



# 8<sup>th</sup> International Symposium on Advanced Control of Chemical Processes

ADCHEM 2012  
Singapore, 10-13 July 2012

Program Booklet

Organized by



Supported by



Held in



## Message from NOC Chairs

Dear colleague,

It gives us great pleasure in welcoming you to the 8<sup>th</sup> International Symposium on Advanced Control of Chemical Processes (ADCHEM 2012). ADCHEM is the triennial meeting of the International Federation of Automatic Control that brings together researchers and practitioners to discuss recent developments in control of chemical, biochemical, and related process systems.

The International Programming Committee has worked very hard to put together a stimulating program. The program accommodates contributions from various application areas and methodologies including those outside classical chemical process control. ADCHEM 2012 is sponsored by the IFAC Technical Committee on Chemical Process Control and co-sponsored by the IFAC Technical Committees on Non-linear Control Systems, Biosystems and Bioprocesses, and Fault Detection, Supervision and Safety of Technical Processes.

Following the tradition of the previous symposia held in Toulouse (1991), Kyoto (1994), Banff (1997), Pisa (2000), Hong Kong (2003), Gramado (2006) and Istanbul (2009), ADCHEM 2012 is held in the city state of Singapore. Often referred to as "The Little Red Dot", Singapore is a melting pot of Asian cultures reflected in its architecture, people, and food. Singapore has several attractions including Botanical Gardens, Night Safari, Jurong Bird Park, Bukit Timah Nature Reserve, Southern Ridges nature trail, and Mount Faber. We hope that in addition to attending the symposia, you will find some time to visit these attractions during your stay.

We wish to extend our sincere thanks to Singapore Development Centre (SGDC), Yokogawa Electric International Pte Ltd. for their continued support of Process Control and related conferences in Singapore. Thanks are also due to the Singapore Tourism Board and the Singapore Exhibition & Convention Bureau for supporting ADCHEM 2012.

Finally, we would like to thank members of the National and International Programming Committees, students at the National University of Singapore and Nanyang Technological University, the Instrumentation and Control Society, and Mr. Alvin Tan and Ms. Xianqin Ding for their continued support in making ADCHEM 2012 a success.

Vinay Kariwala and Lakshminarayanan Samavedham  
(Co-chairs of National Organizing Committee)

## Message from IPC Chair

ADCHEM 2012 was made possible by the volunteers who invested their time. The Area Chairs, the International Programming and National Organizing Committees, the reviewers, the organizers of invited sessions, the session chairs and co-chairs, and the authors deserve the credit for the technical quality of this conference. Thank you!

Each day is opened by a Plenary Lecture, which is followed by two keynote lectures, and then sessions. The afternoons have additional keynote lectures and sessions, and the Wednesday and Thursday technical programs end with poster sessions. Wednesday's plenary by Frank Allgower considers the design of optimal decentralized control in which the structure of the controller is incorporated into the optimization. Thursday's plenary by Jay Hyung Lee consider the role that control engineering can be play in the optimization of energy supply chains. Friday's plenary by Jose Tabora describes the application of data-driven modeling and control methods to batch processes in the pharmaceutical industry. More than half of the keynote presentations were selected from the submissions to the symposium based on the reviews, with the full list of topics including the advanced control of industrial polymerization reactors, wastewater treatment, chromatographic separations, exothermic chemical reactors, particulate dynamics in rotating drums, integrated microchemical systems, ore mineral processing, and solar energy systems. The keynote talks span the spectrum of systems and control technologies including optimization, control, scheduling, state estimation, and fault diagnosis.

The poster sessions for this ADCHEM have been organized a bit differently than in previous years, in that a mix of topics is included in both poster sessions. This makes it easier for an attendee interested only in one topic, such as process modeling, to visit posters on that topic in both poster sessions.

I welcome you to the 2012 ADCHEM and hope that you find the symposium to be intellectually stimulating and enjoyable.

Richard D. Braatz  
(Chair, International Programming Committee)

## National Organizing Committee

Vinay Kariwala, ABB Corporate Research Centre, India (Co-Chair)

Lakshminarayanan Samavedham, National University of Singapore (Co-Chair)

Joseph Lee Ching Hua, Yokogawa Electric Asia Pte. Ltd. (Industry Co-Chair)

## Members

Gade Pandu Rangaiah, National University of Singapore

Min-Sen Chiu, National University of Singapore

Qing-Guo Wang, National University of Singapore

Mohammed Aman Ullah, Nanyang Technological University

Cai Wenjian, Nanyang Technological University

## International Program Committee

Richard D. Braatz, Massachusetts Institute of Technology, USA (Chair)

Alexander Horch, ABB Corporate Research Centre, Germany (Vice-Chair)

## Area Co-Chairs

Zoltan Nagy (UK)            Batch process modelling & control

Rolf Findeisen (DE)        Model-based control

S. Joe Qin (US)            Process and control monitoring

Sunwon Park (KR)         Modeling and identification

Yaman Arkun (TR)         Optimization and scheduling

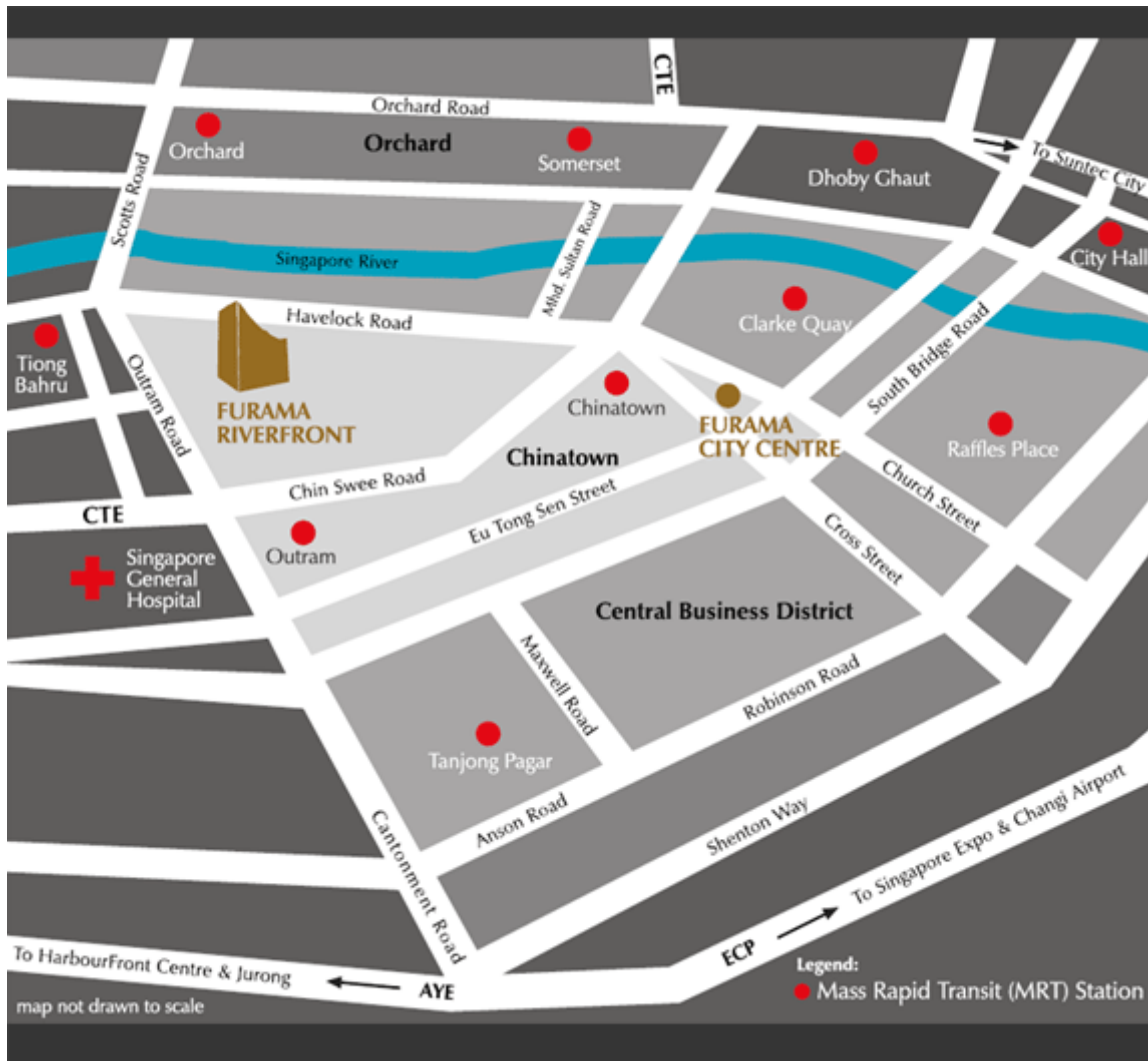
Martin Guay (CA)         Process applications

## Members

Gonzalo Acuna (CL), Paul Serban Agachi (RO), Frank Allgöwer (DE), Thomas Badgwell (US), Roberto Baratti (IT), B. Wayne Bequette (US), Dominique Bonvin (CH), Okko Bosgra (NL), Hector Budman (CA), Eduardo F. Camacho (ES), Benoit Chachuat (UK), Leo H. Chiang (US), M.A.A. Shoukat Choudhury (BD), Luis A. Cisternas (CL), Jean-Pierre Corriou (FR), Moritz Diehl (BE), Denis Dochain (BE), Francis J. Doyle III (US), Stephen P. Duncan (UK), Sebastian Engell (DE), Jose L. Figueroa (AR), Gilles Fevotte (FR), Martha Grover (US), Ravindra D. Gudi (IN), Rudyanto Gunawan (CH), Thomas Gustafsson (SE), Juergen Hahn (US), Katalin Hangos (HU), Shinji Hasebe (JP), Michael A. Henson (US), Morten Hovd (NO), Hsiao-Ping Huang (TW), Elling W. Jacobsen (SE), Sten Bay Jorgensen (DK), Mayuresh V. Kothare (US), Costas Kravaris (GR), In-Beum Lee (KR), Jay H. Lee (KR), Joseph Lu (US), Lalo Magni (IT), Jorge Mandler (US), Ricardo Julian Mantz (AR), Jacinto L. Marchetti (AR), Wolfgang Marquardt (DE), Thomas Meurer (AT), Jaime A. Moreno (MX), A. Julian Morris (UK), Ka Ming Ng (HK), Darci Odloak (BR), Babatunde A. Ogunnaike (US), Michel Perrier (CA), E.N. (Stratos) Pistokopoulos (UK), Cesar de Prada (ES), Jose Ragot (FR), Riccardo Scattolini (IT), Argimiro R. Secchi (BR), Claudio Scali (IT), Sirish Shah (CA), Sigurd Skogestad (NO), Stanko Strmčnik (SI), Moses Tade (AU), Nina Thornhill (UK), Jorge O. Trierweiler (BR), Xue Z. Wang (UK), Adrian Wills (AU), Yoshiyuki Yamashita (JP)

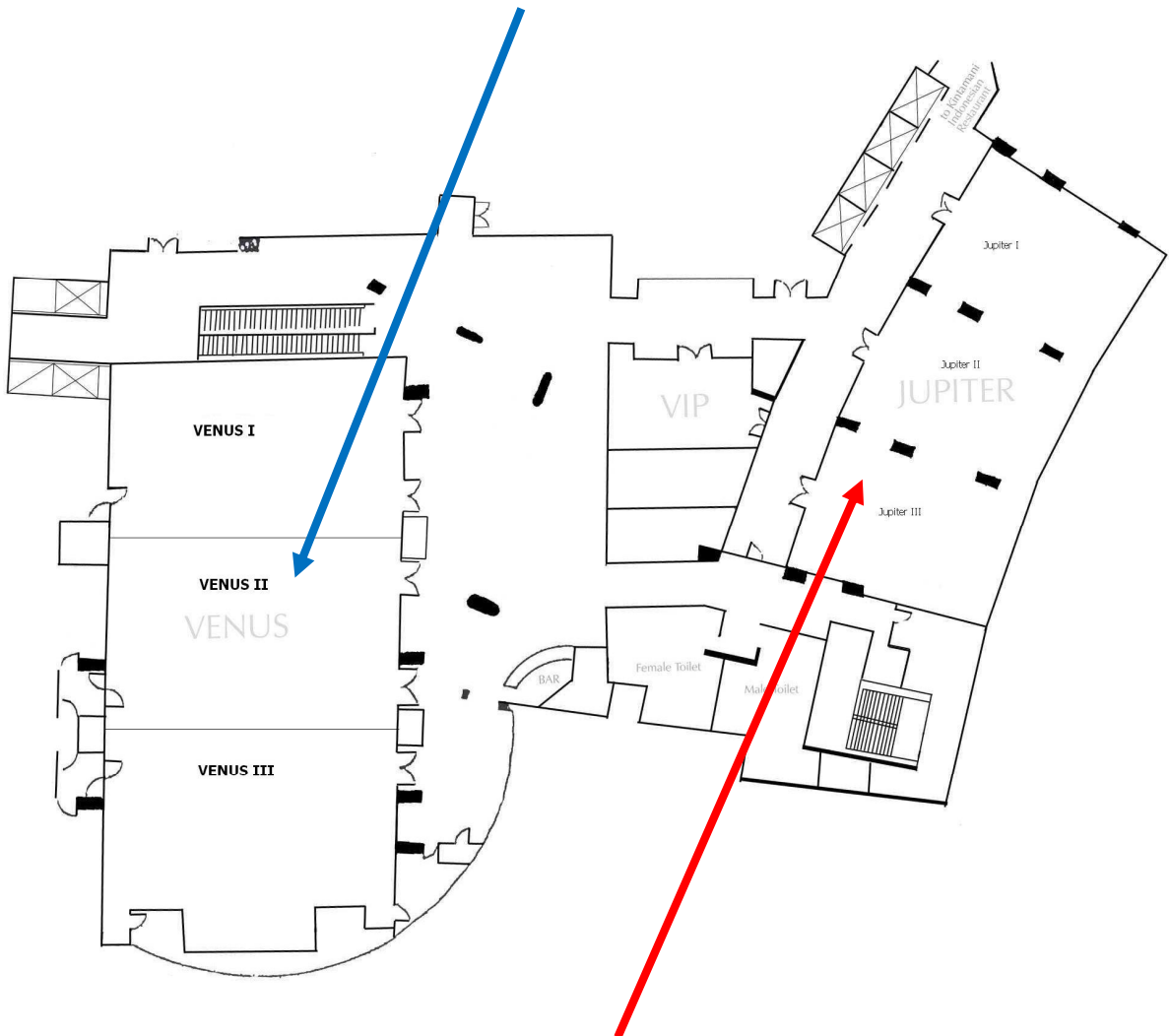
## Conference Venue

Furama RiverFront Hotel  
405 Havelock Road  
Singapore 169633  
Tel: (65) 6333 8898; Fax: (65) 6733 1588  
E-mail: riverfront@furama.com



