good evidence as to what they do, whether they're effective and how exactly they work," said Jenkyn, an associate professor of biomechanics in the departments of mechanical engineering and kinesiology.

Jenkyn has developed two ways to measure how joints in the foot move using optical motion capture and x-ray images -- called x-ray fluoroscopy -- where he can watch someone walk in a shoe with orthotics and track what the bones in the foot are doing.

"It sounds simple, but it's really quite difficult to do," said Jenkyn, who got a five-year grant from the National Science and Engineering Research Council, for his work.

His research also is challenging a 15-year belief in the running shoe industry that people fit into one of three groups when they walk or run: neutral, meaning their foot works properly; overpronator, meaning their heel moves out when it hits the ground and the arch collapses; or oversupinator, where the foot is too rigid.

"What my research has shown and what similar researchers . . . have shown is that this isn't the case at all -- that there's a huge amount of variability in how the foot moves, not just between people, but between footsteps," he said.

Jenkyn also came across another interesting discovery: wearing shoes breaks down several of the smaller muscles in the foot, making them weaker.

It's the reason why if you've been walking barefoot all day, your feet hurt because your exercising those smaller muscles that aren't used to being exercised, he said.

One way to strengthen those muscles, he said, is by walking barefoot for some of the day or to tie shoelaces a little looser, allowing the foot to move more in the shoe.

"You're now relying on the muscles of the body itself to give you the strength and stability rather than something you're putting on the foot," he said.

"Usually with orthotics, the idea is if the arch is falling you put an arch support in and support it. This idea goes against that. If the arch is falling it's probably because you need to be exercising those muscles and strengthening up the arch."

Jenkyn's research is studying whether there's a way different orthotics can be used to protect parts of the foot while exercising the parts of the foot that are weak so that orthotics won't be needed after six or 12 weeks.

So what should people do before they buy shoes?

Jenkyn suggests taking the shoes home for a few days and testing out how they feel by walking or running in them often.

"It really comes down to that," he said. "If the shoe fits, then you wear it."

X.A. Sun

London Business magazine (January 2009)

Accelerating automotive technology

Dr. Andrew Hrymak, Western's new Dean of Engineering and his faculty will succeed by thinking globally and acting locally. "We have a group of very promising nano-engineers," says Hrymak. "Our scientists are working with General Motors on electric cars that use nanotechnology. If that flies, we are looking at a very big thing."

Nanotechnology is the fabrication and manipulation of matter on a scale of less than 100 nanometers in size. In this environment, the head of a pin looks like a boulder. Nanostructures, such as wires and tubes, are engineered by using chemical vapor depositions on different materials like carbon, lithium, and platinum. To be seen at all, nanostructures need to be viewed under powerful scanning and transmission electron microscopes.

The engineer and professor in charge of the nanotechnology lab and the 19 scientists, Dr. Xueliang Sun, who also goes by Andy Sun, holds the distinguished Canada Research Chair in the development of nanomaterials for the fuel cell applications.

The biggest barrier to the widespread adoption of fuel cell technology is cost. The so-called "noble" catalysts made of platinum in the membrane electrode assembly of a fuel cell are expensive – often representing up to 50% of its price. Sun's challenge is to reduce that cost by a factor of four.

Since 2005, Sun's nanotechnology lab has worked on fuel cells and batteries with General Motors. B.C.-based Ballard Power Systems, and Lithium Phostech Inc. of Quebec. His group is the first in the world to develop and patent a 3D manufacturing structure that fuses nanowires to a stable carbon nanotube and adds platinum particles.

"In any new technology, you get the patent first," says Sun. "With GM, we have applied for four patents and three have been awarded. We have a master agreement over IP (intellectual property) issues.

Work on battery technology is taking aim at reducing recharging times. "You can't wait for three days to recharge your car battery," says Jiajun Wang, the team's lithium-ion battery expert. "But short-term charging creates stability problems." They use nanotechnology to create a coating to enhance stability.

Another nanotechnology battery application comes in the area of improved safety. "There are explosions" Wang says matter—of-factly. "The material is safe in computers, but you need to produce much more thermal power for a car."

B. Tryggvason – **Future of Space Exploration**

by Communications Staff
Friday, April 9, 2010

London, Ontario joins major metropolises like Los Angeles, Stockholm, Tel Aviv, Tokyo in hosting a Yuri's Night event on Monday, April 12 – a celebration of Soviet cosmonaut Yuri Gagarin, the first human to leave the bounds of Earth and enter outer space.

Former Canadian astronaut Bjarni Tryggvason will lead a panel on the future of human space exploration from 3:30 to 5 p.m. at The University of Western Ontario in the Biological & Geological Sciences Building, Room BGS 0153. Later that evening, the Hume Cronyn Memorial Observatory is open for stargazing from 8 to 10 p.m.

Tryggvason, now an Adjunct Research Professor in Western's Department of Mechanical and Materials Engineering, served as a Payload Specialist on STS-85 in 1997 – a 12-day Space Shuttle Discovery mission to study changes in the Earth's atmosphere.

For more on the event or Western's Centre for Planetary Science and Exploration (CPSX), please visit http://planetsci.uwo.ca/PS%20Seminar/YurisNight.html

CPSX, sponsor of Yuri's Night in London, represents the largest concentration of planetary scientists in Canada and has made Western the epicentre for planetary science and exploration in the country – particularly for graduate students.

About Yuri's Night

Human spaceflight became a reality 49 years ago with the launch of a bell-shaped capsule Vostok 1. The capsule was carrying Soviet cosmonaut Yuri Gagarin, who took his place in history as the first human to leave the bounds of Earth and enter outer space.

Twenty years later, the United States embarked on a new era in spaceflight with the launch of a new type of spaceship – the Space Shuttle. Designed to carry a larger crew and large volumes of cargo to orbit, the Space Shuttle became synonymous with human spaceflight for an entirely new generation.

In 2001, the "space generation" reached a new space milestone by connecting thousands of people around the world to celebrate and honour the past, while building a stairway to the future. This event was Yuri's Night and it continues to bring the excitement, passion, and promise of space travel closer to people of all ages, nationalities, and backgrounds. The celebration has grown from 64 events in its first year and in 2010 will include more than 216 individual events in 47 countries around the world.

J.T. Wood – **Advances in Magnesium Die Casting Process**

Some relationships were meant to last. Since 2001, the collaboration between Meridian Lightweight Technologies Inc. and an AUTO21 research team has lasted through three AUTO21 projects and is still going strong. *Magnesium Casting* was one of AUTO21's originally funded projects when the Network began in 2001.

Led by Dr. Jeff Wood, an associate professor of Mechanical and Materials Engineering at the University of Western Ontario**,** the project explored how to enhance magnesium die casting processes.

As the project's main industry partner, Meridian Lightweight Technologies provided guidance to the project's development plus cash and in-kind support. Pleased with the results of

the initial project that concluded in 2004, Meridian continued to provide support to subsequent projects, *Magnesium Casting II* (2004-2008) and *Magnesium Casting III*, funded in 2008 for a two-year period.

Magnesium offers many advantages over other automotive metals – it's the lightest of all structural materials and is 75 per cent lighter than traditional steels. As well, it offers high

impact resistance, a high strength-to-weight ratio and can be cast to net shape. It can also offer faster production cycle times as it requires less processing than steel components.

Currently, magnesium is used in several automotive components including instrument panel beams, rear sub frames, front end structures and seating. The metal is so promising

that Canada, China and the U.S. are collaborating on a joint research initiative called the Magnesium Front-End Research and Development (MFERD) project.

With seven manufacturing facilities worldwide and a global technology centre located in Strathroy, Ontario, Meridian is a leading full service supplier of magnesium die cast components and assemblies. The Global Technology Centre provides in-house testing but as John Jekl, product development engineer at the Centre notes, the focus is on development and not necessarily on research. To better meet their customers' needs, Meridian decided to partner with academic researchers to help fill the gap.

Jekl explained that the initial AUTO21 project resulted from a need for Meridian to better understand the mechanical properties of its magnesium cast components. In consultation

with Dr. Wood, *Magnesium Casting I* focused on developing a mechanical property map of the component that would allow Meridian to understand why properties changed across

the part. A key challenge to magnesium casting is that the mechanical properties of large, high-pressure die casts can vary from one location to another. Using numerical simulation

could help predict where critical casting defects might occur and how to move these spots to areas within the casting that don't compromise the part's integrity. It could also be possible to design the mould to keep the critical areas stronger and optimized before tooling begins, which would save time and money.

Based on the firm foundation developed in *Magnesium Casting I*, the second project yielded important information on testing magnesium cast prototypes. A traditional test to evaluate a cast component consists of cutting a smaller section (a coupon) from the cast and using the coupon to evaluate the component's integrity. "Due to the microstructure that results from the die casting process, coupons cut from a casting are not an accurate way to evaluate the component itself," says Dr. Wood. "The effects of small pores particularly in magnesium-based castings, can be exaggerated in coupon tests when in reality, they would make little difference to the behaviour of the component."

Meridian has been able to incorporate the findings of the projects into customer presentations and marketing materials that highlight the company's understanding of magnesium's mechanical properties. Jekl expects useable results from *Magnesium Casting III*, which began in April 2008.

