Centre for Intelligent Control Seminars

Date	**23 January 2008 (Wednesday)**
Time	**10 am – 12 noon**
Venue	**Lecture Theatre 3 (LT3), NUS**
Topic 1	**ISA100 Wireless Standards for Industrial Automation**
Speaker	**K K Siew, President of ISA Singapore Section**

ABSTRACT:

An overview of ISA (Instrumentation, Systems and Automation Society, USA), current industrial wireless technologies and the emerging ISA wireless standards for industrial automation.

BIOGRAPHY:

K K brings with him more than 24 years of industrial experiences in I&C/DCS/ESD/Automation after serving the major oil companies and leading automation vendors for offshore oil and gas, oil refining and petrochemical industries across the Asia Pacific region. Currently, he is the managing director of PAC Technologies in providing consultancy in plant automation and industrial wireless solutions. He is the board member of ISA management division, USA and member of ISA100 Wireless Committee. K K holds a MEng and MBA from the New South Wales State, Australia; and a regular speaker at ISA Technical Conference in Chicago and Houston since 2004.

Topic 2	**Trends in IT and Automation in Pharmaceutical Manufacturing**
Speaker	**Dr David Mastumoto, Vice President of ISA Singapore Section**

ABSTRACT:

Leveraging the ISA 95 framework to define solutions in IT and automation to drive business productivity.

BIOGRAPHY:

Dave is the Asia Pacific Regional It Director for the manufacturing division of Merck & Co., Inc and is currently based in Singapore. He has 20 years of experience in chemical and pharmaceutical manufacturing with Merck including assignments in the US, India, and Japan. Dave received his doctorate in chemical Engineering from MIT in 1988.

Date	**13 February 2008 (Wednesday)**
Time	**11 am – 12 noon**
Venue	**E4 04-04, NUS**
Title	**Handling Uncertainties in Multi-objective Evolutionary Optimization**
Speaker	**Dr Goh Chi Keong (Senior Research Fellow, Data Storage Institute)**

ABSTRACT:

Evolutionary algorithms are biologically-inspired stochastic search methods that are very efficient and effective in solving sophisticated multi-objective (MO) problems. However, the performance of multi-objective evolutionary algorithms (MOEAs) deteriorates in the presence of uncertainties. In certain situations, the solutions found may not even be implementable in practice. In this talk, the challenges faced when handling the different forms of uncertainties: 1) noisy objective functions, 2) dynamic MO fitness landscape, and 3) robust MO optimization will be discussed. Specifically, the impact of these uncertainties on MO optimization will be described and the necessary modifications to the basic MOEA design will be presented.

BIOGRAPHY:

Dr Goh Chi Keong received the BEng and PhD degrees from the Department of Electrical and Computer Engineering at the National University of Singapore in 2003 and 2007, respectively.

He is currently a Senior Research Fellow with Data Storage Institute, Agency for Science, Technology and Research (A*Star). He has served as a Reviewer for various international journals such as the IEEE Transactions on Evolutionary Computation, IEEE Transactions on System, Man, and Cybernetics, Part B, IEEE Transactions on System, Man, and Cybernetics, Part C, Neurocomputing, etc. He has co-chaired the Special Sessions on Evolutionary Computation for Expensive Problems and Evolutionary Computation in Uncertain Environments in the IEEE Congress on Evolutionary Computation.

Date	**27 February 2008 (Wednesday)**
Time	**11 am – 12 noon**
Venue	**E4 04-04, NUS**
Title	**Data-driven Process Modeling Strategy for Chemical Process Operations**
Speaker	**Dr David Wang (Senior Research Fellow, Institute of Chemical and Engineering Sciences**

ABSTRACT:

Process modelling relating process variables with product quality has been a challenge in chemical process operations。 This relationship provides a real-time mechanism on what the product quality will be based on current operating conditions and, further, how to regulate process conditions in order to make the success of the on-spec quality production. It is difficult to develop their relationship using first principles due to the complexity of the process. Data driven modelling can be an effective approach in most chemical process operations.