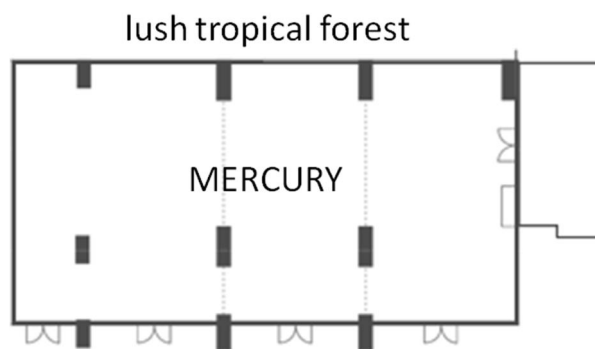
## Floor Plan

Venus Rooms (Level 3, Furama Riverfront): Venue for Conference Presentations (11<sup>th</sup> - 13<sup>th</sup> July)



Jupiter Ballroom (Level 3, Furama Riverfront): Venue for Lunches (11<sup>th</sup> - 13<sup>th</sup> July)

Mercury Ballroom (Level 5, Furama Riverfront): Venue of Conference Banquet (7PM, 12 July 2012)





## Social Program



River Cruise  
6 pm, 10<sup>th</sup> July 2012

Buses for transportation to the quay at Merlion park will be available from Furama Riverfront hotel at 5.15 pm.



Welcome Reception  
7 pm, 10<sup>th</sup> July 2012

Welcome reception will be held at O'Leary Restaurant located within Singapore Flyer premises. Prior to the reception, the participants can enjoy a 30-minutes ride on the flyer.



Conference Banquet  
7 pm, 12<sup>th</sup> July 2012

The banquet will be held in Mercury Ballroom at Furama Riverfront hotel. As you enjoy a sumptuous dinner, lend your eyes and ears to some ethnic music and dance performed by local artists.



## PROGRAMME OVERVIEW

	July 10, Tuesday	July 11, Wednesday	July 12, Thursday	July 13, Friday
8:00 AM- 8:15 AM		Coffee (Foyer)	Coffee (Foyer)	Coffee (Foyer)
8:15 AM- 8:30 AM		Opening Ceremony (Venus I)	Coffee (Foyer)	Coffee (Foyer)
8.30 AM - 9:30 AM		Plenary I (Venus I)	Plenary II (Venus I)	Plenary III (Venus I)
9.30 AM - 10:00 AM		Keynote 1 (Venus I) Keynote 2 (Venus II)	Keynote 5 (Venus I) Keynote 6 (Venus II)	Keynote 9 (Venus I) Keynote 10 (Venus II)
10.00 AM - 10:20 AM		Coffee (Foyer)	Coffee (Foyer)	Coffee (Foyer)
10.20 AM - 12:20 PM		Process Monitoring I (Venus I) Model-Based Control I (Venus II) Energy Systems (Venus III)	Modelling & Ident (Venus I) Model Pred Control I (Venus II) Reaction Networks (Venus III)	Control Applications (Venus I) Optim & Scheduling II (Venus II) Biological Systems II (Venus III)
12.20 PM - 1:40 PM		Lunch (Jupiter Ballroom)	Lunch (Jupiter Ballroom)	Lunch (Jupiter Ballroom)
1.40 PM - 2:10 PM		Keynote 3 (Venus I) Keynote 4 (Venus II)	Keynote 7 (Venus I) Keynote 8 (Venus II)	Keynote 11 (Venus I) Keynote 12 (Venus II)
2.10 PM - 2:30 PM		Coffee (Foyer)	Coffee (Foyer)	Coffee (Foyer)
2.30 PM - 4:30 PM		Process Monitoring II (Venus I) Model-Based Control II (Venus II) Batch Processes (Venus III)	State Estimation (Venus I) Optim & Scheduling I (Venus II) Biological Systems I (Venus III)	Process Applications (Venus I) Optim & Scheduling III (Venus II) Biological Systems III (Venus III)
4.30 PM - 5:30 PM		Poster Session I (Foyer)	Poster Session II (Foyer)	Closing Ceremony (Venus I)
7:00 PM - 10:00 PM	Welcome Reception (O'Leary Restaurant, Singapore Flyer)		Conference Banquet (Mercury Ballroom)	

Venus and Jupiter Rooms are on Level 3 and Mercury Ballroom is on Level 5 of Furama Riverfront

## Instructions for Authors

### Oral Presentations

- The allocated time for the talks are as follows:

Type	Presentation	Discussion
Plenary	50 minutes	10 minutes
Keynote	25 minutes	5 minutes
Regular	17 minutes	3 minutes

- Presentations should be done using MS-Office PowerPoint 2010 or Adobe Acrobat X. A notebook and a projector will be available in all the sessions. All presenters should save their presentations on a USB drive in a format readable on a Windows-based PC.
- Presenters should transfer their files to the notebook at the venue of their presentation as early as possible. Preferable times are during coffee, lunch and inter-session breaks. A student volunteer will be available to assist the presenters.
- Presenters are requested to submit a short biography to the Session Chair, 5 minutes before the beginning of the session. The biography should include at least your title, name and affiliation.

### Poster Presentations

- Posters should be in portrait layout and A1 size (594mm (W) x 841mm (H) /23.3in (W) x 35in (H)).
- Posters should be put up by 1:30 PM on the presentation day and removed right after the session ends.
- Board pins and Velcro tape will be available on-site. Posters are to be put up according to the numbering on the poster panels.
- Authors should be present during the poster session to explain their work and to interact with fellow attendees.

### Guidelines for Session Chairs

- Please take note of the day/time/venue of the session that you are chairing in the program booklet. On the day of the session that you are chairing, obtain any changes to the program from the Secretariat at the Registration Desk.
- Before the start of the session, collect the biographical information of the presenting authors. Use this information to introduce the speaker before his/her presentation.
- Be present in the room where the session is to be held 10 minutes before the start of the session and check that all the presentations have been copied on the notebook provided at the venue.
- Remind the presenting author about the time available for their presentation; see "Instructions to Authors" for details.
- Remind the authors at the 2-minute mark (e.g., at the 15th minute of presentation for regular presentations) to make their concluding remarks. Please ensure sufficient time for discussion.
- In case of "no-show" or if a talk ends early, do not pre-poner the presentations. The additional time can be used for discussions related to papers presented earlier in the session.

Plenary Talk I  
8:30-9:30AM, Wednesday, 11 July 2012 @ Venus I

*Decentralized State Feedback Control for Interconnected Process Systems*

Frank Allgöwer  
Institute for Systems and Automatic Control  
University of Stuttgart  
Stuttgart, Germany



**Abstract:** We consider the problem of constructing decentralized state feedback controllers for linear continuous-time systems. Different from existing approaches, where the topology of the controller is fixed a-priori, the topology of the controller is part of the optimization problem. Structure optimization is done in terms of a minimization of the required feedback and subject to a predefined bound on the tolerable loss of the achieved  $H_\infty$ -performance of the decentralized controller compared to an  $H_\infty$ -optimal centralized controller. We develop a computationally efficient formulation of the decentralized control problem by convex relaxations, which makes it attractive for practical applications.

**Biography:** Frank Allgöwer is Director of the Institute for Systems Theory and Automatic Control at the University of Stuttgart in Germany. He received his Ph.D. degree in Chemical Engineering from the University of Stuttgart. Prior to his present appointment he held a professorship in the electrical engineering department at ETH Zurich. He also held visiting positions at the California Institute of Technology, the NASA Ames Research Center, the DuPont Company, and the University of California at Santa Barbara. His main interests in research and teaching are in the area of systems and control with emphasis on the development of new methods for the analysis and control of nonlinear systems. Of equal importance to the theoretical developments are practical applications and the experimental evaluation of benefits and limitations of the developed methods. Applications range from control of atomic force microscopes and biomedical applications to the control of roller coasters and systems biology. At present Frank Allgöwer is Editor for the journal *Automatica*, Associate Editor of the *Journal of Process Control*, and is on the editorial board of several other journals. Frank Allgöwer has been organizer or co-organizer of several international conferences and has published over 150 scientific articles. Frank Allgöwer received several recognitions for his work including the IEEE Distinguished Lectureship, the appointment as IFAC Fellow, and the Leibniz prize of the Deutsche Forschungsgemeinschaft (DFG).

Plenary Talk II  
8:30-9:30AM, Thursday, 12 July 2012 @ Venus I

*Energy Supply Chain Optimization: A Challenge for Control Engineers?*

Jay H. Lee  
Department of Chemical and Biomolecular Engineering  
Korea Advanced Institute of Science and Technology (KAIST)  
Daejeon, Korea



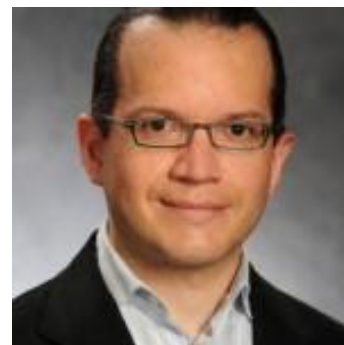
Abstract: Energy systems engineering problems are oftentimes complicated by factors like large amounts of uncertainties and multi-scale nature of decisions. This paper examines a particular aspect of energy systems engineering problems that gives rise to such complications--the coupling between long-term planning decisions like capital investment and policy and shorter-term decisions like production capacity operation and logistics. The paper starts with the discussion of a simple two-stage stochastic program that addresses optimization of an energy supply chain in the presence of uncertainties. The two-stage formulation can handle problems in which all design decisions are made up front and operating parameters act as 'recourse' decisions that can be varied from one time period to another based on realized values of uncertain parameters. The design of a biodiesel production network in the Southeastern region of the United States is used as an illustrative example. The discussion then moves on to a more complex multi-stage multi-scale stochastic decision problem in which periodic investment/policy decisions are to be made on a time scale orders of magnitude slower than that of operating decisions. The problem of energy policy modeling is introduced as an example. In the particular energy policy modeling problem we examine, annual acquisition of energy generation capacities of various types are coupled with hourly energy production and dispatch decisions. The increasing roles of renewable sources like wind and solar necessitates the use of a fine-grained time scale for accurate assessment of their values. The use of storage intended to overcome the limitations of the intermittent sources puts further demand on the modeling. Numerical challenges that arise from the multi-scale nature and uncertainties are reviewed and some possible modeling and solution approaches are discussed. Approximate dynamic programming is proposed as a promising algorithmic strategy to handle such challenges.

Biography: Jay H. Lee obtained his B.S. degree in Chemical Engineering from the University of Washington, Seattle, in 1986, and his Ph.D. degree in Chemical Engineering from California Institute of Technology, Pasadena, in 1991. From 1991 to 1998, he was with the Department of Chemical Engineering at Auburn University, AL, as an Assistant Professor and an Associate Professor. From 1998-2000, he was with School of Chemical Engineering at Purdue University, West Lafayette and then with the School of Chemical Engineering at Georgia Institute of Technology, Atlanta. Starting this fall, he is the Head of the Chemical and Biomolecular Engineering Department at KAIST, Korea. He has held visiting appointments at E. I. Du Pont de Numours, Wilmington, in 1994 and at Seoul National University, Seoul, Korea, in 1997. He was a recipient of the National Science Foundation's Young Investigator Award in 1993 and was elected as an IEEE Fellow and an IFAC Fellow in 2011. He published over 120 manuscripts in SCI journals with more than 2500 ISI citations. His research interests are in the areas of system identification, state estimation, robust control, model predictive control and approximate dynamic programming.

