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Electronically Coupled Distributed Generation Modeling and Control Strategies for Microgrid Applications

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Abstract

A single-stage power converter is proposed for electronically coupled distributed generation, that is capable of both maximum power point tracking and unity power factor dispatching. Modeling for photovoltaic array (the distributed generator) and three-phase grid-connected inverter produce the optimum control parameters. The inverter's controller uses inner and outer control loops to control parameters. The inner control loop converts input from the abc frame to the d, q, 0 frame to dispatch at unity power factor. The outer voltage control loop tracks the maximum power point through the new technique, which can be used in microgrid applications at the primary control level (local controller). A comparison between produced active power from single-stage and twostage power converter is illustrated, showing that single-stage has higher efficincy. A comparison is conducted between variable and fixed DC reference voltages in terms of their active power yields for the proposed single-stage converter system. The paper investigates the impact of different ambient disturbances such as varying weather conditions, solar radiation with severe disturbances, and variable PV cell temperature on the active and reactive power yields. The dynamic reference voltage is proposed. Its effectiveness during variable radiations and temperatures are verified by Matlab/Simulink simulations.