

Model-based maximum power point tracking (MPPT) techniques have been developed recently to improve the dynamic and steady-state performance of MPPT. Although they are successfully implemented in homogeneous photovoltaic (PV) systems, there is still no model-based MPPT for partially shaded PV systems, mainly because the available models are complex and time consuming. This paper develops a fast modeling approach for partially shaded PV systems. By utilizing three developed rules that govern the formation of power peaks in partially shaded PV systems, the proposed approach can quickly find the power peaks of these systems without simulating the entire power curve. The effectiveness of the proposed approach in finding the power peaks of PV systems quickly and accurately is verified using MATLAB-Simulink and real-time simulator in hardware in the loop application. Moreover, a model-based MPPT is developed utilizing the proposed modeling method. The developed MPPT successfully improves the dynamic performance of power extraction, guarantees the operation on the global maximum power peak, and eliminates oscillating steady-state power losses.