Preliminary Conference Program

April 2-4, 2012
Phuket, Thailand

Location
Novatel Phuket Resort
Kalim Beach Patong,
Phuket 83150, Thailand

Power and Energy Systems (AsiaPES 2012)

Sponsor
The International Association of Science and Technology for Development (IASTED)
- Technical Committee on Power and Energy Systems

Conference Chair
Dr. Issarachai Ngamroo - King Mongkut's Institute of Technology Ladkrabang

Keynote Speaker
Prof. Yasunori Mitani - Kyushu Institute of Technology

Tutorial Presenter
Prof. Hassan Bevrani - University of Kurdistan

Special Session Organisers
Dr. Somyot Kaitwanidvilai - King Mongkut's Institute of Technology Ladkrabang
Dr. Atthapol Ngaopitakkul - King Mongkut's Institute of Technology Ladkrabang
Dr. Masayuki Watanabe - Kyushu Institute of Technology

Invited Speakers
Prof. Egon Ortjohann - South Westphalia University of Applied Sciences
Prof. Minwon Park - Changwon National University

International Program Committee
V. G. Agelidis – University of New South Wales, Australia
M. Al-Nimr – Jordan University of Science and Technology, Jordan
P. Balaya – National University of Singapore, Singapore
H. Bevrani – University of Kurdistan, Iran
J. P. Catalao – University of Beira Interior, Portugal
Y. Chen – Pacific Northwest National Laboratory, USA
J. Choi – Chungbuk National University, Korea
J. Darkwa – The University of Nottingham Ningbo, China, Mainland
J. Dayou – Universiti Malaysia Sabah, Malaysia
S. Dechanupaprittha – Kasetsart University, Thailand
A. Faris Ismail – IIUM, Malaysia
I. Goel – Nanyang Technological University, Singapore
B. Gong – Siemens Energy, USA
W. Grega – AGH University of Science and Technology, Poland
Q. Guo – Tsinghua University, PR China
R. Hara – Hokkaido University, Japan
T. Hashiguchi – Kyushu University, Japan
M. Hojo – The University of Tokushima, Japan
K. Hongesombut – Kasetsart University, Thailand
K. Ibrahim – Universiti Sains Malaysia, Malaysia
S. Jangamshetti – Basaveshwar Engineering College (Autonomous), India
P. Jirutitijaroen – National University of Singapore, Singapore
C. Kang – Tsinghua University, China, Mainland
D. N. Ketjoy – Naresuan University, Thailand
J. Krope – University of Maribor, Slovenia
A. Kumar – NIT Kurushetra, India
V. I. Kuprianov – Sirindhorn International Institute of Technology, Thammasat University, Thailand
C. F. Lu – Chung Chou University of Science and Technology, Taiwan
W. Nakawiro – TNB Research Sdn. Bhd., Malaysia
N. S. Nasri – University of Technology, Malaysia
A. Ngaopitakkul – King Mongkuts Institute of Technology Ladkrabang, Thailand
S. Nuchprayoon – Chiang Mai University, Thailand
S. Okamoto – Shimane University, Japan
E. Ortjohann – South Westphalia University of Applied Sciences, Germany
Frequency control is one of the important control problems in interconnected power system design and operation, and is becoming more significant today due to the increasing size, changing structure, emerging renewable energy sources and new uncertainties, environmental constraints, and the complexity of power systems. The frequency in a power system is usually under control using well-known automatic generation control (AGC) loop. AGC markets require increased intelligence and flexibility to ensure that they can be maintained generation-load balance, following serious disturbances.

In a conventional power system, the majority of supply-demand balancing is achieved by controlling the output of dispatchable generation resources to follow the changes in demand, and typically, a smaller portion of the generation capacity in a control area is capable of and is designated to provide frequency regulation service in order to deal with the more rapid and uncertain demand variations provided by renewable energy sources (RESs). Integration of RESs into power system grids have impacts on frequency control as well as other control issues. Increases in distributed generation, microgrids and active control of consumer open the way to new control strategies with a more control hierarchy/intelligence and decentralized property.

The frequency control/AGC systems in a modern power system should handle complex multi-objective regulation optimization problems characterized by a high degree of diversification in policies, control strategies, and widely distribution in demand and supply sources; so it surely must be intelligent. The core of such intelligent system should be based on flexible intelligent algorithms, advanced information technology, and fast communication devices. The frequency control interacting with other ancillary services and energy markets should be also able to contribute to upcoming challenges of future power systems control and operation.

This tutorial provides a thorough understanding of the fundamentals of power system frequency control in the presence of RESs and Microgrids; and addresses several new schemes using robust and intelligent control methodologies. The physical and engineering aspects have been fully considered, and most proposed control strategies are examined by real-time simulations. The tutorial mainly summarizes the long term research and academic experiences of the speaker in three countries of Iran, Japan and Australia.

H. Bevrani received the M.Eng. (Hons.) degree from K. N. Toosi University of Technology, Tehran, Iran, in 1997, and the Ph.D. degree from Osaka University, Osaka, Japan, in 2004, both in electrical engineering. From 2004 to 2006, he was a Postdoctoral Fellow at Kumamoto University, Kumamoto, Japan. From 2007 to 2008, he was a Senior Research Fellow at Queensland University of Technology, Brisbane, Qld., Australia. In 2009 and 2011 he has been invited as visiting professor to Kumamoto University and Kyushu Institute of Technology (Japan), respectively.

