



CREW Seminar Series: Spring 2013

Flux Switching Electrical Generator for Wind Turbine Systems

Abstract

Small wind turbines have considerable cost constraints in order to be competitive in rural systems and applications for farms and villages. Typically, small turbine generators are permanent magnet machines, not optimized for capturing wind energy in the low wind speed range (up to about 7 m/s). The use of gear-box impairs the machine capability to further produce power, since the friction losses are extremely significant. Therefore, no turbine control methodology will impact the best operation of the generator in low speed (since most of the turbine control systems only optimize the aerodynamic performance). Therefore, wind energy considerations must be taken in the proper electromagnetic and mechanical design of an electric generator, and it seems that a flux switching machine is the best candidate for such application. This seminar will discuss a parametric optimization of a flux switching electrical machine customized for a wind turbine application with a typical operating range for average and low power wind energy sites. Statistics of wind resources are taken in consideration for the machine design for definition of the turbine power envelope. It is evaluated both copper and iron losses for three different machine designs. A very important consideration taken in this design is the elimination of gearbox requirements for coupling to the turbine. Although the developed approach makes the machine somewhat voluminous the overall performance is highly improved because a direct-drive flux switching electrical generator becomes very competitive for small scale wind turbines. This design methodology supports widespread application of small scale wind turbines for rural systems, farms and villages showing that a very cost-effective distributed wind system can be approached with this design.

By Prof. Marcelo Simões, Associate Prof., Colorado School of Mines

When: Tuesday, April 2, 11:00am

Location: Weber 202, Colorado State University

Link for simulcast on web: <http://tinyurl.com/CREW-SP13-Simoes>



Dr. Marcelo G. Simões received a BS and MS from University of São Paulo, Brazil, and a Ph.D. from The University of Tennessee, USA, in 1985, 1990, and 1995, respectively, and his D. Sc. degree (Livre-Docência) from the University of São Paulo in 1998. He is Associate Professor with Colorado School of Mines, where he has been establishing research and education activities in the development of intelligent control for high-power-electronics applications in renewable and distributed energy systems. He is currently the Chair for the IEEE IES Smartgrid Committee. He has been involved in activities related to the control and management of smartgrid applications since 2002 with his NSF CAREER award “Intelligent Based Performance Enhancement Control of Micropower Energy Systems.” He has co-authored the books *Renewable Energy Systems: Design and Analysis with Induction Generators* (CRC Press), *Integration of Alternative Sources of Energy* (Wiley/IEEE Press) and *Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration* (Springer-Verlag).

For more information, contact Dr. Sid Suryanarayanan, ECE (Sid.Suryanarayanan@ColoState.Edu)