"We have been impressed with how Dr. Wood has linked the findings of the projects together and demonstrated how the new knowledge can be beneficial," says Jekl. "I'm confident

that the ultimate goal of the research will be possible to achieve by the end of this project."

Meridian has had a long-standing relationship with the University of Western Ontario prior to its involvement with AUTO21. The evolution of the AUTO21 project has been a positive experience for Meridian. "This has been an excellent partnership," says Jekl. "We would definitely be willing to do another project through the program."

Advanced Manufacturing Park to House International Composites Research Centre

By Heather Travis
Wednesday, March 3, 2010

Within weeks The University of Western Ontario expects to break ground at the Advanced Manufacturing Park to house a multi-million dollar project funded through a partnership with federal and provincial governments.

Ted Hewitt, Vice-President (Research & International Relations), did not reveal details of the new project that will take shape in the new research park, located on 25 acres, plus 3.2 joint access acres, assigned to the university in an innovative joint venture with the City of London and Fanshawe College.

An announcement is expected shortly, he said.

"It's big, it's unique, it's the first and only on the planet and it's going to be great news for London," he said, following a meeting Wednesday of London Board of Control to review the agreement with London and Fanshawe.

A recommendation will be made at the city council meeting on March 8 that a Joint Venture Agreement and transfer of land be made to Western and Fanshawe for developing the park.

Western will build in Phase IV of the research park, located on Veterans Memorial Parkway, north of Highway 401 near Bradley Avenue. The objective is to attract research and manufacturing uses which utilize advanced manufacturing technologies and products.

Controllers heard that Western is also pursuing a second project for the new research park.

Hewitt hopes to secure funding for a partnership with the Fraunhofer Institute of Chemical Technology in Germany to establish The International Composites Research Centre and to bring a large-scale press for testing and manufacturing lightweight composite parts for the auto sector and other London industries.

The facility would be unique in Canada and will make London the leading site for advanced composite materials research and testing at a manufacturing scale for several industrial sectors in North America. These sectors include transportation, renewable energy, construction, and others.

These two projects are expected to take up about 10 acres, and the remainder will be available for other research and development opportunities.

"We are as excited as you are," says London Mayor Anne Marie DeCicco-Best.

The board indicated it was committed to moving ahead as soon as possible on development of the research park.

Western's role in the joint venture agreement will be recruiting research and development projects to the area and locating them onsite at the research park, "particularly projects that will mesh well with industry," says Hewitt.

This is Western's third research park, with a location in Sarnia that has a bio-industrial focus and a research park adjacent to the main campus focusing on research and development in areas such as biotechnologies and information technology.

The new research park presents opportunities for the Faculty of Engineering to work with industry partners and enables innovative and unique facilities to be built at the site to attract such industries.

"It's such a great opportunity for London and for Western," says Hewitt.

Western and Fanshawe will prepare a master plan for development of their land, which will form the basis of a site plan over the entire area. As part of the agreement, the research park cannot be used for conventional post-secondary academic program delivery.

Development of the Advanced Manufacturing Park must be completed within 15 years. The land will be transferred to Western for $1.

International Composites Research Centre (ICRC)

The world-renowned Fraunhofer Institute of Chemical Technology is looking to land in London, with The University of Western Ontario signing a memorandum of understanding that would see the development of a joint project - the International Composites Research Centre (ICRC).

"This Centre would be unique in Canada and could make London and our region the leading site for advanced composite materials research and manufacturing-scale testing," says Western President Amit Chakma. "The international reputation of the Fraunhofer Institute would be a great draw and this facility would be utilized by companies in several industrial sectors including the auto sector, the air and space industry, renewable energy, and construction."

Fraunhofer-Gesellschaft is the largest organization for applied research in Europe with more than 80 research units, including 62 Fraunhofer Institutes at different locations in Germany as well as research centers and offices in Europe, the U.S., Asia and the Middle East.

It has 17,000 staff (mostly qualified scientists and engineers) and has an annual research budget of over $2 billion. Two thirds of the research revenue is derived from contracts with industry and from publicly financed research projects.

The International Composites Research Centre would be located at the new Advanced Manufacturing Park in London. It would focus on the development of light-weight materials to be used by auto parts manufacturers and others in industry that produce structural components from composite material that can significantly decrease product weight.

"We have already begun discussions and planning that will see us engage other partners from industry, including automotive manufacturers in North America and their Tier 1 suppliers, other universities and national labs in Canada, the U.S. and around the world," says Western's Vice-President (Research & International Relations) Ted Hewitt.

"Western is an ideal partner for the Fraunhofer-ICT," says Frank Henning, Deputy Director of the Fraunhofer-ICT. "Western has moved with speed to create with us a neutral, university-based platform for applied research. Through the ICRC, North American industry will be able to develop, test, and validate the most advanced materials and processes that will be part of the next generation of competitive, light-weight automobiles, airplanes, construction materials, and so on. We are delighted to partner with The University of Western Ontario."

Dieffenbacher, a leading supplier of industrial press equipment, is a regular equipment partner with Fraunhofer and Hewitt says it will be advantageous for Fraunhofer and Western to team up with Dieffenbacher to investigate advanced manufacturing processes.

Hewitt also believes that the ICRC is the perfect kind of facility for the Advanced Manufacturing Park.

“It will act as a magnet for industrial product development and from Western’s perspective, this expertise will also provide first-class opportunities for basic and applied research, and the training of the next generation of world-class engineers, technicians, and scholars,” he says.

Paul Kurowski – **R. Mohan Mathur Award for Excellence in Teaching**

Mechanical & Materials Engineering Professor Paul Kurowski has been selected as the 2009 recipient of the R. Mohan Mathur Award for Excellence in Teaching for his efforts as Course Coordinator for ES 1050 – Introductory Design and Innovation Studio. “Paul’s involvement in streamlining the design curriculum in the Faculty of Engineering has equipped our students with design skills that are high demand in industry,” says Western Engineering Dean Andrew Hrymak.

Professor Kurowski has also been a significant member of undergraduate and graduate education in Western Engineering, acting as an advisor and mentor for fourth-year students and graduate students in the field of Design and Design Simulation using CAD and FEA. He also just completed teaching a new graduate course for the ADMI MEng program - Advanced Finite Element Analysis.

Professor Kurowski’s research has been focused on teaching methods that concurrently introduce theory and practical implementations providing students with skills readily applicable to the needs of industry. He was the recipient of the 2005 Society of Automotive Engineers, Teaching Excellence Award and the Western Engineering UGS Teaching Excellence Award in 2007.

“His on-going commitment to innovative teaching and the advancement of the undergraduate curriculum at Western Engineering make him a very deserving recipient of the R. Mohan Mathur Award for Excellence in Teaching,” explains Dean Hrymak.

The R. Mohan Mathur Award for Excellence in Teaching is presented annually to an outstanding Western Engineering faculty member to recognize his or her exceptional contributions to University teaching and the promotion of academic excellence amongst our students.

Conferences

Computational Fluid Dynamics Society of Canada

The CFD Society of Canada is pleased to announce that its 18th Annual Conference will be held in London, Ontario, Canada, from Monday May 17, 2010 until Wednesday May 19, 2010. The conference will be located at the University of Western Ontario with accommodation available either on campus in summer residences or at the beautiful and nearby Windermere Manor. The conference will span two full days (May 18-19) and will feature two keynote speakers. The conference will also feature a student paper competition and banquet. The banquet will be held on Tuesday, May 18, 2010, the evening of the first full day of sessions.

The goal of the CFD Society of Canada is to promote computational Fluid dynamics and to provide a framework for communication and collaboration between researchers, developers and practitioners, in industry, government and academia. The annual conferences draw together researchers in CFD to highlight recent advances and challenges encountered in a broad spectrum of application areas and to facilitate scientific and technical exchange. Paper submissions are encouraged in all topics of current interest in the field of CFD. Topics of interest include but are not limited to: compressible, incompressible, multi-phase, and free surface flows; reacting flows and combustion; flows in porous media; environmental and biological flows; turbulence and turbulence modelling; aero-elasticity and aero-acoustics; CFD-dominated multi-disciplinary analysis and optimization; algorithm development; mesh generation and adaptation; error estimation and control; and parallel algorithms.

Organizers

Prof. A. G. Straatman, Ph.D., P.Eng.
Associate Professor and Associate Chair Graduate
Department of Mechanical & Materials Engineering
The University of Western Ontario
London, Ontario, Canada N6A 5B9

Prof. K. Siddiqui, Ph.D., P.Eng.
Associate Professor
Department of Mechanical & Materials Engineering
The University of Western Ontario
London, Ontario, Canada N6A 5B9

5. RESEARCH COLLABORATION WITH EXTERNAL PARTNERS

S. Asokanthan

Center for Integrated RF Engineering, University of Waterloo
London Health Research Institute

Professor Asokanthan has been collaborating with Professor Wedig from the Institute of Technical Mechanics Karlsruhe, Germany and Emeritus Professor Ariaratnam from the Solid Mechanics Division, University of Waterloo on the investigation of stochastic Dynamic behaviour of a variable inertia system. In practice, such flexible rotating mechanical systems are commonly employed for Mechanical, Aerospace and Automotive applications, and the outcomes of this research have been instrumental in the prediction of dangerous critical speed ranges which were not known to exist earlier.

