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Seminar:
Dr. Hengzhao Yang, California State University
The Supercapacitor Technology: Characteristics and Applications
Friday March 23, 2018, 12 Noon, 202 ECEC

Abstract:

During the recent years, energy storage has been increasingly recognized as a critical asset in many applications such as the electric grid and electric vehicles. Take the electric grid for instance. According to the DOE Global Energy Storage Database, 1676 operational or announced projects totaling a rated power of 194.02 GW have been reported as of March 12, 2018. Among various energy storage technologies, supercapacitors feature high power density, long cycle life, and high efficiency although their energy density is lower and their self-discharge rate is higher compared to batteries. This talk focuses on the supercapacitor technology and introduces my work at both the device level and the system level.

To exploit the supercapacitor technology, a comprehensive and in-depth understanding of its characteristics at the device level is crucial. The first part of this talk summarizes my completed work on supercapacitor modeling and characterization, which includes studies of the self-discharge and charge redistribution characteristics as well as the charge, power, and energy capabilities. To illustrate the impact of charge redistribution on power management in environmentally powered wireless sensor nodes, a task scheduling problem is investigated.

The second part of this talk introduces my ongoing work at the system level. The motivation and proposed work of four projects involving supercapacitor-based energy storage systems are outlined. (1) Smart grid. The design, control, and valuation of supercapacitor-based energy storage systems for microgrid applications are being examined. (2) Biomedical devices. A closed-loop power controller is being developed for deep brain stimulation devices. (3) Cyber-physical systems. A mobile robot powered by supercapacitors is being prototyped. (4) Transportation systems. Supercapacitor-based energy storage systems are being designed for roadway energy harvesting systems using piezoelectric transducers.

Bio:

Hengzhao Yang is an Assistant Professor at California State University, Long Beach. Prior to this appointment, he was a Postdoctoral Fellow at the Georgia Institute of Technology from 2013 to 2015 and a Visiting Assistant Professor at Miami University from 2015 to 2016. He received the Ph.D. degree in Electrical and Computer Engineering from the Georgia Institute of Technology in 2013.

His current research interests are energy storage devices and systems for a variety of applications, including smart grid, biomedical devices, cyber-physical systems, wireless sensor networks, and the Internet of Things. He is especially interested in supercapacitor modeling and characterization, supercapacitor-based energy storage systems, and emerging energy storage devices and systems.