

STUDY OF DIFFERENT MPPT'S UNDER ENVIRONMENTAL FLUCTUATIONS

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The performance of Photovoltaic (PV) systems is highly influenced by the efficiency of Maximum Power Point Tracking (MPPT) algorithms, particularly under dynamically changing conditions such as fluctuating irradiance, temperature variations, and partial shading. Despite the availability of numerous MPPT techniques, a clear and consistent comparative evaluation remains limited in current literature. This study presents a detailed performance analysis of three widely used MPPT algorithms—Perturb and Observe (P&O), Incremental Conductance (IC), and Fuzzy Logic Control—implemented through a low-voltage DC-DC converter model. Simulations were conducted in MATLAB Simulink to examine output voltage, current, and power—key parameters that directly indicate the energy-harvesting efficiency of the PV system. These parameters were chosen to provide a quantitative assessment of each algorithm's capability to track the maximum power point accurately. Performance metrics such as tracking speed, stability, and adaptability were also evaluated, as they play a crucial role in ensuring system reliability under real-world environmental variations. The results highlight the strengths and limitations of each algorithm, offering practical insights for selecting the most suitable MPPT strategy in diverse PV system applications.