In this talk, a modelling strategy based on a latent variable model and its practical applications are presented. The modelling strategy, including partial least squares regression (PLS), its comparison with other data driven methods, and the issues to be considered in modelling process, will be discussed along with industrial process quality prediction and control examples.

BIOGRAPHY:

David Wang Dawei is a senior research fellow in Institute of Chemical and Engineering Sciences (ICES), Singapore. He obtained his doctorate in chemical engineering at the University of Sydney in 2000 and joined ICES in 2005. He received BS degree in mathematics and system science and ME degree in automatic control in Northeastern University, China.

His current research interests lie in Process Systems Engineering (PSE) including chemical process control, modeling, monitoring, optimization, and data mining. He was a recipient of Australian Research Council (ARC) award (1999, 2000) and best paper award in IEEE's 4th International Conference on Industrial Informatics (2006). Dr. Wang has published ~50 technical papers and book chapters, and he is reviewer of a number of international conferences and journals such as Computers & Chemical Engineering; Journal of Process Control; AIChE Journal; Industrial & Engineering Chemistry Research; and IEEE Transactions on Industrial Informatics.

He is a member of AIChE, ICS and IEEE.

Date	**12 March 2008 (Wednesday)**
Time	**11 am – 12 noon**
Venue	**E4 04-04, NUS**
Title	**Fault detectability and isolability conditions in the frequency domain**
Speaker	**Mr Lu Jingfang**

ABSTRACT:

A fault is defined to be a change in the plant parameter vector which subsequently alters the frequency response of the plant. In this context, fault detection refers to the ability to identify when a change in the frequency response has occurred while fault isolation refers to the identification of the plant parameter which has changed.

Both these are achieved without the specific identification of the parameter vector. Instead, fault detection and isolation (FDI) are achieved by the construction of a residual vector based on the estimated frequency response. Since this approach is closely related to frequency response identifiability, the relationship between identifiability, detectability and isolability will be derived and presented in this talk. The conditions of detectability and isolability will be proposed in terms of the residual vector. Some simulations studies will be presented to illustrate the results.

BIOGRAPHY:

Mr. Lu Jingfang obtained a Master of Engineering from Shanghai Jiaotong university in 2001. After a two-year experience of software engineer, he joined NUS for a PhD degree in 2003. He is now a software engineer at esec Oerlikon company.

Date	**26 March 2008 (Wednesday)**
Time	**11 am – 12 noon**
Venue	**E4 04-04, NUS**
Title	**A stability criterion of arbitrarily switched second-order LTI systems**
Speaker	**Mr Huang Zhihong**

ABSTRACT:

A switched system is a particular kind of hybrid dynamical systems that consists of a family of subsystems and a logical rule that orchestrates the switching between them. Many real-world processes and systems, for example, chemical, power systems and communication networks, can be modeled as switched systems. The stability issues of switched systems, especially switched linear systems, have attracted considerable interest in the past decade.

In this talk, the stability issues of a pair of planar LTI systems under arbitrary switching are investigated through the geometrical approach, and an easily verifiable, necessary and sufficient condition is derived. The main idea is to characterize the worst case switching signals based upon the variations of the constants of the integration of the subsystems. The condition is generic as all possible combinations of the subsystem dynamics are considered.

BIOGRAPHY:

Mr. Huang Zhihong obtained his Bachelor degree in Department of Electrical & Electronic Engineering from Zhejiang University, Hangzhou, China in 2002. After working as an engineer for 3 years, he came to NUS in the year 2005 to pursue his Ph.D. degree in Department of Electrical & Computer Engineering, NUS, under the supervision of Prof. Xiang Cheng and Prof. Lee Tong Heng. His current research interest is on stability and stabilizability of switched systems.

