

Design and Analysis of Highly Efficient and Reliable Single-Phase Transformerless Inverter for PV Systems

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Abstract : Most of the PV systems are designed with transformer for safety purpose with galvanic isolation. However, the transformer is big, heavy and expensive. Also, it reduces the overall frequency of the conversion stage. Generally PV inverter with transformer is having efficiency around 92%-94% only. To overcome these problems, transformerless PV system is introduced. It is smaller, lighter, cheaper and higher in efficiency. However, dangerous leakage current will flow between PV array and the grid due to the stray capacitance. There are different types of configurations available for transformerless inverters like H5, H6, HERIC, oH5, and Dual paralleled buck inverter. But each configuration is suffering from its own disadvantages like high conduction losses, shoot-through issues of switches, dead-time requirements at zero crossing instants of grid voltage to avoid grid shoot-through faults and MOSFET reverse recovery issues. The main objective of the proposed transformerless inverter is to address two key issues: One key issue for a transformerless inverter is that it is necessary to achieve high efficiency compared to other existing inverter topologies. Another key issue is that the inverter configuration should not have any shoot-through issues for higher reliability.

Keywords : grid-connected, photovoltaic (PV) systems, transformerless inverter, stray capacitance, common-mode, leakage current, pulse width modulation (PWM)

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