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- **Nonlinear adaptive robust control**
- **Algorithms and communications for smart grids**
- **Can network coding bridge the digital divide?**
- **Smart condition nonitoring of power system equipment**
- **Soft Robotics: is it a new paradigm in robotics?**

Albert Y.S. Lam
University of Hong Kong

Wednesday 27 July
11 am - 12 pm,

Rm 418 Macleod Bldg
2356 Main Mall
UBC

Everyone is welcome!

An autonomous vehicle-based public transportation system

Technology of autonomous vehicles (AVs) is getting mature and many AVs will appear on the roads in the near future. AVs become connected with the support of various vehicular communication technologies and they possess high degree of control to respond to instantaneous situations cooperatively with high efficiency and flexibility. In this talk, a new AV-based public transportation system is proposed. It manages a fleet of AVs to accommodate transportation requests, offering point-to-point services with ride sharing. We discuss the three major problems of the system: scheduling, admission control, and pricing. Scheduling is to configure the most economical schedules and routes for the AVs to satisfy the admissible requests while admission control is to determine the set of admissible requests among all requests to produce maximum profit. We develop effective methods to tackle the admission control and scheduling problems. Furthermore, we consider multi-tenancy, which can increase market competition leading to lower service charge and higher quality of service. We study the pricing issue of the multi-tenant AV public transportation system with three types of services defined. To prevent the bidders from raising their bids for higher returns, we propose a strategy-proof Vickrey-Clarke-Groves-based charging mechanism, which can maximize the social welfare, to settle the final charges for the customers. We perform extensive simulations to evaluate the performance of the proposed methods.

Speaker: Albert Lam received the BEng degree (First Class Honors) in Information Engineering from The University of Hong Kong (HKU), Hong Kong, in 2005, and obtained the PhD degree at the Department of Electrical and Electronic Engineering (EEE) of HKU in 2010. He was a postdoctoral scholar at the Department of Electrical Engineering and Computer Sciences of University of California, Berkeley, in 2010-12. He is a Croucher research fellow and now a research assistant professor at HKU-EEE. His research interests including optimization theory and algorithms, evolutionary computation, smart grid, and smart city.

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Jt. Chapter BT-02/COM-19/IT-12/ITS-38/PHO-36/VT-06

Nonlinear adaptive robust control – theory and applications

Bin Yao
Purdue University

Monday 18 July
11am - noon

Rm 418 MacLeod Bldg
2356 Main Mall
UBC

Sponsored by the joint chapters of IEEE Control Systems, Robotics and Automation, and Systems, Man and Cybernetics societies

Control of nonlinear systems with uncertainties has been one of the mainstream areas of focus in control community during the past twenty years. Two approaches have been popular: robust adaptive control and deterministic robust control (DRC). This talk will present a theoretically solid nonlinear adaptive robust control (ARC) approach that well reflects what a human brain normally does — seamless integration of the fast reaction to immediate feedback information and the slow learning utilizing large amount of stored past information that is available in the computer based control systems — to synthesize performance oriented controllers with built-in intelligences under practical constraints. The first half of the seminar focuses on the basic ideas of ARC strategy and touches some specific design issues. The issues include: (i) means to achieve fast robust feedback; (ii) learning techniques (e.g., parameter adaptation) to reduce model uncertainties for an improved performance; (iii) desired compensation structure to alleviate the effect of measurement noises, (iv) direct and indirect ARC designs, (v) integrated direct/indirect ARC design, and (vi) constrained optimization based model compensation ARC. The constructed ARC controllers range from the full-state feedback ARC for MIMO nonlinear systems in semi-strict feedback forms and the nonlinear observer based ARC for a class of nonlinear systems with partial state feedback to the output feedback ARC for uncertain linear systems with bounded disturbances. The second half the seminar focuses on the applications of the proposed ARC approach to the intelligent and precision control of several electro-mechanical/hydraulic systems. The applications include the precision motion control of linear motor driven high-speed/high-acceleration electro-mechanical devices (e.g., machine tools) for precision manufacturing, the ultra precision motion control of piezo-actuator driven devices for nano-positioning, the motion and pressure control of electro-hydraulic systems (e.g., industrial hydraulic excavators), the energy-saving control of electro-hydraulic systems via novel programmable valves, and the coordinated motion and force tracking control of robot manipulators in contact with various contacting surfaces, exoskeletons, redundant drive systems, mobile robots, and a hummingbird-size flapping-wing micro aerial vehicle (MAV). Various experimental results will be shown to illustrate the high performance and versatility nature of the proposed ARC approach.

