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Improved Maximum Power Point Tracking Algorithm for Photovoltaic Systems

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1. Introduction

This paper presents a new learning-based maximum power point tracking algorithm for photovoltaic systems. A description of the nonlinear current-voltage properties of photovoltaic systems, followed by an overview of existing methods of maximum power point tracking are provided.

The new algorithm is introduced and the results of a comparison between the new algorithm and two existing methods of maximum power point tracking are presented. These results indicate that the new algorithm offers some advantages over existing approaches.

2. Learning-Based Algorithm

A new learning-based maximum power point tracking algorithm has been developed which collects historical data about the performance of a photovoltaic system and uses this to more rapidly track large changes in the maximum power point of the system.

A K-Nearest neighbours [1] classification algorithm is used in conjunction with the collected data to estimate new maximum power points for the system each time atmospheric conditions change. The system is then set to operate at this estimated point before using Perturbation and Observation to refine the maximum power point.

3. Comparison of Algorithms

Simulation and experimental comparisons were carried out between the new algorithm, the Perturbation and Observation and the Incremental Conductance [3] techniques using purpose-built software. The simulations were based on the use of an ideal solar cell model [4] while the experimental comparisons were carried out using an electronic load connected to an 80W solar panel.

4. Conclusions

The simulation results indicate that under rapidly changing atmospheric conditions, the new algorithm provides a 1% increase in efficiency over the Incremental Conductance algorithm and approximately 0.7% under slowly changing conditions.

Experimental results indicate that the new algorithm provides an increase in efficiency of approximately 7% over the Incremental Conductance algorithm but the algorithm's sensitivity to noise caused it to perform poorer under slowly changing conditions.

These results indicate that the new algorithm shows potential for improved maximum power point tracking under rapidly changing conditions through the use of learning techniques.

References

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