Mechatronics Education Technology Workshop

Designing and building effective programs

Friday, June 17, 2016
Host: New York University, Tandon School of Engineering

This workshop explores the systematic and intentional design of innovative educational programs in mechatronics at the undergraduate and graduate level. Faculty from progressive institutions that have successfully designed and launched mechatronics programs will present respective case studies on what makes a great program. Case studies will cover interdisciplinary approaches to coursework, experiential learning, and projects. Issues on balancing fundamental theory, and modeling methods with system level issues of hardware components, interfacing requirements, simulation and programming tools, and practical applications of mechatronics and robotics will be discussed. Finally, the industry sponsor, Quanser will present a survey of emerging techniques. Case studies will be drawn from a broad base of representative institution types including research universities, technical colleges, and international perspectives.

Co-chairs

Dr. Vikram Kapila
Professor and Director of M.S. in Mechatronics and Robotics Program, NYU Tandon School of Engineering

Dr. Thomas Lee
Chief Education Officer, Quanser, Adjunct appointments at University of Waterloo, University of New Mexico, York University

Invited speakers

Dr. Soo Jeon
Associate Professor, Mechanical and Mechatronics Engineering, University of Waterloo

Dr. Martin von Mohrenschildt
Associate Professor, Undergraduate Advisor for Mechatronics, McMaster University

Dr. James Mynderse
Mechanical Engineering, Assistant Professor, Director of M.S. Mechatronic Systems Engineering program, Lawrence Technological University

Dr. Devdas Shetty
Dean, School of Engineering and Applied Sciences, Professor of Mechanical Engineering, University of the District of Columbia

Dr. Andy Zhang
Associate Professor, Mechanical Engineering Technology, New York City College of Technology

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Location

Room LC400, Dibner Library Building
New York University Tandon School of Engineering
6 MetroTech Center
Brooklyn, NY 11201
Driving Directions

Agenda

8:00 AM to 9:00 AM	Continental breakfast and check in Room LC400, Dibner Library Building
9:00 AM to 9:30 AM	Welcome and introductions (Kapila, NYU & Lee, Quanser)
9:30 AM to 10:15 AM	Mechatronics Education—An NYU Tandon Perspective (Kapila, NYU)
10:15 AM to 11:00 AM	Mechatronics Engineering Program at University of Waterloo (Jeon, Waterloo)
11:00 AM to 11:15 AM	Break
11:15 AM to Noon	Mechatronics at McMaster University (v. Mohrenschildt, McMaster)
Noon to 2:00 PM	Working lunch Technology demonstration (Lee, Quanser) Lab tour (Kapila, NYU)
2:00 PM to 2:45 PM	Mechatronic Systems Engineering at Lawrence Technological University (2006 – 2016) (Mynderse, Lawrence)
2:45 PM to 3:30 PM	Robust Mechatronics System –Mechatronics Education by Integration of Virtual Simulation and Mechatronics Application (Shetty, UDC)
3:30 PM to 3:45 PM	Break
3:45 PM to 4:30 PM	Learning Product Design through Engaging Hands-on Mechatronics Design Activities (Zhang, NY City College)
4:30 PM to 5:15 PM	Open discussion and closing
5:30 PM to 7:00 PM	Networking reception and more demonstrations

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Dr. Vikram Kapila
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Vikram Kapila is a Professor of Mechanical Engineering at NYU Tandon School of Engineering (NYU Tandon), where he directs a Mechatronics and Control Laboratory, a Research Experience for Teachers Site in Mechatronics and Entrepreneurship, a GK-12 Fellows project, and a DR K-12 research project, all funded by NSF. His research interests include K-12 STEM education, mechatronics, robotics, and control system technology. He received NYU Tandon's 2002, 2008, 2011, and 2014 Jacobs Excellence in Education Award, 2002 Jacobs Innovation Grant, 2003 Distinguished Teacher Award, and 2012 Inaugural Distinguished Award for Excellence in the category Inspiration through Leadership. Moreover, he is a recipient of 2014-2015 University Distinguished Teaching Award at NYU. His scholarly activities have included 3 edited books, 8 chapters in edited books, 1 book review, 57 journal articles, and 126 conference papers. He has mentored 1 B.S., 17 M.S., and 4 Ph.D. thesis students; 35 undergraduate research students and 11 undergraduate senior design project teams; over 300 K-12 teachers and 100 high school student researchers; and 18 undergraduate GK-12 Fellows and 60 graduate GK-12 Fellows. Moreover, he directs K-12 education, training, mentoring, and outreach programs that enrich the STEM education of over 1,000 students annually.

