

# Improving Photovoltaic Performance under Partial Shading with PSO-Optimized ANFIS Controller

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**Abstract:** This research proposes a novel Maximum Power Point Tracking (MPPT) method utilizing an Adaptive Neuro-Fuzzy Inference System (ANFIS), optimized offline via Particle Swarm Optimization (PSO), specifically designed for photovoltaic (PV) systems under partial shading conditions (PSC). Conventional MPPT methods often fail to accurately locate the global maximum power point (GMPP) when faced with partial shading due to the presence of multiple local maxima in the power-voltage characteristic. To overcome this limitation, the ANFIS controller is trained with an extensive dataset generated by PSO, encompassing diverse shading scenarios representative of real-world conditions. Comprehensive simulations executed in MATLAB/Simulink validate the proposed method's effectiveness, demonstrating a tracking efficiency of up to 99.8%. These findings emphasize the significant potential of integrating adaptive neuro-fuzzy systems with particle swarm optimization for improving the robustness and efficiency of PV power extraction in complex environmental conditions.

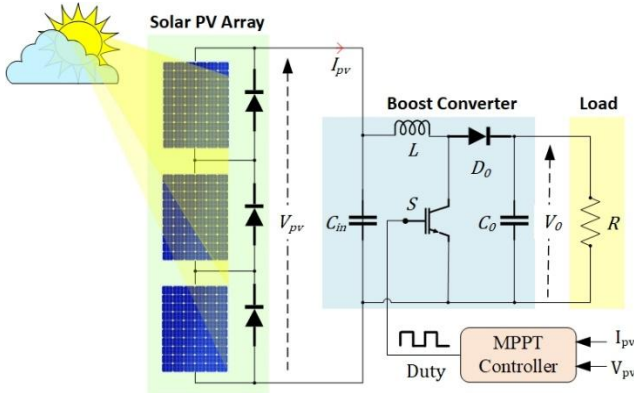


Fig. 1: Schematic Overview of the PV System

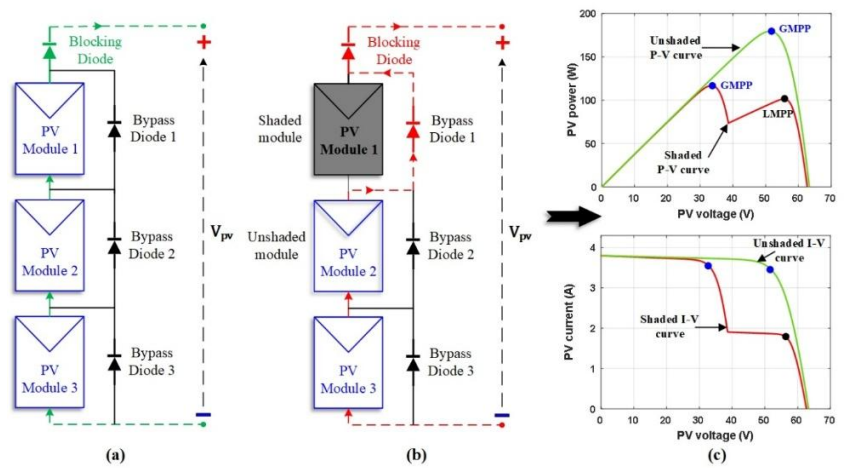


Fig. 2: PV array response: (a) Uniform sunlight, (b) Presence of PSC, (c) Resulting electrical characteristics (I-V and P-V).

In the final version, I will provide additional details along with the relevant bibliography.