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Simplified Three-Phase SSI for PV System Application Controlled via Model Predictive Control

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Abstract

In this paper, for standalone and grid-connected PV systems, a three-phase simplified split-source inverter (SSI) is proposed and controlled using a model-predictive control (MPC). The maximum power point tracking (MPPT) approach used is an incremental conductance method based on a PI controller for both systems. The standalone system is composed of PV modules, a three-phase SSI, and a bidirectional power DC-DC converter that connects a battery bank and a DC-side capacitor. The output AC voltages of SSI are controlled using model-predictive control. The bidirectional power DC/DC converter regulates the DC-link voltage (DCLV). The grid-connected system consists of PV modules, a three-phase SSI, and an AC-side L-filter. The DC-link PI controller generates reference currents for the MPC algorithm. The MPC uses these reference currents to adjust and deliver the PV power to the grid while regulating the DCLV. The PI controllers' parameters are selected for both systems using the Harris Hawks optimization method. Both PV systems simulation results show that under various operating conditions, they have succeeded in fixing a DCLV and producing a high-quality AC output voltage and current at low THD. Experimental results for the three-phase standalone PV system used to verify the system's performance.

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