

Modelling and control of partially shaded photovoltaic arrays

Abstract

The photovoltaic (PV) array controlled by Maximum Power Point Tracking (MPPT) method for optimum PV power generation, particularly when the PV array is under partially shaded condition is presented in this paper. The system modelling is carried out in MATLAB-SIMULINK where the PV array is formed by five series connected identical PV modules. Under uniform solar irradiance conditions, the PV module and the PV array present nonlinear P-V characteristic but the maximum power point (MPP) can be easily identified. However, when the PV array is under shaded conditions, the P-V characteristic becomes more complex with the present of multiple MPP. While the PV array operated at local MPP, the generated power is limited. Thus, the investigation on MPPT approach is carried out to maximize the PV generated power even when the PV array is under partially shaded conditions (PSC). Fuzzy logic is adopted into the conventional MPPT to form fuzzy logic based MPPT (FMPPT) for better performance. The developed MPPT and FMPPT are compared, particularly the performances on the transient response and the steady state response when the array is under various shaded conditions. FMPPT shows better performance where the simulation results demonstrate FMPPT is able to facilitate the PV array to reach the MPP faster while it helps the PV array to produce a more stable output power.