Date	**9 April 2008 (Wednesday)**
Time	**11 am – 12 noon**
Venue	**E4 04-04, NUS**
Title	**Comparative Study of System-Wide Reliability-Constrained Generation Expansion Problem**
Speaker	**Dr Panida Jirutitijaroen**

ABSTRACT:

Most of the optimization techniques proposed for generation expansion problem considers reliability in terms of the overall system. The optimal solution yields system reliability maximization which, in turn, may not guarantee fair improvement of reliability to customers at each bus. When a customer is charged equally the expansion cost, each may not receive the same reliability level. It is interesting to see if the system-wide reliability maximization can lead to fair reliability enhancement to all customers. If not, the problem should be reformulated in order to take into account the distribution of customer reliability at each bus. In this talk, we first formulated the planning problem as a two-stage recourse model using stochastic programming framework. Reliability indexes used are system expected unserved energy cost in the objective function and system expected load loss in the constraint. Sample-Average approximation technique is used to simplify the problem and to obtain the optimal solution. Expected unserved energy indexes of each bus before and after the optimal planning are calculated and analyzed using Monte Carlo simulation. The objective of this study is to determine if a solution from system-wide cost minimization problem can lead to equally improved reliability in all individual buses. The comparison is implemented on a 24-bus IEEE-RTS

BIOGRAPHY:

Panida Jirutitijaroen holds a B.Eng. from Chulalongkorn University, Bangkok, Thailand in 2002 and a Ph.D. degree from Texas A&M University, College Station, USA in 2007. She is currently an Assistant Professor at National University of Singapore. Her research interests include power system analysis, reliability theory applied to power systems, and application of mathematical programming and optimization techniques to power systems.

Date	**21 August 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**Servo Challenges for Enterprise drives**
Speaker	**Dr Venkatakrishnan Venkatarmanan, Senior Research Fellow, Data Storage Institute, Singapore**

ABSTRACT:

The current trend in the enterprise drive is the replacement of 3.5” drives by high-density 2.5" SAS storage arrays for highest I/O scores. All disk drive manufacturers offer enterprise drives with very high capacity and/or with high performances. Enterprise drives operate for 24/7 over a long period and of course work with online transactions in banks, used in internet servers etc. In order to meet the increasing demand for high capacity disk drives the industries are trying to achieve the areal density of 10 Tb/in2 by 2014.

This talk focuses on the servo challenges of high density disk drives. Future disk drives will have low flying height, higher level of media noise and thus low signal-to-noise ratio (SNR). Accordingly, the servo system will not only have to deal with vibrations induced by near-contact recording at lower flying heights, but also need to be able to operate with lower position error signal (PES) sensing SNR due to the head, media and electronic noise. In this talk the problems due to contact induced vibrations and lower position error signal will be presented with experimental results.

BIOGRAPHY:

Dr V. Venkataramanan obtained his B.E in Electrical & Electronics Engineering from Annamalai University India in 1990, M.Eng degree in Control & Instrumentation Eng., in 1992 from Anna University, India and PhD from National University of Singapore in 2002. He is currently working as senior research fellow in A*Star Data Storage Institute, Singapore. His current research interests are high frequency vibration compensation and nonlinear optimal control for hard disk drive servo systems.

Date	**4 September 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**Towards Humanlike Social Touch for Sociable Robotics**
Speaker	**Dr. John-John Cabibihan, NUS**

ABSTRACT:

A grand challenge in robotics is to create robots with an inherent notion of sociability - robots with emotion, capable of imitation and acquisition of social skills, and ultimately, create an emotional connection with humans. To achieve a more natural human-robot interaction, a socially interactive robot must demonstrate 'believable' behavior: it must establish appropriate social expectations, it must regulate social interaction, and it must follow social conventions and norms. Therefore, any humanoid robot that is intended to live in human spaces in the near future must be equipped with the suitable cognitive and structural capabilities for interacting with humans.

Touch is important in social interactions. Social touch are all those instances in which people touch each other, when shaking hands, when giving a hug or when giving a pat in the back as a sign of congratulations. Unless some form of alternative greetings are invented in the future, the typical social touches exchanged among humans may likely remain even with a social robot. This talk will present the bio-inspired mechatronics technologies for artificial hands, tactile sensors and synthetic skin materials that may be able to provide humanlike duplication of social touch for sociable robotics.

