

Integration of reconfigurable fault-tolerant three-level inverter in photovoltaic power system

Omar Fethi BENAOUA, Sami KAHLA, Mohamed Bouchakour, Azzedine Bendiabdellah

Abstract: A lot of previous studies have shown a great interest in connecting photovoltaic (PV) arrays to electric power grids. A Maximum Power Point Tracker (MPPT) controlled 100 kW PV array to boost its power that feeds the grid with the help of a three-level inverter. This paper investigated the effects of open-circuit faults of three-level inverter IGBT switches on the performance of the PV array system. This paper proposes a new diagnostic method called the Double Threshold-Trigonometric Coordinates (DT-TC) that relies on the double threshold technique and the trigonometric coordinates, respectively, for early detection and the precise location of open-circuit faults. To the best knowledge of the authors, two simultaneous open-circuit faults were not considered in the previous studies. The obtained simulation results prove the great success of the proposed diagnosis method even under noticeable changes in irradiation, temperature, and the number of PV array connected in series and in parallel. In this study, the reconfigurable fault-tolerant inverter was included to ensure the perfect continuity of the PV array system and its recovery in an extremely very short time up to 7 ms.

Keywords : diagnosis, DT-TC, fault-tolerant, IGBT, Multi-level Inverter, Open-circuit faults, PV array, reconfigurable