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香港城市大學
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Photovoltaic Panel Health Diagnostic System for Solar Power Plants

Energy & Environment

Energy Conservation/Generation/Management/Storage (Battery)

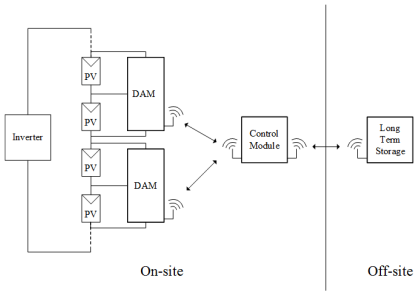

Figure 1. Overview of the diagnostic system.

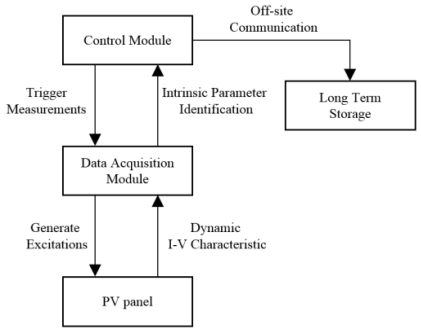

Figure 2. System execution diagram.

IP Status
Patent granted

Technology Readiness Level (TRL) ? 3

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Opportunity

Photovaltaic(PV) power generation has been the fastest growing energy source in recent years. With rapid growth, risk management of this highly penetrated energy resource is required. Conventional methods conduct measurement by gradually shedding the load to obtain the current-voltage characteristics of panels. This method is expensive because it affects the power generation process. Other method like impedance spectroscopy, while highly precise, requires relatively expensive setup. This invention offers a non-invasive method of online data acquisition and onsite data analysis using CI(Computer Intelligence). This will allow minimally-interrupted power generation while the health of panels are monitored and predicted.

Technology

The architecture of the invention consists of two parts. The first part consists of two onsite modules: data acquisition module (DAM) and control module (CM). The second part is an off-site data management system. The DAM includes buck-boost-derived power conversion stage which is connected to two solar panels. The operation of the power conversion stage enables to collect dynamic voltage-current characteristics of the connected solar panels without disturbing the power generation process. The dynamic current voltage characteristic, represented by measured time-series, is analysed by real-coding jumping gene genetic algorithm (RJGGA). RJGGA is implemented on CM, using an accelerator developed for FPGA (Field Programmable Gate Array), thus the analysis is done onsite. The result of the analysis are intrinsic parameters, representing the immediate health-condition of the solar panels.

Long-term collection of the intrinsic parameters within off-site data management system enables to detect gradual deterioration of solar panels and predict their useful-lifetime.

Advantages

- Non invasive photovoltaic diagnostic system
- Lone term investigation of degradation process which enables failure prediction and maintenance scheduling
- Minimal power generation disruption

Applications

- Photovoltaic power generation diagnostics