

Title: A novel integrated multifunctional power quality controller for microgrid

Abstract: In order to maximize the operational efficiency of the distributed energy resources (DER) and take full advantage of distributed power generation, as an effective means of integrating DERs into the traditional power grid, microgrid is presented. Microgrid power quality has the following unique features compared to the conventional power grid: 1) Background harmonic of DERs and harmonic high penetration are more serious than the traditional grid. 2) Bidirectional power flow control is much more challengeable. 3) Voltage fluctuation and sag often happen in microgrid. 4) The overvoltage and overcurrent phenomena is more frequent. In order to solve these problems, a novel variable reactor based on magnetic flux control is proposed in the paper. The system configuration of the novel variable reactor is presented, whilst its operational principle and dynamic performance are analyzed. Based on the developed variable reactor, a novel integrated power quality controller suitable for microgrid is proposed, which can cater for the peculiar requirements of microgrid power quality, such as the harmonic high penetration, frequent voltage fluctuation and overcurrent phenomenon, bidirectional power flow and small capacity etc. For the fundamental, the equivalent impedance of the primary winding is a variable reactor or capacitor. For the n th order harmonic, the equivalent impedance is very high impedance and acts as a "harmonic isolator". The system control strategy is also analyzed in detail. A set of three-phase integrated power quality controller has been constructed. The experimental test results verify the validity of the novel variable reactor and the integrated power quality controller.