

Analysis, Design, and Control of a Non-isolated Boost Three-Port Converter for PV Applications

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Abstract

This paper presents the modeling, analysis, design, and control of non-isolated boost three-port converter (TPC). In contrast to conventional converters that suffer from low efficiency as a result of multiple power stage conversions, the single-inductor TPC studied here has only single stage conversion between any two of the converter three ports. However, the TPC dynamic analysis are complicated due to the different energy management modes of operation. In this paper the non-isolated DC-DC boost TPC is studied in details. The converter components design and dynamic modeling are presented. Also, the converter switched, averaged, and small signal dynamic model are derived. In addition, the converter controller design for output voltage regulation and input PV maximum power point tracking are presented. The system is simulated using Matlab/Simulink and the obtained results show good performance for different converter modes of operation.

IEEE Conference on Power Electronics and Renewable Energy (CPERE), Aswan City, Egypt 2019, October