Mechatronics Education—An NYU Tandon Perspective

I will provide an overview of the evolution of mechatronics education and research conducted under our Mechatronics and Control lab. Our work began in late 1990s with an undergraduate instructional control lab and a web-enabled control lab. Exposure to real-time and web-enabled control during this development process catalyzed further learning and exploration in hands-on mechatronics education, leading to the creation of a Mechatronics course in early 2000s. Hands-on controls and mechatronics education nurtured our students' interest and capacity to develop novel, low-cost, mechatronics education and research tools. Beginning in 2007, equipped with practical mechatronics education and training, a cadre of graduate students deployed in NYC K-12 schools to promote STEM learning by integrating mechatronics and robotics-based lessons and activities. Moreover, the mobile device revolution of late 2000s was seized to research novel mechanisms for human-machine interaction. Over the past five years, we have designed novel mobile augmented reality tools for education and research alike. In addition, our Advanced Mechatronics course is building students' interest and skills in cyber physical systems. Finally, collaboration with and support from colleagues has led to the creation of a new M.S. degree in Mechatronics and Robotics, which has received intense interest from fall'16 applicants.

Tom Lee Ph.D.

Chief Education Officer
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Dr. Lee is an authority in the field of engineering education innovation and physical system modeling and simulation. He received his Ph.D. in Mechanical Engineering from the University of Waterloo, Canada. He received his B.A.Sc. and M.A.Sc. in Systems Design Engineering at the University of Waterloo. In his current position as Chief Education Officer at Quanser (Toronto, Canada), he directs the product strategy and academic community development activities of the company. His past positions included Vice President of Application Development for Maplesoft and Product Manager for Certicom. He also is an adjunct faculty member at the University of Waterloo (Systems Design Engineering), University of New Mexico (Electrical and Computer Engineering), and York University (Mechanical Engineering). His past professional positions included Vice President of Applications Engineering at Maplesoft. His current service activities include Chair of the Corporate Advisory Council, Electrical and Computer Engineering Heads Association (ECEDHA), and Judge Advisor for the FIRST Robotics competition.

About Quanser

Quanser is a leading developer of experiments and courseware for controls research and teaching. Their open-architecture control solutions are used worldwide by thousands of universities, colleges, research laboratories and commercial organizations. Quanser's distinctively modular control systems allow educators to cost-effectively employ the same power plant to perform experiments of varying complexity. The industry-relevant courseware and cutting-edge workstations help teach Introductory, Intermediate or Advanced controls to students in Electrical and Mechanical Engineering. Quanser's control laboratory equipment helps universities captivate the brightest minds, motivates them to succeed and produces graduates with industry-relevant skills.

Dr. Soo Jeon
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Dr. Soo Jeon is an associate professor in the department of Mechanical and Mechatronics Engineering at University of Waterloo. He received his BS (1998) and MS (2001) from Seoul National University, Korea and PhD (2007) from University of California at Berkeley, all in mechanical engineering. Before joining University of Waterloo in 2009, he worked in Applied Materials Inc. in Santa Clara as a Mechanical Engineer. His current research is focused on sensing and control for mechanical systems, sensory-rich robotic manipulation, and control of power-assistive devices. For his research, he received RudonphKalman Best paper award from the Dynamic Systems and Control Division (DSCD) of ASME in 2010 and Discovery Accelerator Supplement (DAS) Award from NSERC (Natural Sciences and Engineering Research Council of Canada) in 2015. He is currently serving as associate editors for ASME Journal of Dynamic Systems, Measurement and Control, and for IEEE Transactions on Automation Science and Engineering.