Professor Asokanthan has also been working With Professor Mansour form the Center for Integrated RF Engineering, University of Waterloo in the area of MEMS-based switching systems. In particular, a gold-based six mask micromachining process known as the UW-MEMS process has been used in the effective fabrication of a MEMS-based switch. This switch was used in the experimental investigation of the dynamic bouncing behaviour of this class of switches for the purpose of validating mathematical models proposed by Professor Asokanthan's research group. Professor Asokanthan plays an active role in establishing funds for the on-going enhancement of the facilities that are provided via the UW-MEMS process.

Professor Asokanthan also worked with Professor Thompson from the London Health Research Institute, St. Joseph Health Care to examine the dynamic effects of the MRI units on the building structure while the machines are in operation. Ultimately, the results from this analysis were used to determine if the MRI induced structural vibration would cause any adverse effects on the reproductive cycles of the mice population housed in adjacent two laboratories.

J. Dryden

Virginia Tech, Blacksburg, Virginia

Dr. Dryden's research involves analysis of the elastic field and properties of Functionally Graded Materials. Functionally graded materials are inhomogenous materials in which the material properties are varied continuously from point to point. This is achieved by varying the volume fraction of the constituents, i.e. ceramic and metal in a predetermined manner. The ceramic constituent of the material provides the high temperature resistance due to its low thermal conductivity. The ductile metal constituent, on the other hand, prevents fracture caused by stressed due to high temperature gradient in a very short period of time.

C. Dunning

General Dynamics Land Systems (Canada)

Currently, there are insufficient data that characterizes lower limb damage as a result of high impact, high acceleration scenarios, such as those sustained during high speed crashes, airplane ejections, or as a result of anti-tank mines. These types of injury limits have been defined for the spine, but an improved understanding of shank (i.e. lower leg) fracture mechanics is needed. This has been the focus of my GDLS-C funded research (2005-2009), which has the overall objective of quantifying the impact loads the tibia (i.e. lower leg bone) may encounter without sustaining a lifestyle-changing injury (i.e. severe lower leg damage, possibly leading to amputation). More specifically, we are attempting (1) to determine acceptable loading thresholds for which a human tibia can reasonably withstand, (2) to develop a validated Finite Element model of the tibia to replicate human response, and (3) to calibrate the response of a suitable biofidelic (i.e. anthropometric test dummy, ATD) leg such that is more representative of the human response during high impact loading. GDLS-C is specifically interested in these data to use as design limits for improvements to their vehicles, such that they may provide increased safety for on-board soldiers during a mine blast event. However, these data are being placed in the public domain (through relevant journal publications and presentations) so that they may be used by others for a variety of applications.

J.M. Floryan

Stuttgart University, Germany
Tokyo Metropolitan University, Japan
Warsaw Technical University, Poland

Professor Floryan has been collaborating with profs. Asai and Inasawa from the Tokyo Metropolitan University, Japan, prof.Rist from the Stuttgart University, Germany and prof.Szumbarski from the Warsaw Technical University, Poland, on the development of novel strategies for flow management and prediction and control of the laminar-turbulent transition process.

R. Gurka (Visiting Professor) **Ben-Gurion University, Beer-Sheva, Israel**

Dr. Roi Gurka's research at UWO focuses on the aerodynamic performance of migratory birds. This is part of a joint collaboration between biology, psychology and engineering departments, named 'AFAR'. Using advanced imaging techniques in a specially designed wind tunnel; we investigate the flow, estimate the forces (e.g., drag and lift), and explore the impact of turbulence on live birds performances. The current projects are: i) unsteady aerodynamics of European starling, ii) characterization of the turbulent boundary layer over the wings and tail of white-throated sparrows, iii) the role of preen-oil as a means of drag reduction, iv) unique flight modes of osprey, such as intermittent gliding.

In addition, Dr. Gurka collaborates with other investigators from UWO on the following topics: fluid-structure interaction of elongated bodies where we characterize the flow dynamics around these bodies while they experience dynamical motion such as flutter and vortex induced vibration. This work is motivated to improve bridge design, etc. On a different topic, we scalar transport in turbulent flows is being investigated experimentally and theoretically in order to better understand the dispersion phenomena in the atmosphere. This work will shed light on the transport mechanism in cases of pollution, oil spill, etc.

T. Jenkyn

Own The Podium 2010 and the Canadian Curling Association

From 2007 until Feb. 2010 Professor Jenkyn was funded by the Own the Podium Top Secret Program, with sponsorship from the Canadian Curling Association. He examined the physics and biomechanics of the sweeping motion in the sport of curling. This research culminated in a patented design for a new broom head. Prototypes of this broom were used by our men's and women's Olympic Curling Teams at the Vancouver Games in February 2010, culminating in a gold and a silver medal. The broom heads have also been used by the Canadian Senior Women's Team who won the gold medal at the World Senior Curling Championships this past April in Russia. This research continues with the CCA as the sole sponsor and we are looking forward to the next Winter Games in Russia in 2014. The new broom head was patented in collaboration with Prof. Jeff Wood of MME and Mr. Scott Arnold, a national team curling coach. We have recently licensed our patent to a Canadian manufacturer and the new brooms are commercially available this curling season.

Nike, Saucony, New Balance
Sole Science Pedorthics, London, Ontario
Barefoot Science Inc., Mississauga, Ontario

Running shoe and orthotics research

Since 2006, Professor Jenkyn has been working with several running shoe manufacturers looking at the biomechanics of the foot and ankle during walking and running. The companies involved are Nike, Saucony and New Balance. Additionally, he is investigating the biomechanics of orthotics for the treatment of foot and ankle disorders with NSERC funding. Two orthotic companies are collaborating, Sole Science Pedorthics of London, ON and Barefoot Science Inc of Mississauga, ON. These companies are supplying orthotics and labour as in-kind contributions and will benefit from the research in the form of new orthotic designs.

Fowler Kennedy Sports Medicine Clinic
Arthrex Inc. Florida, USA

<u>Knee osteoarthritis and surgery</u>

For the past 8 years Professor Jenkyn has been working with the researchers and physicians at the Fowler Kennedy Sport Medicine Clinic investigating the biomechanics of knee osteoarthritis. Specifically we have been studying a particular surgical intervention called the high tibial osteotomy (HTO). This research is sponsored by CIHR and by Arthrex, Inc, FL, USA, which is a manufacturer of surgical equipment and medical implants.

R. Khayat

Université de Nice and the Centre de Mise en Forme des Materiaux, France
Centre National de Recherche Scientifique, Le Havre, France

Ongoing collaborative efforts are conducted between two French institutions and Dr. Roger Khayat's group in fluid dynamics at UWO. The first French group is located in the Nice region (Univerrsité de Nice and the Centre de Mise en Forme des Materiaux), where experiments are carried out to examine the instability of flowing liquid curtains of ordinary and polymeric liquids. The theory is developed at UWO and compared with experiment. Two other joint studies are also conducted, one on the flow of two-layered films, and the other on the lubrication of polymeric liquids. The second French group is located at the Centre National de Recherche Scientifique in Le Havre (Normandie). The group conducts experiments on the thermal convection of complex fluids such as polymeric liquids and nanofluids. These latter fluids consist of ordinary liquids with a small fraction of mtal or metal oxide particles, which enhance significantly the heat transfer of the base liquid. Again, the theory is developed at UWO and validated against experiment.

R. Klassen

Transform Automotive Ltd.
Ontario Power Generation
Atomic Energy of Canada Ltd.
MDS-Prad Technologies Corp.

Professor Robert J. Klassen's research is directed toward assessing, both experimentally and analytically, the extent of local plastic deformation in metallic components. Over the past year Prof. Klassen has worked with TransForm Automotive Ltd, an US/Canada based automotive parts manufacturer, to investigate the role of fabrication parameters in the complex metal flow forming process that they use to manufacture automotive components at their plant located in London Ontario. Professor Klassen worked with Ontario Power Generation and with the Atomic Energy of Canada Ltd to study the effect of localized creep deformation in preventing stress concentrations, and hence premature failure, in internally scratched zirconium alloy pressure tubes used in CANDU nuclear reactors. Professor Klassen has also worked with MDS-Prad Technologies Corp. (Montreal) to assess the effect of temperature on the hardness of ceramic coatings on nickel-based superalloy components used in gas turbine engines.

George K. Knopf

National Research Council - Industrial Materials Institute
National Research Council - Institute for Research in Construction

1. Laser micromachining and rapid fabrication of polymer micro-devices

Laser micromachining is a complex nonlinear process with numerous stochastic parameters related to the laser apparatus and the material specimen. Early collaborative research between UWO and NRC-IMI involved the development of nonlinear models to predict the level of pulse energy needed to create a dent with specific depth and diameter. More recent research has focused on reducing surface roughness through laser polishing. Laser micromachining has also been used to rapidly construct mould masters for fabricating large volumes of disposable polymeric micro-devices. One innovation involves using laser machined mould masters for hot-embossing microfluidic devices with features and structures that have near optical quality surface finishes. In addition, on-going research involves the design and microfabrication of planar and curved polymer edge-light and backlight illumination systems for automotive applications. Specifically, the collaborative work involves exploring how uniform illumination can be achieved by modifying the shape and distribution of microelements across the curved transparent waveguide.