BIOGRAPHY:

Dr. Cabibihan is an Assistant Professor at the Department of Electrical and Computer Engineering at the National University of Singapore. Dr. Cabibihan's goal is to develop the enabling technologies for sensorized artificial skins with humanlike similarities. His main research interests are in bio-inspired tactile sensing, artificial skins, humanoid and prosthetic artificial hands, and social robotics. He was conferred with a Ph.D. degree in Biomedical Robotics at the Scuola Superiore Sant'Anna, Pisa, Italy in May 2007. In 2005, he was a visiting research fellow at the Laboratories Mécanique et Technologie (LMT) of the Ecole Normale Supérieure de Cachan, France. He received his M.Sc. degree in Manufacturing Engineering (with high distinction) from De La Salle University, Manila, Philippines in 2002. He received his B.Sc. degree in Manufacturing Engineering and Management in 1999 at the same university.

Date	**4 September 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**Towards Humanlike Social Touch for Sociable Robotics**
Speaker	**Dr. John-John Cabibihan, NUS**

ABSTRACT:

This talk will cover some important discoveries so far on the structure and functions of human visual system. The core area in the brain, the primary visual cortex is believed to be organized to realize some fundamental functions, such as edge detection and motion detection and then to fulfill the high level perception including object recognition. The experimental procedure to investigate the visual cortex is introduced, and the computational model that underlies the computational principles of visual system is also presented. The aim of the research work is to establish a bridge between neuroscience and computer science in the area of visual perception, and to elicit novel, intelligent and efficient methods for image analysis, computer vision, etc.

BIOGRAPHY:

Huajin Tang received the B.Eng and M.Eng degrees from Zhe Jiang University, Shanghai Jiao Tong University, in 1998 and 2001, respectively. He obtained the Ph.D. degree in electrical and computer engineering from the National University of Singapore in 2005. From 2004 he has been an R&D engineer in STMicroelectronics, before pursing the postdoctoral research in Queensland Brain Institute, University of Queensland, Australia since 2006.

He has authored or coauthored a number of papers in peer-reviewed international journals, including IEEE Trans. on Neural Networks, Circuits & Systems, Neural Computation, Neurocomputing, etc. He has also coauthored one monograph in 2007 published by Springer in his research area. His research interests include machine learning, neural networks, computational and biological intelligence. He is now a research fellow in Institute for Infocomm Research (I2R), A*Star.

Date	**2 October 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**Fault Tolerant Control**
Speaker	**Dr Mouhacine Benosman (Research Scientist, Temasek Laboratories, NUS**

ABSTRACT:

Fault tolerant control (FTC) aims at achieving acceptable performance and stability for the safe fault-free system as well as for the faulty system. The available schemes can be classified into two types; passive and active FTC. Active FTC aims at ensuring the stability and some performances, possibly degraded, for the post-fault model. This is achieved by reconfiguring on-line the controller, based on the fault detection and diagnosis (FDD) block that detects isolates and estimates the current fault. Passive FTC consists on using a unique robust controller that will deal with all the expected faults and thus in this case no on-line control reconfiguration is needed and no FDD block is required. In practice these two methodologies have to be combined to achieve efficient practical fault tolerant control. Indeed, passive FTC complements active FTC during the time period when the FDD module of the active scheme is trying to isolate and estimate the fault. During this estimation time, the system's performances may degrade to reach unacceptable level or even worse the system may become unstable. Thus, passive FTC have to be used during this period to ensure at least the stability of the system, before switching to an active FTC based on the estimated post-fault model, to ensure the best possible post-fault performances. In this talk, we will present some passive and active FTCs for linear and nonlinear models.

BIOGRAPHY:

Mouhacine Benosman received his degree in Engineering and Master in Systems Control from Tlemcen University in 1997, 1998, respectively. In 2002, he received the Ph.D. degree in Systems Control from Ecole Centrale de Nantes. In 2001, He was visiting researcher at the Robotics Centre of La Sapienza University at Rome. From 2002 to 2004, he was assistant lecturer with the Electrical and Control Engineering Department of Reims University. In 2005, he was post-doctoral researcher with the Control Group of the Industrial Control Center of Strathclyde University at Glasgow. Since 2006, he has been research scientist with the Temasek Laboratories at the National University of Singapore. His research interests concern nonlinear systems control and its applications.

