# Fault Detection and Classification in PY Systems using MRA DWT and AdaBoost classifier

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**Abstract:**
The increasing integration of photovoltaic (PV) systems into the global energy grid emphasizes the need for robust fault detection and classification methodologies to ensure optimal performance and reliability. This research presents a novel approach for fault identification in PV arrays by combining the Multiresolution Analysis (MRA), Discrete Wavelet Transform (DWT), and AdaBoost classifier. The proposed methodology involves capturing the unique frequency and time-domain characteristics associated with various fault types within PV arrays. MRA is employed to extract relevant features from the acquired data, followed by DWT to enhance the discriminative power of the features. The processed data is then fed into an AdaBoost classifier, leveraging its ensemble learning capabilities to improve fault classification accuracy. Simulation and Experimental validation is conducted using real-world 3X3 PV array data under different fault scenarios, including shading, module failures, and electrical anomalies. The results demonstrate the effectiveness of the proposed approach in accurately detecting and classifying faults, even in the presence of noise and changing environmental conditions. Comparative analyses with existing fault detection methods highlight the superiority of the proposed MRA-DWT-AdaBoost framework in terms of accuracy, robustness, and computational efficiency.

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## Contents

**I. Introduction**

A photovoltaic (PV) array, also known as a solar array, is a system of interconnected solar cells that work together to convert sunlight into electrical energy. These solar cells, also called photovoltaic cells, are made of semiconductor materials, typically silicon. When exposed to sunlight, these cells generate an electric current through the photovoltaic effect, producing direct current (DC) electricity. The fundamental building blocks of a PV array, solar cells are responsible for capturing sunlight and converting it into electrical energy. There are different types of solar cells, such as monocrystalline, polycrystalline, and thin-film, each with its own advantages and disadvantages [1]. A group of interconnected solar cells forms a module or panel. Solar panels are the basic building units of a PV array and are often grouped together to form larger arrays. The panels are designed to withstand various environmental conditions and are typically mounted on rooftops, ground mounts, or integrated into building structures. A fault refers to any deviation or anomaly from the normal and expected operation of the system, which can lead to a decrease in performance, efficiency, or, in some cases, complete system failure. The typical layout of PV system is shown in Fig. 1.

Authors

Figures

References

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