Modified MPPT based PI Controller for Standalone PV Switched Capacitor Inverter

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Abstract :In this paper, we have proposed a new technique for Switched Capacitor based inverter based on a standalone photovoltaic module. The new technique is based on PI based controller. The purpose of this control system is to saturate any fluctuations of the output of the solar panel or the standalone PV module and give a clear DC constant input voltage to the main circuit of switched capacitor. The switched capacitor is used to give capacitance value according to the pulses given in the SC (switched capacitor) module gates of the transistors used for switching. The possibility of executing Maximum Power Point Tracking which is to realizeit as a measurable augmentation in the efficiency of the Photovoltaic System. Initially, the Switched capacitor based driven with P and O MPPT technique gives about 4-6% of THD output sine wave. In the proposed algorithm, the P and O technique is modified with the use of Fuzzy Controller and PI controller which stabilizes the system, lowers cost and is easier to implement. The THD values are improved by 88%, THD is less than 1% and the efficiency is about 99%. Photovoltaic (PV)based proposed algorithm isa technique for producing electrical power in AC mode by changing solar radiation into coordinate current power utilizing semiconductors that display the photovoltaic impact.

IndexTerms **- Switched Capacitor(SC), Photovoltaic Inverter(PI), Total Harmonic Distortion(THD).**

I. INTRODUCTION

A PV system contains a wide range of segments other than the PV modules. For effectively arranging a PV system,it is critical to comprehend the function of the diverse parts and know their real particulars. [8] Further, it is critical to know the impact on the area of the (normal) execution of a PV system. PV systems can be basic, comprising of only a PV module and burden, as in the direct powering of an engine, which just needs to work when the sun illuminates.[3]When,forinstance,an entire house ought to be powered, the system must be operational day and night. [5]- [7] It additionally may need to nourish both AC and DC loads, save power and may even incorporate a back-up generator. [9] [10] Contingent upon the system configuration, we can recognize three primary kinds of PV systems: independent, lattice associated, and half breed. The fundamental PV system standards and components continue as before. Systems are adjusted to meet specific pre-requisites by differing the type and amount of the fundamental components.

Switched-capacitor (SC) control inverter achieves control change by electronically exchanging capacitors between the information control source and the heap. SC control inverters are widely utilized for dc-dc changes. [1][2] In this paper, control strategies, topologies, effectiveness issues, THD issues and uses of SC dc-dc converters are implemented by proposing a new technique for MPPT PI based Switched Capacitor Inverters.The most distinctive element of SC dc-dc converters is the non-involvement of inductors and transformers for dealing with power, prompting higher power densities contrasted with traditional dc-dc converters. So,this benefit motivates further for improving the inverter technique. Figure 1 shows conventional circuit for Switched Capacitor Inverter and Figure 2 shows the switched capacitor circuit.

