New Power Electronics Converter Interfacing a Hybrid Dc/Ac Microgrid

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Abstract

Distributed loads can either be ac or dc. It is also possible to combine ac and dc subgrids to form the hybrid microgrid. The main advantage of the hybrid microgrid is that it has higher efficiency and lesser power conversion. In this work is proposed a new integrated power electronics converter able to connect a Distributed Generation (DG) unit with a hybrid dc/ac microgrid. The main advantage of the proposed circuit is the high level of integration by reducing one switch and drive circuitry. However the proposed circuit maintains the same features of the conventional solution (converter with six switches) such as: (i) bidirectional power flow between dc and ac micro grids, (ii) independent control in both ac and dc parts, and (iii) different operation conditions using a unique power conversion circuit. While proposing this new solution, this work also presents its models as well as an analysis of the converter in terms of its operation and Pulse-Width-Modulation (PWM) strategy. Furthermore, the power flow among ac and dc links and the hybrid microgrid will be demonstrated, highlighting the bidirectional characteristic of the converter. The outcomes of this research will be presented through a set of simulation results obtained by using the PSIM software. In order to demonstrate that this converter could be used successfully in a hybrid ac/dc micro grid environment, different operation modes have been selected, such as ac and dc links demanding energy from the DG (ModeI), dc microgrid demanding energy while the ac link is disconnected (ModeII), ac link demanding energy while the dc link is disconnected (ModeIII), and two modes in which ac and dc microgrids are generating power to the system respectively (Mode IV and V).

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