Collaborator: National Research Council of Canada – Industrial Materials Institute (NRC-IMI)

Collaborating Researchers: Drs. Suwas Nikumb and Evgueni Bordatchev (NRC-IMI, London)

2. Range sensing and geometric modeling for virtual reality environments

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

Collaborator: National Research Council of Canada – Institute for Research in Construction (NRC-IRC)

Collaborating Researchers: Dr. Roberto Canas (NRC-IRC, London)

P. Kurowski

Cargill Meats Canada

"Fryer: Sanitation Water Recovery and Storage Project."
Every evening the Sanitation Department fills the inline production fryers with approximately 1500 gallons of water, each and adds cleaning chemicals. Then the fryer circulation pumps and filter systems are started to heat the water and chemical to a boil. This process takes two to three hours. Once the stakeholders have completed the boil out of the fryers, they open the bottom valves of the fryer piping and dump the hot water with the chemical solution to drain. Sanitation then rinses the fryers to remove any residual cleaning solution and dumps this water directly to drain.

Nazar Associates/World Health Organization
"Quality Control and Specifications for the TCu380A Intrauterine Contraceptive Device"

Global birth-control programs intensively use intrauterine contraceptive devices (IUDs), based mainly on the TCu380A, an IUD specification designed more than 25 years ago. World Health Organization is presently coordinating a revision of the manufacturing and purchasing standards. Nazar Associates Inc of Toronto has assisted with plastics technical issues.

Eric Savory

CEATI International
Central Michigan University
Ecole Centrale de Nantes, France
Manitoba Hydro
Pratt and Whitney Canada
Purdue University
University of Toronto
University of Saskatchewan
University of Toronto

Within Canada, Eric Savory has ongoing research collaborations with Pratt and Whitney Canada, concerning the aerodynamics of jet engine compressor stages, and with Manitoba Hydro and CEATI International, to examine the effects of thunderstorm outflow winds on transmission line systems. He is collaborating with the University of Calgary and University of Saskatchewan on a project examining the flows around surface mounted bluff obstacles, and with the University of Toronto to develop sensor technologies for detecting the onset and growth rates of hidden mould in buildings. Internationally, Dr Savory works with the Ecole Centrale de Nantes (France), studying the role of large-scale turbulence in the wind flow over urban areas in the dispersion of pollutants from street canyons. He is also collaborating with Central Michigan University, concerning numerical modeling of the structure of thunderstorm downburst winds and with Purdue University on quantifying how the wind flow over roof-mounted photovoltaic energy systems cools the panels and so enhances their electrical conversion efficiency

K. Siddiqui

Masco Canada
National Research Council of Canada
Trojan Technologies

Work in collaboration with National Research Council (K. Siddiqui): We are working in collaboration with the Gas Turbine Laboratory at the National Research Council, Ottawa to develop effervescent atomization fuel injector for enhanced gas turbine performance. The effervescent atomization technique has the potential to provide the best spray quality for gas turbine combustion, which will result in improved combustion efficiency and reduced pollutant emissions. The work involves the detailed characterization of the bubble dynamics within the injector and the spray behavior at the exit. In addition to gas turbine fuel injector, the effervescent atomization technique also has wide range of applications in waste-water treatment, chemical plants, food processing and bio- and nuclear reactors.

Work in collaboration with Masco Canada (A.G. Straatman and K. Siddiqui): This work was in collaboration with Masco Canada who manufactures and market plumbing products. In this collaborative work, we developed a novel secondary bleed valve that would convert the single-quantity flush valve into a dual-quantity flush valve. This secondary bleed valve provides a means for selecting the flush quantity based on the direction of actuation of the flush handle. The innovative aspects of this bleed valve are design simplicity, durability and reliability. This new flush system has passed all necessary certifications and currently in the marketing phase. A patent application has already been filed for this product.

Work in collaboration with Trojan Technologies (K. Siddiqui): Trojan Technologies are world leaders in developing UV disinfecting systems. This collaborative work is focused on the hydrodynamic testing of a scaled reactor design.

A.G. Straatman

KMW Energy Inc
Masco Canada (see K. Siddiqui)

A project was undertaken to explore the residency time of exhaust particles in a large stack past the burning section of an energy-from-waste power plant. KMW needed to modify the design of the stack section to yield a specific minimum residency time before passing the exhaust through the heat exchangers. The minimum residency time was required to ensure that the undesirable constituents of the exhaust were fully combusted before entry into the heat exchangers. The study provided details on the flow of the exhaust gas and a parametric study on the stack arrangements that could be used to achieve the minimum residency time.

Andy X. Sun

General Motors of Canada (Fuel Cell and Li Ion Batteries for Electric Vehicles): Since 2005, we have been collaborating with GM scientists to develop one-dimensional nanomaterials in fuel cell applications. Our ideas are to integrate metal oxide nanowires as Pt-based catalyst supports for fuel cell electrodes to reduce cost and improve durability of fuel cells. Recently, we are also working on Sn-based anodes in Li Ion Batteries for Electric Vehicles (EV).

Ballard Power Systems (Fuel cell studies): We are developing nitrogen-doped carbon nanotubes as Pt catalyst support for PEM fuel cells to significantly improve mass transport and utilization of expensive Pt electrocatalyst and reduce fuel cell cost.

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

Lithium Phostech Inc.(Li Ion Batteries for Electric Vehicles): Lithium-ion battery (LIB) is one of the most promising power systems for Electric Vehicles. In collaboration with scientists in Phostech, we are focusing on understanding and synthesis of LiFePO4/carbon composites as cathodes for LIB.

SpringPower International, Ontario (Li Ion Batteries for Electric Vehicles): We are concentrating on Si-based nanostructures as anodes for Li Ion Batteries. Silicon has the highest specific capacity, 4200 mAh/g, compared with commercial graphite, 372 mAh/g. However, the problem of silicon anodes is its huge volume change in Li insertion and desertion. The way to overcome the problem is to utilize NANOsilicon such as nanotubes, nanowires and mesoporous silicon.

O.R. Tutunea-Fatan

National Research Council of Canada
Hand and Upper Limb Centre, St. Joseph's Hospital, London, Ontario

In collaboration with the National Research Council of Canada Professor **R. Tutunea-Fatan** and his group are working in collaboration with researchers from the Centre for Automotive Materials and Manufacturing at the NRC's Institute for Industrial Materials located in London to develop optimized computer numerically-controlled (CNC) micromachining strategies for porous titanium foams characterized by superior biocompatibility properties, which makes them extremely suitable for biomedical applications. A second research stream aims to investigate multi-axis CNC laser polishing operations, in an attempt to determine correlations between process parameters and quality of the surface produced, typically characterized by an average roughness in the nanometer domain.

On another project in collaboration with The National Research Council of Canada **R. Tutunea-Fatan and J.A. Johnson** are working in collaboration with surgeons and researchers from the Hand and Upper Limb Centre from St. Joseph Hospital in London to develop computer assisted techniques capable to optimize the insertion trajectory of the implant within the medullary canal of the targeted bone. This work will translate into preoperative computer assisted software to be used for surgical simulation and training, as well as implant shape optimization purposes.

J.T. Wood

The Canada Centre for Mineral & Energy Technology – Materials Technology Laboratory
Meridian Lightweight Technologies
Transform Automotive

Work in collaboration with Meridian Lightweight Technologies (J.T. Wood):

"Magnesium Casting Processes"

Magnesium alloys (low density, high specific strength) are gaining prominence as a structural material in the automotive industry. High-pressure die-casting is the most common way to produce magnesium components; however, the castings are prone to unavoidable microstructural defects, compensation for which results in the design of larger, hearvier and more costly parts. Our research uses a variety of engineering disciplines to predict the local variations in mechanical properties. Successful project completion will enable realistic prediction of actual local microstructure and mechanical properties, and permit the optimization of section thickness for mass and cost reduction.

Work in collaboration with CANMET-MTL (The Canada Centre for Mineral and Energy Technology - Materials Technology Laboratory) (J.T. Wood):

"Magnesium Front End Research Development"

Magnesium castings have traditionally been produced using the conventional high pressure die-casting process (HPDC); however, this process is not typically used for parts that require high structural integrity. As part of the Magnesium Front End project, a high vacuum die casting process (SVDC) was developed, which can be used to produce high integrity magnesium castings intended for structural applications. Current research involves investigation into the factors that need to be optimized before the process can be used consistently for production of a large number of magnesium parts.

Work in collaboration with Transform Automotive (R.J. Klassen and J.T. Wood):

We are working to determine the local stress and strain in the tooling and workpiece during splined mandrel flowforming.

J. Yang

Dept. of Food Science, University of Guelph
Department of Materials Science & Engineering, McMaster University
LANXESS
Rosstech Signals Incorporation, Orillia
Trojan Technologies, London, Ontario

Since late 2007, Dr. Leo Lau (Surface Science Western, Departments of Chemistry and Physics and Astronomy), Dr. Jun Yang (Department of Mechanical and Materials Engineering) and Dr. Beth Gillies (Departments of Chemistry and Chemical and Biochemical Engineering) have collaborated 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 high-value-added polymer surface and devices. Since late 2009, 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 joined this research team to develop conductive polymers and self-cleaning polymer products. These projects have been funded by ORF, OCE, LANXESS and NSERC.