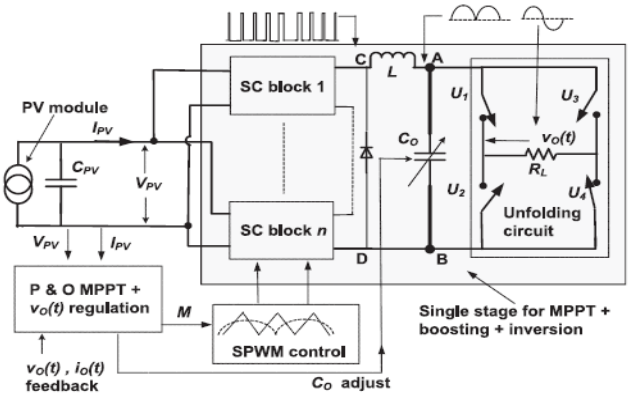

Figure 1: Switched Capacitor Inverter for PV based system

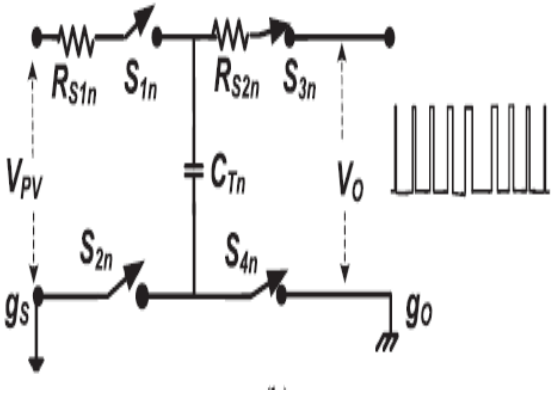

Figure 2: Switched Capacitor

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II. IMPLEMENTATION

The maximum power is computed online using a modified perturb and observe algorithm. The computed maximum power is compared with instantaneous actual SOLAR power.The error between reference (maximum) power and actual power activates ON/OFF controller with a PI controller to control the Switched Capacitors circuit transistors. Therefore, the instantaneous power extracted from the SOLAR is maintained between the tolerance bands.

Firstly, we study about PI Controller. A PI controller consists of four elements. In this control,a modified P and O algorithm is fed and then two PI controllers are added to remove error and reduce the THD of the output waveform.

Figure 3 below is the image of PI block in MATLAB:

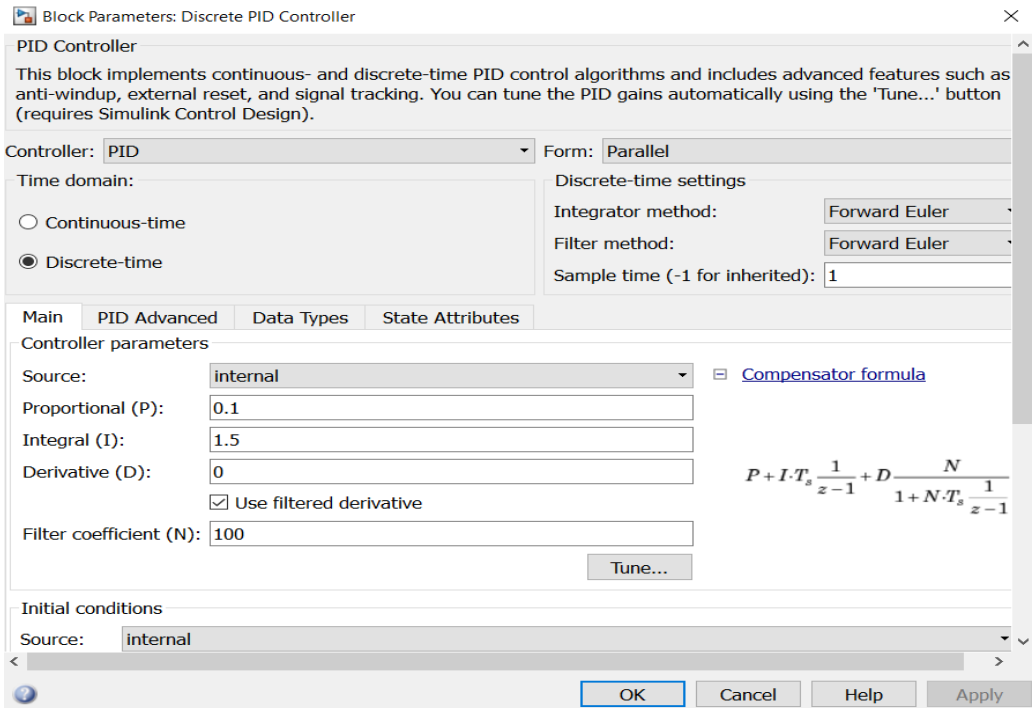

Figure 3: Toolbox of PI

For the maximum power point tracking, we have made PI based constant calculations, in which three input constants are taken, K_p, and K_i and K_d. The K_p and K_i are used for detecting and correcting error respectively for two inputs,error and change in error.

The reduction of THD is achieved by proposing PI based MPPT for PWM of the gates instead of the conventional P&O based MPPT techniques. The implemented model is shown in Figure 4 and the control scheme is shown in figure 5.

