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A New Control Technique of DC Link Voltages for Separate MPPT's In Three Level Inverter

M. Rajyalakshmi, Ms. Jyoshna Devi

***Abstract*— Demand of electrical energy is increases at a rapid rate. The improvement of energy efficiency and the effective use of renewable energy sources are key to fulfill the energy demand. The use of renewable energy sources like fossil fuels can create global warming, acid rains etc. Generation of electrical energy through photo voltaic cells is alternative to reach the demand. It is important to improve the overall efficiency of photo voltaic inverter, when it is connected to grid. There are many ways of connecting PV modules to grid. Among all these topologies, the centralized inverter is preferred in high power applications for practical pea sons. In the presence of partial shading, maximum power point tracking (MPPT) on PV module is more important than the conversion efficiency. However, in terms of maximum power point tracking, the mid-point inverter may not be best topology with which to maximize the power generation. It is necessary to consider the mismatches in PV modules. With the proposed method, each dc link voltage of the three-level inverter can be asymmetrically regulated. When PV modules are split into two and each split module is connected to the respective dc-link capacitors of the inverter, the asymmetric control can be helpful because separate MPPTS are possible. The simulation is carried out by MATLAB-SIMULINK software.**

***Index Terms*—Invertor, Generation of electrical energy, MPPT, PV Module.**

I. INTRODUCTION

Currently, the use of renewable energy is gaining increased amounts of attention due to environmental issues. Moreover, while the cost of the fossil fuels has increased, the cost of photovoltaic (PV) generation has decreased. Therefore, PV generation is becoming a viable solution in the event of an energy crisis. For example, multi-megawatt PV plants are common in many places [1]. Because the DPC method is based on variable switching frequency, the filter design cannot easily meet the harmonic and EMI regulations [2]. For better MPPT, additional DC-DC converters can be used to connect split PV modules to the centralized inverter [3]. However, in terms of maximum power point tracking (MPPT), the centralized inverter may not be the best topology with which to maximize the power generation, as all of the PV modules are rigidly tied to a single inverter [4]. Solar-tracking PV Plants in Navarra: A10 MW Assessment, Progree in Photovoltaic's [5]. However, Harmonic current reduction controls for grid-connected PV generation systems [6].
Here we considered the dc-link voltage as symmetrical and constant, but most of the cases the dc-link is asymmetrical the control of asymmetrical voltage is difficult; several attempt to control the DC-Link voltages asymmetrically in multi-level inverters have been reported [7]. It would be desirable to consider a real maximum power point tracking method for mismatching compensation in PV array under partially Shaded Conditions [9]. In particular, the T-type three-level inverter shown in Fig. 1 is preferred because conduction losses are further minimized by reducing the average number of switch modules on the current paths [10]. For better MPPT, additional dc–dc converters can be used to connect split PV modules to the centralized inverter [8], [11].However, although this structure may be helpful to deal with partial shade, the conversion efficiency may be degraded due to multiple conversions. Moreover, the installation and maintenance costs increase. Therefore, it is worth augmenting the degree of freedom for MPPT while the number of conversion stages does not increase.
Intrinsically, the SVM method is complicated to implement because the dwell time of each vector should be geometrically computed. In addition, the sector in which the voltage vector is included should be identified and an extra table is required to optimize the switching patterns [14]. Recently, Asymmetric Control of DC-Link Voltages for Separate MPPTs in Three-Level and five level Inverter [15]-[16].