Since November 2008, Dr. Jun Yang and Dr. Leo Lau have collaborated with researchers of Rosstech Signals Incorporation, Orillia, Ontario to develop photocatalytic air filters that can remove VOCs (volatile organic compounds) and other poisonous gases under visible light radiation. This project has been partially supported by NRC-IRAP (Industrial Research Assistance Program).

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

C. Zhang

Biorem Technologies, Guelph, Ontario
Pratt and Whitney Canada

Research project with Biorem Technologies Inc. in Guelph, Ontario

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

Research project with Pratt and Whitney Canada in Mississauga, Ontario

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

PUBLICATIONS

1. REFEREED JOURNAL ARTICLES

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13. "Over-Constrained Formulation of the Immersed Boundary Condition Method" by S.Z. Hussain, J.Szumbarski and **J.M. Floryan**, *Computer Methods in Applied Mechanics and Engineering*, v.199, 94-112, 2009.

14. **TR Jenkyn**, R Shultz, JR Giffin, TB Birmingham. 2009. "A comparison of subtalar joint motion during anticipated medial cutting turns and level walking using a multi-segment foot model." *Gait and Posture*. In press

15. D Bechard. AE Kedgley, V Nolte, **TR Jenkyn**. "Total kinetic energy production of body segments is different between racing and training paces in elite Olympic rowers." *Sport Biomechanics*. In press, 2009

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2. REFEREED CONFERENCE PROCEEDINGS

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5. Mohammadi M., **Dryden J.R**., "Influence of Nonconstant Poisson's Ratio on the Stresses in a FG Pipe", Cancam Conference, May 31, Halifax, 2009.

6. Quenneville CE, Fraser GS, **Dunning CE**: Injury Tolerance Criteria for Short Duration Axial Loading of the Tibia, Annual Meeting of the American Society of Biomechanics, University Park, PA, August 26-29, 2009. (abstract 1040) (poster)

7. Quenneville CE, Fraser GS, **Dunning CE**: Evaluation of Synthetic Composite Tibias for Fracture Testing, Annual Meeting of the American Society of Biomechanics, University Park, PA, August 26-29, 2009. (abstract 1035) (podium)

8. Quenneville CE and **Dunning CE**: Development of a Finite Element Model of the Tibia for Short-Duration High-Force Axial Impact Loading, 18th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, New Orleans, Louisiana, March 5, 2010. *(podium and poster)*

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18. "Flow in a Channel with Grooved Walls" by A. Mohammadi and **J.M. Floryan**, Proceedings of the Proceedings of the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada.

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33. Giles J.W., Glennie A., Ferreira L.M., Athwal G., Faber K.J., **Johnson J.A**. Interface distraction and loosening of the polyethylene glenoid implant for various joint loading modalities: implications for failure in total shoulder arthroplasty. *44th Annual Meeting of the Canadian Orthopaedic Research Society*, Edmonton, June,2010.

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43. Lalone E.A., McDonald C.P., Ferreira L.M., King G.J.W., **Johnson J.A**. Visualization of 3D elbow kinematics using reconstructed surfaces. *56th Annual Meeting of the Orthopaedic Research Society*, New Orleans, March, 2010.

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63. **R.J. Klassen**, Y. Liu; "The Role of Grain Boundaries in the Creep of Sub-micrometer Thick Cu and Cu/Si_3N_4 Microbeams at 300K", Failure of Small-Scale Structures: Deformation and Failure Symposium TMS (The Minerals, Metals, and Materials Society) Annual Meeting, Seattle, WA, USA, February 2010

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74. M. Heydari Araghi and **S. Salisbury**, "A Feedback-based Dynamic Instrument for Measuring Mechanical Properties of Soft Tissues for Minimally-Invasive Surgery," *Proc. Canada-US CanSmart Workshop on Smart Materials and Structures*, Montreal, QC, Oct. 2009.

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76. Vermeire B C, Orf L G & **Savory E** "A parametric study of thunderstorm downburst lines", Proc 5th Int Symp on Computational Wind Engineering (CWE2010), Chapel Hill, North Carolina, USA May 2010.

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79. Shaikh, N., and **Siddiqui, K**., "Influence of airflow separation on the turbulent flow structure over wind-generated water waves" *ASME Fluids Engineering Division Summer Conference*, Vail, Colorado, August 3-6, 2009.

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83. Sookdeo, S., and **Siddiqui, K**., "PIV technique implementation for velocity measurements inside flat-plate collector tube" *4th Canadian Solar Building Conference*, Toronto, June 25-27, 2009.

84. Babaei, H., and **Siddiqui, K.,** "Theoretical Study on Thermoacoustic Couples" *Canadian Congress of Applied Mechanics*, Halifax, June 1-4, 2009.

85. Wang, M., and **Siddiqui, K**., "The Impact of Aperture Size on the Thermal Performance of a Parabolic-Dish Concentrated Solar Energy System" *Canadian Congress of Applied Mechanics*, Halifax, June 1-4, 2009.

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87. Shaikh, N., and **Siddiqui, K.,** "An experimental Investigation of the Reynolds stress distribution over wind generated water waves" *Canadian Congress of Applied Mechanics*, Halifax, June 1-4, 2009.

88. Nabavi, M., **Siddiqui, K**., Ng, H. D. "Simulation of the Temperature Distribution in a Directly-Irradiated Solar Chemical Reactor" *Canadian Congress of Applied Mechanics*, Halifax, June 1-4, 2009.

89. **A.V. Singh**, S. Arghavan, 2009, On vibrations of single- and multi-walled carbon nanotubes, 7th International Symposium on Vibrations of Continuous Systems, Zakopane, Poland, July 19 – 25, 2009.

90. Farrokhnejad, M**., Straatman, A. G.,** Wood, J. T., "A CFD Study of Convective Cooling of a Cylinder using a Perforated Helical Coil," *The 18th Annual Conference of the CFD Society of Canada*, London, Canada, May 2010.

91. DeGroot, C. T**., Straatman, A. G.,** "A finite-volume model for flow in conjugate fluid-porous domains with moving grids," *The 18th Conference of the CFD Society of Canada*, London, Canada, May 2010.

92. Farrokhnejad, M., **Straatman, A. G.,** Wood, J. T., "A Volume of fluid based numerical simulation of solidification in binary alloys on fixed non-uniform co-located grids," Proceedings of the *ASME 2009 International Manufacturing Science and Engineering Conference* MSEC2009 October 4-7, 2009, West Lafayette, Indiana, USA" *The 18th Conference of the CFD Society of Canada*, London, Canada, May 2010.

93. **X. Sun,** Madhu Sudan Saha, Youqui Chen, Hao Liu, Ruying Li, Siyu Ye "Nitrogen-doped Carbon Nanotubes as a Novel Class of Catalyst Support for PEM Fuel Cells: Synthesis, Characterization and Applications". 216th Electrochemical Society Conference, Vienna, Austria, Oct.2-9. 2009.

94. **X. Sun,** Youqui Chen, Hao Liu, Ruying Li, "Nanowires and Nanotubes for Fuel Cells: Synthesis, Characterization and Applications", 60th International Electrochemical society, Beijing, China, August 16-22. 2009.

95. **X. Sun,** Madhu Sudan Saha, Youqui Chen, Hao Liu, Ruying Li, "Nitrogen-doped Carbon Nanotubes for PEM Fuel Cells". Energy Conversion and Storage, Wuhan, China, August 23-26. 2009

96. **Tutunea-Fatan, O.R**., Bernick, J.H., Lalone, E., King, G.J.W., and Johnson, J.A., 2010, "Application of Collision Detection to Assess Implant Insertion in Elbow Replacement Surgery," in *Medical Imaging 2010: Visualization, Image-Guided Procedures, and Modeling*, edited by Kenneth H. Wong, Michael I. Miga, Proceedings of SPIE, Vol. 7625, CID: 7625-1K

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99. LiMin Zhang, Qiuquan Guo and **Jun Yang**, "Modeling and experiment of impacts of UV lamp surface temperature by water temperature in UV water disinfection", Proceeding of 18th Annual Conference of The CFD Society of Canada, Ontario, Canada, 2010.

100. LiMin Zhang, Philip Ron Spencer, Qiuquan Guo and **Jun Yang**, "CFD Simulation in Ultraviolet Water Disinfection Systems: Effects of Multiple Reflections and Refractions Occur at Interfaces", Proceeding of 18th Annual Conference of The CFD Society of Canada, Ontario, Canada, 2010.

101. Yu Liu and **Jun Yang**, "Modeling of Nanoscale Water Battery", Proceeding of 18th Annual Conference of The CFD Society of Canada, Ontario, Canada, 2010.

102. Peng, J. Zhu and **C. Zhang**, "Numerical Study on the Approach to Improve the Uniformity of the Radial Solids Distribution in CFB Risers by Changing Inlet Air Jets Arrangements," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19 2010.

