Wind Turbine Maximum Power Point Tracking via Integrated Generator-Rectifier System

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Abstract
High-efficiency and high-power density are critical in MW-class mechanical-to-electrical energy conversion systems that operate within a limited speed range, such as wind-turbine-driven generators. The deployment of an integrated generator-rectifier system has been proposed as an alternative ac-to-dc conversion architecture at the MW-scale. Such a system stacks passive and active rectifiers in series to form a relatively high-dc-bus voltage using relatively low-voltage-rating switches. By processing a substantial amount of power on the diode bridge, conversion losses may be reduced by 40% compared to those of conventional architectures that rely only on active switches. In addition, the overall system costs may be reduced and with a potential reliability improvement. These features make such a system attractive for off-shore wind-turbine applications. The integrated generator-rectifier system must be able to perform maximum power point tracking (MPPT) to be applicable to wind-turbine system. This talk discusses how electrical power and torque control may be achieved on the integrated generator-rectifier system. This control capability provides the basis for the provision of MPPT functionality.

Variable Pole Induction Machines for Electric Vehicles

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Abstract
An electric vehicle (EV) motor must operate efficiently over a wide torque/speed range, with speeds up to 20,000 RPM in certain designs. Although most modern EVs released after 2013 use permanent magnet-based motors, the U.S. Department of Energy is pushing towards a non-rare earth or magnet-less motor drive future. Induction machines (IM) are fully established as viable alternatives to provide such functionality. The design of a fixed pole IM to meet the initial start and low speed specifications requires a sacrifice in the performance at higher speeds and vice versa. In contrast, a variable-pole induction machine opens an alternative design space to effectively meet the wide operating torque/speed range requirements. The pole configuration additional degree of freedom may be used to optimize the machine performance in dynamic EV applications. This presentation discusses the benefits of variable pole structures from operation and machine design perspectives for EV applications.