Electric Energy

EESG

Systems Group

SEMINAR series

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Sudip K. Mazumder

Associate Professor
University of Illinois at Chicago

Sudip K. Mazumder currently is an Associate Professor and Director, Laboratory of Energy and Switching-Electronics Systems (LESES) in the ECE Department at the University of Illinois, Chicago (UIC). He received the 2005 ONR Young Investigator Award and the 2003 NSF CAREER Award for work related to distributed control and stabilization of interactive power networks using jointly optimized control-communication framework. He has led multiple federally and industry supported projects related to distributed and decentralized control of power networks and has developed a scaled experimental and simulation (including real-time) testbed for validation and calibration. Dr. Mazumder is the Chair, Student / Industry Coordination Activities, IEEE Energy Conversion Congress and Exposition (most prestigious IEEE power electronics conference), for both 2009 and 2010. Dr. Mazumder received UIC's 2008 Faculty Research Award and 2006 College of Engineering Diamond Research Award for outstanding research performance and scholarly activities.

Hosted by: Professor Marija Ilić
Depts. of ECE and EPP
milic@ece.cmu.edu

Sequence Based Stability and Control of Interactive Power-Electronics Networks

Optimal compromise between stability margin and performance of switching power converters (SPCs) is an ongoing challenge. It has now attained newer heights due to traditional applications such as VRMs/POL converters that are of-late demanding significant performance improvements and due to newer DPS/ network applications (ranging from Microgrids and FutureGens based on Alternative Energy Sources, More-Electric-Aircrafts (MEA) for aerospace applications, to Advanced Naval Electric Power Systems (AEPS) for electric ships), which demand performance and stability, not only for individual converters but for the network as a whole.

The obvious question is why are traditional approaches based primarily on averaged models alone not enough? This is because linear/nonlinear averaged model cannot account for the "global dynamics" of a SPC/SPC network and is limited to averaged dynamics under "periodic switching conditions". Hence, the associated stability tools and control techniques are limited in their capabilities as well. Thus, there is need for a generalized approach that is powerful enough to account for the global dynamics of standalone/integrated/networked SPCs under saturated, quasi-saturated and unsaturated (periodic switching) operating conditions.

Based on the research advancements made in the last decade, including recent breakthroughs by Professor Mazumder, this talk will delineate (using fundamental concepts and several practical applications) this generalized global stability approach, how it can integrate existing averaged model concepts as well as methodologies based on nonlinear maps, and how it can lead to advanced "optimal sequence based" hybrid and distributed controllers. For network control of complex homogenoeous and heterogeneous SPCs, impact of distributed network delay will be demonsrated. In that context, an interesting problem related to the joint optimization of control performance and network throughput under stability constraint will be outlined.

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