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Switching of Series-Parallel Connected Modules in an Array for Partially Shaded Conditions in a Pollution Intensive Area Using High Powered MOSFETs

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Abstract : Photovoltaic (PV) modules may become a trend for future PV systems because of their greater flexibility in distributed system expansion, easier installation due to their nature, and higher system-level energy harnessing capabilities under shaded or PV manufacturing mismatch conditions. This is as compared to the single or multi-string inverters. Novel residential scale PV arrays are commonly connected to the grid by a single DC–AC inverter connected to a series, parallel or series-parallel string of PV panels, or many small DC–AC inverters which connect one or two panels directly to the AC grid. With an increasing worldwide interest in sustainable energy production and use, there is renewed focus on the power electronic converter interface for DC energy sources. Three specific examples of such DC energy sources that will have a role in distributed generation and sustainable energy systems are the photovoltaic (PV) panel, the fuel cell stack, and batteries of various chemistries. A high-efficiency inverter using Metal Oxide Semiconductor Field-Effect Transistors (MOSFETs) for all active switches is presented for a non-isolated photovoltaic and AC-module applications. The proposed configuration features a high efficiency over a wide load range, low ground leakage current and low-output AC-current distortion with no need for split capacitors. The detailed power stage operating principles, pulse width modulation scheme, multilevel bootstrap power supply, and integrated gate drivers for the proposed inverter is described. Experimental results of a hardware prototype, show that not only are MOSFET efficient in the system, it also shows that the ground leakage current issues are alleviated in the proposed inverter and also a 98 % maximum associated driver circuit is achieved. This, in turn, provides the need for a possible photovoltaic panel switching technique. This will help to reduce the effect of cloud movements as well as improve the overall efficiency of the system.

Keywords : grid connected photovoltaic (PV), Matlab efficiency simulation, maximum power point tracking (MPPT), module integrated converters (MICs), multilevel converter, series connected converter
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