103. B. Peng, **C. Zhang** and J. Zhu,"CFD Simulation on the Use of Shapeless Internals to Improve the Uniformity of Radial Solids Concentration Profile in CFB Risers," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19, 2010.
104. Wang and **C. Zhang**, "A Numerical Approach to Develop Linear Control Models of NOx and Soot Emissions in a Direct Injection Diesel Engine," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19, 2010.
105. D. Brown, **C. Zhang** and J. Jiang, "Modern Control of Computationally Modeled Heat Transfer Systems Using the Numerical Method of Lines," Proc. ASME Summer Heat Transfer Conference, San Francisco, CA, July 19-23, 2009.
106. B. Peng, **C. Zhang**, J. Zhu and X. Qi, "CFD Modeling of a CFB Riser Using Improved Inlet Boundary Conditions," Proc. 6th International Symposium on Multiphase Flow, Heat Mass Transfer and Energy Conversion, Xi'an, China, July 11-15, 2009.
107. Y. N. Zhang, **C. Zhang** and J. Jiang, "Numerical Simulation of Heat Transfer of Supercritical Fluids In Tubes Using Different Turbulence Models," Proc. 20th International Symposium on Transport Phenomena, Victoria, Canada, July 7-10, 2009.
108. D. Brown, **C. Zhang** and J. Jiang, "Modern Control of Computationally Modeled Fluid Flow Systems Using the Numerical Method of Lines," Proc. 20th International Symposium on Transport Phenomena, Victoria, Canada, July 7-10, 2009.

3. ORAL AND POSTER PRESENTATIONS

1. Rasoulinejad P, McLachlin SD, Bailey SI, Gurr KR, Bailey CS, **Dunning CE**: Sub-axial Cervical Spine Instability Following Unilateral Facet Injury: A Biomechanical Analysis, 38th Clinical Seminar in Orthopaedic Surgery, London, Ontario, October, 2009. *(podium)*

2. "Convection Roll Instability due to Spatially Distributed Heating" by M.Z. Hossain and **J.M. Floryan**, Presented at the Canadian Society for Mechanical Engineering Forum 2010, June 7-9, 2010, Victoria, BC. Speaker: J.M. Floryan.

3. "A Gridless Algorithm for Analysis of Flows in Micro-Channels with Time-Dependent Cross-Sections" by S.Z. Hussain and **J.M. Floryan**, Presented at the Canadian Society for Mechanical Engineering Forum 2010, June 7-9, 2010, Victoria, BC. Speaker: J.M.Floryan

4. "Flow in a Channel with Grooved Walls" by A. Mohammadi and **J.M. Floryan**, Presented at the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada. Speaker: A. Mohammadi.

5. "Spectrally-Accurate Method for Analysis of Ellis Fluid in a Channel with Arbitrary Roughness" by M. F. Bakhasheshi, **J.M. Floryan** and P.N. Kaloni, Presented at the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada. Speaker: M.F. Bakhashehi,

6. "Spectrally Accurate Method for Analysis of Flows in Annuli Bounded by Corrugated Walls" by H.V. Moradi and **J.M. Floryan**, Presented at the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada. Speaker: H.V. Moradi.

7. "Roll Instability of Stationary Fluid Exposed to Spatially Distributed Heating" by M.Z. Hossain and **J.M. Floryan,** Presented at the Proceedings of the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada. Speaker: M.Z. Hossain.

8. "Efficient Over-Determined Implementation of the Immersed Boundary Conditions Method" by S.Z. Husain and **J.M. Floryan**, Presented at the Proceedings of the 18th Annual Conference of the CFD Society of Canada, May 10-12, 2010, London, Ontario, Canada. Speaker: S.Z. Husain.

9. "Spectrally-Accurate Method for Flows in Grooved Channels" by A. Mohammadi and **J.M. Floryan**. Presented at the Southern Ontario Numerical Analysis Day (SONAD) 2010, May 14,2010, University of Waterloo, Ontario, Canada. Speaker: A. Mohammadi.

10. "Course Linking in the Undergraduate Curriculum at Western Engineering" by P.M. Kurowski and **J.M. Floryan**, Presented at the Inaugural Conference of the Canadian Engineering Education Association, June 7-9, 2010, Queen's University, Kingston, Canada. Speaker: P.M. Kurowski.

11. "Analysis of Dynamics of Flow Modified by Distributed Heating" by M. Hossain and **J.M. Floryan**, 11th Pan-American Congress of Applied Mechanics, Jan.4-8, 2010, Foz do Iguaco, Brasil. Speaker: J.M. Floryan

12. L. Y. Jiang, Continuum Modeling of Polymer-matrix Nanocomposites, OCE - LANXESS – UWO Workshop on Green-Engineering of Polymer Surfaces Devices, The University of Western Ontario, February 5, 2010.

13. R. Oviasuyi and **R.J. Klassen**: Micro-Indentation based Investigation of the Anisotropy of Plastic Deformation in Select Zirconium Alloys, presented at the 22nd Canadian Materials Science Conference, Waterloo ON, June 2010

14. M. Haghshenas and **R.J. Klassen**: An investigation of the effect of forming forces on the mandrel teeth during splined mandrel flow forming under different forming conditions, presented at the 22nd Canadian Materials Science Conference, Waterloo ON, June 2010.

15. A.Z.M. Islam and **R.J. Klassen**: FE Analysis of Residual Stress at Grain Boundaries That Undergo SCC in the A600 Ni-based Alloy, presented at the 22nd Canadian Materials Science Conference, Waterloo ON, June 2010.

16. B. Bose and **R.J. Klassen**: Effect of Ion-Irradiation on the Indentation Creep of Zr-2.5%Nb Pressure Tube Material at 298K, presented at the 22nd Canadian Materials Science Conference, Waterloo ON, June 2010.

17. **Knopf, G.K**. (2010) "Bioelectronic photosensing array for non-planar imaging", *SPIE Smart Structures/NDE*, San Diego CA, March 7-11, 2010.

18. Al-Aribe,K. and **Knopf, G.K.** (2010) "Photoresponsive hydrogel microvalve activated by bacteriorhodopsin proton pumps", *SPIE Smart Structures/NDE*, San Diego CA, March 7-11, 2010

19. M.T. Perri, A.L. **Trejos, M.D. Naish**, R.V. Patel and R.A. Malthaner, "New Tactile Sensing System Helps to Locate Occult *Tumours During VATS," Canadian Surgery Forum 2009*, Victoria, BC, September 10–13, 2**009.**

20. **C.D.**W. Ward, A.L. Trejos, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "Design of a Multi-Screen, Hands-Free Poi*nter System for Training in* Minimally Invasive Surgery," Poster Presentation, *WORLDiscoveries Research Showcase*, London, ON, February 5, 2010.

21. H. Azimian, J. Breetzke, A.L. Trejos, R.V. Patel, **M.D. Naish**, B. Kiaii, J. Moore, C. Wedlake, and Terry Peters, "Preoperative Planning of Robotics-Assisted Minimally Invasive Cardiac Surgery," Poster Presentation, *WORLDiscoveries Research Showcase*, London, ON, February 5, 2010

22. H. Azimian, J. Breetzke, A.L. Trejos, R.V. Patel, **M.D. Naish** and B. Kiaii "Preoperative Planning of Robotics-Assisted Minimally Invasive Cardiac Surgery," Poster Presentation, *Lawson Health Research Institute Research Day, London, ON, March 23, 20*10.

23. C.D.W. Ward, A.L. Trejos, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "Multi-Sc**reen, Hand**s-Free Pointer System for Training in Minimally Invasive Surgery," Poster Presentation, *Lawson Health Research Institute Research Day, London, ON, March 23, 2010*.

24. A. Talasaz, R.V. Patel and **M.D. Naish**, "Haptics-Enabled Teleoperation for Robot-Assisted Tumour Localization," Poster Presentation, *Lawson Health Research Institute Research Day, London, ON, March 23, 2010.*

25. *A.L. Trejos,* S. Jayaraman, R.V. Patel, **M.D. Naish** and C.M. Schlachta, "S**ensing For**ces in Natural Orifice Surgery," Oral Presentation, *12th World Congress of Endoscopic Surgery*, *National Harbor, MD, April 14–17, 2010.*

26. *S. Ja*yaraman, A.L. Trejos, A.C. Lyle, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "A Novel Sensorized Instrument-Based Minimally Invasive Surgery (SIMIS) Tool: Initial Construct Validation of Position Sensing," Poster Presentation, *12th World Congress of Endoscopic Surgery*, National Harbor, MD, April 14–17, 2010.

27. S. Jayaraman, A.L. Trejos, A.C. Lyle, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "A Novel Sensorized Instrument-Based Minimally Invasive Surgery (SIMIS) Tool: Initial Construct Validation of Force Sensing" Oral Presentation, *12th World Congress of Endoscopic Surgery*, National Harbor, MD, April 14–17, 2010.

28. C.D.W. Ward, A.L. Trejos, **M.D. Naish**, R.V. Patel and C.M. Schlachta, "Multi-Screen, Hands-Free Pointer System for Training in Minimally Invasive Surgery," Poster Presentation," *12th World Congress of Endoscopic Surgery*, National Harbor, MD, April 14–17, 2010.

