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Maximum power transfer of PV-fed inverter-based distributed generation with improved voltage regulation using flywheel energy storage systems

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Abstract

One of the main issues accompanied with the high penetration of photovoltaic (PV) distributed generation (DG) systems in low voltage networks is the overvoltage challenge. The amount of injected power to the grid is directly related to the voltage at the point of common coupling, which necessitates limiting the amount of injected power to the grid to conservative values compared to the available capacity from the PV panels particularly at light loading. In order to mitigate the tradeoff between injecting the maximum amount of electrical power and voltage rise phenomena, many control schemes were suggested in order to optimize the operation of PV DG energy sources as well as maintaining safe voltage levels. Unlike these conventional methods, this paper proposes a combined PV inverter-based distributed generation and flywheel energy storage system to ensure improved voltage regulation as well as making use of the maximum available power from the PV source at any instant, decoupling its relation with the terminal voltage. The concluded assumptions were simulated through Matlab/Simulink and verified experimentally.

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