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The control of power electronic converters for grid code compliance in wind energy generation systems

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Abstract

This research report reviews some of the latest control schemes for the power electronic converters found in modern variable speed wind turbines in order to comply with various grid codes. Various control schemes, in order to comply with low voltage ride-through requirements, active and reactive power control and frequency control, are presented. The report first investigates the South African grid code requirements for wind energy generation, and then makes a comparison to grid codes of countries with significant penetration levels and vast experience in wind energy generation. This is followed by a review of the state of the art in fixed and variable speed wind turbine technologies. The research revealed that Type 3 generators offer significant advantages over others but suffer due to grid faults. Various active control schemes for fault ride-through were researched and the method of increasing the rotor speed to accommodate the power imbalance was found to be the most popular. It was found that Type 4 generators offer the best fault ride-through capabilities due to their full scale converters. The research will assist power system operators to develop appropriate and effective grid codes to enable a stable and reliable power system. The research will also provide turbine manufacturers and independent power producers with a comprehensive view on grid codes and relate them to the associated turbine technologies.