Mechatronics Program at University of Waterloo

The Mechatronics Engineering (MTE) program at University of Waterloo was developed as a joint effort between the three participating departments (ME, ECE and SYDE), to expand the Faculty of Engineering to meet the needs of industry specifically around Waterloo and in general in Canada. The program is designed to provide the students with a firm grasp of the fundamentals, and to integrate the various disciplines throughout the program. Our philosophy has been that, to be able to properly design systems that draw on the various traditional engineering disciplines, it is necessary to present and integrate these throughout all years of a comprehensive program. The program consists of 32 core technical engineering courses, 17 of which are provided by MME, 6 by ECE, and 5 by SYDE. There are 5 technical elective courses in the 4th year, from MME, ECE and SYDE. Combining in-depth classroom learning with productive, paid work experience (Co-op program) as well as various experiential learning opportunities such as engineering clinic and capstone design, the MTE program at University of Waterloo has earned a unique reputation for the quality of its graduates.

Dr. Martin von Mohrenschildt
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Dr. v. Mohrenschildt obtained his Ph.D in Mathematics from the ETH-Zurich. He is a faculty member at McMaster University Engineering, initially in Electrical and Computer Engineering, and then in Computing and Software. From 2005-2011 he was the Chair of the Department. During this time he implemented the Mechatronics Program at McMaster University. While Dr. V. Mohrenschildt initially studied mathematics he always had a big passion for electrical and mechanical systems. His research interests include signal processing and control, sensors and data acquisition, real time data processing.

Over the years Dr. v. Mohrenschildt and his students build several software/hardware systems for industrial applications. This includes automotive components like fuel injection controller and a chassis dyno drive robot. For the mining industry he continues to develop a system of sensors that are used commercially to analyze vibrating screens. He and his students do both, hardware and software, developing production ready components. He also designed and build a minivan sized fully immersive 6DOF flight/driving simulator that, in a team with neuroscientist Dr. Shedden, in which they use EEG to study the effect of motion cuing in learning.

Mechatronics Program at McMaster University

The Mechatronics program at McMaster University was created in 2007 and is housed in the Engineering Department of Computing and Software. Comparing the McMaster program with other Mechatronics programs, we have more of an embedded/control focus the other programs which are usually more mechanical heavy and housed in mechanical departments. The McMaster program is CEAB (Canadian Engineering Accreditation Board) accredited. Students take courses form two other Departments, Mechanical Engineering (Measurements), and from Engineering Physics (Electronics, Thermodynamics). The idea is the mix the Mechatronics students with students in other disciplines, not having separate courses, the expose the students to the different cultures. At McMaster Level I is common to all Engineering Disciplines, and students compete to enter the program of their choice. A limit of 50 students are accepted for Mechatronics. In Level II students get exposed to an even balance of software, electronics and mechanical courses. In Level III the corner courses are two custom digital interfacing, micro controller courses, signals and systems and a classic controls course. The Mechatronics Engineering students have 2 software Design courses, taken together with the Computer Engineering students. In Level IV students take an applied control, real-time course that is also taken by the software students and 4 electives of their choice from different disciplines.

Dr. James Mynderse
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James A. Mynderse, Assistant Professor, is the Director of the M.S. in Mechatronic Systems Engineering program in the A. Leon Linton Department of Mechanical Engineering at Lawrence Technological University. Dr. Mynderse joined Lawrence Tech from Purdue University where he received PhD, MS, and BS degrees in Mechanical Engineering. Dr. Mynderse teaches at the undergraduate and graduate levels in dynamic systems and control, modern control systems, mechatronic design, and mechatronic system integration. His courses include active and collaborative learning and problem-based learning modules which improve student participation and learning. He also serves as the faculty advisor for the Lawrence Tech Baja SAE team. His current research interests include dynamic systems and controls with applications to piezoelectric actuators, microfluidics, unmanned aerial vehicles, additive manufacturing, and motion and vibration perception and control.