29. H. Azimian, J. Breetzke, A.L. Trejos, R.V. Patel, **M.D. Naish** and B. Kiaii, "Preoperative Planning of Robotics-Assisted Minimally Invasive Cardiac Surgery," Oral Presentation, *13th Annual Scientific Meeting of the International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS)*, Berlin, Germany, June 16–19, 2010.

30. A.L. Trejos, B. Kiaai, I. Ross, C. Scalesse, R.V. Patel and **M.D. Naish**, "Towards a Patient Eligibility Measure for Robotics-Assisted Bypass Surgery," Poster Presentation, *13th Annual Scientific Meeting of the International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS)*, Berlin, Germany, June 16–19, 2010.

31. **X. Sun,** Madhu Sudan Saha, Youqui Chen, Hao Liu, Ruying Li, Siyu Ye "Nitrogen-doped Carbon Nanotubes as a Novel Class of Catalyst Support for PEM Fuel Cells: Synthesis, Characterization and Applications". 216th Electrochemical Society Conference, Vienna, Austria, Oct.2-9. 2009.

32. **X. Sun,** Youqui Chen, Hao Liu, Ruying Li, "Nanowires and Nanotubes for Fuel Cells: Synthesis, Characterization and Applications", 60th International Electrochemical society, Beijing, China, August 16-22. 2009.

33. **X. Sun,** Madhu Sudan Saha, Youqui Chen, Hao Liu, Ruying Li, "Nitrogen-doped Carbon Nanotubes for PEM Fuel Cells". Energy Conversion and Storage, Wuhan, China, August 23-26. 2009

34. **J.T. Wood**, M. Farrokhnejad, J. Jekl "Structure-property relationships for die-cast Mg alloys", in AUTO21 Advanced Technology Session, AUTO21/APMA Conference, June 7-10, 2010, Windsor, Canada, 2010.

35. LiMin Zhang, Qiuquan Guo and **Jun Yang**, "Modeling and experiment of impacts of UV lamp surface temperature by water temperature in UV water disinfection", 18th Annual Conference of The CFD Society of Canada, Ontario, *Canada,* May 17-19, *2010.*

36. LiMin Zhang, Philip Ron Spencer, Qiuquan Guo and **Jun Yang**, "CFD Simulation in Ultraviolet Water Disinfection Systems: Effects of Multiple Reflections and Refractions Occur at Interfaces", 18th Annual Conference of The CFD Society of Canada, Ontario, *Canada, May 17-19, 2010.*

37. Yu Liu and **Jun Yang**, "Modeling of Nanoscale Water Battery", 18th Annual Conference of The CFD Society of Canada, Ontario, *Canada, May 17-19, 2010.*

38. **Jun Yang,** "New developments of Atomic Force Microscopy for Research in Biology, Chemistry and Materials Engineering", Nano Ontario 2010, London, Ontario, May 16-18, 2010.

39. Yu Liu, H. Y. Nie, W. M. Lau W.M. and **Jun Yang**, "Novel Methods to Induce and Characterize Molecular Cross-Linking of n-C32H66 in Self-Assembled Monolayers", Nano Ontario 2010, London, Ontario, May 16-18, 2010.

40. Binyu Yu, K. M. Leung, Q. Guo, W. M. Lau, **Jun Yang**, "Synthesis of Ag-TiO2 Composite Nano-Thin Film for Antibacterial Application", Nano Ontario 2010, London, Ontario, May 16-18, 2010.

41. K. M. Leung, G. Southam, W. M. Lau and **Jun Yang**, "Electrically Conductive Biological Nanowires", Nano Ontario 2010, London, Ontario, May 16-18, 2010.

42. Mei Liu, Y. Chen, R. Li, A. Sun and **Jun Yang** ，"Controllable Self-Assembly of Nanowires into Nanodevices by Hydrodynamic Focusing"， Nano Ontario 2010, London, Ontario, May 16-18, 2010.

43. N. W. Ghonaim, W. M. Lau, D. Goldman, C.G. Ellis, and **J. Yang**. (2009) Evaluating microvascular response to localized oxygen level variations by *in vivo* video microscopy. Microcirculation Abstract accepted for poster presentation at the regional fall meeting of the Microcirculatory Society "Frontiers in Microcirculation: Control Processes and Clinical Applications", University of Missouri, Colombia. October 16-17, 2009.

44. B. Peng, J. Zhu and **C. Zhang**, "Numerical Study on the Approach to Improve the Uniformity of the Radial Solids Distribution in CFB Risers by Changing Inlet Air Jets Arrangements," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19, 2010.

45. B. Peng, **C. Zhang** and J. Zhu, "CFD Simulation on the Use of Shapeless Internals to Improve the Uniformity of Radial Solids Concentration Profile in CFB Risers," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19, 2010.

46. D. Wang and **C. Zhang**, "A Numerical Approach to Develop Linear Control Models of NOx and Soot Emissions in a Direct Injection Diesel Engine," Proc. 18th Annual Conference of the CFD Society of Canada, London, Canada, May 17-19, 2010.

47. D. Brown, **C. Zhang** and J. Jiang, "Modern Control of Computationally Modeled Heat Transfer Systems Using the Numerical Method of Lines," Proc. ASME Summer Heat Transfer Conference, San Francisco, CA, July 19-23, 2009.

48. B. Peng, **C. Zhang**, J. Zhu and X. Qi, "CFD Modeling of a CFB Riser Using Improved Inlet Boundary Conditions," Proc. 6th International Symposium on Multiphase Flow, Heat Mass Transfer and Energy Conversion, Xi'an, China, July 11-15, 2009.

49. Y. N. Zhang, **C. Zhang** and J. Jiang, "Numerical Simulation of Heat Transfer of Supercritical Fluids In Tubes Using Different Turbulence Models," Proc. 20th International Symposium on Transport Phenomena, Victoria, Canada, July 7-10, 2009.

50. D. Brown, **C. Zhang** and J. Jiang, "Modern Control of Computationally Modeled Fluid Flow Systems Using the Numerical Method of Lines," Proc. 20th International Symposium on Transport Phenomena, Victoria, Canada, July 7-10, 2009.

4. INVITED LECTURES

J.M. Floryan

May 2010 Warsaw Technical University, Poland ("Hydrodynamic Stability Theory" - 30 hrs lecture series)

Jan.2010 Departamento de Matemática Aplicada e Estatística SME, São Carlos-SP, Brasil ("Immersed Boundary Conditions Concept in Computational Fluid Dynamics)

Nov.2009 Department of Mechanical and Materials Engineering, The University of Western Ontario, London,, Ontario, Canada ("Droplet Deformation Driven by Electric Field").

Nov.2009 Warsaw Technical University, Poland ("Stability Concepts and their Use in the Analysis of System Dynamics", six hours lectures series)

July 2009 Stuttgart University, Germany (" Open Questions in the Modelling of the Effects of Surface Roughness")

July 2009 Marburg University, Germany ("On the laminar-Turbulent Transition in the Presence of Distributed Roughness Effects")

July 2009 RWTH Aachen, Germany ("Effects of Distributed Surface Roughness on the Laminar-Turbulent Transition")

July 2009 ETH Zurich, Switzerland ("Modelling of Distributed Roughness Effects")

July 2009 Munich technical University, Germany ("Effects of Distributed Surface Roughness on Flow Instabilities")

T.R. Jenkyn

Dec 2009 Report of findings to the Canadian Curling Association and the Canadian Olympic Committee, Own the Podium 2010 Program, from the follow-up project titled: "Curling mechanics and biomechanics- results relevant to Olympic preparations and training"

May 2010 "What the foot does inside the shoe". Keynote lecture at the Annual Conference of the Ontario Chiropodists Association, Toronto, Ontario

E. Savory

April 2010 "Experimental and numerical modeling of thunderstorm downbursts and their effects on structures", Ecole Centrale Lyon, France

X.A. Sun

May 2009 Nanomaterials for Clean Energy", University of Toronto, May 5, 2009

August 2009 Nanotube-based and Nanowire-based Naomaterials for Fuel Cells". Northern American – China Fuel cell Conference, China, Shanghai

Dec. 2009 "Development of One-Dimensional Naomaterials for Fuel Cells". International Fuel Cell Workshop, China, Tianjin

May 2010 Nanomaterials for Clean Energy", McMaster University, Hamilton, Ontario

5. TECHNICAL REPORTS

1. "Spectral Algorithm for Analysis of Flows in Grooved Channels" by A, Mohammadi and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-1/2010, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2010.

2. "Spectrally-Accurate Algorithm for Moving Boundary Problems for the Navier-Stokes Equations" by S.Z.Husain and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-4/2009, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2009.

3. "Spectrally-Accurate Method for Analysis of Stationary Flows of Second-Order Fluids in Rough Micro-Channels" by A. Mohammadi, **J.M. Floryan** and P.N. Kaloni, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-3/2009, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2009.

4. "An Efficient Linear Solver for Problems Arising from the Spectral Implementation of the Immersed Boundary Conditions Method" by S.Z.Hussain and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-2/2009, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2008.

