

Optimizing Stability and Performance with a New MPPT Algorithm for Photovoltaic Applications

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Abstract

Photovoltaic (PV) systems play a critical role in renewable energy generation, with the maximum power point tracking (MPPT) algorithm being essential for optimizing their efficiency. This paper presents a novel MPPT algorithm designed to enhance stability and performance under varying environmental conditions. The proposed method leverages advanced adaptive control strategies to dynamically adjust to fluctuations in irradiance and temperature, ensuring rapid convergence to the maximum power point while minimizing oscillations. Simulations and experimental results demonstrate the algorithm's superior tracking efficiency, improved response time, and robustness compared to conventional techniques such as Perturb and Observe (P&O) and Incremental Conductance (IncCond). The findings highlight the potential of the new MPPT approach to improve the overall energy yield and reliability of photovoltaic applications, paving the way for more sustainable energy solutions.

Keywords

Power Electronics, MPPT, Photovoltaics, Energy