Mechatronics Program at Lawrence Tech

The Lawrence Tech MS in Mechatronic Systems Engineering (MSMSE) program was founded in 2006 and is housed within the A. Leon Linton Department of Mechanical Engineering with assistance from the Department of Electrical and Computer Engineering. The Mechatronic Systems Laboratory, a cornerstone of the program, provides dedicated space for students both as a classroom and a laboratory. The program is designed for working professionals who are graduates of accredited undergraduate mechanical or electrical engineering programs. All course work is offered in the evening, allowing students to complete their studies in approximately two years.

Our goal is to provide students with a combination of classroom theory and hands-on experience. Theory classes include dynamics, vibrations, control theory, and the integration of common and advanced sensors and actuators. Two practical classes provide students with the experience of developing an integrated electro-mechanical system and the required communication and engineering skills.

MSMSE students will be expected to: learn and apply mechatronic engineering principles and theories, develop analytical and problem solving skills for mechatronic systems, evaluate technical mechatronics engineering publications, effectively communicate technical information, understand the importance of lifelong learning and the professional and ethical responsibilities of the engineering profession.

Dr. Devdas Shetty
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Dr. Devdas Shetty serves as dean of the School of Engineering and Applied Sciences at the University of the District of Columbia, DC, where he is also a Professor of Mechanical Engineering. He previously served as Dean of Engineering at Lawrence Technological Institute, Southfield, Michigan. He was also Dean of Research and Vernon D Roosa Manufacturing Professor at the University of Hartford, Connecticut. He also held positions at the Albert Nerkin School of Engineering at the Cooper Union for the Advancement of Science and Art in New York City. The author of four books, and more than 230 scientific articles and papers, five patents. His work has been cited for contribution to the understanding of surface measurement, intellectual achievements in mechatronics and contributions to product design.

Dr. Shetty has led several successful multi institutional engineering projects. In partnership with Albert Einstein College, he invented the mechatronics process for supporting patients with ambulatory systems for rehabilitation. In partnership with Armament Research, Development and Engineering Center (ARDEC), he led a multi-university industry team for the successful design and testing of a hybrid projectile. He established academic and research programs in Laser Manufacturing in collaboration with Connecticut Center for Advanced Technology (CCAT) under the National Aerospace Leadership Initiative (NALI).

Mechatronics Program at University of the District of Columbia (UDC)

Several Mechatronics courses are offered in the Department of Mechanical Engineering, Electrical Engineering and Computer Science. Several highlights of our offerings include an industry sponsored Mechatronics research program and an international collaboration in Mechatronics training in India, South Korea and the Caribbean. We are looking to expand our curriculum by working on an initiative to start a concentration in Mechatronics at the Graduate level.

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Dr. Zhang earned his Doctorate in Engineering from the Graduate Center of City University of New York (CUNY) in 1995. He is a member of American Society of Mechanical Engineers (ASME) and a member of American Society for Engineering Education (ASEE).

He is an Associate Professor in the Department of Mechanical Engineering Technology of NYC College of Technology/CUNY. He currently serves as the Director of the Mechatronics Technology Center (MTC) which was funded in 2010 by a grant from the National Science Foundation's Advanced Technology Education (ATE) division. MTC serves as a platform for students to engage in hands-on multidisciplinary design activities, to explore new ideas, and to learn from their mistakes.

Mechatronics Program in City Tech (NYC College of Technology/CUNY):

One of the problems that many engineering graduates face when looking for their first job is: do you have experience? Employers prefer graduates with relevant experience to those without. Why is experience so important to employers? Can students accumulate "working" experience while studying in college? The Mechatronics Technology Center (MTC) in City Tech provides a platform for students to engage in multidisciplinary design activities inside and outside of the classrooms to help students to gain "working" experience and skills through hands-on design activities that simulate the actual design activities that occur in the industry. Faculty members from the Mechanical Engineering Technology and Computer Engineering Technology departments were involved in creating multidisciplinary design projects. The design projects provide students with new insights that relate what they learn in their coursework with actually design activities in the industry. The hands-on mechatronics design activities also provided the students opportunities to sharpen their critical thinking and analytical skills, to practice concurrent engineering, to acquire people skills as well as management skills needed for the students when looking for employment.

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