

Artificial neural network based maximum power point tracking controller for photovoltaic standalone system

ABSTRACT

This article presents a two-stage maximum power point tracking (MPPT) controller using artificial neural network (ANN) for photovoltaic (PV) standalone system, under varying weather conditions of solar irradiation and module temperature. At the first-stage, the ANN algorithm locates the maximum power point (MPP) associated to solar irradiation and module temperature. Then, a simple controller at the second-step, by changing the duty cycle of a DC-DC boost converter, tracks the MPP. In this method, in addition to experimental data collection for training the ANN, a circuit is designed in MATLAB-Simulink to acquire data for whole ranges of weather condition. The whole system is simulated in Simulink. Simulation results show small transient response time, and low power oscillation in steady-state. Furthermore, dynamic response verifies that this method is very fast and precise at tracking the MPP under rapidly changing irradiation, and has very low power oscillation under slowly changing irradiation. Experimental results are provided to verify the simulation results as well.

Keyword: Artificial neural network (ANN); DC-DC boost converter; Digital signal processor (DSP); Maximum power point tracking (MPPT); Photovoltaic (PV)