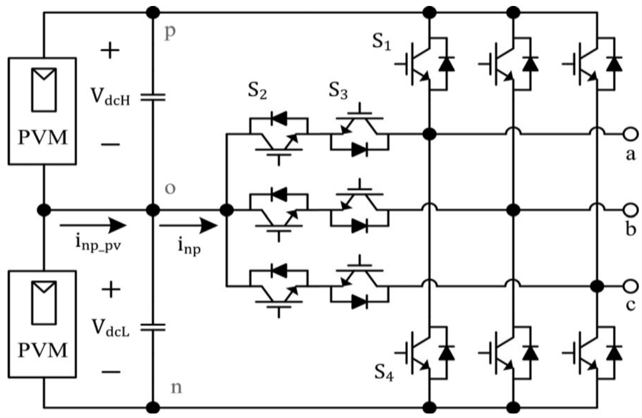


Fig.1. PV modules and the T-type three-level PV inverter

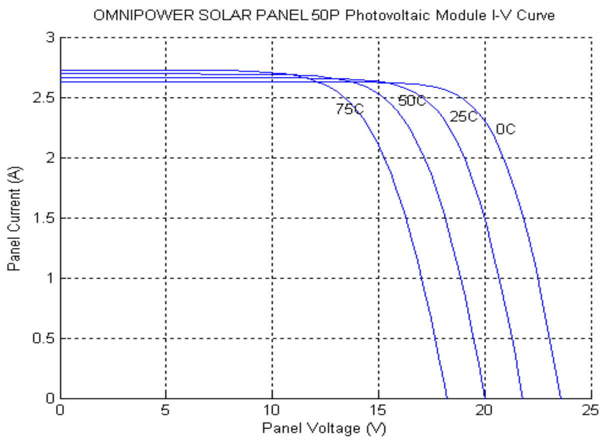
II. PHOTOVOLTAIC MODULES

Photovoltaic modules mainly depends upon two factors
1.Temperature variation
2.Irradiance variation

1.TEMPERATURE VARIATION

Temperature increases then output power will be decreased. An MPPT system needs to be implemented in order to deliver most power during the operation of solar battery and to be able to track the changes in power due to changes in atmospherical conditions.

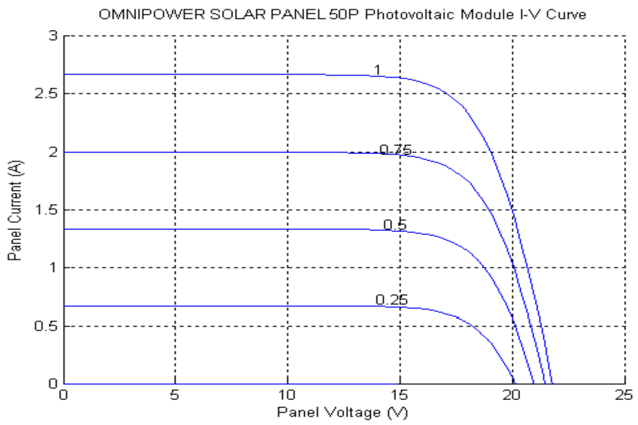
K.Jyotshna Devi, B.Tech (Electrical and Electronics Engineering) degree from the Jawaharlal NehruTechnological University, Anantapur
M.Rajyalakshmi, Asst. Professor, B.Tech (Electrical and Electronics Engineering) degree from the Jawaharlal NehruTechnological University, Anantapur



Fig(a)

2.IRRADIANCE VARIATION

Irradiance increases then output power will be increased.



Fig(b)

The output power of a solar PV panel changes in accordance with changes in radiation and temperature levels. This makes it not possible to use the direct coupled methodology to automatically track the MPP. These changes in climatic conditions are shown by the I-V and also the P-V curves displayed in Figures 2-2 and 2-3.

III. MPPT CONTROL SYSTEM

Both the PO and IC MPPT control algorithms can be implemented in a silicon chip to control either the DC-DC converter input directly by victimisation the device duty cycle as an impact variable, or by setting the reference Vref adequate VMPP for a voltage feedback controller circuit as shown in Figures 2-13 and 2-14 severally.