Plenary Talk III  
8:30-9:30AM, Friday, 13 July 2012 @ Venus I

*Data Driven Modelling and Control of Batch Processes in the Pharmaceutical Industry*

Jose E. Tabora  
Chemical Development, Bristol-Myers Squibb Co.,  
New Brunswick, NJ, 08903, USA



**Abstract:** Regulatory changes in the pharmaceutical industry have recast the role of chemical engineering in the development of processes for the large-scale manufacture of Active Pharmaceutical Ingredients. Health authorities' expectations have increased regarding proven demonstration of adequate process performance, process robustness, and quality control across development and manufacturing scales. These expectations have substantially increased the demands of experimental data collection, process monitoring, and multivariate process understanding. To address these requirements, innovative implementation of established and emerging automation, modeling, data management, and process monitoring techniques have been increasingly added to the repertoire of process development tools in particular, those carried out in agitated stirred tanks. This article will introduce the application of these techniques across the range of process development (from early to late phase) challenges. In particular, this article describes the implementation of Data Exploration Analysis to results obtained with automated parallel experimentation for batch reaction characterization and automated batch crystallization processes integrated to population balance modeling. Collectively these examples of new strategies for the automation of experimental batch processes, data analysis, and modeling provide an overview of recent trends in pharmaceutical chemical process development.

**Biography:** Jose E. Tabora obtained a B.S. degree in Chemical Engineering from Louisiana State University, Baton Rouge, in 1990, and a Ph.D. degree in Chemical Engineering from The University of Virginia, Charlottesville, in 1996. He joined the Department of Chemical Engineering at Merck specializing in process development and scale up of chemical organic synthesis and crystallization of active pharmaceutical ingredients. He joined the Development Engineering department at Eli Lilly Research Laboratories from 2005 to 2007. Currently he is a Senior Principal Scientist at Bristol Myers-Squibb after joining the Chemical Development organization in 2007. His research interests are in the areas of Data Science and Data Exploration Analysis and their application to chemical process development, crystallization theory and modeling, fluid-phase equilibria, and mechanistic, statistical, and hybrid models for chemical unit operations. He is also adjunct assistant professor at Manhattan College where he teaches reaction engineering. He is the winner of the 2011 Excellence in QBD Award presented by the Pharmaceutical Division of the American Institute of Chemical Engineers.

## Keynote Talks

1. Tiago Fiorenzano Finkler, Michael Kawohl, Uwe Piechottka and Sebastian Engell, *Realization of Online Optimizing Control in an Industrial Polymerization Reactor*

*Abstract:* In this work, the operation of an industrial semi-batch polymerization reactor is economically optimized using an NMPC scheme. The goal is the minimization of the batch duration without violating the tight constraints for the product specification. Important issues for the practical implementation such as the development and experimental validation of a suitable process model, the estimation of unmeasured states and the real time solution of the nonlinear optimization problem are depicted. The effectiveness of the control scheme is illustrated by results taken from the implementation at the real plant.

2. Olle Trollberg and Elling Jacobsen, *Extremum Seeking Control of the CANON Process - Existence of Sub-Optimal Stationary Solutions*

*Abstract:* The paper considers extremum seeking control (ESC) for on-line optimization of the CANON process, a new and potentially highly effective process for ammonium removal from wastewater. For gradient estimation we employ the classical method based on periodic excitation. From simulations we find that the ESC scheme can lock onto sub-optimal stationary solutions, far removed from the optimal solution, and that the ESC may have multiple stationary solutions for given controller parameters. The cause of this is investigated through analysis of a general dynamic model. Based on the analysis, it is shown that for systems for which the optimum corresponds to the input-output transfer-function having a transmission zero at the origin, there will in general exist a number of stationary solutions to the ESC with periodic excitation. The solutions are characterized by the phase lag of the system, rather than a zero gradient of the objective function, and are hence in general not related to the optimality conditions. For systems that can be described by Hammerstein or Wiener models, as typically considered in ESC, the solution will in general correspond to the zero gradient condition fulfilled at the optimum. As shown, the CANON process can not be described by Hammerstein or Wiener models, and this then explains the observed existence of sub-optimal stationary solutions.

3. Paul Suvarov, Alain Vande Wouwer and Achim Kienle, *A simple robust control for simulated moving bed chromatographic separation*

*Abstract:* Simulated moving bed (SMB) is a continuous chromatographic process used for the separation of chemical mixtures. This paper presents an almost plug-and-play control strategy, which requires little prior knowledge about the adsorption properties. A discrete-time nonlinear model derived from the wave theory is the basis to control the position of the adsorption and desorption fronts. The front velocities are estimated on-line enabling the compensation of initial parameter discrepancies, and drift due to column aging or temperature fluctuation. The overall performance of the control strategy is evaluated using numerical simulation for two case studies relative to the separation of fructo-oligosaccharides and cyclopentanone – cycloheptanone, respectively.

4. Attila Kozma, Joel Andersson, Carlo Savorngnan and Moritz Diehl, *Distributed Multiple Shooting for Optimal Control of Large Interconnected Systems (I)*

*Abstract:* Large interconnected systems consist of a multitude of subsystems with their own dynamics, but coupled with each other via input-output connections. Each subsystem is typically modelled by ordinary differential equations or differential-algebraic equations. Simulation and optimal control of such systems pose a challenge both with respect to CPU time and memory requirements. We address optimal control of such systems by applying “distributed multiple

shooting”, a generalization of the direct multiple shooting method, which uses the decomposable structure of the system in order to obtain a highly parallel algorithm. The interconnections are allowed to be infeasible during the iterations but are driven to feasibility by a Newton-type optimization algorithm. We evaluate the performance of the distributed multiple shooting method on a large scale estimation problem.

5. Aditya Tulsyan, Biao Huang, Bhushan Gopaluni and J. Fraser Forbes, *Performance Assessment of Nonlinear State Filters*

*Abstract:* Nonlinear state filters of different approximations and capabilities have been developed in the last decade. The quality of different nonlinear filters, in terms of the mean squared error (MSE) of the estimates, depends on the approximations used in the filtering algorithm; however, there are no known methods for effectively evaluating the relative performance of these filters. A new method which measures the performance of different state filters against the theoretical posterior Cramer-Rao lower bound (PCRLB) is proposed. The complex high-dimensional integrals in PCRLB are approximated using sequential Monte-Carlo (SMC) methods. Efficacy of the proposed method is illustrated through a simulation example.

6. Ngoc Ha Hoang, Françoise Couenne, Yann Le Gorrec, Cheng-Liang Chen and B. Erik Ydstie, *Passivity based controller and observer of exothermic chemical reactors*

*Abstract:* This paper focuses on nonlinear control and state estimation of non-isothermal exothermic Continuous Stirred Tank Reactors (CSTRs). More precisely, the asymptotic stabilization of such CSTRs about any operating point (including unstable open loop stationary point) is treated using the jacket temperature as the only control input. Since state variables are used in the feedback law, a state observer is also proposed. The convergence properties of the controller coupled with the observer are shown using passivity based tools in the Hamiltonian framework. Some numerical simulations with a first order chemical reaction are given to validate our theoretical results.

7. Javan Dave Tjakra, Jie Bao, Nicolas Hudon and Runyu Yang, *Studies of Particulate System Dynamics in Rotating Drums using Markov Chains*

*Abstract:* This work aims to develop an approach to study and capture the collective dynamics of particulate systems, which are important for operation of those processes. The collective dynamics of particles in a horizontal rotating drum are modeled based on a stochastic approach, using the Markov chains operators developed from DEM simulations. Quantitative analysis of the features of collective dynamics, namely dynamic modes of oscillatory behavior and spatial particle distribution of particle movement, are performed based on eigenvalues and singular values analysis of Markov chains operator, respectively. Furthermore, the quantitative measures are shown that it can be linked to the qualitative flow regimes of particulate systems in a horizontal rotating drum.

8. Mayuresh V. Kothare, *Dynamics and Control of Integrated Microchemical Systems (I)*

*Abstract:* Microchemical systems are a new generation of miniature chemical systems that carry out chemical reactions and separations in precisely fabricated three dimensional microreactor configurations in the size range of a few microns to a few hundred microns. Typical microchemical systems combine fluid handling and reaction capabilities with electronic sensing and actuation, are fabricated using integrated circuit (IC) manufacturing techniques and use silicon and related IC industry materials, polymers, ceramics, glass or quartz as their material of construction. The use of such systems for in-situ and on-demand chemical production is gaining increasing importance as the field of microreaction engineering transitions from a theoretical



concept to a technology with significant industrial applications. In this paper, we provide an overview of the issues involved in modeling, design and control of microchemical systems and as examples, demonstrate some of these concepts with our work on modeling and control of microreformers for hydrogen delivery systems in micro-fuel cells. The paper concludes by suggesting possible areas of future research.

9. Vinay Bavdekar, Sirish Shah and Sachin Patwardhan, *Perspectives on State Estimation: Spot Estimates Versus Distributions*

*Abstract:* The conventional Kalman filter gives an analytical expression for the spot estimate of the states, which is the mean of the assumed Gaussian distribution. Conventional Bayesian state estimators are developed under the assumption that the mean of the posterior of the states is the 'best' estimate. While this can be true in the case where the posterior can be adequately approximated as a Gaussian distribution, in general it may not hold when the distribution of the posterior is non-Gaussian. In any case, the posterior distribution, whether it is Gaussian or not, contains a lot of information that is useful. This study explores the information contained in such distributions. The need for combining Bayesian state estimation with extracting information from the distribution is demonstrated in this work.

10. Tianyou Chai, *Optimal Operational Control for Complex Industrial Processes (I)*

*Abstract:* Process control should aim at not only ensuring that controlled variables to best follow their set points, but also requiring the optimal control for operation of whole industrial plant to make the operational indexes (i.e., quality, efficiency and consumptions during the production phase) into their targeted ranges. It also requires that operational indexes for quality and efficiency should be enhanced as high as possible, whilst the indexes related to consumptions are made to their lowest possible level. Based upon a survey on the existing operational optimization and control methodologies, this paper presents a data driven hybrid intelligent optimal operational control for complex industrial processes and a hybrid simulation system. Simulations and industrial applications to a roasting process for the hematite ore mineral processing industry are used to demonstrate the effectiveness of the proposed method. Issues for future research on the optimal operational control for complex industrial processes are outlined in the final section.

11. Steven X. Ding, *Data-Driven Design of Model-Based Fault Diagnosis Systems (I)*

*Abstract:* In this paper, recent development of data-driven design of fault detection and isolation (FDI) systems is presented. The major attention and focus are on the observer-based FDI systems, which can provide high FDI performance and are efficient for the real-time implementation.

12. Eduardo F. Camacho and Manuel Berenguel, *Control of solar energy systems (I)*

*Abstract:* This work deals with the main control problems found in solar power systems and the solutions proposed in literature. The paper first describes the main solar power technologies, its development status and then describes the main challenges encountered when controlling solar power systems. While in other power generating processes, the main source of energy can be manipulated, in solar energy systems, the main source of power which is solar radiation cannot be manipulated and furthermore it changes in a seasonal and on a daily base acting as a disturbance when considering it from a control point of view. Solar plants have all the characteristics needed for using industrial electronics and advanced control strategies able to cope with changing dynamics, nonlinearities and uncertainties.

# Technical Program

Wednesday July 11, 2012

<b>WePT1</b>	Venus I
<b>Plenary I</b> (Plenary Session WePT1.1)	08:30-09:30

Chair: Findeisen, Rolf      Otto-von-Guericke-Univ. Magdeburg

Co-Chair: Horch, Alexander      ABB

*Decentralized State Feedback Control for Interconnected Process Systems.*

Schuler, Simone      Univ. of Stuttgart

Muenz, Ulrich      Siemens

Allgower, Frank      Univ. of Stuttgart

<b>WeKAT1</b>	Venus I
<b>Keynote 1</b> (Keynote Session WeKAT1.1)	09:30-10:00

Chair: Nagy, Zoltan K.      Loughborough Univ.

Co-Chair: Trierweiler, Jorge      Federal Univ. of Rio Grande do Otávio Sul

*Realization of Online Optimizing Control in an Industrial Polymerization Reactor.*

Finkler, Tiago Fiorenzano      TU Dortmund

Kawohl, Michael      Tech. Univ. Berlin

Piechottka, Uwe      Evonik Industries

Engell, Sebastian      TU Dortmund

<b>WeKAT4</b>	Venus II
<b>Keynote 2</b> (Keynote Session WeKAT4.1)	09:30-10:00

Chair: Perrier, Michel      Ec. Pol.

Co-Chair: Vande Wouwer, Alain      Univ. de Mons

*Extremum Seeking Control of the CANON Process – Existence of Sub-Optimal Stationary Solutions.*

Trollberg, Olle      KTH Royal Inst. Of Tech.

Jacobsen, Elling      KTH Royal Inst. Of Tech.

<b>WeAT2</b>	Venus I
<b>Process Monitoring I</b> (Regular Session)	10:20-12:20

Chair: Yu, Jie      McMaster Univ.

Co-Chair: Wang, Jin      Auburn Univ.

10:20-10:40      WeAT2.1

*Detecting Model-Plant Mismatch of Nonlinear Multivariate Systems Using Mutual Information.*

Gao, Xukai      Zhejiang Univ.

Chen, Gui      Zhejiang Univ.

Xie, Lei      Zhejiang Univ.

Su, Hongye      Zhejiang Univ.

Wang, Shuqing      Zhejiang Univ.

10:40-11:00      WeAT2.2

*Monitoring Crystal Growth Based on Image Texture Analysis Using Wavelet Transformation.*

Zhang, Bing      Louisiana State Univ.

Abbas, Ali      The Univ. of Sydney

Romagnoli, Jose      Louisiana State Univ.

11:00-11:20      WeAT2.3

*A Comprehensive Evaluation of Statistics Pattern Analysis Based Process Monitoring.*

Galicia, Hector      Auburn Univ.

He, Qinghua (Peter)      Tuskegee Univ.

Wang, Jin      Auburn Univ.