Speaker: Dr. Yao received his PhD degree in Mechanical Engineering from the University of California at Berkeley in 1996 after obtaining B.Eng. in Applied Mechanics from Beijing University of Aeronautics and Astronautics of China in 1987 and M.Eng. degree in Electrical Engineering from Nanyang Technological University of Singapore in 1992. He has been with the School of Mechanical Engineering at Purdue University since 1996 and was promoted to the rank of Associate Professor in 2002 and Professor in 2007. He was also honored as a Kuang-piu Professor in 2005, a Changjiang Chair Professor at Zhejiang University by the Ministry of Education of China in 2010, and an awardee of the National Recruitment of Global Experts of China in 2011. Dr. Yao was awarded a Faculty Early Career Development (CAREER) Award from the National Science Foundation (NSF) in 1998 and a Joint Research Fund for Outstanding Overseas Chinese Young Scholars from the National Natural Science Foundation of China (NSFC) in 2005. His research interests include the design and control of intelligent high performance coordinated control of electro-mechanical/hydraulic systems, optimal adaptive and robust control, nonlinear observer design and neural networks for virtual sensing, modeling, fault detection, diagnostics, and adaptive fault-tolerant control, and data fusion. He has published significantly on the subjects with well over 270 technical papers while enjoying the application of the theory through industrial consulting. He is the recipient of the O. Hugo Schuck Best Paper (Theory) Award from the American Automatic Control Council in 2004, the Outstanding Young Investigator Award of ASME Dynamic Systems and Control Division (DSCD) in 2007, and the Best Conference Paper Awards on Mechatronics of ASME DSCD in 2012. He is a Fellow of ASME and a senior member of IEEE and has chaired numerous sessions and served in a number of International Program Committee of various IEEE, ASME, and IFAC conferences including the General Chair of the 2010 IEEE/ASME International Conference on Advanced Intelligent Mechatronics and the International Program Committee Chair of the 6th IFAC Symposium on Mechatronic Systems in 2013. From 2000 to 2002, he was the Chair of the Adaptive and Optimal Control Panel and, from 2001 to 2003, the Chair of the Fluid Control Panel of the ASME Dynamic Systems and Control Division (DSCD). He was the founding member to the ASME DSCD Mechatronics Technical Committee in 2005 and served in various roles including TC Chair. He was a Technical Editor of the IEEE/ASME Transactions on Mechatronics from 2001 to 2005 and Associate Editor of the ASME Journal of Dynamic Systems, Measurement, and Control from 2006 to 2009. Details can be found at https://engineering.purdue.edu/~byao

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Chris Develder
Ghent University

Algorithms and communications for smart grids: knowing and controlling power consumption

Tuesday 19 July
3:30 pm - 4:30 pm

Rm 418, Macleod Bldg
2356 Main Mall, UBC

Everyone is welcome!

The modern power grid is facing various challenges that gave rise to the adoption of smart grids. One such challenge is the increasing penetration of distributed renewable energy sources (DRES), another the anticipated electrification of transportation (i.e., electric vehicles). Part of the smart grid solution lies in demand response (DR) approaches to try and match the available production by adapting the flexibility in power consumption, i.e., shift consumption in time. Further, the fact that renewable sources are dispersed into the distribution networks, calls for enhanced monitoring of these parts of the grid. This presentation will highlight research that mainly pertains to “knowing” power consumption, as a necessary condition for “controlling” it. Starting with the latter, we will highlight sample case studies on DR algorithms. Then, we’ll focus on results from data analytics on clustering and modeling user behavior, in terms of total power consumption and the flexible portion thereof (e.g., in electric vehicle charging). Finally, we will briefly illustrate how communication network middleware can support smart grid applications, showing results from the European project C-DAX, which demonstrated PMU-based real-time state estimation in a real-life distribution grid.

