Solar PV Switched Capacitor Inverter with Embedded Fuzzy PI based Control System

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Abstract **-** In this paper, we have modified the control system used switched capacitor inverter based on PV. The work 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 be realized 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, lower cost and easier to implement. The THD values are improved by 88.5% and the THD is about 0.46% and the efficiency is about 99%.

Keywords **-** Photovoltaic, Switched Capacitor, Fuzzy-PI

I. INTRODUCTION

MPPT as per full form maximum power point tracking figuring is absolutely vital to raise the adequacy of the sun based board as it has been found that elite 30-40% of energy scene is changed over into electrical energy. If we discussed all present MPPT strategies, Perturb and Observe and Incremental Amount Conductance are the most typically utilized because of their clear use and lesser time to follow the maximum power point and besides other financial reasons. Under sudden changing atmosphere conditions (irradiation level) as MPP changes constantly, P&O accepts it as a change in MPP in light of trouble rather than that of irradiation and sometimes ends up in figuring mistakenly MPP. In any case this issue is discarded in Incremental Conductance strategy as the count takes two instances of voltage and current to enroll MPP. In any case, instead of more viability the unpredictability of the computation is high appeared differently in relation to the past one and thus the expense of execution increases. So we have to vindicate with a tradeoff among repercussion and adequacy. It has been watched that the capability of the system in like manner relies on the converter. [7][6]

In this paper, we construct a technique for MPPT using Fuzzy-PI method. The paper is organized as follows: The introduction part briefs about importance of MPPT and then in Implementation and results all Simulink work on Switched capacitor inverter based on PV is shown. After which conclusion of this paper is mentioned.

Switched Capacitor Inverter with Fuzzy PI technique - For the maximum power point tracking, we have made a fuzzy logic based fis file, in which three inputs are taken, one is speed in rpm, and other is error and third is change in error. Below is the image for fuzzy logic system in figure 4.2 and in figure 4.3 surface diagram of fis file is shown. There are three membership functions in each input.

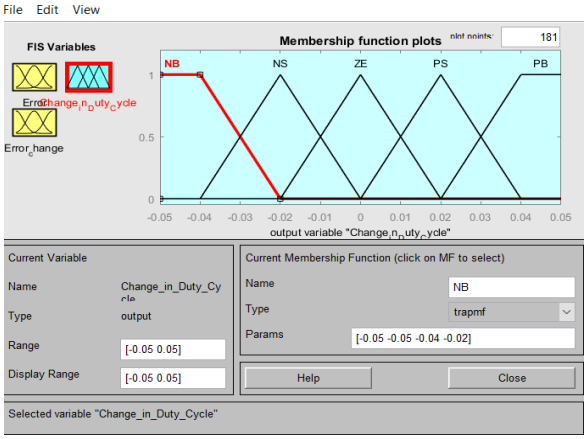

Figure 1: FIS Fuzzy Inference System

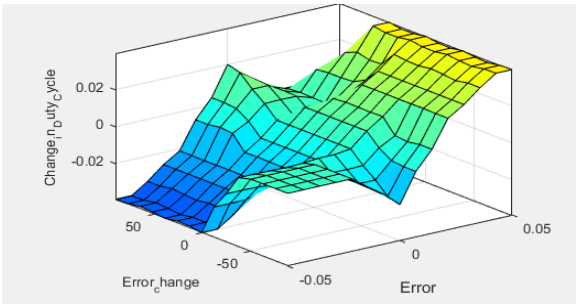

Figure 2: Rules Surface View

II. IMPLEMENTATION MODEL AND RESULTS

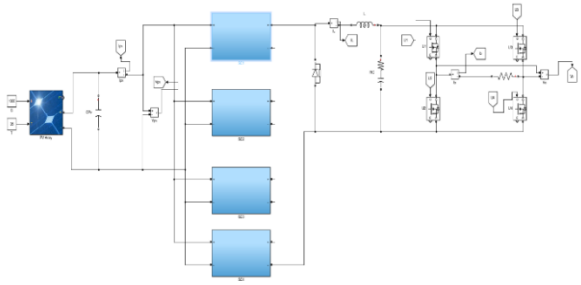

Figure 2(a)

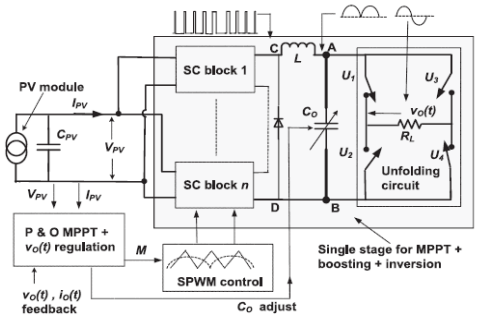

Figure 2(b)

Figure 2(a & b): Switched Capacitor Inverter Model

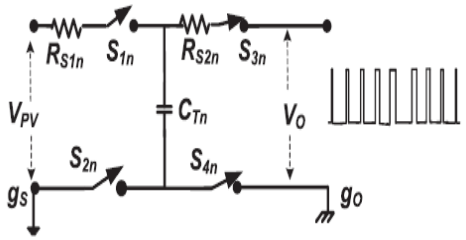

Figure 3: Switched Capacitor

Figure 2 and Figure 3 shows the Switched Capacitor Invertor and Circuit Working of SC respectively.