11:20-11:40      WeAT2.4

*Process Performance Analysis in Large-Scale Systems Integrating Different Sources of Information.*

Cecílio, Inês M.      Imperial Coll. London

Rapp, Knut      ABB

Thornhill, Nina      Imperial Coll. London

11:40-12:00      WeAT2.5

*Feed-Forward Process Control Strategy for Pharmaceutical Tablet Manufacture Using Latent Variable Modeling and Optimization Technologies.*

Muteki, Koji      Pfizer

Swaminathan, Vidya      Pfizer

Sekulic, Sonja.S      Pfizer

Reid, George. L      Pfizer

12:00-12:20      WeAT2.6

*A Multiway Gaussian Mixture Model Based Adaptive Kernel Partial Least Squares Regression Approach for Inferential Quality Predictions of Batch Processes.*

Yu, Jie      McMaster Univ.

<b>WeAT3</b>	Venus II
<b>Model-Based Control I</b> (Regular Session)	10:20-12:20

Chair: Lee, Kwang Soon      Sogang Univ.

Co-Chair: Gudi, Ravindra      IIT Bombay

10:20-10:40      WeAT3.1

*A Multiple Linear Modeling Approach for Nonlinear Switched Systems.*

Hariprasad, K      IIT Bombay

Bhartiya, Sharad      IIT Bombay

Gudi, Ravindra      IIT Bombay

10:40-11:00      WeAT3.2

*A New Robust NMPC Scheme and Its Application to a Semi-Batch Reactor Example.*

Lucia, Sergio      TU Dortmund

Finkler, Tiago Fiorenzano      TU Dortmund

Basak, Dahn      TU Dortmund

Engell, Sebastian      TU Dortmund

11:00-11:20      WeAT3.3

*Optimal LQ-Control of a PDAE Model of a Catalytic Distillation Process.*

Alizadeh Moghadam, Amir      Univ. of Alberta

Aksikas, Ilyasse      King Abdelaziz Univ.

Dubljevic, Stevan      Univ. of Alberta

Forbes, J. Fraser      Univ. of Alberta

11:20-11:40      WeAT3.4

*Optimal Batch Process Regulation Using Self-Optimizing Control, NCO Tracking.*

Singhal, Martand      IIT Bombay

Gudi, Ravindra      IIT Bombay

11:40-12:00      WeAT3.5

*Cooperative Adaptive Optimization for a Class of Nonlinear Systems.*

Guay, Martin      Queen's Univ.

12:00-12:20      WeAT3.6

*Control Structure Design for Stabilizing Unstable Gas-Lift Oil Wells.*

Jahanshahi, Esmaeil      Norwegian Univ. of Sci & Tech.

Sigurd, Skogestad      Norwegian Univ. of Sci & Tech.

Hansen, Henrik      Norwegian Univ. of Sci & Tech.

<b>WeAT5</b>	Venus III
<b>Energy Systems</b> (Invited Session)	10:20-12:20
Chair: Budman, Hector M.	Univ. of Waterloo
Co-Chair: Yamashita, Yoshiyuki	Tokyo Univ. of Agriculture and Tech.
Organizer: Budman, Hector	Univ. of Waterloo
10:20-10:40	WeAT5.1
<i>Disturbance Estimator Based Non Linear MPC of a Three Phase Separator (I).</i>	
da Costa Mendes, Paulo Renato	Univ. Federal de Santa Catarina
Normey-Rico, Julio Elias	Univ. Federal de Santa Catarina
Plucenio, Agustinho	Univ. Federal de Santa Catarina
Leão Carvalho, Rodrigo	Univ. Federal de Santa Catarina
10:40-11:00	WeAT5.2
<i>Target-Rate Tracking for Shale-Gas Multi-Well Pads by Scheduled Shut-Ins (I).</i>	
Knudsen, Brage Rugstad	Norwegian Univ. of Sci & Tech.
Foss, Bjarne	Norwegian Univ. of Sci & Tech.
Whitson, Curtis H.	Norwegian Univ. of Sci & Tech.
Conn, Andrew R.	IBM
11:00-11:20	WeAT5.3
<i>Implementing Optimal Hydrogen Networks Management (I).</i>	
de Prada, Cesar	Univ. of Valladolid
Gomez Sayalero, Elena	Univ. of Valladolid
Gutierrez, Gloria	Univ. of Valladolid
Sarabia, Daniel	Univ. of Valladolid
Méndez, Carlos A.	INTEC (UNL-CONICET)
Sola, Mikel	Petronor
González, Rafael	Petronor
11:20-11:40	WeAT5.4
<i>Microbial Fuel Cell Operation with Periodic Connection of the External Resistance (I).</i>	
Grondin, Félix	École Pol. De Montréal
Perrier, Michel	École Pol. De Montréal
Tartakovsky, Boris	National Res. Council of Canada
11:40-12:00	WeAT5.5
<i>Kinetic Studies on Biobutanol Recovery Process Using Adsorbent Resin (I).</i>	
Eom, Moon-Ho	GS Caltex
Kim, Woohyun	KAIST
Lee, Julia	GS Caltex
Lee, Jay H.	KAIST
Park, Sunwon	KAIST
12:00-12:20	WeAT5.6
<i>Model Predictive Control of a Hybrid Fuel Cell and Battery Power System.</i>	
Behrendt, Martin	Max Planck Inst. For Dynamics of Complex Tech.
Bajcinca, Naim	Max Planck Inst. For Dynamics of Complex Tech.
Zenith, Federico	SINTEF
Krewer, Ulrike	TU Braunschweig

<b>WeKBT1</b>	Venus I
<b>Keynote 3</b> (Keynote Session WeKBT1.1)	13:40-14:10
Chair: Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.
Co-Chair: Karim, M. Nazmul	Texas Tech. Univ.
<i>A Simple Robust Control for Simulated Moving Bed Chromatographic Separation.</i>	
Suvarov, Paul	Univ. de Mons
Vande Wouwer, Alain	Univ. de Mons
Kienle, Achim	Univ. Magdeburg
<b>WeKBT4</b>	Venus II
<b>Keynote 4</b> (Keynote Session WeKBT4.1)	13:40-14:10
Chair: Corriou, Jean-Pierre	ENSIC
Co-Chair: Findeisen, Rolf	Otto-von-Guericke-Univ. Magdeburg
<i>Distributed Multiple Shooting for Optimal Control of Large Interconnected Systems.</i>	
Kozma, Attila	KU Leuven
Andersson, Joel	KU Leuven
Savorgnan, Carlo	KU Leuven
Diehl, Moritz	KU Leuven
<b>WeBT2</b>	Venus I
<b>Process Monitoring II</b> (Regular Session)	14:30-16:30
Chair: Yamashita, Yoshiyuki	Tokyo Univ. of Agriculture and Tech.
Co-Chair: Févotte, Gilles	Univ. Lyon 1 and EMSE
14:30-14:50	WeBT2.1
<i>Process Monitoring Based on Generalized Orthogonal Neighborhood Preserving Embedding.</i>	
Miao, Aimin	Zhejiang Univ.
Song, Zhi-Huan	Zhejiang Univ.
Wen, Qiaojun	Zhejiang Univ.
Ge, zhiqiang	Zhejiang Univ.
14:50-15:10	WeBT2.2
<i>Parametric Mismatch Detection and Isolation in Model Predictive Control.</i>	
Wang, Hong	Zhejiang Univ.
Song, Zhi-Huan	Zhejiang Univ.
Xie, Lei	Zhejiang Univ.
15:10-15:30	WeBT2.3
<i>Root Cause Diagnosis of Plant-Wide Oscillations Using Granger Causality.</i>	
Yuan, Tao	Univ. of Southern California
Qin, S. Joe	Univ. of Southern California
15:30-15:50	WeBT2.4
<i>A Bias-Eliminated Subspace Identification Method for Errors-In-Variables Systems.</i>	
Liu, Tao	RWTH Aachen Univ.
15:50-16:10	WeBT2.5
<i>Fault Detection and Accommodation in Particulate Processes with Delayed, Sampled Measurements.</i>	
Napasindayao, Trina	Univ. of California, Davis
El-Farra, Nael H.	Univ. of California, Davis
16:10-16:30	WeBT2.6
<i>Acoustic Emission: A New In-Line and Non-Intrusive Sensor for Monitoring Batch Solution Crystallization Operations.</i>	
Févotte, Gilles	Univ. Lyon 1 and EMSE

<b>WeBT3</b>	Venus II
<b>Model-Based Control II (Regular Session)</b>	14:30-16:30
Chair: Ozkan, Leyla	Tech. Univ. of Eindhoven
Co-Chair: Wang, Xue	Leeds Univ.
14:30-14:50	WeBT3.1
<i>Tube Based Quasi-Min-Max Output Feedback MPC for LPV Systems.</i>	
Su, Yang	National Univ. of Singapore
Tan, Kok Kiong	National Univ. of Singapore
Lee, Tong Heng	National Univ. of Singapore
14:50-15:10	WeBT3.2
<i>A Comparison of the Computational Efficiency of Generalised Function MPC Using Active Set Methods.</i>	
Khan, Bilal	Univ. of Sheffield
Rossiter, Anthony	Univ. of Sheffield
15:10-15:30	WeBT3.3
<i>Dissipativity-Based Nonlinear Control for Plantwide Stability.</i>	
Hioe, Denny	Univ. of New South Wales
Bao, Jie	Univ. of New South Wales
15:30-15:50	WeBT3.4
<i>Explicit-Model Predictive Control: A Simulation Based Scalability Study.</i>	
Gupta, Arun	ABB
Bhartiya, Sharad	IIT Bombay
Nataraj, P.S.V.	IIT Bombay
15:50-16:10	WeBT3.5
<i>Asymptotic Characteristics of Toeplitz Matrix in SISO Model Predictive Control.</i>	
Tran, Quang N.	Eindhoven Univ. of Tech.
Ozkan, Leyla	Eindhoven Univ. of Tech.
Ludlage, Jobert	IPCOS B.V.
Backx, Ton	Eindhoven Univ. of Tech.
16:10-16:30	WeBT3.6
<i>Optimisation and Closed-Loop Control of Crystal Shape Distribution in Seeded Cooling Crystallisation of L-Glutamic Acid.</i>	
Yang, Yang	Univ. of Leeds
Ma, Chao Yang	Univ. of Leeds
Wang, Xue	Univ. of Leeds

<b>WeBT5</b>	Venus III
<b>Batch Processes (Regular Session)</b>	14:30-16:30
Chair: Rangaiyah, Gade	National Univ. of Singapore
Pandu	
Co-Chair: Lee, Jong Min	Seoul National Univ.
14:30-14:50	WeBT5.1
<i>A Process for CO<sub>2</sub> Post Combustion Capture Based on Amine Supported on Solid Pellets.</i>	
Bittanti, Sergio	Pol. Di Milano
Calloni, Lorenzo	RSE SpA
De Marco, Antonio	Consultant
Notaro, Maurizio	RSE Milan
Prandoni, Valter	CESI RICERCA
Valsecchi, Antonio	RSE Milan

14:50-15:10	WeBT5.2
<i>Concentration Control for Semi-Batch pH-Shift Reactive Crystallization of L-Glutamic Acid.</i>	
Su, Qing Lin	National Univ. of Singapore
Braatz, Richard D.	Massachusetts Inst. of Tech.
Chiu, Min-Sen	National Univ. of Singapore
15:10-15:30	WeBT5.3
<i>Data-Driven Based Integrated Learning Controller Design for Batch Processes.</i>	
Jia, Li	Shanghai Univ.
Cao, Luming	Shanghai Univ.
Chiu, Min-Sen	National Univ. of Singapore
15:30-15:50	WeBT5.4
<i>Scheme for Time-Optimal Operation of Semi-Batch Emulsion Polymerization Reactors.</i>	
Pelz, Katja	TU Dortmund
Brandt, Heiko	TU Dortmund
Finkler, Tiago Fiorenzano	TU Dortmund
Engell, Sebastian	TU Dortmund
15:50-16:10	WeBT5.5
<i>Dynamic Simulation and Optimization of Population Balance Model for Gas Anti-Solvent Recrystallization Process.</i>	
Lee, Shin Je	Seoul National Univ.
Kim, Sungho	Seoul National Univ.
Kim, Hyoun-Soo	Agency for Defense Development
Lee, Youn-Woo	Seoul National Univ.
Lee, Jong Min	Seoul National Univ.
16:10-16:30	WeBT5.6
<i>Measurement Noise Influence on Statistical Properties of Batch-End Quality Predictions.</i>	
Vanlaer, Jef	KU Leuven
Van den Kerkhof, Pieter	KU Leuven
Gins, Geert	KU Leuven
Van Impe, Jan F.M.	KU Leuven

<b>WePosterT1</b>	Foyer
<b>Poster Session I (Poster Session)</b>	16:30-17:30
Chair: Kariwala, Vinay	ABB
Co-Chair: Samavedham, Lakshminarayanan	National Univ. of Singapore
<i>WePosterT1.1: A Model-Based Direct Adaptive Control Strategy for Nonlinear Processes.</i>	
Chen, Chyi-Tsong	Feng Chia Univ.
<i>WePosterT1.2: Boosting Weighted Partial Least Squares for Batch Process Quality Prediction.</i>	
Chiu, Chih-Chiun	National Tsing Hua Univ.
Qin, Xusong	Hong Kong Univ. of Sci & Tech.
Yao, Yuan	National Tsing Hua Univ.
<i>WePosterT1.3: Integration of RTO with MPC through the Gradient of a Convex Function.</i>	
Alvarez, Luz Adriana	Univ. of São Paulo
Odloak, Darci	Univ. of São Paulo
<i>WePosterT1.4: Performance Assessment of Model Predictive Control in Anaerobic-Anoxic-Oxic Process.</i>	
Liu, Hongbin	Kyung Hee Univ.
Shen, Wenhao	South China Univ. of Tech.
Yoo, ChangKyoo	Kyung Hee Univ.

