

Comparative Analysis of PVECS with H Bridge Inverter in Open Loop and Closed Loop Configurations

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Abstract

This work details the design, simulation, and analysis of a standalone Photovoltaic (PV) system, focusing on enhancing power quality and maximizing energy extraction. It begins by introducing standalone PV systems and the critical role of Maximum Power Point Tracking (MPPT), specifically the Perturb and Observe (P&O) algorithm, in optimizing power output from solar panels. Key components of the PV system are thoroughly discussed, including the PV array, boost converter (with design equations and specifications), single-phase H-bridge inverter (with modes of operation), and LC filters (with design considerations and specifications). Comprehensive simulation results from MATLAB Simulink environment is presented for four different cases: PV inverter open-loop system without filter, PV inverter open-loop system with filter, PV inverter closed-loop system without filter, PV inverter closed-loop system with filter. Waveforms for PV voltage, PV current, PV power, output voltage, output current is presented. THD analysis of the output voltage waveform is carried to demonstrate the difference in THD values in each case. Finally, output voltage, output current, output power, power factor and THD values are tabulated for variation of resistance from 10 Ω to 200 Ω .

Keywords

Standalone PV system, perturb and observe, MPPT, H bridge inverter.