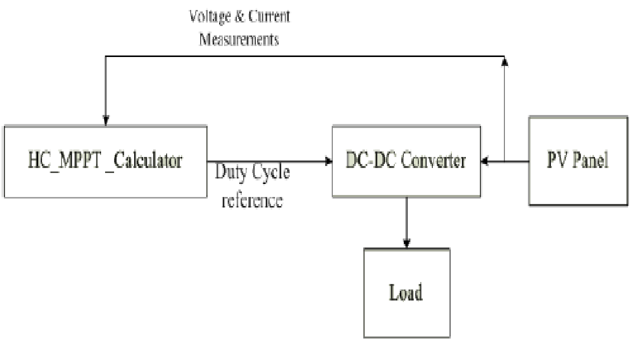


Fig.2 Block diagram of MPPT with direct control method

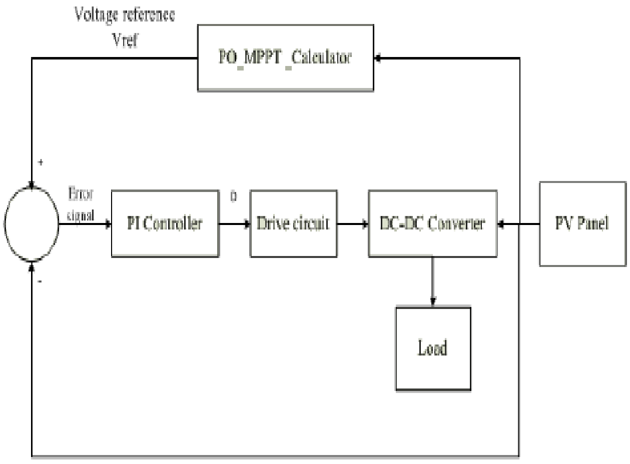


Fig.3 Block diagram of MPPT with PI compensator

IV. T- TYPE INVERTER

Three-level inverters are used widely in the heavy industry. Compared to ancient two-level inverters, three-level inverters have the benefits. The harmonic contents of a three-level inverter are less than that of a two- level at identical switching frequency. Besides voltage stress of every main switch is reduced to 1/2 the dc bus voltage. When using discontinuous pulse dimension modulation (DPWM), the switching loss is reduced and better harmonic characteristics are obtained at a high modulation index as compared with an inverter using continuous pulse width modulation (CPWM).

The DC-link voltage of a three- level electrical converter is split by capacitors in series. Therefore, the neutral-point voltage is also unbalanced, which might cause failure of the switching devices and an increase in the total harmonic distortion (THD).

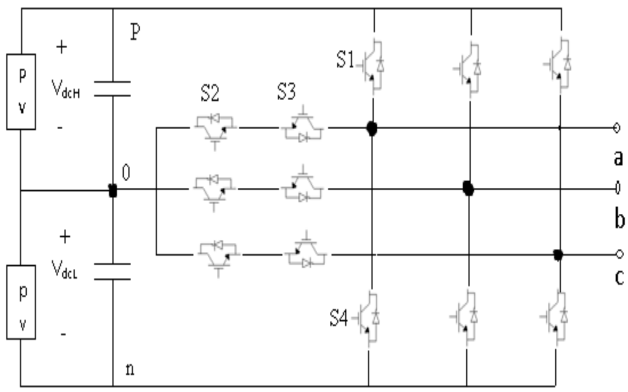


Fig.4 Schematic Three level T-type topology

V. THREE-LEVEL T-TYPE INVERTER

In the past, several studies regarding three-level npc (Neutral point Clamped) inverter are enforced. Currently, the active researches of improved topologies are on process. Among improved topologies, three-level T-type inverter is used during this paper. The T-type inverters use IGBT as a main switch same because the conventional 2-level inverters.

State	Vout	T1	T2	T3	T4
P	+Vdc/2	on	on	off	off
O	0	off	on	on	off
N	-Vdc/2	off	off	on	on

Table.1 Switching states

. A bi-directional switch is connected between the neutral- point and every output. The switching loss and therefore the switching noise of three-level inverter ar reduced relatively to the conventional 2-level inverters because the devices operate below half dc-link voltage. The physical phenomenon loss of T-type electrical converter is same as 2-level inverter's however lower than the npc inverter's because the current is conducted through a single switch

VI. SIMULATION RESULTS AND ANALYSIS

COMPLETE SIMULINK PV SYSTEM

A PV solar array, an MPPT algorithm, and a DC-DC boost converter are modelled and simulated one by one in the previous chapters. They represent the physical subsystems built for the current PV power system. After being verified singly, they are connected together and combined with the load.