---

WePosterT1.5: *Robust-Distributed MPC with Robust Observer to Handle Communication Loss.*

Kumar, Divya	Univ. of Waterloo
Al-Gherwi, Walid	Sanofi Pasteur Canada
Budman, Hector M.	Univ. of Waterloo

---

WePosterT1.6: *Reduced Model of a Beer Microfiltration Plant.*

Podar Cristea, Smaranda	Univ. of Valladolid
Mazaeda, Rogelio	Univ. of Valladolid
Palacin, Luis	Univ. of Valladolid
de Prada, Cesar	Univ. of Valladolid

---

WePosterT1.7: *The Relative Exergy Destroyed: A New Tool for Process Design and Control.*

Munir, Muhammad Tajammal	The Univ. of Auckland
Yu, Wei	The Univ. of Auckland
Young, Brent	The Univ. of Auckland

---

WePosterT1.8: *Fixed Interval Smoothing of Nonlinear/Non-Gaussian Dynamic Systems in Cell Space.*

Ungarala, Sridhar	Cleveland State Univ.
-------------------	-----------------------

---

WePosterT1.9: *Identification and Control of a Fuel Cell System Using Wavelet Network-Based Hammerstein Models.*

Wu, Wei	National Cheng Kung Univ.
Jhao, Da-Wei	National Yunlin Univ. of Science and Tech.

---

WePosterT1.10: *Systematic Approaches for PI System<sup>TM</sup> Data Compression Tuning.*

Silveira, Rodrigo Paulo	Univ. Federal do Rio Grande do Sul
Trierweiler, Jorge Otávio	Univ. Federal do Rio Grande do Sul
Farenzena, Marcelo	Univ. Federal do Rio Grande do Sul
Teixeira, Herbert Campos Gonçalves	Petróleo Brasileiro SA

---

WePosterT1.11: *Improved LQG Benchmark for Control Performance Assessment on ARMAX Model Process.*

Liu, Zhe	Zhejiang Univ.
Su, Hongye	Zhejiang Univ.
Xie, Lei	Zhejiang Univ.
Gu, Yong	Zhejiang Univ.
Sha, Jingjing	Zhejiang Univ.

---

WePosterT1.12: *Valve Backlash and Stiction Detection in Integrating Processes.*

Farenzena, Marcelo	Federal Univ. of Rio Grande do Sul
Trierweiler, Jorge Otávio	Federal Univ. of Rio Grande do Sul

---

WePosterT1.13: *Automatic Inspection of TFT-LCD Glass Substrates Using Optimized Support Vector Machines.*

Yousefian Jazi, Ali	Pukyong National Univ.
Liu, Jay	Pukyong National Univ.
Lee, Hokyung	LG Chem LTD

---

WePosterT1.14: *A Frequency Response Identification Method for Discrete-Time Processes.*

Cheon, Yu Jin	Pohang Univ. of Science & Tech.
Kim, Hyunjoo	Pohang Univ. of Science & Tech.
Kim, Kyungsu	Kyungpook National Univ.
Lee, In-Beum	Pohang Univ. of Science & Tech.
Sung, Su Whan	Kyungpook National Univ.
Lee, Jietae	Kyungpook National Univ.

---

WePosterT1.15: *Effectiveness of Signal Excitation Design Methods for Ill-Conditioned Processes Identification.*

Kuramoto, André Seichi Ribeiro	Univ. of São Paulo
Reyes Vaillant, Osmel	Univ. of São Paulo
Garcia, Claudio	Univ. of São Paulo

---

WePosterT1.16: *Detection of No-Model Input/Output Combination in Transfer Matrix in Closed-Loop MIMO Systems.*

Reyes Vaillant, Osmel	Univ. of São Paulo
Juliani, Rodrigo	Univ. of São Paulo
Garcia, Claudio	Univ. of São Paulo

---

WePosterT1.17: *Sequential Monte Carlo Filtering Using Nested Particles with Local Gaussian Assumptions.*

Ungarala, Sridhar	Cleveland State Univ.
-------------------	-----------------------

---

WePosterT1.18: *Closed Loop Identification of Quadruple Tank System Using an Improved Indirect Approach.*

Parikh, Nishant N.	Pandit Deendayal Petroleum Univ.
Patwardhan, Sachin C.	IIT Bombay
Gudi, Ravindra	IIT Bombay

Thursday July 12, 2012

<b>ThPT1</b>	Venus I
<b>Plenary II</b> (Plenary Session ThPT1.1)	08:30-09:30
Chair: Qin, S. Joe	Univ. of Southern California
Co-Chair: Guay, Martin	Queen's Univ.

*Energy Supply Chain Optimization: A Challenge for Control Engineers?*

Lee, Jay H. KAIST

<b>ThKAT1</b>	Venus I
<b>Keynote 5</b> (Keynote Session ThKAT1.1)	09:30-10:00
Chair: Lee, Jay H.	KAIST
Co-Chair: Ding, Steven X.	Univ. of Duisburg-Essen

*Performance Assessment of Nonlinear State Filters.*

Tulsyan, Aditya Univ. of Alberta  
 Huang, Biao Univ. of Alberta  
 Gopaluni, Bhushan Univ. of British Columbia  
 Forbes, J. Fraser Univ. of Alberta

<b>ThKAT4</b>	Venus II
<b>Keynote 6</b> (Keynote Session ThKAT4.1)	09:30-10:00

Chair: Hangos, Katalin M. Computer & Automation Rsrch. Inst. of the Hungarian Academy of Sciences  
 Co-Chair: Trierweiler, Jorge Federal Univ. of Rio Grande do Otávio Sul

*Passivity Based Controller and Observer of Exothermic Chemical Reactors.*

Hoang, Ngoc Ha Univ. Claude Bernard Lyon 1  
 Couenne, Francoise Univ. of Lyon 1  
 Le Gorrec, Yann FEMTO-ST  
 Chen, Cheng-Liang National Taiwan Univ.  
 Ydstie, B. Erik Carnegie Mellon Univ.

<b>ThAT2</b>	Venus I
<b>Modeling and Identification</b> (Regular Session)	10:20-12:20

Chair: Lee, In-Beum Pohang Univ. of Science & Tech.  
 Co-Chair: Häggblom, Kurt-Erik Abo Akademi Univ. Erik

10:20-10:40 ThAT2.1

*MIMO Uncertainty Model Identification of Time-Delay Systems.*

Häggblom, Kurt-Erik Abo Akademi Univ.

10:40-11:00 ThAT2.2

*Set-Based Adaptive Estimation for a Class of Nonlinear Systems with Time-Varying Parameters.*

Dhaliwal, Samandeep Hatch and Associates  
 Guay, Martin Queen's Univ.

11:00-11:20 ThAT2.3

*An Extended AUDI Algorithm for Simultaneous Identification of Forward and Backward Paths in Closed-Loop Systems.*

Jiang, Benben Tsinghua Univ.  
 Yang, Fan Tsinghua Univ.  
 Jiang, Yongheng Tsinghua Univ.  
 Huang, Dexian Tsinghua Univ.

11:20-11:40 ThAT2.4

*Adaptive Outlier Detection and Classification for Online Soft Sensor Update.*

Galicia, Hector Auburn Univ.  
 He, Qinghua (Peter) Tuskegee Univ.  
 Wang, Jin Auburn Univ.

11:40-12:00 ThAT2.5

*Improving Performance and Stability of MRI Methods in Closed-Loop.*

Segundo Potts, Alain Univ. of Sao Paulo  
 Romano, Rodrigo Alvite Inst. Mauá de Tecnologia  
 Garcia, Claudio Univ. of Sao Paulo

12:00-12:20 ThAT2.6

*Identification and Controller Tuning of Cascade Control Systems Based on Closed-Loop Step Responses.*

Jeng, Jyh-Cheng National Taipei Univ. of Tech.  
 Lee, Ming-Wei China Steel Corp.

<b>ThAT3</b>	Venus II
<b>Model Predictive Control</b> (Regular Session)	10:20-12:20

Chair: Bao, Jie The Univ. of New South Wales  
 Co-Chair: Allgower, Frank Univ. of Stuttgart

10:20-10:40 ThAT3.1

*A Unified Approach to Plant-Wide Dissipative Model Predictive Control.*

Tippett, Michael James The Univ. of New South Wales  
 Bao, Jie The Univ. of New South Wales

10:40-11:00 ThAT3.2

*Advanced-Multi-Step Nonlinear Model Predictive Control.*

Yang, Xue Carnegie Mellon Univ.  
 Biegler, Lorenz T. Carnegie Mellon Univ.

11:00-11:20 ThAT3.3

*Self-Triggered Model Predictive Control for Network Scheduling and Control.*

Henriksson, Erik Royal Inst. of Tech.  
 Quevedo, Daniel E. The Univ. of Newcastle  
 Sandberg, Henrik Royal Inst. of Tech.  
 Johansson, Karl Henrik Royal Inst. of Tech.

11:20-11:40 ThAT3.4

*Dissipativity-Based Distributed Nonlinear Predictive Control for Cascaded Systems.*

Varutti, Paolo Otto-von-Guericke-Univ. Magdeburg  
 Kern, Benjamin Otto-von-Guericke-Univ. Magdeburg  
 Findeisen, Rolf Otto-von-Guericke-Univ. Magdeburg

11:40-12:00 ThAT3.5

*Cooperative Distributed MPC Using the Alternating Direction Multiplier Method.*

Koegel, Markus J. Otto-von-Guericke-Univ. Magdeburg  
 Findeisen, Rolf Otto-von-Guericke-Univ. Magdeburg

12:00-12:20 ThAT3.6

*A Comparison of the Computational Efficiency of Multi-Parametric Predictive Control Using Generalised Function Parameterisations.*

Khan, Bilal Univ. of Sheffield  
 Rossiter, J. Anthony Univ. of Sheffield

<b>ThAT5</b>	Venus III	<b>ThKBT1</b>	Venus I
<b>Reaction Networks</b> (Invited Session)	10:20-12:20	<b>Keynote 7</b> (Keynote Session ThKBT1.1)	13:40-14:10
Chair: Hangos, Katalin M.	Computer & Automation Rsrch. Inst. of the Hungarian Academy of Sciences	Chair: Park, Sunwon	KAIST
Co-Chair: Tangirala, Arun K.	IIT Madras	Co-Chair: Wang, Hong	Zhejiang Univ.
Organizer: Hangos, Katalin M.	Computer & Automation Rsrch. Inst. of the Hungarian Academy of Sciences	<i>Studies of Particulate System Dynamics in Rotating Drums Using Markov Chains.</i>	
Organizer: Szederkenyi, Gabor	Computer and Automation Res. Inst. of the Hungarian Academy of Sciences	Tjakra, Javan Dave	Univ. of New South Wales
		Bao, Jie	Univ. of New South Wales
		Hudon, Nicolas	Univ. of New South Wales
		Yang, Runyu	Univ. of New South Wales
10:20-10:40	ThAT5.1	<b>ThKBT4</b>	Venus II
<i>Identification of Complex Biological Network Classes Using Extended Correlation Analysis (I).</i>		<b>Keynote 8</b> (Keynote Session ThKBT4.1)	13:40-14:10
Lee, Dennis	Univ. of Strathclyde	Chair: Guay, Martin	Queen's Univ.
Yue, Hong	Univ. of Strathclyde	Co-Chair: Kariwala, Vinay	ABB
Yu, Jun	Univ. of Strathclyde	<i>Dynamics and Control of Integrated Microchemical Systems.</i>	
Marshall, Steve	Univ. of Strathclyde	Kothare, Mayuresh V.	Lehigh Univ.
10:40-11:00	ThAT5.2	<b>ThBT2</b>	Venus I
<i>Model Structure Validation of Cell Signaling Pathways Using Colored Petri Nets (I).</i>		<b>State Estimation</b> (Regular Session)	14:30-16:30
Csercsik, Dávid	Computer & Automation Res. Inst. of the Hungarian Academy of Sciences	Chair: Shah, Sirish L.	Univ. of Alberta
Hangos, Katalin M.	Computer & Automation Res. Inst. of the Hungarian Academy of Sciences	Co-Chair: Gudi, Ravindra	IIT Bombay
11:00-11:20	ThAT5.3	14:30-14:50	ThBT2.1
<i>On the Geometry of Equilibrium Solutions of Kinetic Systems Obeying the Mass Action Law (I).</i>		<i>State Estimation in the Automotive SCR DeNOx Process.</i>	
Alonso, Antonio A.	IIM-CSIC	Zhou, Guofeng	Tech. Univ. of Denmark
Szederkenyi, Gabor	Computer and Automation Res. Inst. of the Hungarian Academy of Sciences	Jorgensen, John Bagterp	Tech. Univ. of Denmark
		duwig, Christophe	Haldor Topsøe
		Huusom, Jakob Kjøbsted	Tech. Univ. of Denmark
11:20-11:40	ThAT5.4	14:50-15:10	ThBT2.2
<i>Inducing Sustained Oscillations in Mass Action Kinetic Networks of a Certain Class (I).</i>		<i>State Estimation of a Non-Linear Hybrid System Using an Interacting Multiple Model Algorithm.</i>	
Otero Muras, Irene	ETH Zurich	Prakash, Jagadeesan	Madras Inst. of Tech.
Szederkenyi, Gabor	Computer and Automation Res. Inst. of the Hungarian Academy of Sciences	M, Elenchezhiyan	MIT Campus Anna Univ.
Alonso, Antonio A.	IIM-CSIC	Shah, Sirish	Univ. of Alberta
Hangos, Katalin M.	Computer and Automation Res. Inst. of the Hungarian Academy of Sciences	15:10-15:30	ThBT2.3
		<i>Comparative Study of State Estimation of Tubular Microreactors Using UKF and EKF.</i>	
		Miyabayashi, Keisuke	Kyoto Univ.
		Tonomura, Osamu	Kyoto Univ.
		Kano, Manabu	Kyoto Univ.
		Hasebe, Shinji	Kyoto Univ.
11:40-12:00	ThAT5.5	15:30-15:50	ThBT2.4
<i>Reconstructing Plant Connectivity Using Directed Spectral Decomposition.</i>		<i>Advanced State Estimation Techniques for Packed Bed Reactors.</i>	
Tangirala, Arun K.	IIT Madras	Pacharu, Sreenivasa Rao	IIT Bombay
Sebastian, Gigi	IIT Madras	Gudi, Ravindra	IIT Bombay
		Patwardhan, Sachin C.	IIT Bombay
		15:50-16:10	ThBT2.5
		<i>Effect of Noises on the Performance of Nonlinear State Estimator for Semi Batch Autocatalytic Esterification Reactor.</i>	
		Rohman, F.S.	Univ. Sains Malaysia
		Sata, S.A.	Univ. Sains Malaysia
		Aziz, N	Univ. Sains Malaysia



