

PHYSICAL COLLOQUIUM
INVITATION

Monday, 09.01.2017, 4.15 p.m., W2-1-148

speaks

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Colorado / USA

about

Integration of Large Amounts of Wind Energy

While Maintaining Utility Grid Reliability

Wind energy is recognized worldwide as cost-effective and environmentally friendly and is among the world's fastest-growing sources of electrical energy. Despite the amazing growth in global wind power installations in recent years, science and engineering challenges still exist. For instance, since electrical power supply and demand must match on the grid to maintain grid reliability, the variability of generated wind power creates challenges to integrating large amounts of wind energy on the utility grid. Recently, research utilizing systems and control techniques has begun to demonstrate that it is possible to actively control the power generated by wind turbines and wind farms to help stabilize the grid frequency. In this talk, we will first provide an overview of wind energy systems by introducing the primary structural components and operating regions of wind turbines. The operation of the utility grid will be briefly reviewed by discussing the electrical system, explaining the importance of preserving grid reliability through controlling the grid frequency (which is a measure of the balance between electrical generation and load), and describing the traditional methods of providing ancillary services for frequency support using conventional generation utilities. We will then outline how wind turbines and wind farms can be controlled to help stabilize and balance the frequency of the utility grid. Results of simulation studies as well as experimental field tests will be presented to show the promise of the techniques being developed. We shall close by discussing continuing challenges and on-going and future research avenues that can further facilitate the growth of wind energy.

Bio: Lucy Pao is a Professor in the Electrical, Computer, and Energy Engineering Department and a Professor (by courtesy) in the Aerospace Engineering Sciences Department at the University of Colorado Boulder. She is currently also a Fellow of Hanse-Wissenschaftskolleg Institute for Advanced Study, Delmenhorst, Germany. She earned B.S., M.S., and Ph.D. degrees in Electrical Engineering from Stanford University. Her research has primarily been in the control systems area, with applications ranging from atomic force microscopy to disk drives to digital tape drives to megawatt wind turbines and wind farms. Selected recent honors include elevation to Fellow of the Institute of Electrical and Electronics Engineers (IEEE) in 2012, the 2012 IEEE Control Systems Magazine Outstanding Paper Award (with K. Johnson), election to Fellow of the International Federation of Automatic Control (IFAC) in 2013, and the 2015 Society for Industrial and Applied Mathematics (SIAM) Journal on Control and Optimization Best Paper Prize (with J. Marden and H. P. Young). Selected recent and current professional society activities include being General Chair for the 2013 American Control Conference, an IEEE Control Systems Society (CSS) Distinguished Lecturer (2008-2014), a member of the IEEE CSS Board of Governors (2011-2013 (elected) and 2015 (appointed)), Fellow of the Renewable and Sustainable Energy Institute (2009-present), IEEE CSS Fellow Nominations Chair (2016-), member of the IFAC Fellow Selection Committee (2014-2017), and member of the International Program Committees for the 2016 Indian Control Conference, the 2016 IFAC Symposium on Mechatronic Systems, and the 2017 IFAC World Congress.

All interested persons are cordially invited.

Sgd. Prof. Martin Kühn