Advances in photovoltaic parameter estimation using computational data analysis and numerical methods

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Photovoltaic (PV) systems are a cornerstone of renewable energy technologies [1], necessitating precise parameter estimation for optimal performance and reliability [2] [3]. This study presents novel advancements in PV parameter estimation leveraging computational data analysis and numerical methods.

Our research integrates two key investigations. The first study employs total least squares and metaheuristic algorithms to enhance the accuracy of PV parameter estimation. These methodologies effectively address errors and uncertainties in measurement data (current and voltage), demonstrating significant improvements in the robustness and efficiency of PV systems. The application of these advanced computational techniques underscores their potential in improving the reliability of PV system performance, which is critical in enhancing its efficiency.

The second study explores the effect of measurement intervals on the accuracy of PV parameter estimation. By systematically varying measurement intervals, we illustrate the substantial impact on estimation precision. This investigation highlights the necessity of strategic measurement planning in PV system operation. Together, these studies provide a comprehensive framework for improving PV parameter estimation. The integration of total least squares, metaheuristic algorithms, and strategic measurement interval planning offers a robust approach to addressing challenges in PV systems. Our findings have wide-ranging implications for engineering, environmental sciences, and various interdisciplinary fields.

Keywords

Metaheuristic methods, Parameter estimation, Optimization.

References

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