16:10-16:30	ThBT2.6
<i>An Ensemble Kalman Filter for Systems Governed by Differential Algebraic Equations (DAEs).</i>	
Puranik, Yash	IIT Bombay
Bavdekar, Vinay	Univ. of Alberta
Patwardhan, Sachin C.	IIT Bombay
Shah, Sirish	Univ. of Alberta

<b>ThBT3</b>	Venus II
<b>Optimization and Scheduling I (Regular Session)</b>	14:30-16:30
Chair: Budman, Hector M.	Univ. of Waterloo
Co-Chair: de Prada, Cesar	Univ. of Valladolid

14:30-14:50	ThBT3.1
<i>Handling Infeasibilities in Dual Modifier-Adaptation Methodology for Real-Time Optimization.</i>	
Navia, Daniel	Univ. of Valladolid
Martí, Rubén	Univ. of Valladolid
Sarabia, Daniel	Univ. of Valladolid
Gutierrez, Gloria	Univ. of Valladolid
de Prada, Cesar	Univ. of Valladolid

14:50-15:10	ThBT3.2
<i>Optimization of Petroleum Production Networks – through Proxy Models and Structural Constraints.</i>	
Shamlou, Sheri	Norwegian Univ. of Sci & Tech.
Gunnerud, Vidar	Norwegian Univ. of Sci & Tech.
Conn, Andrew R.	IBM

15:10-15:30	ThBT3.3
<i>A Polynomial-Chaos Based Algorithm for Robust Optimization in the Presence of Bayesian Uncertainty.</i>	
Mandur, Jasdeep	Univ. of Waterloo
Budman, Hector M.	Univ. of Waterloo

15:30-15:50	ThBT3.4
<i>Varicol Process Optimization Strategy Based on the Solution of a MINLP.</i>	
Torres, Ixbalank	Univ. de Mons
Vande Wouwer, Alain	Univ. de Mons

15:50-16:10	ThBT3.5
<i>Hierarchical Economic NMPC for a Class of Hybrid Systems Using Neighboring-Extremal Updates.</i>	
Wolf, Inga Janina	RWTH Aachen Univ.
Muñoz, Diego A.	Univ. Pontificia Bolivariana
Schmitz, Moritz	RWTH Aachen Univ.
Marquardt, Wolfgang	RWTH Aachen Univ.

16:10-16:30	ThBT3.6
<i>Formulating an Optimization Problem for Minimization of Losses Due to Utilities.</i>	
Lindholm, Anna	Lund Univ.
Giselsson, Pontus	Lund Univ.

<b>ThBT5</b>	Venus III
<b>Biological Systems I (Regular Session)</b>	14:30-16:30
Chair: Rangaiah, Gade	National Univ. of Singapore
Pandu	
Co-Chair: Gouze, Jean-Luc	INRIA

14:30-14:50	ThBT5.1
<i>Saturated Output-Feedback Control of Continuous Anaerobic Digestors.</i>	
Schaum, Alexander	Univ. Autonoma Metropolitana
Garcia-Sandoval, Juan Paulo	Univ. of Guadalajara
Alvarez, Jesus	Univ. Autonoma Metropolitana
Gonzalez-Alvarez, Victor	Univ. of Guadalajara

14:50-15:10	ThBT5.2
<i>Application of a Continuous-Discrete Unknown Input Observer to Estimation in Phytoplanktonic Cultures.</i>	
Rocha-Cóztatl, Edmundo	Univ. Nacional Autonoma de Mexico-UNAM
Moreno, Jaime A.	Univ. Nacional Autonoma de Mexico-UNAM
Vande Wouwer, Alain	Univ. de Mons

15:10-15:30	ThBT5.3
<i>Extremum Seeking Control of Batch Cultures of Microalgae Nannochloropsis Oculata in Pre-Industrial Scale Photobioreactors.</i>	
Deschenes, Jean-Sebastien	Univ. du Québec à Rimouski
St-Onge, Pierre N.	Univ. du Québec à Rimouski
Collin, Jean-Charles	Univ. du Québec à Rimouski
Tremblay, Réjean	Univ. du Québec à Rimouski

15:30-15:50	ThBT5.4
<i>Global Stability of Full Open Reversible Michaelis-Menten Reactions.</i>	
Gouze, Jean-Luc	INRIA
Belgacem, Ismail	INRIA Biocore

15:50-16:10	ThBT5.5
<i>Process Simulation of Bioethanol Production from Brown Algae.</i>	
Fasahati, Peyman	Pukyong National Univ.
Liu, Jay	Pukyong National Univ.

16:10-16:30	ThBT5.6
<i>A Biogas-Based Switching Control Policy for Anaerobic Digestion Systems.</i>	
Sbarciog, Mihaela	Univ. de Mons
Moreno, Jaime A.	Univ. Nacional Autonoma de Mexico-UNAM
Vande Wouwer, Alain	Univ. de Mons

<b>ThPosterT1</b>	Foyer
<b>Poster Session II (Poster Session)</b>	16:30-17:30
Chair: Samavedham, Lakshminarayanan	National Univ. of Singapore
Co-Chair: Kariwala, Vinay	ABB

<i>ThPosterT1.1: Population Balance Modelling and Experimental Study for Synthesis of TiO<sub>2</sub> Nanoparticles Using Continuous Hydrothermal Process.</i>	
Chen, Man	Univ. of Leeds
Ma, Cai Yun	Univ. of Leeds
Lin, Tian	Univ. of Leeds
Wang, Xue	Univ. of Leeds

---

ThPosterT1.2: *Scheduling of Energy Flows for Parallel Batch Processes Using Max-Plus Systems.*

Mutsaers, Mark	Eindhoven Univ. of Tech.
Ozkan, Leyla	Eindhoven Univ. of Tech.
Backx, Ton	Eindhoven Univ. of Tech.

---

ThPosterT1.3: *A Comparative Study of Dual Active-Set and Primal-Dual Interior-Point Method.*

Goswami, Nababithi	National Inst. of Tech. Durgapur
Mondal, Supriyo K.	National Inst. of Tech. Durgapur
Paruya, Swapan	National Inst. of Tech. Durgapur

---

ThPosterT1.4: *GNURadio, Scilab, Xcos and COMEDI for Data Acquisition and Control: An Open Source Alternative to LabVIEW.*

Patil, Jagdish	IIT Bombay
Dubey, Balashish	IIT Bombay
Moudgalya, Kannan M.	IIT Bombay
Peter, Rakesh	Amrita Univ.

---

ThPosterT1.6: *Spline Dynamic Matrix: A Novel Representation of Dynamic Models.*

Escobar, Matheus	Federal Univ. of Rio Grande do Sul
Trierweiler, Jorge Otávio	Federal Univ. of Rio Grande do Sul

---

ThPosterT1.7: *A Novel Multi-Objective Optimization Based Experimental Design and Its Application for Physiological Model of Type 1 Diabetes.*

Maheshwari, Vaibhav	National Univ. of Singapore
Rangaiah, Gade Pandu	National Univ. of Singapore
Samavedham, Lakshminarayanan	National Univ. of Singapore

---

ThPosterT1.8: *A Sliding Mode Control Strategy for Temperature Trajectory Tracking in Batch Processes.*

Chen, Chyi-Tsong	Feng Chia Univ.
------------------	-----------------

---

ThPosterT1.9: *Self-Calibrating, Event-Driven Flow Control and Measurement.*

Preisig, Heinz A	Norwegian Univ. of Sci & Tech.
Roll, Sebastian	Norwegian Univ. of Sci & Tech.

---

ThPosterT1.10: *The Polyhedral Off-Line Robust Model Predictive Control Strategy for Uncertain Polytopic Discrete-Time Systems.*

Bumroongsri, Pornchai	Chulalongkorn Univ.
Kheawhom, Soorathep	Chulalongkorn Univ.

---

ThPosterT1.11: *Optimization of a Methane Autothermal Reforming-Based Hydrogen Production System with Low CO<sub>2</sub> Emissions.*

Wu, Wei	National Cheng Kung Univ.
Tungpanututh, Chutima	National Yunlin Univ. of Sci & Tech.

---

ThPosterT1.12: *Randomized Algorithm of Constrained MPC for Linear Systems with Bounded Additive Disturbances.*

Lu, Xin	Xiamen Univ.
Huang, Chunqing	Xiamen Univ.
Zhao, Kejun	Xiamen Univ.

---

ThPosterT1.13: *Sensitivity Analysis with Optimal Input Design and Model Predictive Control for Microalgal Bioreactor Systems.*

Yoo, Sung Jin	Seoul National Univ.
Oh, Se-Kyu	Seoul National Univ.
Lee, Jong Min	Seoul National Univ.

---

ThPosterT1.14: *Recovering from a Gradual Degradation in MPC Performance.*

Jimoh, Mohammed	Univ. of Glasgow
Howell, John	Univ. of Glasgow

---

ThPosterT1.15: *Estimation of Kinetic Parameters of a Polymerization Reactor Using Real Data.*

Botelho, Viviane Rodrigues	Federal Univ. of Rio Grande do Sul (UFRGS)
de Souza, Moreira, Isadora	Braskem S. A.
Trierweiler, Jorge Otávio	Federal Univ. of Rio Grande do Sul
Neumann, Gustavo Alberto	Braskem S.A.
Farenzena, Marcelo	Federal Univ. of Rio Grande do Sul

---

ThPosterT1.16: *A New Approach for Practical Identifiability Analysis Applied to Dynamic Phenomenological Models.*

Botelho, Viviane Rodrigues	Federal Univ. of Rio Grande do Sul (UFRGS)
Trierweiler, Luciane Ferreira	Federal Univ. of Rio Grande do Sul
Trierweiler, Jorge Otávio	Federal Univ. of Rio Grande do Sul

---

ThPosterT1.17: *Process Monitoring of Dynamic Processes Using Kernel Independent Component Analysis.*

Zhang, Yingwei	Northeastern Univ.
An, Jiayu	Northeastern Univ.
Ma, Chi	Northeastern Univ.

---

ThPosterT1.18: *Application of Fault Monitoring and Diagnostic Techniques and Their Challenges in Petrochemical Industries.*

Kanchi, Lakshmi Kiran	Yokogawa Electric International Pte Ltd
Selvaraj, Sankar	Yokogawa Electric International Pte Ltd
Lee, Joseph	Yokogawa Electric International Pte Ltd

Friday July 13, 2012

<b>FrPT1</b>	Venus I
<b>Plenary III</b> (Plenary Session FrPT1.1)	08:30-09:30
Chair: Horch, Alexander	ABB
Co-Chair: Nagy, Zoltan K.	Loughborough Univ.

*Data Driven Modelling and Control of Batch Processes in the Pharmaceutical Industry.*

Tabora, Jose	Bristol Myers-Squibb
--------------	----------------------

<b>FrKAT1</b>	Venus I
<b>Keynote 9</b> (Keynote Session FrKAT1.1)	09:30-10:00
Chair: Kothare, Mayuresh V.	Lehigh Univ.
Co-Chair: Park, Sunwon	KAIST

*Perspectives on State Estimation: Spot Estimates versus Distributions.*

Bavdekar, Vinay	Univ. of Alberta
Shah, Sirish	Univ. of Alberta
Patwardhan, Sachin C.	IIT Bombay

<b>FrKAT4</b>	Venus II
<b>Keynote 10</b> (Keynote Session FrKAT4.1)	09:30-10:00
Chair: Qin, S. Joe	Univ. of Southern California
Co-Chair: Samavedham, Lakshminarayanan	National Univ. of Singapore

*Optimal Operational Control for Complex Industrial Processes.*

Chai, Tianyou	Northeastern Univ.
---------------	--------------------

<b>FrAT2</b>	Venus I
<b>Control Applications</b> (Regular Session)	10:20-12:20
Chair: Chiu, Min-Sen	National Univ. of Singapore
Co-Chair: Tizzo, Livia Martins	UNICAMP / BRASKEM S.A.