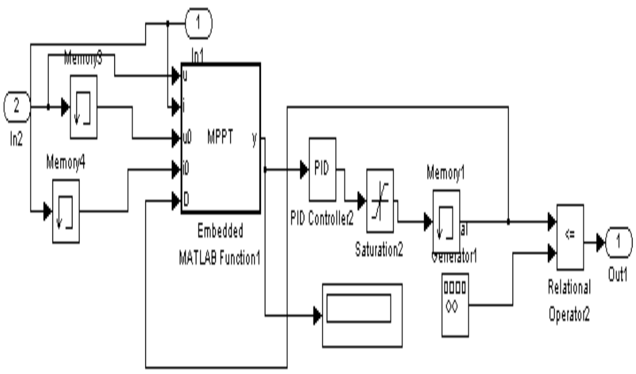


Fig.5 Incremental Conductance modelling in MATLAB

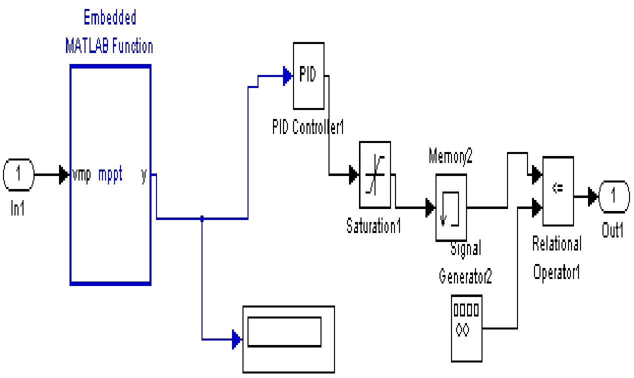


Fig.6 Constant voltage modelling in MATLAB

VII. SIMULATION RESULTS

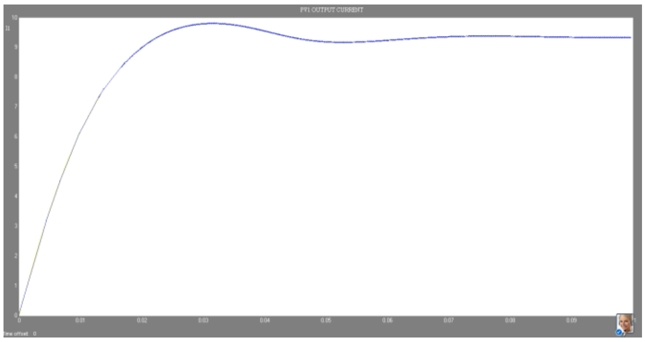


Fig.7 Output current of PV Module1

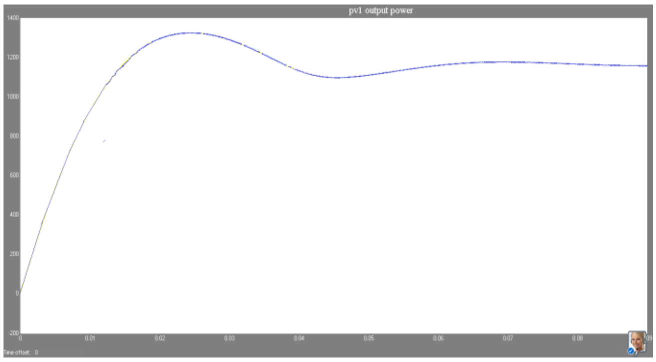


Fig.8 Output power of PV Module1

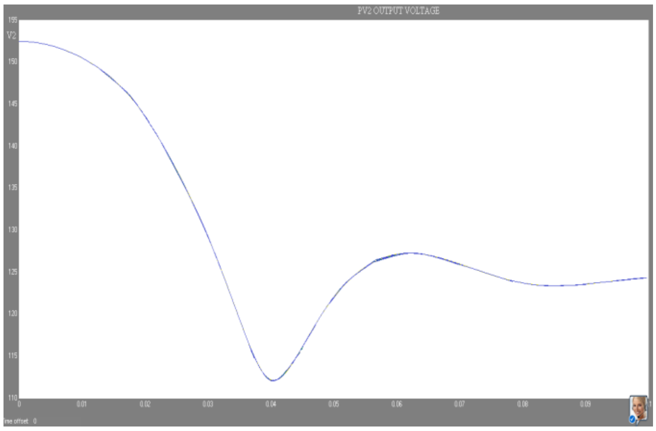


Fig.9 Output voltage of PV Module1

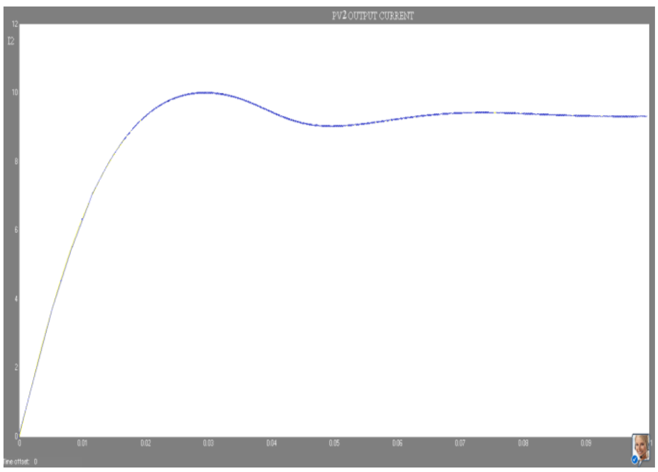


Fig.10 Output current of PV Module2

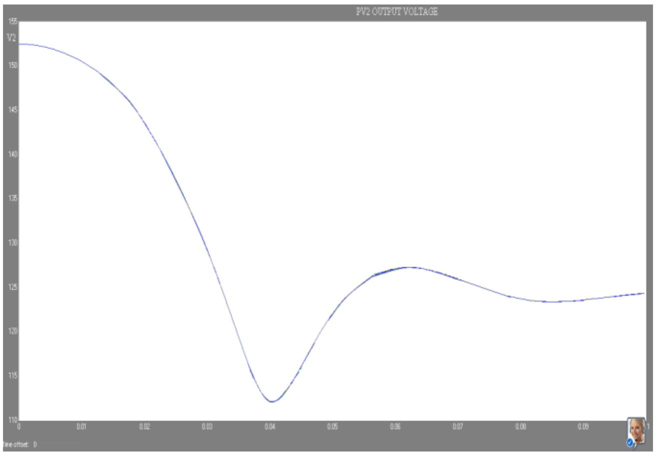


Fig.11 Output power of PV Module2

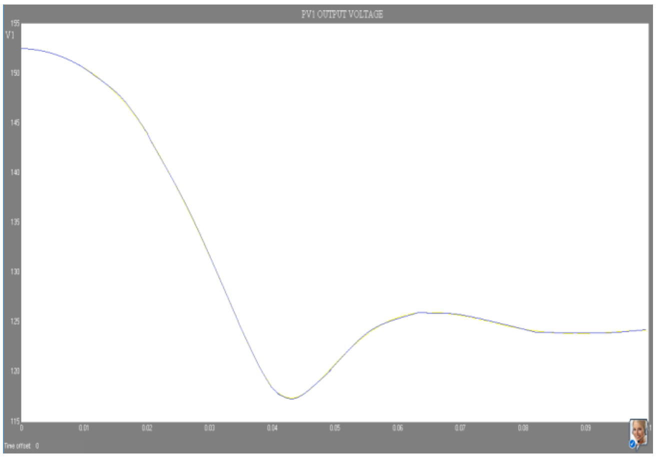


Fig.12 Output Voltage of PV Module2

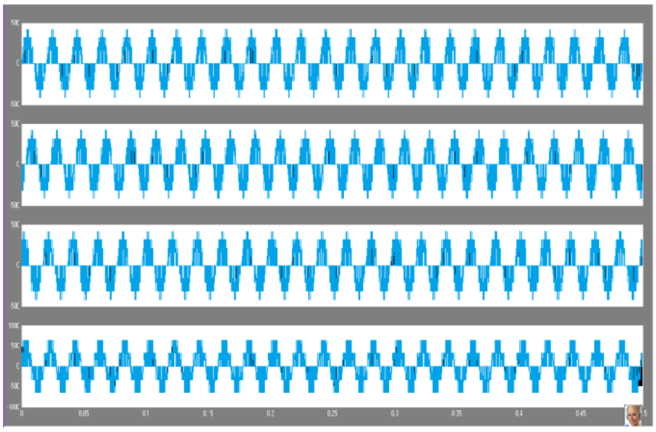


Fig.13 T type three level output voltage

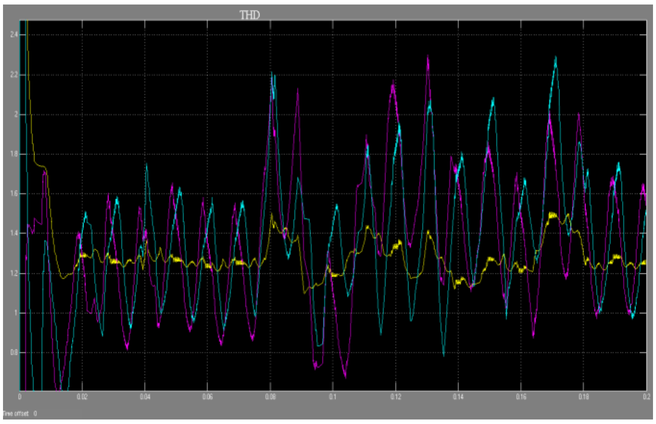


Fig.14 Total Harmonic Distortion of T- type inverter .

1	Ptrack	1340	1390
2	Efficiency	86.41	89.63

Table.2 Comparision between CV AND IC Algorithm

S.no.	Specification	Conventional	T- type method
1	No. of Switching devices	12	12
2	THD	8%	2.40%

Table .3 Comparision between Conventional and T type inverter

