



BIG energy seminar series

Addressing the scale and complexity of the global energy challenge.



Control of Power Inverters in Renewable Energy and Smart Grid Integration

Dr. Qing-Chang Zhong

Chair in Control and Systems Engineering

Dept. of Automatic Control and Systems Engineering

The University of Sheffield

Monday November 5th at 1:00 PM

Engineering Center - Room ECEE 1B55

Summary: Renewable energy sources have been regarded as the most promising means to solve the energy and environmental issues we face nowadays. How to integrate renewable energy into smart grids presents many challenging problems in control and power electronics. A well-integrated smart grid provides the backbone for the high-level functions of smart grids, such as wide-area control, communication, information, marketing and security.

In this talk, an overview of the enabling technologies in control and power electronics to facilitate the integration of renewable energy into smart grids developed by the speaker and his team over the last 10 years will be presented. These include different strategies to improve the power quality in smart (or micro) grids, grid-friendly connection of renewable energy using inverters that mimic synchronous generators (synchronverters), the provision of a neutral line for inverters, parallel operation of inverters to share the load in proportional to their capacity (robust droop controllers), inverters with capacitive output impedances (C-inverters), active capacitors implemented with inverters, harmonic droop controllers, sinusoid-locked loops (not just to lock the phase but also the frequency and amplitude), and an all-in-one control strategy to deal with the power quality issues (including negative-sequence currents, reactive power and harmonics) in the traction power systems of high-speed trains. It will be shown that the integration of profound expertise in control and power electronics often leads to artful solutions to these problems.

These technologies also have wide applications in ship power systems, aircraft power systems, hybrid electric vehicles, distributed generation (CHP and V2G etc), uninterrupted power supplies (UPS), rotary frequency converters, static synchronous compensator (STATCOM) and HVDC transmission etc.

Dr. Qing-Chang Zhong

Qing-Chang Zhong received the Ph.D. degree in control theory and engineering from Shanghai Jiao Tong University, Shanghai, China, in 1999, and the Ph.D. degree in control and power engineering (awarded the Best Doctoral Thesis Prize) from Imperial College London, London, U.K., in 2004.

He holds the Chair Professor in Control and Systems Engineering at the Dept of Automatic Control and Systems Engineering, the University of Sheffield. He is a Fellow of IET (2010) and a Senior Member of IEEE (2004). He is an Associate Editor of IEEE Transactions on Power Electronics and of the Conference Editorial Board of IEEE Control Systems Society. He is a Vice Chair of IFAC TC 6.3 (Power and Energy Systems) and IFAC TC 2.2 (Linear Control Systems), and has been on the Program Committees of many international conferences. He was awarded one of the seven Leverhulme Trust Senior Research Fellowships in 2009 by the Royal Academy of Engineering, UK. He has attracted over £ 2M research funding from EPSRC, RAEng, TSB, and industrial companies etc during the last five years. His current research focuses on advanced control theory, power electronics, renewable energy, smart grid integration, electrical vehicles and control applications in other industrial sectors. The details of some of his projects can be found from <http://zhongqc.staff.shef.ac.uk>.

Campus Map: Engineering Center <http://www.colorado.edu/campusmap/map.html?bldg=EC&x=11&y=8>

Sponsored by the Electrical, Computer, and Energy Engineering Department and the Renewable and Sustainable Energy Institute (RASEI)

rasei.colorado.edu