10:20-10:40	FrAT2.1
-------------	---------

*Improvements in Energy Efficiency of Polyethylene Autoclave Reactor Using Advanced Process Control.*

Quachio, Raphael	Siemens
Pinto, Gilson Alexandre	Siemens
Tizzo, Livia Martins	UNICAMP / BRASKEM S.A.
Shimizu Germiniani, Diogo	Braskem Petroquimica SA
Pavanelli, Paula Edilene	Siemens

10:40-11:00	FrAT2.2
-------------	---------

*Closed-Loop Control of SCR System Using a NOx Sensor Cross-Sensitive to NH3, pp. 738-743.*

Bonfils, Anthony	IFP Energies nouvelles
Creff, Yann	IFP Energies nouvelles
Lepreux, Olivier	IFP Energies nouvelles
Petit, Nicolas	MINES ParisTech

11:00-11:20	FrAT2.3
-------------	---------

*Economically Optimal Operation of Kaibel Distillation Column: Fixed Boilup Rate, pp. 744-749.*

Ghadrdan, Maryam	Norwegian Univ. of Sci & Tech.
Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.
Halvorsen, Ivar J.	SINTEF ICT

11:20-11:40	FrAT2.4
-------------	---------

*A Reliability Measure for Model Based Stiction Detection Approaches.*

Srinivasan, Babji	Texas Tech. Univ.
Spinner, Timothy	Texas Tech. Univ.
Rengaswamy, Raghunathan	Texas Tech. Univ.

11:40-12:00	FrAT2.5
-------------	---------

*Discrepancy Based Control of Continuous Fluidized Bed Spray Granulation with Internal Product Classification.*

Palis, Stefan	Univ. Magdeburg
Kienle, Achim	Univ. Magdeburg

12:00-12:20	FrAT2.6
-------------	---------

*An Integrated Approach for C-Control of Antisolvent Crystallization Processes.*

Kamaraju, Vamsi Krishna	National Univ. of Singapore
Chiu, Min-Sen	National Univ. of Singapore

<b>FrAT3</b>	Venus II
<b>Optimization and Scheduling II</b> (Regular Session)	10:20-12:20

Chair: de Prada, Cesar	Univ. of Valladolid
Co-Chair: Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.

10:20-10:40	FrAT3.1
-------------	---------

*Economically Optimal Controlled Variables for Parallel Units - Application to Chemical Reactors.*

Jäschke, Johannes	Norwegian Univ. of Sci & Tech.
Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.

10:40-11:00	FrAT3.2
-------------	---------

*Selection of Self-Optimizing Controlled Variables for Dynamic Processes.*

Hu, Wuhua	Nanyang Tech. Univ.
Mao, Jianfeng	Nanyang Tech. Univ.
Xiao, Gaoxi	Nanyang Tech. Univ.
Kariwala, Vinay	ABB

11:00-11:20	FrAT3.3
-------------	---------

*An Optimization-Based Framework for the Scheduling of Automated Manufacturing Systems.*

Aguirre, Adrián M.	INTEC (UNL-CONICET)
Méndez, Carlos A.	INTEC (UNL-CONICET)
de Prada, Cesar	Univ. of Valladolid

11:20-11:40	FrAT3.4
-------------	---------

*Model Based Optimisation of Tubular Reactors for LDPE Production.*

Van Erdeghem, Peter M.M.	KU Leuven
Logist, Filip	KU Leuven
Vallerio, Mattia	KU Leuven
Dittrich, Christoph	SABIC Petrochemicals
Van Impe, Jan F.M.	KU Leuven

11:40-12:00	FrAT3.5
-------------	---------

*Economic Back-Off Selection Based on Optimal Multivariable Controller.*

Magbool Jan, Nabil	Indian Inst. of Tech. Madras
Narasimhan, Sridharakumar	Indian Inst. of Tech. Madras
Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.

12:00-12:20	FrAT3.6
-------------	---------

*Quantitative Methods for Optimal Regulatory Layer Selection.*

Yelchuru, Ramprasad	Norwegian Univ. of Sci & Tech.
Skogestad, Sigurd	Norwegian Univ. of Sci & Tech.

<b>FrAT5</b>	Venus III
<b>Biological Systems II</b> (Regular Session)	10:20-12:20
Chair: Karim, M. Nazmul	Texas Tech. Univ.
Co-Chair: Perrier, Michel	Ec. Pol.
10:20-10:40	FrAT5.1
<i>Time-Optimal Batch Diafiltration.</i>	
Paulen, Radoslav	STU in Bratislava
Fikar, Miroslav	Slovak Univ. of Tech. in Bratislava
Foley, Greg	Dublin City Univ.
Kovács, Zoltán	Univ. of Applied Sciences Giessen-Friedberg
Czermak, Peter	Kansas State Univ.
10:40-11:00	FrAT5.2
<i>Partial Least Squares (PLS) Model for Prediction of Definitive and Intermediate Treatment Outcomes in Diabetes Ketoacidosis (DKA) Patients.</i>	
Balakrishnan, Naviyn Prabhu	National Univ. of Singapore
Tan Su-Lyn, Daphne Gardner	Singapore General Hospital
Rangaiah, Gade Pandu	National Univ. of Singapore
Mong, Bee Yong	Singapore General Hospital
Su-Yen, Goh	Singapore General Hospital
Samavedham, Lakshminarayanan	National Univ. of Singapore
11:00-11:20	FrAT5.3
<i>Optimization of Bioethanol Ethanol Production in Fed-Batch Fermentation.</i>	
Li, Zheng	Texas Tech. Univ.
Dewan, Alim	Texas Tech. Univ.
Karim, M. Nazmul	Texas Tech. Univ.
11:20-11:40	FrAT5.4
<i>Predicting Concentrations of a Mixture in Bioreactor for On-Line Monitoring Using Raman Spectroscopy.</i>	
Oh, Se-Kyu	Seoul National Univ.
Yoo, Sung Jin	Seoul National Univ.
Lee, Jong Min	Seoul National Univ.
11:40-12:00	FrAT5.5
<i>A Systematic Methodology for Controller Tuning in Wastewater Treatment Plants.</i>	
Mauricio-Iglesias, Miguel	CAPEC, Tech. Univ. of Denmark
Jørgensen, Sten Bay	CAPEC, Tech. Univ. of Denmark
Sin, Gurkan	CAPEC, Tech. Univ. of Denmark
12:00-12:20	FrAT5.6
<i>Multi-Scale Models for the Optimization of Batch Bioreactors.</i>	
Liew, Emily W.T.	Curtin Univ.
Nandong, Jobrun	Curtin Univ.
Samyudia, Yudi	Curtin Univ.
<b>FrKBT1</b>	Venus I
<b>Keynote 11</b> (Keynote Session FrKBT1.1)	13:40-14:10
Chair: Lee, Jay H.	KAIST
Co-Chair: Qin, S. Joe	Univ. of Southern California
<i>Data-Driven Design of Model-Based Fault Diagnosis Systems.</i>	
Ding, Steven X.	Univ. of Duisburg-Essen

<b>FrKBT4</b>	Venus II
<b>Keynote 12</b> (Keynote Session FrKBT4.1)	13:40-14:10
Chair: Allgower, Frank	Univ. of Stuttgart
Co-Chair: Kothare, Mayuresh V.	Lehigh Univ.
<i>Control of Solar Energy Systems.</i>	
Camacho, Eduardo F.	Univ. of Seville
Berenguel, Manuel	Univ. of Almeria
<b>FrBT2</b>	Venus I
<b>Process Applications</b> (Regular Session)	14:30-16:30
Chair: Wang, Xue	Univ. of Leeds
Co-Chair: Lee, Kwang Soon	Sogang Univ.
14:30-14:50	FrBT2.1
<i>Model Reduction of a Batch Drum Granulator by Proper Orthogonal Decomposition.</i>	
Mangold, Michael	Max Planck Inst. for Dynamics of Complex Tech. Systems
14:50-15:10	FrBT2.2
<i>Closed-Loop Re-Identification of an Industrial Debutanizer Column.</i>	
Neves Pitta, Renato	Univ. of São Paulo / Petrobras
Odloak, Darci	Univ. of São Paulo
15:10-15:30	FrBT2.3
<i>Application of a New Dataset Selection Procedure for the Prediction of the Syngas Composition of a Gasification Plant.</i>	
Astolfi, Giacomo	Univ. Pol. delle Marche
Zanoli, Silvia Maria	Univ. Pol. delle Marche
Barboni, Luca	Api Oil Company
15:30-15:50	FrBT2.4
<i>Modelling and Simulation of Counter-Current and Confined Jet Reactors for Continuous Hydrothermal Flow Synthesis of Nano-Materials.</i>	
Ma, Cai Yun	Univ. of Leeds
Wang, Xue	Univ. of Leeds
Tighe, Chris J	Univ. Coll. London
Darr, Jawwad A	Univ. Coll. London
15:50-16:10	FrBT2.5
<i>Parameter Estimation for Crystallization Processes Using Taylor Method.</i>	
Cao, Yi	Cranfield Univ.
Kariwala, Vinay	ABB
Nagy, Zoltan K.	Loughborough Univ.
16:10-16:30	FrBT2.6
<i>Extended Kalman Filter with Adaptive Grid Allocation for a Fixed-Bed Adsorption Process.</i>	
Won, Wangyun	Sogang Univ.
Lee, Kwang Soon	Sogang Univ.

<b>FrBT3</b>	Venus II
<b>Optimization and Scheduling III (Regular Session)</b>	14:30-16:30
Chair: Corriou, Jean-Pierre	ENSIC
Co-Chair: Sundaramoorthy, Arul	Massachusetts Inst. of Tech.
14:30-14:50	FrBT3.1
<i>An Efficient Solution Algorithm for Large-Scale Stochastic Mixed-Integer Linear Programs.</i>	
Sundaramoorthy, Arul	Massachusetts Inst. of Tech.
Li, Xiang	Massachusetts Inst. of Tech.
Evans, James M. B.	Massachusetts Inst. of Tech.
Barton, Paul	Massachusetts Inst. of Tech.
14:50-15:10	FrBT3.2
<i>Optimal Control of Nonlinear Chemical Processes Using the Variational Iteration Method.</i>	
Maidi, Ahmed	Univ. Mouloud MAMMERI
Corriou, Jean-Pierre	ENSIC
15:10-15:30	FrBT3.3
<i>A Data-Driven Approach for Selecting Controlled Variables.</i>	
Ye, Lingjian	Ningbo Inst. of Tech. Zhejiang Univ.
Cao, Yi	Cranfield Univ.
Song, Zhi-Huan	Zhejiang Univ.
Li, Yingdao	Zhejiang Univ.
15:30-15:50	FrBT3.4
<i>Extending Discrete Batch-End Quality Optimization to Online Implementation.</i>	
Gins, Geert	KU Leuven
Vanlaer, Jef	KU Leuven
Van den Kerkhof, Pieter	KU Leuven
Van Impe, Jan F.M.	KU Leuven
15:50-16:10	FrBT3.5
<i>Robust Design of Closed-Loop Nonlinear Systems with Input and State Constraints.</i>	
Muñoz, Diego A.	Univ. Pontificia Bolivariana
Marquardt, Wolfgang	RWTH Aachen Univ.
16:10-16:30	FrBT3.6
<i>An Investigation of Economics-Driven NMPC-Formulations for a Continuous Catalytic Distillation System.</i>	
A. N. Idris, Elrashid	TU Dortmund
Engell, Sebastian	TU Dortmund

<b>FrBT5</b>	Venus III
<b>Biological Systems III (Regular Session)</b>	14:30-16:30
Chair: Gunawan, Rudiyanto	ETH Zurich
Co-Chair: Vande Wouwer, Alain	Univ. de Mons
14:30-14:50	FrBT5.1
<i>Experimental Design and Probabilistic Modeling of E. Coli Fermentation.</i>	
Komulainen, Tiina M.	Oslo and Akershus Univ.
Stølen, Anne Bleken	Oslo and Akershus Univ.
Janbu, Astrid Oust	Oslo and Akershus Univ.