The reduction of THD is achieved by proposing Fuzzy-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.

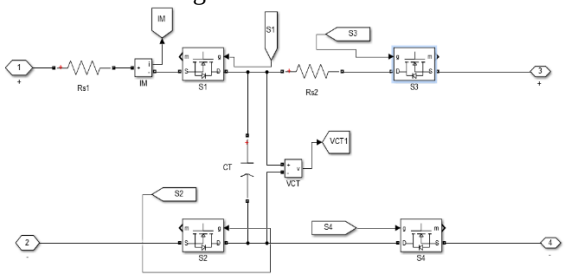

Figure 4: The implemented SC inverter model

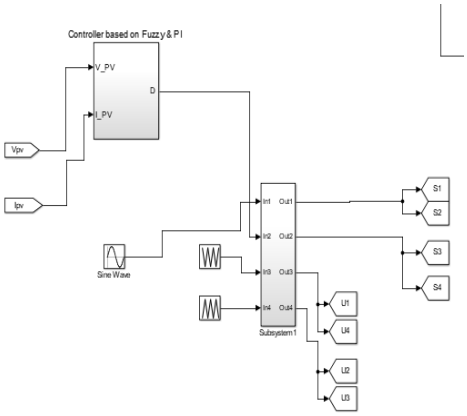

Figure 5: Control Scheme of Fuzzy-PI

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 Fuzzy-PI Control logic. The results are shown from figure 7 to 10.

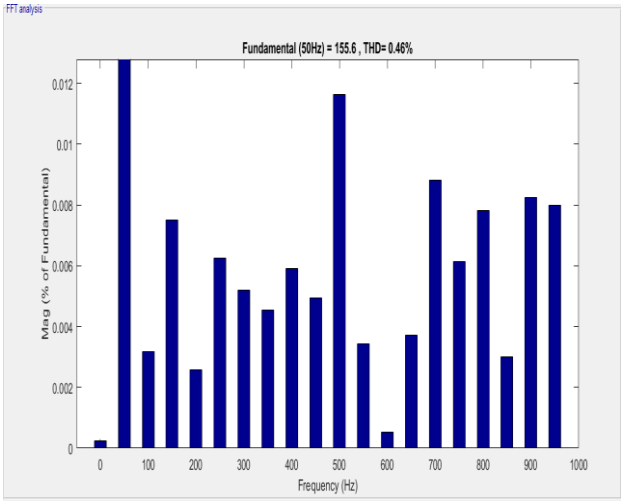

Figure 6: Total Harmonic Distortion

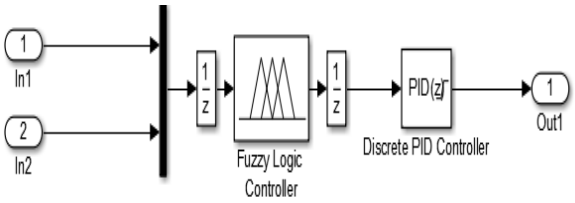

Figure 7: Fuzzy-PI based Controller

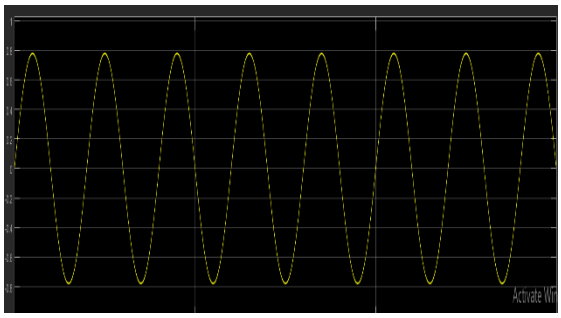

Figure 7: Output Current

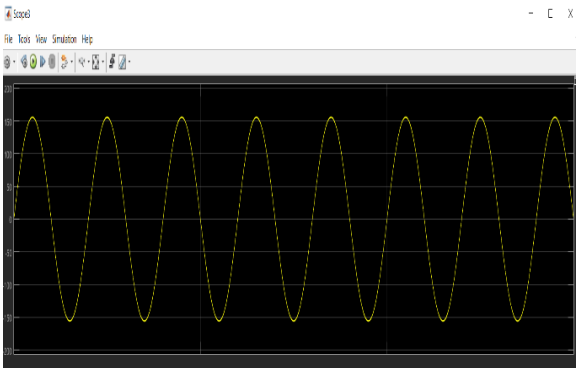

Figure 8: Output Voltage

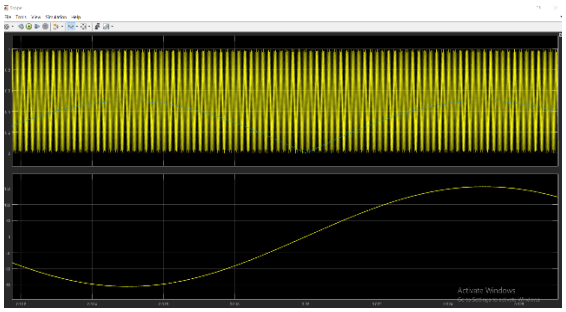

Figure 9: Carrier and Reference Signals

III. CONCLUSION

In this thesis, The Fuzzy-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 it improves the dynamics and steady state performance of the photovoltaic system. It gives low THD and its improved by 88.4% from previous configurations of the control system.

IV. REFERENCE

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