



Signal Processing for Solar Array Monitoring, Fault Detection, and Optimization (Synthesis Lectures on Power Electronics)

Mahesh Banavar, Andreas Spanias, Toru Takehara

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Although the solar energy industry has experienced rapid growth recently, high-level management of photovoltaic (PV) arrays has remained an open problem. As sensing and monitoring technology continues to improve, there is an opportunity to deploy sensors in PV arrays in order to improve their management. In this book, we examine the potential role of sensing and monitoring technology in a PV context, focusing on the areas of fault detection, topology optimization, and performance evaluation/data visualization. First, several types of commonly occurring PV array faults are considered and detection algorithms are described. Next, the potential for dynamic optimization of an array's topology is discussed, with a focus on mitigation of fault conditions and optimization of power output under non-fault conditions. Finally, monitoring system design considerations such as type and accuracy of measurements, sampling rate, and communication protocols are considered. It is our hope that the benefits of monitoring presented here will be sufficient to offset the small additional cost of a sensing system, and that such systems will become common in the near future.

Table of Contents: Introduction / Overview of Photovoltaics / Causes Performance Degradation and Outage / Fault Detection Methods / Array Topology Optimization / Monitoring of PV Systems / Summary

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