Date	**16 October 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**Feature extraction by cluster-based recursive bayesian linear discriminant analysis with application to face recognition**
Speaker	**Mr Huang Dong (NUS-ECE)**

ABSTRACT:

Automatic (machine) recognition of patterns are important problems in a variety of engineering and scientific disciplines such as biology, medicine, marketing, computer vision, artificial intelligence, and remote sensing. One of the most important component of a pattern recognition system is feature extraction. Although great advancement has been made on feature extraction techniques, how to develop a general procedure for effective feature extraction remains an interesting and challenging problem. This talk presents a new feature extraction algorithm. Compared to popular techniques, like FLD, this new technique has several advantages: elimination of feature number constraint, applicable to multi-modal class distribution, and a criterion function with direct relationship to Bayes error. The new technique is applied on face recognition problem and UCI databases and shows improved performance.

BIOGRAPHY:

Mr Huang Dong received his Bachelor of Engineering degree from the National University of Singapore in 2005. He is now pursuing his Ph.D. degree at the Department of Electrical & Computer Engineering in NUS. His present research focuses on pattern recognition with application to face recognition, brain-computer-interface.

Date	**30 October 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**A Memetic Search Algorithm for Rule Extraction**
Speaker	**Mr. Brian Ang Ji Hua (NUS-ECE)**

ABSTRACT:

Rule-based algorithms have been gaining increasing attention from researchers for classification tasks as compared to non-rule based techniques. Non-rule based techniques though are able to attain high predictive accuracy, are not able to provide any comprehensible rules or explicit knowledge to the users due to their black-box nature. Rule-based algorithms on the other hand are able to provide high level linguistic rules or knowledge. In areas such as management decision support, medical diagnosis, etc., where human experts play a critical role, these knowledge derived are particularly useful which are able to compliment and expedite their decisions. Among these rule-based search optimization algorithms, Evolutionary Algorithms (EAs) stand out as they can be easily implemented and by performing multiple searches concurrently and in a non-deterministic manner, they are also less likely to get trapped in local optima while approaching the global optimum.

Though EAs are able to oversee the macro-picture well, they do not exploit the search space thoroughly. Hence, local search is required to improve the optimization of EAs that concentrated mainly on global exploration. This seminar discusses the hybridization of EAs with Artificial Immune Systems (AIS) for rule extraction, where the global search is performed by the EAs while local search inspired by the AIS is used for fine-tuning of the evolved rules. The rules are encoded using variable length chromosome representation allowing easy adaptation and through the structural mutation and crossover operators, the appropriate number of rules is optimized.

BIOGRAPHY:

Mr. Brian Ang received the B.Eng. degree from the Department of Electrical and Computer Engineering at the National University of Singapore in 2004. He is currently a Ph.D. candidate at the Centre for Intelligent Control, National University of Singapore. His current research interests lies in the area of using computational intelligence techniques for data analysis.

Date	**13 November 2008 (Thursday)**
Time	**11 am – 12 noon**
Venue	**E4 04-07, NUS**
Title	**A General Framework for Delay Compensation for Input-delay Systems via Predictive Control Design**
Speaker	**Cao Lingling (NUS-ECE)**

ABSTRACT:

In this talk, a predictive control scheme is proposed for both linear and nonlinear systems with constant input delay. The central idea is that the control signal is constructed based on the prediction of the state in the future rather than on the current state. Its performance depends on the prediction accuracy. The controller developed for linear systems is mathematically equivalent to Artstein model reduction or finite spectrum assignment (FSA). For nonlinear systems in companion form or lower triangular form, stability can be guaranteed provided that the prediction error is bounded.

BIOGRAPHY:

Miss. Cao Lingling received the B.Sc. degree from the Department of Applied Mechanics at Fudan University, China, in 2006. She is currently a Ph.D. candidate at the Department of Electrical and Computer Engineering, National University of Singapore. Her current research interests lies in the area of process control of a biological system.