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DESIGN OF EFFECTIVE CONTROLLER FOR GRID CONNECTED PHOTOVOLTAIC SYSTEM USING AN ADAPTIVE MPPT TECHNIQUES

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Abstract

This study introduces an adaptive method for monitoring and maximizing the power output of a grid-connected photovoltaic (PV) system. The approach integrates a Neuro Fuzzy Controller (NFC) with Shuffled Shepherd Optimization (SSO) to adaptively manage the PV system's operation. Through the application of SSO, the parameters for the Maximum Power Point Tracking (MPPT) based on the NFC controller are optimally selected, ensuring efficient and accurate power regulation. The proposed methodology is tested on a 100-kW PV system connected to a medium distribution utility to evaluate its effectiveness. To further improve the PV system's output, a novel enhanced boost converter with high gain is designed and implemented. This converter is formulated to achieve better voltage regulation and power conversion efficiency. The study also includes a real-time experimental setup to validate the performance of the proposed system, ensuring its applicability in practical scenarios. Comparative analyses are conducted against other existing controllers to highlight the advantages of the NFC-SSO-based approach. The results demonstrate that the proposed controller significantly enhances the performance of MPPT control, leading to improved tracking sensitivity and accuracy. This increased efficiency in power generation confirms the effectiveness of the NFC-SSO method, making it a viable solution for optimizing the operation of grid-connected PV systems. These findings provide valuable insights for the development of more efficient and reliable renewable energy systems, contributing to the broader adoption of solar power technologies.

Key words: boost converter, MPPT Technique, Neuro Fuzzy Controller (NFC), PV Array, SSO Algorithm

Received: January, 2024; Revised final: March, 2024; Accepted: April, 2024; Published in final edited form: August, 2024

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