

Optimization of photovoltaic energy harvesting using clonal selection algorithm

ABSTRACT

The rising demand for renewable energy sources has fueled extensive research in photovoltaic (PV) systems. However, conventional Maximum Power Point Tracking (MPPT) algorithms often encounter challenges when tracking the global maximum power point under non-uniform irradiance conditions. To address this issue, the Clonal Selection Algorithm (CSA) is proposed as an effective approach to enhance MPPT algorithm performance. The CSA dynamically adjusts the voltage perturbation size based on instant ambient irradiance and temperature, leading to improved global maximum power point tracking and enhanced efficiency in PV systems. Experimental results demonstrate the superiority of the proposed CSA over conventional MPPT algorithms, especially in scenarios with varying solar irradiance. The CSA's adaptability allows PV systems to operate closer to their optimal efficiency, maximizing energy harvest from available solar resources. Overall, this research contributes valuable insights into sustainable and efficient energy solutions by leveraging the capabilities of the CSA. Successfully integrating the CSA in PV systems plays a critical role in establishing an eco-friendly and resilient renewable energy infrastructure, for a greener future.