Guest lectures:

Trend of the Smart Grid Development

by

Prof. Wei-Jen Lee, Energy Systems Research Center, University of Texas at Arlington, US

and

Estimation and Control of Future Power Grid: Challenges and Opportunities

by

Prof. Bikash Pal, Imperial College London

August 15 2017, 10:00 – 11:55

Aalborg University, Department of Energy Technology, Pontoppidanstræde 111, auditorium

Guest Lecture 1, 10:00 – 10:55

The electrical power system in the US has been named as "the supreme engineering achievement of the 20th century" by the National Academy of Sciences. While the power system is a technological marvel, it is also reaching the limit of its ability to meet the nation's electricity needs. In addition, our nation is moving into the digital information age that demands higher reliability from the nation's aging electrical delivery system.

The modernization of the electricity infrastructure leads to the concept of "smart grid". A comprehensive smart grid design should cover both top-down and bottom-up approaches. For the current centralized generation and transmission system, upgrading the power delivery infrastructure, enforcing the system security requirement, and increasing interoperability are well known techniques to improve the reliability and the controllability of the power system. For the bottom-up approach, one of the most important features is its ability to support a more diverse and complex network of energy technologies. Specifically, it will be able to seamlessly integrate an array of locally installed, distributed power sources with smaller CO_2 footprint, such as fuel cells, photovoltaic, and wind generation, into the power system.

This presentation discusses the opportunities and challenges for the development of Smart Grid, highlights the smart grid related researches that I have been involved recently, and explores the possibility for future collaborations. The presentation concludes with the listing of issues needed to be addressed to ensure successful integration procedures that will eventually create new structures of efficient, modular and environmentally responsive electricity infrastructure that will have an impact nationally as well as globally.

About the Lecturer

Professor Lee received the B.S. and M.S. degrees from National Taiwan University, Taipei, Taiwan, R.O.C., and the Ph.D. degree from the University of Texas, Arlington, in 1978, 1980, and 1985, respectively, all in Electrical Engineering.

In 1986, he joined the University of Texas at Arlington, where he is currently a professor of the Electrical Engineering Department and the director of the Energy Systems Research Center.

He has been involved in the revision of IEEE Std. 141, 339, 551, 739, 1584, and dot 3000 series development. He is the Vice President of the IEEE Industry Application Society (IAS). He is a Distinguished Lecturer (DL) of IEEE IAS (2017-2018). He is an editor of IEEE Transactions on Industry Applications and IAS Magazine and editorial board member of Journal of Modern Power Systems and Clean Energy (MPCE) and CSEE Journal of Power and Energy Systems. He has been inducted as a member of Academy of Distinguished Scholar at the University of Texas at Arlington since 2012. He is the project manager of IEEE/NFPA Collaboration on Arc Flash Phenomena Research Project.

Prof. Lee has been involved in research on utility deregulation, renewable energy, smart grid, microgrid, energy internet and virtual power plants (VPP), arc flash hazards and electrical safety, load and wind capacity forecasting, power quality, distribution automation and demand side management, power systems analysis, online real-time equipment diagnostic and prognostic system, and microcomputer based instrument for power systems monitoring, measurement, control, and protection. He has served as the primary investigator (PI) or Co-PI of over one hundred funded research projects with the total amount exceed US$15 million dollars. He has published more than one hundred and thirty journal papers and two hundred forty conference proceedings. He has provided on-site training courses for power engineers in Panama, China, Taiwan, Korea, Saudi Arabia, Thailand, and Singapore. He has refereed numerous technical papers for IEEE, IET, and other professional organizations.

Prof. Lee is a Fellow of IEEE and registered Professional Engineer in the State of Texas.

Guest Lecture 2, 11:00 – 11:55

Electrical generation, transmission and distribution systems all over the world have entered a period of significant renewal and technological change. There have been phenomenal changes/deployments in technology of generation driven by the worldwide emphasis on energy from wind and solar as a sustainable solution to our energy need. Increasingly energy demand from heating and transportation will be met by electricity. So to accommodate changes in either end the transmission grid is required to operate in more responsive manner. This is the most credible challenge in smart transmission grid operation today. The practice of centralised control has been challenged by communication network and security of large volume of data. The new form of demand has also challenged our traditional approach to demand modelling. Coupled with domestic scale storage and generation – the operation and control of distribution network requires innovation in modelling and control.

This talk will highlight the problems and will provide some insight into the future. It will then suggest a few possible specific research directions to follow based on relevant technical study conducted at Bikash Pal's research group at Imperial College London.

About the Lecturer

Bikash Pal holds the Chair of Power Systems at Imperial College London. His research over the past 20 years has focused on designing robust control techniques to guard against power system stability problem. He has led strategic research in power transmission control and state estimation with lasting support from Engineering and Physical Research Council (EPSRC), UK, Council of the European Union and power industries: ABB, UK Power Networks and National Grid, UK. Currently he leads an eight-university UK-India research consortium on Smart Grid and Storage and a six-university UK-China research consortium in Smart Grid and Control. His research group have won President's outstanding research team award at Imperial College London, 2016. He has written two books on power system stability and control, published 75 IEEE/IET journal papers, graduated 18 PhDs and supervised 20 post docs. He was with the faculty of IIT Kanpur and Jadavpur University before joining Imperial College London in 2001. Prof Pal's DLP lectures have benefited many colleagues in power engineering profession worldwide. He has offered course on power system stability and control and on power system protection for practicing engineers from Brazil, Chile, Mexico, Europe, Middle East and India. He is consultant to National Grid UK and ALSTOM Grid UK (now GE Grid Solution UK Ltd), UK Power Networks and STATNET Norway where he provided technical solution to power network stability related problems. He has been approached by the United Nation (Framework for Climate Change) for clean development mechanism programme. As Editor-in-Chief (2005-2012) of IET Generation, Transmission and Distribution journal, he has demonstrated outstanding leadership in promoting high quality research from our power engineering colleagues. He chairs IEEE PES Working Group on Distribution System State Estimations: Practical Challenges, Limitations of Current Tools and Research Need. He is Editor-in-Chief of IEEE Transactions on Sustainable Energy. He was honoured by the German Research Foundation (DFG) with Mercator Professorship in 2011. Prof Pal is a Fellow of IEEE for his contribution to power system stability and control. He is also a visiting Professor at Tsinghua University.