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Static variable load for grid-connected photovoltaic system

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Abstract

This study addresses a static variable load for grid-connected photovoltaic system. In order to make the proposed system more improving powers disturbances, the interconnection of grid- photovoltaic assembled a reversible converter. The power circuit is composed of two 75 watts series photovoltaic panels associates to a static variable load with a dc-dc boost converter interconnect an alternative grid via reversible converter controlled by pulse width-modulation technique. In the dc–dc power conversion, the incremental conductance maximum power point tracking is introduced to improve the conversion efficiency of conventional boost converter. Moreover, a simple control system is designed for the current control of the reversible inverter to synchronize the output current to the alternative voltage in the grid and less variation under static load changes. Obtain results by using Matlab/simulink indicates that the present photovoltaic -grid system able to exchange the direction of active powers in the alternative grid for static variable load caused by reversible converter design.

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Keywords: Grid-connected photovoltaic; Reversible inverter; INC-MPPT; Exchanging power.

Nomenclature

PV	photovoltaic
INC -MPPT	incremental conductance maximum power point tracking algorithm
SVL	static variable load
PWM	pulse width-modulation

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1. Introduction

Traditional electric power systems are designed in large part to utilize large base load power plants, with limited ability to rapidly ramp output or reduce output below a certain level. The increase in demand variability created by intermittent sources such as photovoltaic presents new challenges to increase system flexibility [1]. Recently, solar systems are seeking more attention as solar energy is omnipresent, and cost of photovoltaic cell is reducing nowadays. The Photovoltaic systems are intermittent in nature and cannot satisfy the power requirement alone throughout the year. Hence, mostly the grid integrated PV system with advancement is preferred to ensure the continuous power flow [2]. Generally, grid integrated PV systems enable dc–dc converter was employed for maximum power point tracking to achieve output voltage regulation. However, the output voltage of the dc-dc conversion PV systems is continuous and voltage signal in grid is alternative. So, to connect the PV with the grid it's necessary to using a dc–ac converter. In general, this structure enables a dc voltage control and a disturbance powers control strategy.

This paper presents two Photovoltaic Panels for static variable load which each panel generate 75 w. So the total generated power is 150 w. Also, the PV with static variable load system connected to an alternative grid for calibrates the demand of exchanges powers. In this paper the incremental conductance MPPT is used to regulate output dc voltage PV system, a reversible converter is employed to connect the grid to the PV-SVL system and a simple control strategy in favor of synchronized the alternatives current and tension in the grid. With mean a test by using Matlab/simulink for SVL it is observed a fast dynamic response validity and effectiveness of the proposed control strategy for the interconnection grid PV-SVL system. The obtain simulation results designate also the proposed control system with the reversible converter able to exchange the direction of active powers in grid connected solar energy source system for static variable load.

2. System description

A schematic of the system is shown in Fig. 1. The system consists of PV array, diode, dc-link capacitor, voltage source inverter with a harmonic reduction filter, a step-up transformer and power grid. DC power generated from the solar array charges the dc-link capacitor. The grid connection inverter turns the dc into ac power, which has a sinusoidal voltage with the same frequency as the utility grid. The diode blocks the reverse current flow through the PV array. The transformer steps up output voltage source inverter (VSI), dc-ac converter to the nominal value of the power grid and providing electrical isolation between the PV system and electric network. The harmonics reduction filter eliminates the harmonic components other than the fundamental electrical frequency for 50Hz.

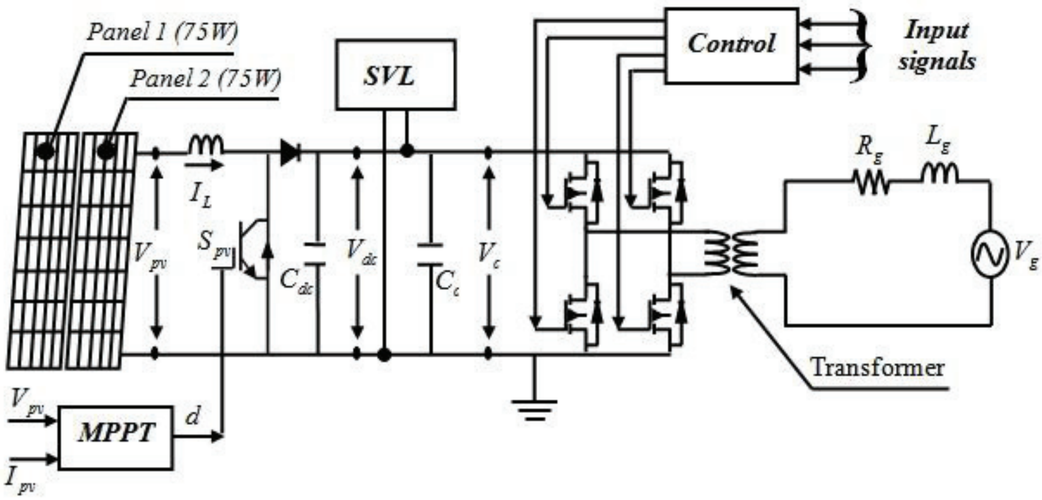

Fig. 1. Total conversion system scheme.