14:50-15:10	FrBT5.2
<i>A Simple Output-Feedback Controller for Fed-Batch Cultures of Microbial Strains with Overflow Metabolism.</i>	
Vargas, Alejandro	Inst. de Ingenieria UNAM
Dewasme, Laurent	Univ. de Mons
Moreno, Jaime A.	Univ. Nacional Autonoma de Mexico-UNAM
Vande Wouwer, Alain	Univ. de Mons
15:10-15:30	FrBT5.3
<i>Fluorescence Spectroscopy As a Tool for Ethanol Fermentation On-Line Monitoring.</i>	
Ranzan, Cassiano	Federal Univ. of Rio Grande do Sul
Trierweiler, Luciane Ferreira	Federal Univ. of Rio Grande do Sul
Hitzmann, Bernd	Univ. Hohenheim
Trierweiler, Jorge Otávio	Federal Univ. of Rio Grande do Sul
15:30-15:50	FrBT5.4
<i>Parameter Estimation, Analysis, and Design of Synthetic Gene Switching Models: System Behavior and Performance-Based Approaches.</i>	
Kim, Kwang-Ki	Univ. of Illinois
Cheong, Kim Seng	National Univ of Singapore
Chen, Kejia	Univ. of Illinois
Braatz, Richard D.	Massachusetts Inst. of Tech.
15:50-16:10	FrBT5.5
<i>Construction of Kinetic Model Library of Metabolic Networks.</i>	
Jia, Gengjie	National Univ. of Singapore
Gunawan, Rudiyanto	ETH Zurich
16:10-16:30	FrBT5.6
<i>Kinetic Study of Metabolic Pathways in Clostridium Acetobutylicum.</i>	
Kim, Woohyun	KAIST
Eom, Moon-Ho	GS Caltex
Lee, Sang-Hyun	GS Caltex
Choi, Jin-Dal-Rae	GS Caltex
Park, Sunwon	KAIST

## Author Index

<b>A</b>	
A. N. Idris, Elrashid.....	FrBT3.6
Abbas, Ali.....	WeAT2.2
Aguirre, Adrián M.....	FrAT3.3
Aksikas, Ilyasse.....	WeAT3.3
Al-Gherwi, Walid.....	WePosterT1.5
Alizadeh Moghadam, Amir.....	WeAT3.3
Allgower, Frank.....	WePT1.1
.....	ThAT3
.....	FrKBT4
Alonso, Antonio A.....	ThAT5.3
.....	ThAT5.4
Alvarez, Jesus.....	ThBT5.1
Alvarez, Luz Adriana.....	WePosterT1.3
An, Jiayu.....	ThPosterT1.17
Andersson, Joel.....	WeKBT4.1
Astolfi, Giacomo.....	FrBT2.3
Aziz, N.....	ThBT2.5
<b>B</b>	
Backx, Ton.....	WeBT3.5
.....	ThPosterT1.2
Bajcinca, Naim.....	WeAT5.6
Balakrishnan, Naviyn Prabhu.....	FrAT5.2
Bao, Jie.....	WeBT3.3
.....	ThAT3
.....	ThAT3.1
.....	ThKBT1.1
Barboni, Luca.....	FrBT2.3
Barton, Paul.....	FrBT3.1
Basak, Dahn.....	WeAT3.2
Bavdekar, Vinay.....	ThBT2.6
.....	FrKAT1.1
Behrendt, Martin.....	WeAT5.6
Belgacem, Ismail.....	ThBT5.4
Berenguel, Manuel.....	FrKBT4.1
Bhartiya, Sharad.....	WeAT3.1
.....	WeBT3.4
Biegler, Lorenz T.....	ThAT3.2
Bittanti, Sergio.....	WeBT5.1
Bonfils, Anthony.....	FrAT2.2
Botelho, Viviane Rodrigues.....	ThPosterT1.15
.....	ThPosterT1.16
Braatz, Richard D.....	WeBT5.2
.....	FrBT5.4
Brandt, Heiko.....	WeBT5.4
Budman, Hector M.....	WeAT5
.....	WePosterT1.5
.....	ThBT3
.....	ThBT3.3
Bumroongsri, Pornchai.....	ThPosterT1.10
<b>C</b>	
Calloni, Lorenzo.....	WeBT5.1
Camacho, Eduardo F.....	FrKBT4.1
Cao, Luming.....	WeBT5.3
Cao, Yi.....	FrBT2.5
.....	FrBT3.3
Cecílio, Inês M.....	WeAT2.4
Chai, Tianyou.....	FrKAT4.1
Chen, Cheng-Liang.....	ThKAT4.1
Chen, Chyi-Tsong.....	WePosterT1.1
.....	ThPosterT1.8
Chen, Gui.....	WeAT2.1
Chen, Kejia.....	FrBT5.4
Chen, Man.....	ThPosterT1.1
Cheon, Yu Jin.....	WePosterT1.14
Cheong, Kim Seng.....	FrBT5.4
Chiu, Chih-Chiun.....	WePosterT1.2
Chiu, Min-Sen.....	WeBT5.2
.....	WeBT5.3
.....	FrAT2
.....	FrAT2.6
Choi, Jin-Dal-Rae.....	FrBT5.6
Collin, Jean-Charles.....	ThBT5.3
Conn, Andrew R.....	WeAT5.2
.....	ThBT3.2
Corriou, Jean-Pierre.....	WeKBT4
.....	FrBT3
.....	FrBT3.2
Couenne, Francoise.....	ThKAT4.1
Creff, Yann.....	FrAT2.2
Csercsik, Dávid.....	ThAT5.2
Czermak, Peter.....	FrAT5.1
<b>D</b>	
da Costa Mendes, Paulo Renato.....	WeAT5.1
Darr, Jawwad A.....	FrBT2.4
De Marco, Antonio.....	WeBT5.1
de Prada, Cesar.....	WeAT5.3
.....	WePosterT1.6
.....	ThBT3
.....	ThBT3.1
.....	FrAT3
.....	FrAT3.3
de Souza, Moreira, Isadora.....	ThPosterT1.15
Deschenes, Jean-Sebastien.....	ThBT5.3
Dewan, Alim.....	FrAT5.3
Dewasme, Laurent.....	FrBT5.2
Dhaliwal, Samandeep.....	ThAT2.2
Diehl, Moritz.....	WeKBT4.1
Ding, Steven X.....	ThKAT1
.....	FrKBT1.1
Dittrich, Christoph.....	FrAT3.4
Dubey, Balashish.....	ThPosterT1.4
Dubljevic, Stevan.....	WeAT3.3
duwig, Christophe.....	ThBT2.1
<b>E</b>	
El-Farza, Nael H.....	WeBT2.5
Engell, Sebastian.....	WeKAT1.1
.....	WeAT3.2
.....	WeBT5.4
.....	FrBT3.6
Eom, Moon-Ho.....	WeAT5.5
.....	FrBT5.6
Escobar, Matheus.....	ThPosterT1.6
Evans, James M. B.....	FrBT3.1
<b>F</b>	
Farenzena, Marcelo.....	WePosterT1.10
.....	WePosterT1.12
.....	ThPosterT1.15
Fasahati, Peyman.....	ThBT5.5
Févotte, Gilles.....	WeBT2
.....	WeBT2.6
Fikar, Miroslav.....	FrAT5.1
Findeisen, Rolf.....	WePT1
.....	WeKBT4
.....	ThAT3.4
.....	ThAT3.5
Finkler, Tiago Fiorenzano.....	WeKAT1.1
.....	WeAT3.2
.....	WeBT5.4
Foley, Greg.....	FrAT5.1
Forbes, J. Fraser.....	WeAT3.3
.....	ThKAT1.1
Foss, Bjarne.....	WeAT5.2
<b>G</b>	
Galicia, Hector.....	WeAT2.3
.....	ThAT2.4
Gao, Xukai.....	WeAT2.1
Garcia, Claudio.....	WePosterT1.15
.....	WePosterT1.16
.....	ThAT2.5
Garcia-Sandoval, Juan Paulo.....	ThBT5.1
Ge, zhiqiang.....	WeBT2.1
Ghadrdan, Maryam.....	FrAT2.3
Gins, Geert.....	WeBT5.6
.....	FrBT3.4
Giselsson, Pontus.....	ThBT3.6
Gomez Sayalero, Elena.....	WeAT5.3
González, Rafael.....	WeAT5.3

Gonzalez-Alvarez, Victor.....	ThBT5.1	FrAT3.2	
Gopaluni, Bhushan.....	ThKAT1.1	FrBT2.5	
Goswami, Nababithi.....	ThPosterT1.3	WeKAT1.1	
Gouze, Jean-Luc.....	ThBT5	Kern, Benjamin.....	ThAT3.4
.....	ThBT5.4	Khan, Bilal.....	WeBT3.2
Grondin, Félix.....	WeAT5.4	.....	ThAT3.6
Gu, Yong.....	WePosterT1.11	Kheawhom, Soorathep.....	ThPosterT1.10
Guay, Martin.....	WeAT3.5	Kienle, Achim.....	WeKBT1.1
.....	ThPT1	.....	FrAT2.5
.....	ThAT2.2	Kim, Hyoun-Soo.....	WeBT5.5
.....	ThKBT4	Kim, Hyunjoo.....	WePosterT1.14
Gudi, Ravindra.....	WeAT3	Kim, Kwang-Ki.....	FrBT5.4
.....	WeAT3.1	Kim, Kyungsu.....	WePosterT1.14
.....	WeAT3.4	Kim, Sungho.....	WeBT5.5
.....	WePosterT1.18	Kim, Woohyun.....	WeAT5.5
.....	ThBT2	.....	FrBT5.6
.....	ThBT2.4	Knudsen, Brage Rugstad.....	WeAT5.2
Gunawan, Rudiyanto.....	FrBT5	Koegel, Markus J.....	ThAT3.5
.....	FrBT5.5	Komulainen, Tiina M.....	FrBT5.1
Gunnerud, Vidar.....	ThBT3.2	Kothare, Mayuresh V.....	ThKBT4.1
Gupta, Arun.....	WeBT3.4	.....	FrKAT1
Gutierrez, Gloria.....	WeAT5.3	.....	FrKBT4
.....	ThBT3.1	Kovács, Zoltán.....	FrAT5.1
<b>H</b>			
Hägglblom, Kurt-Erik.....	ThAT2	Kozma, Attila.....	WeKBT4.1
.....	ThAT2.1	Krewer, Ulrike.....	WeAT5.6
Halvorsen, Ivar J.....	FrAT2.3	Kumar, Divya.....	WePosterT1.5
Hangos, Katalin M.....	ThKAT4	Kuramoto, André Seichi Ribeiro.....	WePosterT1.15
.....	ThAT5	<b>L</b>	
.....	ThAT5	Le Gorrec, Yann.....	ThKAT4.1
.....	ThAT5.2	Leão Carvalho, Rodrigo.....	WeAT5.1
.....	ThAT5.4	Lee, Dennis.....	ThAT5.1
Hansen, Henrik.....	WeAT3.6	Lee, Hokyung.....	WePosterT1.13
Hariprasad, K.....	WeAT3.1	Lee, In-Beum.....	WePosterT1.14
Hasebe, Shinji.....	ThBT2.3	.....	ThAT2
He, Qinghua (Peter).....	WeAT2.3	Lee, Jay H.....	WeAT5.5
.....	ThAT2.4	.....	ThPT1.1
Henriksson, Erik.....	ThAT3.3	.....	ThKAT1
Hioe, Denny.....	WeBT3.3	.....	FrKBT1
Hitzmann, Bernd.....	FrBT5.3	Lee, Jietae.....	WePosterT1.14
Hoang, Ngoc Ha.....	ThKAT4.1	Lee, Jong Min.....	WeBT5
Horch, Alexander.....	WePT1	.....	WeBT5.5
.....	FrPT1	.....	ThPosterT1.13
.....	ThPosterT1.14	.....	FrAT5.4
Howell, John.....	ThPosterT1.14	Lee, Joseph.....	ThPosterT1.18
Hu, Wuhua.....	FrAT3.2	Lee, Julia.....	WeAT5.5
Huang, Biao.....	ThKAT1.1	Lee, Kwang Soon.....	WeAT3
Huang, Chunqing.....	ThPosterT1.12	.....	FrBT2
Huang, Dexian.....	ThAT2.3	.....	FrBT2.6
Hudon, Nicolas.....	ThKBT1.1	Lee, Ming-Wei.....	ThAT2.6
Huusom, Jakob Kjøbsted.....	ThBT2.1	Lee, Sang-Hyun.....	FrBT5.6
<b>J</b>			
Jacobsen, Elling.....	WeKAT4.1	Lee, Shin Je.....	WeBT5.5
Jahanshahi, Esmaeil.....	WeAT3.6	Lee, Tong Heng.....	WeBT3.1
Janbu, Astrid Oust.....	FrBT5.1	Lee, Youn-Woo.....	WeBT5.5
Jäschke, Johannes.....	FrAT3.1	Lepreux, Olivier.....	FrAT2.2
Jeng, Jyh-Cheng.....	ThAT2.6	Li, Xiang.....	FrBT3.1
Jhao, Da-Wei.....	WePosterT1.9	Li, Yingdao.....	FrBT3.3
Jia, Gengjie.....	FrBT5.5	Li, Zheng.....	FrAT5.3
Jia, Li.....	WeBT5.3	Liew, Emily W.T.....	FrAT5.6
Jiang, Benben.....	ThAT2.3	Lin, Tian.....	ThPosterT1.1
Jiang, Yongheng.....	ThAT2.3	Lindholm, Anna.....	ThBT3.6
Jimoh, Mohammed.....	ThPosterT1.14	Liu, Hongbin.....	WePosterT1.4
Johansson, Karl Henrik.....	ThAT3.3	Liu, Jay.....	WePosterT1.13
Jorgensen, John Bagterp.....	ThBT2.1	.....	ThBT5.5
Jørgensen, Sten Bay.....	FrAT5.5	Liu, Tao.....	WeBT2.4
Juliani, Rodrigo.....	WePosterT1.16	Liu, Zhe.....	WePosterT1.11
<b>K</b>			
Kamaraju, Vamsi Krishna.....	FrAT2.6	Logist, Filip.....	FrAT3.4
Kanchi, Lakshmi Kiran.....	ThPosterT1.18	Lu, Xin.....	ThPosterT1.12
Kano, Manabu.....	ThBT2.3	Lucia, Sergio.....	WeAT3.2
Karim, M. Nazmul.....	WeKBT1	Ludlage, Jobert.....	WeBT3.5
.....	FrAT5	<b>M</b>	
.....	FrAT5.3	M, Elenchezhiyan.....	ThBT2.2
Kariwala, Vinay.....	WePosterT1	Ma, Cai Yun.....	ThPosterT1.1
.....	ThKBT4	.....	FrBT2.4
.....	ThPosterT1	Ma, Chao Yang.....	WeBT3.6
.....	.....	Ma, Chi.....	ThPosterT1.17
.....	.....	Magbool Jan, Nabil.....	FrAT3.5





