

Study of Single Phase Five Level Inverter for Solar-PV Applications

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Abstract— This paper deals with five level inverter topology for solar-PV generation in standalone applications. Desired voltage has been obtained by regulated pulse width modulated (PWM) gating signal fed to gate of bidirectional inverter switches. Perturb and Observe (P&O) based maximum power point tracking (MPPT) tracks maximum generated power. DC/AC converter has been established to regulate power to rated values. The results has been established and verified in MATLAB/Simulink platform. The results explored for Load power at converter end. Boost converter are well suited for the grid connectivity.

Keywords - Inverters, Pulse Width modulation, Maximum power point trackers, Voltage measurement, Mathematical model, PV system arrays, Irradiation MPPT.

I. INTRODUCTION

The demand for renewable energy has increased significantly over the years because of shortage of fossil fuels and greenhouse effect. Among various types of renewable energy sources, solar energy and wind energy have become very popular and demanding due to advancement in power electronics techniques.

In the proposed work, one MPPT algorithms viz. Perturb and Observe (PO) analyzed and implemented for PV array. Thereafter, PV array connected to a boost converter to optimize the PV output and DC/AC inverter (five-level multi-level) to convert the DC output voltage of the solar modules into the AC system. The results of MPPT algorithm responses compared for grid connected PV array. In addition, performance analysis of PV array with MPP tracking done in terms of voltage response, current response and power response using the input parameters, temperature and solar radiation obtained from reference data sheet. The proposed model, the entire components and control systems simulated under MATLAB/Simulink Software.

II. SIMULINK AND MODELING OF PROPOSED MODEL

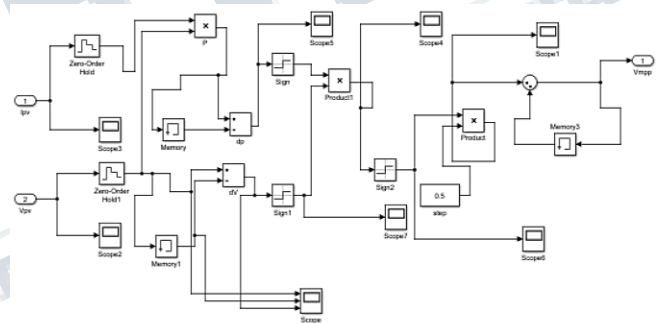


Fig.1 Simulink model of Perturb & Observe

Fig.1 shows the simulink diagram for PO with step value of 0.5 and sensed voltage and current V_{pv} and I_{pv} .

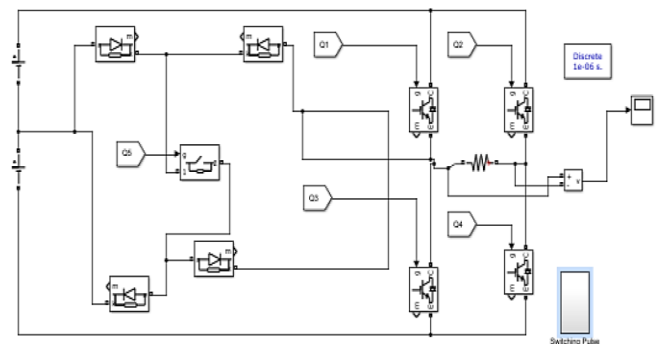


Fig.2 Simulink model of single-phase five-level PWM inverter

Fig.2 shows the simulink diagram for five-level multi-level inverter.

III. RESULTS AND DISCUSSION

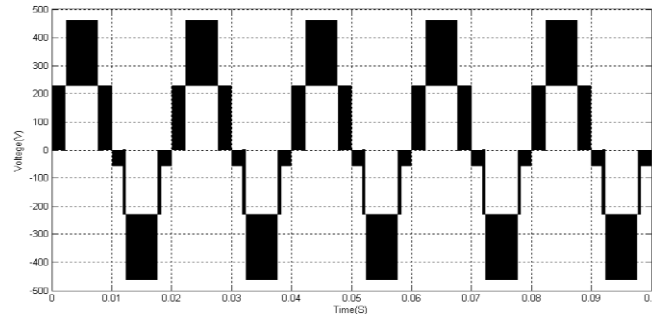


Fig. 3 Inverter output voltage for single-phase five-level

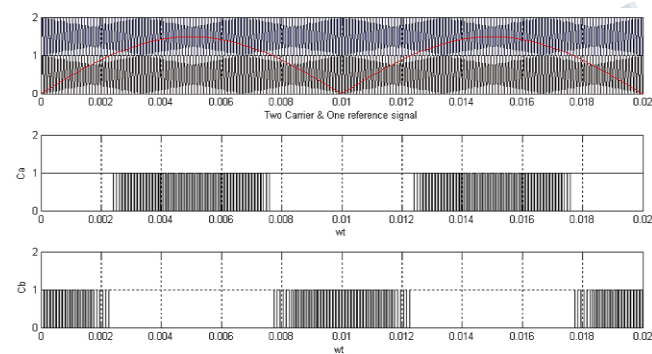


Fig. 4 Output of two carriers (CA & CB)

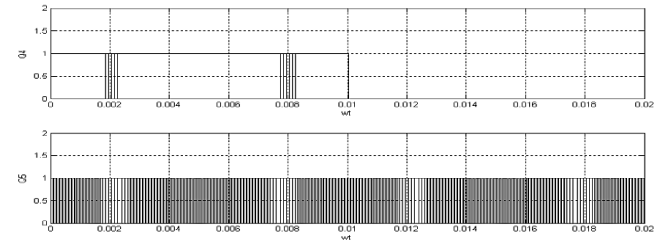
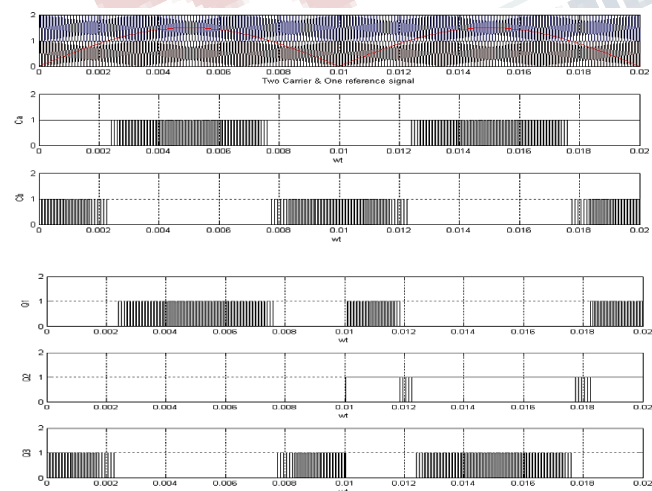


Fig.5 Switching patterns of the proposed single -phase five- level PWM inverter

V. CONCLUSION

In the proposed work the “Study of single- phase five-level inverter for solar PV- applications” have been done. The MPPT techniques considered in the proposed work is Perturb & Observe (PO). The simulations carried out for PV array cascaded with boost converter. The results investigated for load power at converter end. Boost converters are well suited for grid connectivity. Further the simulations carried out for developed PV system with 95V AC utility grid through a single-phase five-level PWM DC/AC inverter. This MPPT techniques based on the number of control variables involved, types of control Strategies, circuitry , and applications are possibly useful for selecting an MPPT technique for a Particular application for grid or standalone mode of operations.

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