Speaker: Chris Develder is an Associate Professor with the research group IBCN of the Dept. of Information Technology (INTEC) at Ghent University - iMinds, Ghent, Belgium. He currently leads two research teams within IBCN, one on information retrieval and extraction, the other on smart grids. His research interests also still include optical networks (dimensioning, modeling, optimization, esp. for grid/cloud computing). Chris received the MSc degree in computer science engineering and a PhD in electrical engineering from Ghent University (Ghent, Belgium), in July 1999 and December 2003 respectively (as a fellow of the Research Foundation, FWO). From Jan. 2004 to Aug. 2005, he worked for OPNET Technologies, on (optical) network design and planning. In September 2005, he re-joined INTEC as a postdoctoral researcher, and as a postdoctoral fellow of the FWO since October 2006 (until 2012). In Oct. 2007 he obtained a part-time, and since Feb. 2010 a fulltime professorship at Ghent University. He has stayed as a research visitor at UC Davis (Jul.-Oct. 2007), CA, USA and at Columbia University, NY, USA (Jan. 2013 - Jun. 2015). He was and is involved in various national and European research projects (e.g., FP7 Geysers, FP7 Increase, FP7 C-DAX). He regularly serves as reviewer/TPC member for international journals and conferences (IEEE Trans. Smart Grid, IEEE/OSA JLT, IEEE/OSA JOCN, IEEE/ACM Trans. Networking, Computer Networks, IEEE Network, IEEE JSAC, IEEE Communications Magazine; IEEE Globecom, IEEE ICC, IEEE SmartGridComm, ACM SIGIR, ACM CIKM, etc.). He is Senior Member of IEEE and Member of ACM.

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Ulrich Speidel
University of Auckland

Thursday 21 July
2:30 pm to 3:30 pm

IRMACS Centre
ASB 10901 (Board Room)
Simon Fraser University

Light refreshments
Open to public
Please register so we more accurately estimate room size & refreshments

Information
Circuits and Systems
Chair Ljiljana Trajkovic
ljilja@cs.sfu.ca

Can network coding bridge the digital divide in Pacific Island countries?

Many Pacific Island nations rely on expensive satellite Internet links with low bandwidth and high latency. Small populations, low per-capita GDP, huge distances and a mostly very deep ocean make submarine fibre cables prohibitive for many. To add insult to injury, many ISPs in the islands struggle to utilise the full capacity of their satellite links. The culprit is TCP queue oscillation, an effect discovered decades ago - and widely considered solved through the evolution of TCP/IP stacks. However, we show that it does still occur across satellite links where a large number of TCP senders share the same bandwidth into the island. We also demonstrate that coding packets allows TCP flows to recoup some of the capacity lost to queue oscillation, and report about ongoing work to simulate whole-of-island network coding of traffic.

Speaker: Ulrich Speidel is a senior lecturer in Computer Science at the University of Auckland, New Zealand. He trained as a physicist in Germany and New Zealand, morphed into a CS person as part of his PhD, and served as an associate professor at the University of Tokyo in 2010. His research covers aspects of information theory, signal processing, network measurement, Internet protocols, applications and security.

CAS
IEEE CIRCUITS AND SYSTEMS SOCIETY
IEEE VANCOUVER/VICTORIA JOINT CHAPTER

Charles Q. Su
Newcastle University

Thursday 21 July
12:00 PM - 1:00 PM

BC Hydro
Edmonds A01 Auditorium
Skytrain Room
6911 Southpoint Dr Bby

Smart condition nonitoring of power system equipment

During the last three decades, there have been many new developments in condition monitoring (CM) of high voltage equipment in electrical power systems. Hundreds of new instruments are in use around the world. Enormous quantities of CM data are collected from on-line and off-line tests every day. Now it might be the right time to ask "Are we using CM instruments wisely?"

In fact, one of the problems often encountered by industry is how to interpret the mass of CM data. Of course, CM program must be accurate, reliable and cost-effective for any utility. The cost includes instrumentation and on-going testing and data interpretation. The common problems experienced by industry are:

- over-usage of techniques and instruments, making CM costly;
- misunderstanding of the principles underlying the operation of CM equipment, and its capability and applicability;
- difficulty in interpreting complex and voluminous data, and therefore in diagnosing incipient faults;
- difficulty in determining the critical fault levels on which repair/replacement decisions should be based;
- difficulty in estimating sufficiently accurately the remaining service lifetime of insulation.

