

An enhanced adaptive perturb and observe technique for efficient maximum power point tracking under partial shading conditions

ABSTRACT

In this paper, we propose enhanced adaptive step size Perturb and Observe (P&O) maximum power point tracking (MPPT) with properly organized comparison sequences which lead to achieving the actual maximum power point (MPP) effectively in the presence of partial shading conditions, taking into account the optimization of all aspects of high-performance MPPT to be novel, simpler, fast, and accurate, with the best efficiency reaching up to almost 100%. In this study, the proposed algorithm, along with a boost converter, was designed and simulated in MATLAB/Simulink to validate the performance of the suggested technique. Four different levels of partial shading conditions were considered for system examination: weak, moderate, and two different levels of strong shading. Each case was applied separately first and then combined in a sequence arrangement to provide robust and comprehensive testing which can provide a guaranteed assessment of the proposed algorithm. The performance of the suggested technique is discussed and compared with that of conventional P&O and conventional incremental conductance (IC) MPPT techniques. The failure of the conventional techniques to work efficiently in the presence of partial shading conditions was observed from the simulation results. Meanwhile, the success of the proposed technique and its high performance were clearly confirmed under partial shading conditions with no increase in complexity or convergence time.

Keyword: Partial shading conditions; Maximum power point tracking (MPPT); Global maximum power point (GMPP); Perturb and Observe (P& O); Incremental conductance (IC)