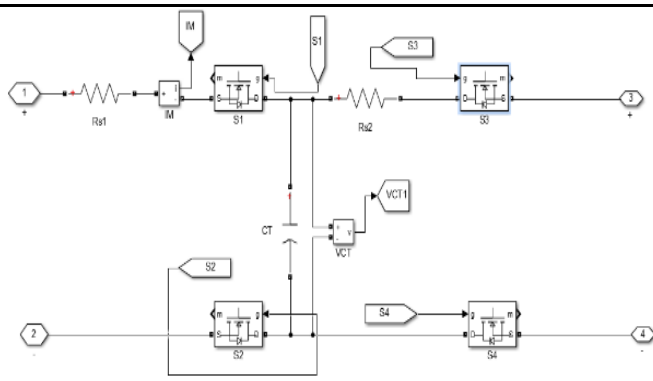

Figure 4: The implemented SC inverter model

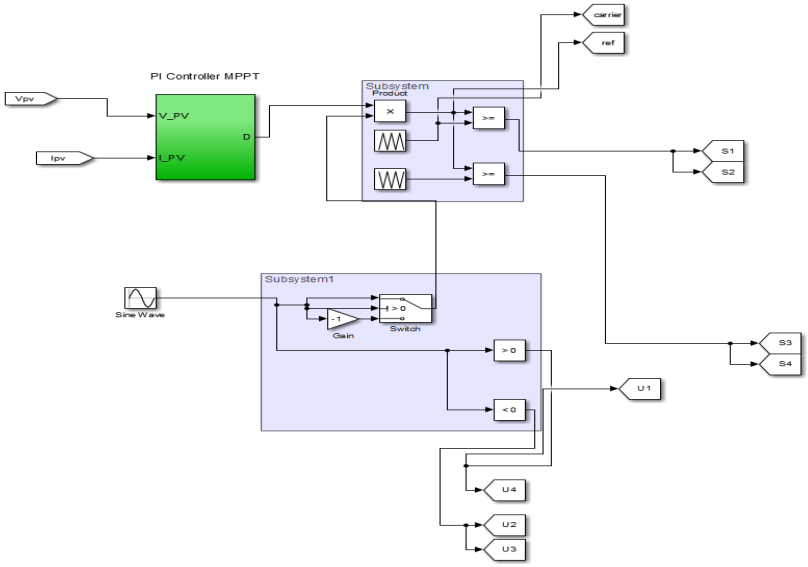

Figure 5: Control Scheme of PI

III. Simulation Results

The resultant THD is shown in Figure 6. As in [1], the THD comes out to be 4 -5% which is enhanced by the use of PI Control logic. The results are shown from figure 7 to 10.