Given the above problems, a new concept of Smart Condition Monitoring (SCM) is proposed to wisely apply and develop new condition monitoring techniques. It should not be confused with "smart grid" which obviously has different meaning. Smart condition monitoring would be concerned on the following:

- smart selection of CM techniques
- smart sensor development
- smart data interpretation and diagnosis
- smart failure investigation and failure prevention
- smart sharing

In this seminar, the idea of SCM will be presented using case studies from power industry.

Speaker: Dr. Charles Su received his MEng in 1981 and PhD in 1990 (University of New South Wales, Australia). He was a tests and operations engineer from 1971-1978 and an honorary research associate at the University of Western Australia in 1985. From 1991 until 2001 he was senior lecturer, associate professor and head of the HVICM Group at Monash University, Australia. Commencing in 2002, he worked as the chief technologist at Singapore Power (SPPG) for 5 years. From 2007 to 2011 he was a professor and the chair of the Research Committee at the Petroleum Institute, UAE. He was also a guest professor at the Electrical Power University, Beijing in 2012 and Wuhan University in 2013. He is currently with Newcastle University, UK.

Charles has published two books and over 150 journal and conference papers. He received the Vice-Chancellor's Special Commendation for Teaching Excellence at Monash University in 2001 and an IEEE Standards Award for contribution to the standard "Guide on the Measurement of Partial Discharges in Rotating Machines" in 2002. He has provided consulting services to many utilities in the world and has conducted a number of training courses for the industry in Australia, America, UAE, Singapore, China, Malaysia, Taiwan, Hong Kong and Indonesia. He is a Fellow of the IET (former IEE), a member of CIGRE A2, and a Senior Member of IEEE since 1991.

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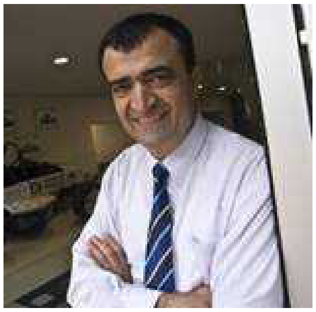

Gursel Alici

Soft Robotics: is it a new paradigm in robotics?

Monday 11 July
10:00 AM

MCLD 418
UBC Vancouver

As an emerging field of robotics, soft robotics is the science and engineering of the robots primarily made of soft materials, components and active structures such that they can safely interact and adapt with natural world better than their predecessors (i.e. robots made of hard components). In parallel to recent developments in soft smart materials and additive manufacturing (aka 3D printing), it has been gathering significant momentum to bring a new dimension to the establishment of new robotic concepts. The progress in soft robotics will have a significant impact especially on medical applications including prosthetic limbs or devices, wearable robots, assistive devices, and rehabilitation devices. When there is an application for which a safe human-machine interaction and adaptability with a physical environment are required, there is a need for robotic arms or systems or components with adjustable stiffness, made of soft materials with programmable characteristics. The progress in soft robotics strongly depends on the progress in materials science and technology. In this talk, we will present what soft robotics is, outline the significance of soft materials in establishing soft robotic systems, and some of the current research challenges in the field.

Speaker: Gursel Alici received the Ph.D. degree in robotics from the Department of Engineering Science, Oxford University, Oxford, U.K., in 1994. He is currently a Professor at the University of Wollongong, Wollongong, Australia, where he is the Head of the School of Mechanical, Materials and Mechatronic Engineering since 2011. His research interests are soft robotics, system dynamics and control, robotic drug delivery systems, novel actuation concepts for biomechatronic applications, robotic mechanisms and manipulation systems, soft and smart actuators and sensors, and medical robotics. He has published more than 300 refereed publications in his areas of research.

Dr. Alici was a Technical Editor of the IEEE/ASME Transactions on Mechatronics during 2008–2012. He is a Technical Editor of the IEEE Access, the first IEEE open access journal with interdisciplinary scope. He is a Member of the Mechatronics National Panel formed by the Institution of Engineers, Australia. He has served on the international program committee of numerous IEEE/ASME International Conferences on Robotics and Mechatronics. He was the General Chair of the 2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics held in Wollongong, Australia. He is the leader of Soft Robotics for Prosthetic Devices theme of the ARC Center of Excellence for Electromaterials Science. He received the Outstanding Contributions to Teaching and Learning Award in 2010 and the 2013 Vice-Chancellor's Interdisciplinary Research Excellence Award from the University of Wollongong

Information:
Contact John Madden, jmadden@ece.ubc.ca, if you would like to meet with Gursel on Monday.

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