Performance of a Doubly Fed Induction Generator (DFIG) Wind Turbine System During System Imbalances

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Monday April 21, 2008, Finely Conference Room, 3:00 – 4:00 pm

Abstract
The major concern in smooth operation of the DFIG wind turbine technology is control of wind turbine generators to ensure stable operation and to avoid sympathetic trips during system imbalances. The operation of the DFIG under different disturbances is analyzed using MATLAB Simulink® and the built-in model developed by DIgSILENT® in their PowerFactory software. The specific imbalances studied are a balanced fault and an unbalanced fault at the terminals of the grid side voltage source converter of the DFIG. Conventional control method used for DFIG uses back-to-back PWM converters employing stator flux orientation control and rotor flux orientation control. In this work two different types of control techniques, viz., Sequence controllers and Direct Power Control (DPC) are under study for the system modification. The dc link voltage of the VSC is perturbed during the unbalanced fault due to negative sequence components in the system. Hence, the positive sequence components are implemented in the positive synchronous reference frame and the negative sequence components are implemented in the negative synchronous reference frame. In DPC approach the power required for the converters are commanded using the line voltages or the line voltage flux irrespective of their balance. This type of control achieves constant switching frequency as it is implemented using optimum switching table. Thus these controls take care of the imbalances. This control is a lot simpler and robust in nature and also provides ideal line currents even when the supply side voltages are imbalanced. Hardware implementation of DPC is in progress.

Biography
Murali Mohan Baggu is a Ph.D. Student in Electrical Engineering (Committee Member). He obtained his MS degree in Electrical Engineering from University of Idaho, Moscow, ID in 2005. During his masters, he worked on Thermal modeling of induction machines for hybrid electric vehicle applications. He is currently a Ph.D. candidate in the Electrical & Computer Engineering department of Missouri S&T. His work involves modeling of power converters for Doubly-Fed-Induction Generators (DFIG). His research deals with modifying the conventional controllers of DFIG for grid and wind (mechanical) disturbances. The techniques like Direct Power Control (DPC), sequence controllers and temporary storage devices coupled with converters are under investigation. His research interests are in power electronics, electric machines and drives and power system stability and Protection.