Maximizing Efficiency: Simulation-Based Modeling of Hybrid Power Systems with MPPT Technology

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Abstract: The paper introduces a study focused on the behavior analysis and performance control of a hybrid power system (HPS) comprising two renewable energy sources: photovoltaic and wind systems connected to a continuous bus. The investigation encompasses two main aspects: control strategies and maximizing the utilization of renewable resources. Given the inherent fluctuation of renewable resources, there exists a risk of compromising energy efficiency concerning specific demand requirements. Therefore, in pursuit of maximizing the efficiency of the renewable energy system, it becomes imperative to implement methods for tracking the maximum power point of the input sources, a task undertaken within the MATLAB/Simulink platform.
To enhance the efficiency of photovoltaic energy conversion, a Maximum Power Point Tracker (MPPT) utilizing perturb and observe set theory is proposed. This approach is grounded in linguistic rules applied to control the step-up converter for MPPT purposes. In the case of the wind system, optimization is achieved by considering the optimal power curve as the load characteristic, incorporating knowledge of the turbine characteristic Cp (λ).

References

[1] B.Benlahbib, N.Bouarroudj, F.Bouchafaa,''A Single Input T-S FLC Algorithm for System MPPT-Experimental Validation'', International Conference on Artificial Intelligence in Renewable Energetic Systems. Univercite Tipaza, Algeria, 2017.

[2] B. Kanagasakthivel and D. Devaraj, "Simulation and performance analysis of Solar PV-Wind hybrid energy system using MATLAB/SIMULINK," *2015 International Conference on Computing and Communications Technologies (ICCCT)*, Chennai, India, 2015.

[3] G. An *et al*., "Short-Term Wind Power Prediction Based on Particle Swarm Optimization-Extreme Learning Machine Model Combined With Adaboost Algorithm," in *IEEE Access*, vol. 9, pp. 94040-94052, 2021.

[4] L. G. Vasant and V. R. Pawar, "Solar-wind hybrid energy system using MPPT," *2017 International Conference on Intelligent Computing and Control Systems (ICICCS)*, Madurai, India, 2017

[5] P. Roy, J. He, T. Zhao and Y. V. Singh, "Recent Advances of Wind-Solar Hybrid Renewable Energy Systems for Power Generation: A Review," in *IEEE Open Journal of the Industrial Electronics Society*, vol. 3, pp. 81-104, 2022.