VIII. CONCLUSION

In this project, two MPPT control algorithms, constant voltage ‘CV’ and progressive conductance ‘ Inccond ’, are mentioned. Based on the results presented, the subsequent conclusions may be stated: The ‘CV’ algorithm is easy to implement and sometime combined along with other MPPT techniques.

In low star irradiance conditions, the ‘CV’ algorithmic program is used.

The two model MPPT control algorithm combines ‘CV’ and Inccond technique is presented. Mathematical models were used to simulate the PV module in the analysis of the algorithm performances under randomly varying atmospheric conditions. a boost device was controlled using the combined MPPT control to maximise PV power flow to a load.

IX. FUTURE SCOPE

Modern MPPT strategies such fuzzy logic Controller (FLC) or artificial neural network management may be employed in the longer term simulation study particularly when using a large solar battery. FLC offers the advantage of varied the increment of the duty cycle with accuracy and lustiness beneath ever-changing environmental conditions. These intelligent algorithms are terribly promising because they're adaptive, non-linear in nature and are convenient for PV control. FLC will be further optimized by the utilization of genetic algorithms.

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AUTHOR'S DETAIL

K.Jyotshna Devi, She received the B.Tech (Electrical and Electronics Engineering) degree from the Jawaharlal NehruTechnological University, Anantapur in 2011 and persuing the M.Tech (Power Electronics) from Jawaharlal Nehru Technological University, Anantapur. She is currently working as Assistant Professor & Dept. of Electrical and Electronic Engineering, S.V.P.C.E.T,Puttur. Her area of interest in the field of power electronic converters and Electric Drives.

M.Rajyalakshmi, She received the B.Tech (Electrical and Electronics Engineering) degree from the Jawaharlal NehruTechnological University, Anantapur in 2012 and persuing the M.Tech (Power Electronics) from Jawaharlal Nehru Technological University, Anantapur.her area of interest in the field of modern power electronics,electrical drives,power systems.