With aging power distribution systems and new opportunities for renewable energy generation, the smart grid and microgrid are becoming increasingly important. Microgrid allows the addition of local loads and local distributed generation (DG) including wind power, solar, hydroelectric, fuel cells, and micro-turbines. Microgrid holds out the hope of scalable growth in power distribution systems by distributed coordination of local loads and local DG so as not to overload existing power grid generation and transmission capabilities. Sample microgrids are smart buildings,
isolated rural systems, and offshore drilling systems. Microgrid takes power from the main power grid when needed, and is able to provide power back to the main power system when there is local generation excess.

When connected to the main distribution grid, microgrid receives a frequency reference from grid synchronous generators. Standard operating procedures call for disconnecting microgrid from the main power grid when disturbances occur. On disconnection, or in islanded mode, the absence of rotating synchronous generation leads to a loss of frequency references. After islanding, it is necessary to return Microgrid DG frequencies to synchronization, provide voltage support, and ensure power quality.

In this talk we develop a new method of synchronization for cooperative systems linked by a communication graph topology that is based on a novel distributed feedback linearization technique. This cooperative feedback linearization approach allows for different dynamics of agents such as occur in the DGs of a microgrid. It is shown the new cooperative protocol design method allows for frequency synchronization, voltage synchronization, and distributed power balancing in a microgrid after a grid disconnection islanding event. The distributed nature of the cooperative feedback linearization method is shown to lead to sparse communication topologies that are more suited to microgrid control, more reliable, and more economical than standard centralized secondary power control methods.

About the Speaker

F.L. Lewis, Member, National Academy of Inventors. Fellow IEEE, Fellow IFAC, Fellow U.K. Institute of Measurement & Control, PE Texas, U.K. Chartered Engineer. UTA Distinguished Scholar Professor, UTA Distinguished Teaching Professor, and Moncrief-O'Donnell Chair at The University of Texas at Arlington Research Institute. Qian Ren Thousand Talents Professor,
Northeastern University, Shenyang, China. IEEE Control Systems Society Distinguished Lecturer. He obtained the Bachelor's Degree in Physics/EE and the MSEE at Rice University, the MS in Aeronautical Engineering from Univ. W. Florida, and the Ph.D. at Ga. Tech. He works in feedback control, reinforcement learning, intelligent systems, and distributed control systems. He is author of 6 U.S. patents, 273 journal papers, 375 conference papers, 15 books, 44 chapters, and 11 journal special issues. He received the Fulbright Research Award, NSF Research Initiation Grant, ASEE Terman Award, Int. Neural Network Soc. Gabor Award 2009, U.K. Inst Measurement & Control Honeywell Field Engineering Medal 2009. Received IEEE Computational Intelligence Society Neural Networks Pioneer Award 2012. Distinguished Foreign Scholar, Nanjing Univ. Science & Technology. Project 111 Professor at Northeastern University, China. Received Outstanding Service Award from Dallas IEEE Section, selected as Engineer of the Year by Ft. Worth IEEE Section. Listed in Ft. Worth Business Press Top 200 Leaders in Manufacturing. Received the 2010 IEEE Region 5 Outstanding Engineering Educator Award and the 2010 UTA Graduate Dean’s Excellence in Doctoral Mentoring Award. Elected to UTA Academy of Distinguished Teachers 2012. Texas Regents Outstanding Teaching Award 2013. He served on the NAE Committee on Space Station in 1995. Founding Member of the Board of Governors of the Mediterranean Control Association. Helped win the IEEE Control Systems Society Best Chapter Award (as Founding Chairman of DFW Chapter), the National Sigma Xi Award for Outstanding Chapter (as President of UTA Chapter), and the US SBA Tibbets Award in 1996 (as Director of ARRI’s SBIR Program).

All are welcome!

Enquiry: 3442 8420

MBE Seminar 2013-2014/036