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New Topology of Photovoltaic Microinverter based on Boost converter

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Abstract

This paper proposes a new microinverter topology dedicated to photovoltaic off-grid systems or connected to the grid. This Microinverter is based on simple boost with high gain in the aim of a reduction of the total number of active components allowing, thus a high efficiency conversion. In a first part of this contribution, we describe the general topology of this micro-inverter and present the simulation tests developed in order to validate its functioning. Finally, the last part is dedicated for discussion of the simulation results, the efficiency of this topology and the feasability of its used in a photovoltaic generation system connected to the grid.

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Keywords: Photovoltaic system, Microinverter, Boost, PWM, Operational Amplifier.

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1. Introduction

The power converter topology, system stability, and control of grid-connected photovoltaic power plants have attracted considerable interest in recent years. As the existing technologies are not suitable for large-scale PV power plants yet [1-4]. In the last two decades, extensive research has been carried out in proposing new inverter topologies [5-7].

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Microinverters offer distinct advantages in flexibility, efficiency, and safety for solar photovoltaic panels, but cost-effective options have been limited in the past. In designing Microinverters today, however, engineers can confidently rely on a broad range of solutions for implementing alternative inverter topologies that improve module efficiency, reliability, and cost. The improvement of the Microinverter topology requires an optimal choice of power electronic components, integrated devices and specialized microcontrollers, including Analog Devices [7-12].

The primary objective of the study presented in this paper is to contribute to the improvement and development in the photovoltaic Microinverter technology by using the Boost converter topology at low power available for direct conversion of the power produced by one PV panel. If it is effectively implemented with good performance, the developed Microinverter can be a low-cost alternative to the commercial isolated grid-connected PV inverters in the market [13-14]. The simple structure of the Boost topology and easy current control with low power at the grid interface are the key motivations for this work.

Nomenclature

PWM	Pulse Width Modulation
AC	Alternative Current
OpAmp	Operational Amplifier

2. Description of the proposed topology

In Fig. 1, we present the Microinverter topology drawn using the PSIM software environment. It includes a boost converter and DC–AC inverter (conventional converter). In this structure, the boost converter is used to increase the input voltage to the required grid voltage value. However, by using an intelligent control strategy (such as the bipolar PWM), the inverter bridge converts the increased DC voltage to a sinusoidal waveform which will be filtered in order to inject it in the network.

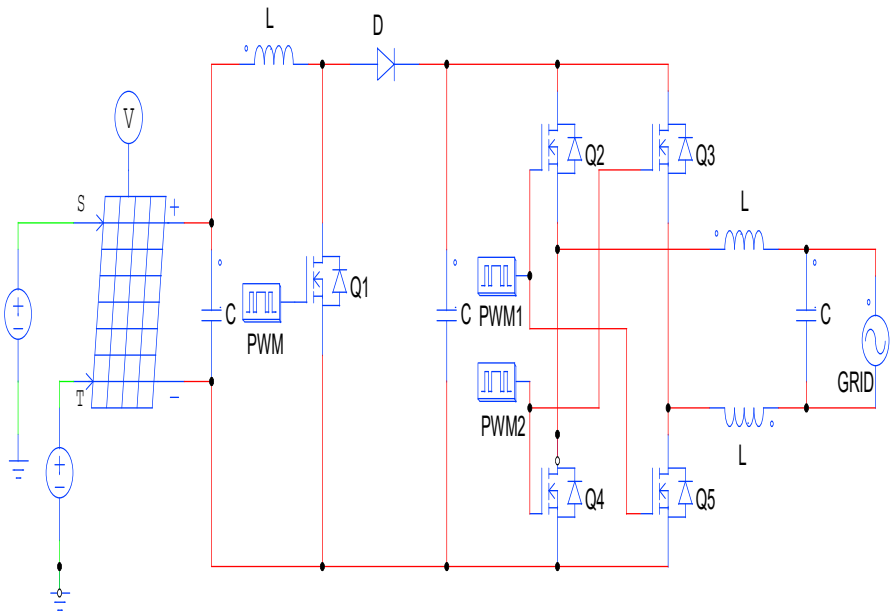

Fig. 1. Conventional Microinverter topology which includes DC-DC Boost and DC-AC inverter.