5. "Immersed Boundary Conditions Method for Three-Dimensional Heat Diffusion Problems" by David César Del Rey Fernandez, S.Z. Husain and **J.M. Floryan**, Expert Systems in Fluid Dynamics Research Laboratory Report ESFD-1/2009, Department of Mechanical and Materials Engineering, The University of Western Ontario, London, Ontario, N6A 5B9, Canada, 2009.

6. R. Ben Mrad and **M.D. Naish**, "Mechatronics—Multidisciplinary Engineering," discussion paper prepared for the Research Committee of Engineers Canada, August 28, 2009.

7. **Savory, E**. "Modeling and prediction of failure of transmission lines due to high intensity winds (HIW) - Phase 2 (CRDPJ 335928–06)", Final report submitted to NSERC.

8. **Savory, E**. "Integrated automotive cooling module development by full-scale simulation of real operating environments (CRDPJ 305792–03)", Final report submitted to NSERC.

9. **Straatman, A. G.,** Siddiqui, K., "The Development of a Mechanically Actuated, Self Resetting, Secondary Bleed Valve for Teck II Fixtures," Technical Report for Masco Industries, London, Ontario, March 2010.

10. **Sun, X.A**. GM technique report on metal silicide nanowires for PEM Fuel cells, 2009.

11. **Sun, X.A**. Ballard technique report on Nanotubes for PEM Fuel cells, 2009.

12. **Sun, X.A**. Defense technique report on NanoEnergetic Materials, 2009.

13. D. Wang and **C. Zhang**, Computational Flow Dynamic Analysis of Air Distribution in Biofilters and Biotrickling Filters, Report for BIOREM Technologies Inc. and MITACS, 2009.

14. E. Abu-Ramadan and **C. Zhang**, CFD Modeling and Design Recommendation for REC Engine, Report for Revolution Engine Corporation and MITACS, 2009.

6. BOOKS AND BOOK CHAPTERS

1. H.B. Kitoaka, **T.R. Jenkyn**. "Chapter 83. Ankle and foot biomechanics" in Reconstructive Surgery of the Joint. B. Morrey and K-N An, editors. 3rd edition, Churchill-Livingston 2009.

2. **Knopf, G.K**. and Wang, W.W. "Biophotoreceptor arrays", *Encyclopedia of Industrial Biotechnology: Bioprocess, Bioseparation, and Cell Technology*, Editors M.C. Flickinger and C. Vona, John Wiley [17 pages, available online], 2010.

3. **M.D. Naish**, R.V. Patel, A.L. Trejos, M.T. Perri, R.A. Malthaner, "Robotic Techniques for Minimally Invasive Tumor Localization," to appear in *Surgical Robotics—Systems Applications and Visions* (J. Rosen, B. Hannaford, R. Satava, eds.), Springer: New York, 2010.

4. **A.G. Straatman**, "Heat transfer in graphitic foams," in *Heat transfer in multiphase materials*, Edited by Andreas Oschner, Springer, 2010.

7. PATENTS

1. **Knopf, G.K**., Wang, W.W., and Bassi, A.S. (2009) "Bioelectronic photodetector and imaging arrays based on bacteriorhodopsin (bR) thin films and flexible printed electronic circuits" [USA Patent No. 7,573,024 – issued August 2009].

2. **Jenkyn**,**T.R**., S. Arnold, and **J.T. Wood**, Curling Head for Curling Broom, 2010 (provisional U.S patent).

3. C.M. Schlachta, R.V. Patel, A.L. Trejos and **M.D. Naish**, "Hands-Free Pointer System," PCT patent pending, Number PCT/CA2008/001690, filed November 21, 2009.

4. Thompson, B. E., Yu, Q., Bariault, E., **Straatman, A. G**., Redman, P., "Heat transfer assembly and methods thereof," North American Patent, Patent application number: 20090308571, 2009**.**

5. **Straatman, A. G.**, Fisher, B. T., Siddiqui, K., Stauder, F., "Secondary Bleed valve for dual flush valve," North American Patent, Patent Application number: 123-3-26-U; 60137-668PUS1, 2010.

6. **Sun, X**., Zhang, G., Sun, S., Li, R. Cai, M. "A General Strategy for the Kilogram-Scale Production of Various Metal and Bimetallic-Composite Nanostructures", US patent, pending, January, 2010.

7. **Yang, Jun**, Zhifeng Ding and Leo Lau, "Hybrid Solar Energy Conversion System with Photocatalytic Disinfectant Layer", Filed as provisional US patent. (serial number 61/302,627).

PROFESSIONAL SERVICES

1. REVIEW OF REFEREED JOURNALS AND BOOK CHAPTERS

S.F. Asokanthan

ASME Journal of Applied Mechanics
Journal of Vibration and Control

R.O. Buchal

Journal of Mechanical Engineering Science
Journal of Computing and Information Science in Engineering (JCISE)
Journal of Engineering Design (JED)
Experimental Techniques

J.R. Dryden

Journal of Elasticity

C.E. Dunning

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

J.M. Floryan

European Journal of Mechanics
International Journal of Numerical Methods in Fluids,
Microgravity Science and Technology
International Journal of Heat and Fluid Flow
Experiments in Fluids
Journal of Process Mechanical Engineering
Fluid Dynamics Research
Journal of Fluid Mechanics
Phys.Fluids
Theoretical and Computational Fluid Mechanics
Archives of Mechanics
CSME Transactions

T.R. Jenkyn

Journal of Orthopaedic Research
Journal of Biomechanics
Gait and Posture
Medicine and Science in Sports and Exercise

L.Y. Jiang

Journal of Physics D: Applied Physics
International Journal of Applied Mechanics
Physica E;
ASME Journal of Applied Mechanics
International Journal of Fracture
Mechanics Research Communications
Journal of Computational and Theoretical Nanotechnology
Archives of Mechanics
Proceedings of the Royal Society A; IMECE conference
CSME transaction.

R.E. Khayat

Journal of Fluid Mechanics
Physical Review E
Physical Review Letters
International Journal for Numerical Methods in Heat and Fluid Flow
International Journal for Numerical Methods in Fluids
Physics of Fluids
Chemical Engineering Communications

R.J. Klassen

The Canadian Metallurgical Quarterly
The Journal of Materials Science

G.K. Knopf

International Journal of Control and Intelligent Systems
International Journal of Optomechatronics
Biosensors and Bioelectronics
Measurement Science and Technology
Journal of Intelligent Manufacturing
International Journal of Advanced Manufacturing Technology
Computer Aided Design
Computer Methods and Programs in Biomedicine

M.D. Naish

IEEE Transactions on Automation Science and Engineering
IEEE/ASME Transactions on Mechatronics
International Journal of Robotics Research

S. Salisbury

IEEE/ASME Transactions on Mechatronics
ASME Journal of Manufacturing Science and Engineering

E. Savory

Journal of Wind Engineering and Industrial Aerodynamics
Wind and Structures
Experimental Thermal and Fluid Science
Proceedings of the Institution of Mechanical Engineers, Part D, Journal of Automobile Engineering
JZUS-A (Applied Physics & Engineering)

D. Shinozaki

Polymer Engineering and Science
Journal of Materials Science

K. Siddiqui

Experimental Thermal Fluid Science
Journal of Wind Engineering and Industrial Aerodynamics
Asia-Pacific Journal of Chemical Engineering

A.G. Straatman

International Journal of Heat and Mass Transfer
ASME Journal of Heat Transfer
Carbon

X.A. Sun

Journal of American Chemical Society
Nanotechnology
Materials of Chemistry
J. Phys. Chem.,
Electrochemistry Communication,
Electrochemical Solid-State Letter.
Appl. Phys. Lett.
Carbon
Langumir

O.R. Tutunea-Fatan

International Journal of Manufacturing Research
Journal of Machining Science and Technology
Journal of Engineering Manufacture

J. Yang

Lab on a chip
Transactions on Ultrasonics, Ferroelectrics, and Frequency Control
Bioanalysis
Journal of Chromatography A
Journal of Materials Processing Technology
Journal of Applied Physics
Sensors & Actuators: B. Chemical

C. Zhang

International Journal of Heat and Mass Transfer

2. REVIEW OF GRANT APPLICATIONS

S.F. Asokanthan

NSERC CREATE

R.O. Buchal

NSERC
Ontario Centres of Excellence

J.M. Floryan

NSERC Discovery
NSERC
NSERC CRD
NSERC Strategic
National Science Foundation, USA
Polish Ministry of Regional Development
Saudi Arabia Research Office

L.Y. Jiang

NSERC Discovery
Strategic Research Grant for City University of Hong Kong

R.J. Klassen

Canada Research Chair Tier 2 Research Chair application

G.K. Knopf

NSERC-CHRP (Collaborative Health Research Projects)

M.D. Naish

NSERC Discovery

E. Savory

GACR Czech Science Foundation

D. Shinozaki

NSERC Strategic, Operating grants

K. Siddiqui

National Science Foundation
Atlantic Innovation Fund

A.G. Straatman

NSERC Discovery
NSERC RTI

X.A. Sun

NSERC Discovery
NSERC Strategic
NSERC CRD
NSERC IDI
OEC
Ontario Research Fund
National Science Foundation (US)
Department of Energy (US)

O.R. Tutunea-Fatan

NSERC I2I (Idea to Innovation) Program
MITACS Accelerate Program

J. Yang

NSERC Strategic