Currently, he is an associate professor at University of Kurdistan. His special fields of interest include intelligent and robust control applications in Power system and Power electronic industry. He has published 2 books, 6 book chapters and about 100 international journal and conference papers. He is a senior member of Institute of Electrical and Electronics Engineers (IEEE), member of the Institute of Electrical Engineers of Japan (IEEJ) and the Institution of Engineering and Technology (IET).

H. Bevrani was born in Kurdistan, Iran. He received Ph.D. degree from Osaka University, Osaka, Japan, in 2004, in electrical engineering. From 2004 to 2006, he was a Postdoctoral Fellow at Kumamoto University, Kumamoto, Japan. From 2007 to 2008, he was a Senior Research Fellow at Queensland University of Technology, Brisbane, Australia. From 2000, he has been an academic member of University of Kurdistan. From 2009, he was working as a professor in Kumamoto University. His special fields of interest include intelligent and robust control applications in Power system and Power electronic industry. Prof. Bevrani is a senior member of Institute of Electrical and Electronics Engineers (IEEE), member of the Institute of Electrical Engineers of Japan (IEEJ) and the Institution of Engineering and Technology (IET).

10:30 – 11:00 COFFEE BREAK
Location: Siam Foyer

11:00 – AsiaPES TUTORIAL SESSION CONTINUED
Location: Siam A

12:00 – LUNCH BREAK
Location: TBA

14:00 – AsiaPES INVITED SPEAKER – “TRANSITION REQUIREMENTS AND STRATEGIES FOR SMART GRID UNDER GERMANY CONDITION”
Presenter: Prof. Egon Ortjohann (Germany)
Location: Siam A
The Fifth IASTED Asian Conference on
Power and Energy Systems
~AsiaPES 2012~
April 2 – 4, 2012
Phuket, Thailand

TUTORIAL SESSION

Frequency Control in Modern Power Systems: Challenges and New Perspectives
Prof. Hassan Bevrani
University of Kurdistan, Iran
bevrani@uk.ac.ir

Duration
3 hours

Abstract
Frequency control is one of the important control problems in interconnected power system design and operation, and is becoming more significant today due to the increasing size, changes in structure, emerging renewable energy sources and new services, environmental constraints, and the complexity of power systems. The frequency in a power system is usually under control using well-known automatic generation control (AGC) loop. AGC markets require increased intelligence and flexibility to ensure that they can provide generation-load balance, following serious disturbances.

In a conventional power system, the majority of supply-demand balancing is achieved by controlling the output of dispatchable generation resources to follow changes in demand, and typically, a smaller portion of the generation capacity in a control area is capable of and is designated to provide frequency regulation service in order to deal with the mild and uncertain demand variations provided by renewable energy resources (REFs). Integration of REFs into power system grids has impacts on frequency control as well as other control issues. Increases in distributed generation, microgrids, and active consumer involvement pave the way to new control strategies with a more control-hierarchy intelligence and decentralized properly.

The frequency control/AGC systems in a modern power system should handle complex multi-objective optimization problems characterized by high degree of uncertainties such as: policies, control strategies, and power distribution is demand and supply sources; so it simply must be intelligent. The core of such intelligent system should be based on flexible intelligent algorithms, advanced information technology, and test communication devices. The frequency control interacting with other ancillary services and power markets should also be able to contribute to upcoming challenges of fully power systems operational and economic.

This tutorial provides a thorough understanding of the fundamentals of power system frequency control in the presence of REFs and microgrids, and addresses new schemes using robust and intelligent control methodologies. The technical and engineering aspects have been fully considered, and most proposed control strategies are examined by real-time simulations. The tutorial mainly summarizes long-term research and academic experiences of the speaker in three countries of Iran, Japan, and Australia.

Objectives
- In tutorial, the participants will learn about the most important issues on the frequency control of modern power systems. Following an overview on the relevant literature, the main topics of the tutorial is the power system AGC/frequency control synthesis, concerning the integration of PCSs/REFs and microgrids, that are of most interest today, is presented. The need for revising existing frequency control standards is emphasized.
- The participants will feel what happens to the frequency control requirements if numerous REFs are added to the existing generation portfolio, how to handle changes in topology caused by switching in the network and how to make the AGC/frequency control system robust and able to take advantage of the potential flexibility of distributed energy resources.

Timeline
This tutorial is designed for a 3 hour presentation. Participants of this tutorial will gain an overview on power system frequency control issue and more details on frequency control synthesis concerning new challenges in a modern power system.
- 10 mins - Power System Control Air Overview
- 40 mins - Power System Frequency Control: Fundamentals and New Perspectives
- 50 mins - Frequency Control Concerning Renewable Sources and Microgrids
- 30 mins - Test Break
- 60 mins - Robust and Intelligent Frequency Control Synthesis
- 20 mins - Conclusions and Discussions

Background Knowledge Expected of the Participants
The tutorial could be useful for engineers and operators in power system planning and operation, as well as academic researchers and university students in electrical engineering. Basic knowledge in power system dynamic and control is preferable, but not necessary.

Qualifications of the Instructors
H. Bevrani received the M.Eng. (Hons) degree from K. N. Toosi University of Technology, Tehran, Iran, in 1997, and the Ph.D. degree from Osaka University, Osaka, Japan, in 2004, in electrical engineering. From 2004 to 2006, he was a Postdoctoral Fellow at Kumamoto University, Kumamoto, Japan. From 2007 to 2009, he was a Senior Research Fellow at Queensland University of Technology, Brisbane, Australia. In 2009 and 2011 he was invited as a visiting professor to Kumamoto University and Kyoto Institute of Technology (Japan), respectively.

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