Intelligent Monitoring of Solar Photovoltaic System

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by

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The global solar photovoltaic (PV) installations are increasing rapidly in an effort to slow down the process of global warming and meet the growing demand of electrical energy. The clean and green energy from solar PV power plants is being utilized at every level from utility scale to distributed generation (DG) applications. The large-scale PV plants are normally installed in grid-tied topology because of its operational advantages. As the size of PV power plants increases, the probability of error occurrence also increases. When a small PV plant is installed on the rooftop of a house it is much easier to trace a fault and get the system back on track, however, as the size of PV plants grow the string sizes increase in PV arrays along with the number of grid-tied inverters, and it becomes a cumbersome and tiring activity to find the nature and location of the fault.

In this research, an algorithm with system for fault classification and identification is presented which is able to sense the abnormality in the system output and identify the fault at both system level and component level of the PV power plant. The algorithm proposes mathematical operations which use signal processing and data driven tools to formulate the intelligent fault detection and monitoring mechanism. Additionally, efforts to identify the power mismatch between healthy and degraded PV module-based systems is proposed along with the power output improvement and power flow management.

To assess the adaptability of the proposed algorithms, numerical simulations and experimental analysis are conducted at both component level and system level of the solar PV system. The results obtained from tests show that the proposed fault detection and identification approaches are able to detect an abnormal event in the PV system and accurately identify the nature of fault as well.

Keywords: Solar photovoltaic systems, Condition monitoring, Fault classification, Photovoltaic modules, Power electronics Converters.