UNIVERSITI TEKNOLOGI MARA

FAILURE DETECTION ANALYSIS OF GRID-CONNECTED PHOTOVOLTAIC SYSTEM USING AN IMPROVED COMPARATIVE BASED METHOD

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ABSTRACT

All around the globe, prodigious growth of Grid-Connected Photovoltaic (GCPV) systems installation is observed including Malaysia. In order to gain feasible economic return, failure detection (FD) mechanisms are given utmost attention to monitor the performance and yet able to detect fault occurrence of the operating GCPV system especially in the form of analysis algorithm. Numerous studies have reported FD analysis algorithm using comparative based method (CBM), but limitedly demonstrate the FD analysis sequence that will finally determine the type of failure occurred in the GCPV system. Moreover, the evaluation on the reliability of the FD analysis algorithm applied using large amount of field data instead of simulated data is still limited and significant, especially in the context of tropical climate conditions. Thus, the aim of this study is to detect fault occurrence in GCPV system via three consecutive FD analysis of comparison between actual AC power and predicted AC power as early FD, evaluation of AR values against AR threshold of 0.9 as intermediate FD and determination of type of failure through current and voltage ratio methods as advance FD based on CBM method. The analysis was conducted using one-year historical data of 2019 from eight selected GCPV systems as the case studies. Based on the early FD of AC power comparison, two systems (System 7 and System 8) were identified as showing early failure symptoms with percentage difference of gradients between actual AC power and predicted AC power were 26 % and 52 % respectively. Furthermore, through the evaluation of AR values against AR of 0.9, the maximum monthly cumulative percentage of AR (MMCPAR) less than 0.9 for System 7 and System 8 were 67 % and 95 % respectively, i.e more than 50 %. The early and intermediate FD analysis conducted have confirmed that System 7 and System 8 were having failure. Finally, via advance FD analysis of current and voltage ratio, System 7 was detected as having partial shading problem, meanwhile System 8 was having abnormal inverter shut down problem. This study has demonstrated a sequential FD analysis algorithm, which ultimately succeeded to determine the type of fault occurred in the GCPV system and it is worthy to be embedded in FD software for GCPV system.

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