The IAS Concordia University Student Branch and the IAS, PELS, IES and PES Montreal Chapters cordially invite you to a technical seminar titled

"Wide Bandgap Semiconductors and Adaptive Control: Game Changers for Next Generation Power Electronics"

Date Friday, November 18th 2016

Time 2:00 PM to 3:30 PM

Location EV 3.309, EV Building, Concordia University, H3G 2W1

Raghav Khanna (M'14) received the PhD degree from the University of Pittsburgh in 2014. Prior to finishing graduate school, he worked for several industries including Lockheed Martin (Philadelphia, PA), PPG Industries (Pittsburgh, PA) and HRL Laboratories (Malibu CA). At HRL, he was directly involved with the development of GaN based battery chargers for electric vehicles. In the 2014-2015 academic year, he taught power and analog electronics at Bucknell University (Lewisburg, PA) as a visiting assistant professor. In the 2015-2016 academic year, he joined the Electrical Engineering and Computer Science Department at The University of Toledo as an assistant professor. His research interests are in physics and behavioral modeling of wide bandgap semiconductors, with applications in renewable energy, electric vehicles, aerospace and maritime systems, and in low power consumer electronics. He recently received a $200K grant from the Office of Naval Research to continue some of these research activities. He is also conducting extensive research on renewable energy integration and maximum power point tracking in photovoltaic systems.

Dr. Raghav Khanna
Assistant Professor,
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Abstract

Next generation power electronics will benefit from smaller, faster, more efficient conversion circuits. The silicon (Si) based transistor has been the mainstay of power switching applications for 30 years, but may be reaching a technological plateau, particularly as the demand for robust, high voltage green energy systems continues to increase. Wide bandgap semiconductors (WBGs) based on gallium nitride (GaN) and silicon carbide (SiC) are attractive candidates to replace Si transistors for future generation power electronic circuits.

This talk will present modeling and characterization techniques for GaN based power conversion circuits. It will be shown that a converter efficiency of 96% is obtained at a voltage level of 300 V and switching frequency of 1 MHz using GaN transistors. The reported efficiency is the highest to date at the indicated voltage and frequency. It will also be shown that the fast switching capability of WBGs, although generally a beneficial feature, can also lead to detrimental transient high *dv/dt* effects. Modeling strategies for predicting and mitigating these high *dv/dt* effects in WBGs will also be presented. Such models will enable future design engineers to extract the best possible performance from the devices with limited risk of circuit/device failure. Finally, a target application for GaN/SiC devices is in photovoltaic (PV) power conversion circuits. This talk will also present a new adaptive control scheme for maximum power point tracking in PV systems. Due to the adaptive nature of the controller, it will be shown that the system will benefit from high frequency operation, making it a suitable algorithm for integration with GaN/SiC based power conversion circuits.

Admission: Free for all interested IEEE members & non-members.

Registration is required: *https://meetings.vtools.ieee.org/m/42132*

Food & refreshments will be served.