Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Novel Flux-Switching Permanent Magnet Machines for Efficient Energy Conversion

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Abstract—The objective of this presentation is to present information about Wisconsin Electric Machines and Power Electronics Consortium at the University of Wisconsin-Madison and electric machine research in novel flux-switching permanent magnet (FSPM) machines. Permanent magnet electric machines are an energy-efficient substitute for electric motors. They offer applications in appliances, industrial, automotive, aerospace, oil and gas, and medical equipment. The FSPM machines have permanent magnets in the stator, and the rotor is similar to that of a switched reluctance machine. The FSPM machines have the benefits of robust rotor and having permanent magnet in the stator, which give opportunities in high-speed applications. This presentation demonstrates two novel FSPM machines developed by Dr. Sarlioglu's research team. The first machine is a low-pole dual-stator six-slot-four-pole (6/4) configuration proposed to reduce the fundamental frequency and high-frequency losses. The proposed dual-stator 6/4 FSPM machine is also compared to the conventional 6/4 FSPM machine to demonstrate reduction of harmonics distortion and cogging torque. The second machine is designed to integrate fluid dynamics into the electric machine. The rotor of the FSPM machine is shaped as airfoils to perform axial-flow compression. The proposed machine makes the axial-flow compressor electric machine system more compact and energy efficient. This research is funded by NSF CAREER Award.

Bio—Bulent Sarlioglu is an assistant professor at University of Wisconsin-Madison, and Associate Director, Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC). Dr. Sarlioglu spent more than ten years at Honeywell International Inc.'s aerospace division, most recently as a staff systems engineer, earning Honeywell's technical achievement award in 2003 and an outstanding engineer award in 2011. Dr. Sarlioglu contributed to multiple programs where high-speed electric machines and drives are used mainly for aerospace applications. One of the examples was a turbo-compressor system where the turbine, compressor, and PM motor are mounted on the same shaft. The compressor and turbine are used as part of an air supply system for a Department of Energy 80-kW fuel cell system. The motor was variable speeds up to 100,000 rpm and power up to 17 kW. Dr. Sarlioglu is the inventor or co-inventor of sixteen US patents and many other international patents. His research areas are high-speed electric machines, novel electric machines, and application of wide bandgap devices to power electronics to increase efficiency and power density. Dr. Sarlioglu was a recipient of the Honeywell's Outstanding Engineer Award in 2011. He received the NSF CAREER Award in 2016.

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