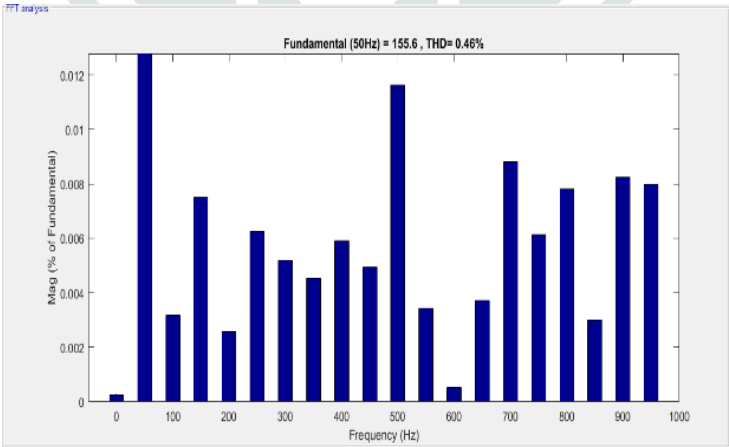

Figure 6: Total Harmonic Distortion

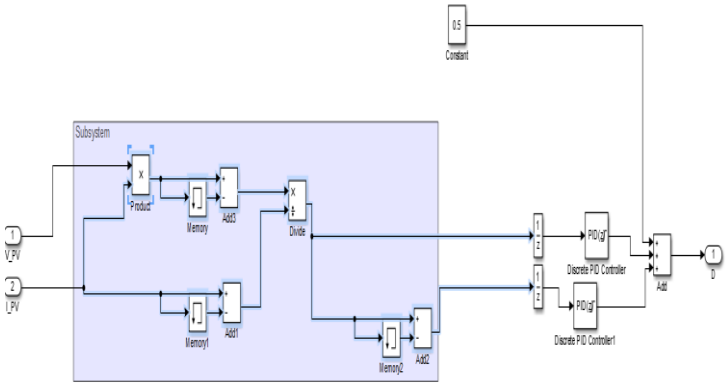

Figure 7: PI based Controller

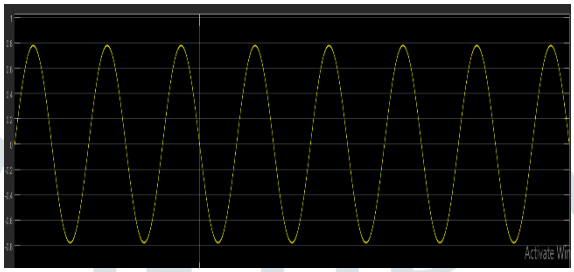

Figure 8: Output Current

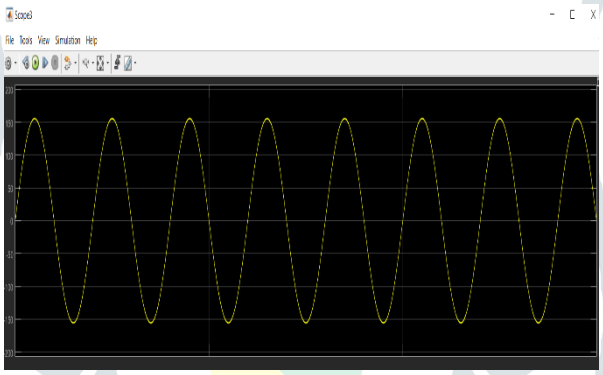

Figure 9: Output Voltage

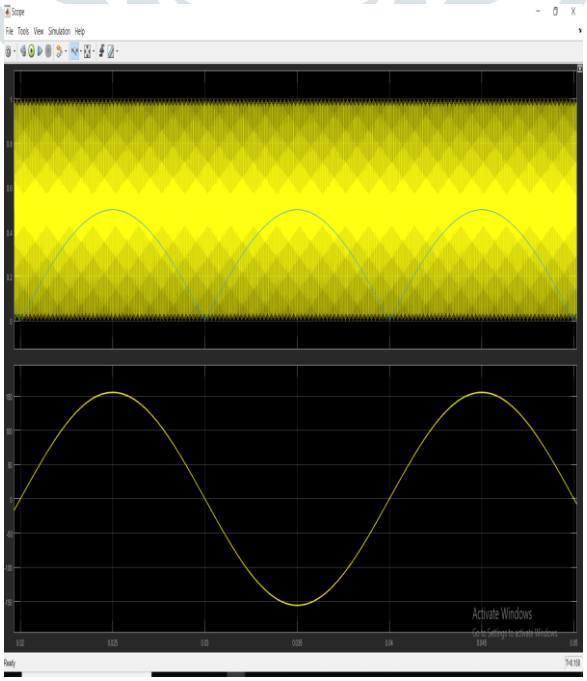

Figure 10: Carrier and Reference Signals

IV. CONCLUSION

In this paper, The PI MPPT algorithms are discussed and their simulation results are presented. Here,we have many valid points to prove that presented method has better performance than classic SC inverter model with PV in terms of stability. All these algorithms improve the efficiency of the converter system as well as the dynamics and steady state performance of the photovoltaic system. It gives low THD and is improved by 88% from previous configurations of the control system.

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