

Filter Design for a Nine Level Voltage Source Inverter for Renewable Energy Applications

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Abstract:

The rapid deflation of fossil reserves coupled with environmental pollution and degradation caused by direct and indirect crude oil-related activities has resulted in the need for a sustainable alternative and environmentally friendly means of energy generation. The quest triggers the upsurge of research in the field of Renewable energy sources and its conversion. Multilevel voltage converters serve as the main interface between the renewable energy source (solar, wind etc.) and the utility grid. The converter nonlinear nature results in the need for special modulation techniques and output filters that will minimise or eliminates the output harmonics to comply with the IEEE 519 standards. Therefore, this paper aims at assessing and comparing the harmonic content of a nine-level voltage source converter using four passive filters i.e. LC, LCL, LCL with series and parallel resistance. The output voltage and current waveforms, frequency spectrum and total harmonic distortion (THD) of all the filters are compared and analysed. It is found that all the filters have THD less than 5% with LCL with parallel resistor having the least THD content of 1.82%. The investigation is carried out via simulation using PSIM and Matlab software.

Keywords Multilevel converters; Harmonic distortion; Passive filter; Voltage source inverters (VSI)

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