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Simulation of PV Based Seven Level Asymmetric Multilevel Inverter with Boost Converter Using MPPT Algorithm

Anna Ranganadh

Assistant Professor, Dept. of EEE, Gurunanak Institute of Technology, Hyderabad, India

ABSTRACT: This paper manages reproduction of PV based seven level asymmetric multilevel inverter with support converter utilizing greatest power point following calculation. Greatest power point following (MPPT) strategies are utilized I photovoltaic (PV) frameworks to boost the PV exhibit yield control by following consistently the most extreme power point (MPP).In this paper irritate and watch (P&O) is utilized. The bearer based PWM is utilized for the proposed multilevel Inverter. A point by point investigation of proposed PV based inverter is done in MATLAB/SIMULINK and the outcomes are checked.

KEYWORDS: THD, PWM, maximum power point tracking (MPPT), perturb and observe (P&O), photovoltaic (PV).

I. INTRODUCTION

A photovoltaic exhibit changes over daylight in to power. The voltage and current accessible at the terminals of the PV cluster may straightforwardly nourish little loads, for example, lighting frameworks and DC engines. More advanced applications require electronic converters to process the power from the exhibit. These converters might be utilized to direct the voltage and current at the heap, to control the power in matrix associated frameworks and primarily to track the most extreme power point (MPP) of the cluster. Converters with the most extreme power point following (MPPT) highlight utilize a calculation to consistently distinguish the greatest prompt energy of the PV exhibit. Since the working state of the cluster may change arbitrarily amid the operation of the framework a MPPT calculation is essential with the goal that the most extreme prompt power can be separated and conveyed to the air conditioner stack through multilevel inverter. One of the benefits of multilevel Inverter is that it empowers the interface of sustainable sources, for example, photograph voltaic, wind and energy units in the dc input part of the multilevel inverter.

Multilevel inverter is to incorporate a close sinusoidal voltage from a few levels of dc voltages regularly acquired from capacitor voltages. As the quantity of level builds, an incorporated yield waveform has more advances, which deliver staircase wave those methodologies, a coveted waveform. The topology considered for this work is the fell H-connect inverter which requires a few free dc sources. Ordinarily, each period of a fell multilevel inverter requires "n" dc hotspots for 2n+1 level. A plan to lessen the quantity of dc sources required for the fell multilevel inverter, this paper centers PV nourished awry course MLI with MPPT calculation utilizing settled recurrence transporter based PWM that utilizations unequal dc sources in each stage to produce a seven level equivalent advance multilevel yield. To track the most extreme power from PV clusters utilizing P&O. This structure is great for high power applications which give low THD for expanded regulation Index.

System Composition

The system explained in this paper is categorized into three individual systems:-

1. Generating a dc signal using photovoltaic system
2. Tracking maximum power from PV using MPPT.
3. Step up of generated DC signal using boost converter.

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4. Pulse pattern generation.
5. Conversion of DC signal to AC signal using single phase asymmetric MLI.

II. PV MODELLING

Demonstrating of a sunlight based cell is finished by interfacing a present source in parallel with a reversed diode alongside an arrangement and a parallel protection as appeared in Fig.3. The arrangement protection is because of obstruction in the way of stream of electrons from n to p intersection and parallel protection is because of the spillage current. The yield normal for a PV module relies upon the sun oriented protection, the cell temperature and the yield voltage of the PV module. Since PV module has nonlinear qualities, it is important to show it for the plan and reenactment of Maximum Power Point Tracking (MPPT) for PV framework applications. The proportionate circuit of single diode demonstrates appeared in Fig.1.The current source IL speaks to the cell photograph current. Rsh and Rs are the shunt and arrangement protections of the cell individually. The simulink model of PV module is appeared in Fig.2

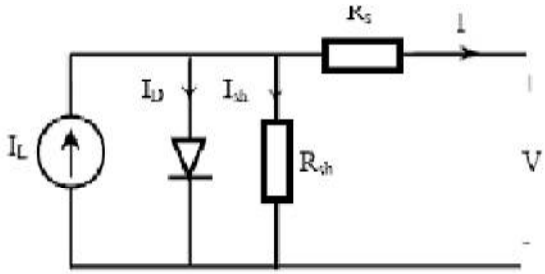

Fig.1 Equivalent Circuit of PV Cell

The equation (1) is the current output of photovoltaic

$$I=IL-I0\ (e(v+IRs)/VT.a)-1-V+RsI/Rsh \text{ ----------(1)}$$

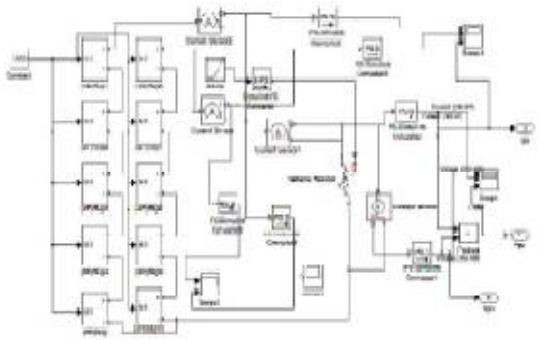

Fig.2.Simulink model of PV module

The I-V and P-V output a characteristic of PV module at 1000W/m2 and 500W/m2 irradiation is shown in Fig.6 a t 25 o C is shown in Fig.7.

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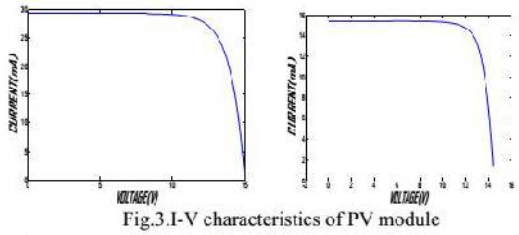

Fig.3.I-V characteristics of PV module

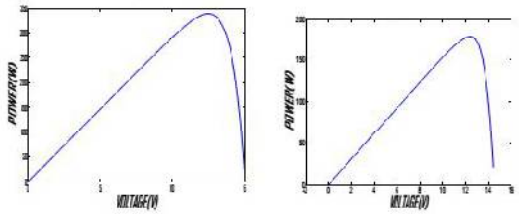

Fig.4.P-V characteristics of PV module

As the irradiance level is conflicting for the duration of the day, the measure of electric power created by the sunlight based module is continually changing with climate conditions. To conquer this issue, Maximum Power Point Tracking (MPPT) calculation is utilized. It tracks the working purpose of the I-V bend to its most extreme esteem. Accordingly, the MPPT calculation will guarantee most extreme power is conveyed from the sunlight based modules at a specific climate conditions. In this proposed inverter, Perturb and Observe (P and O) calculation is utilized to remove most extreme power from the modules. The flowchart for MPPT is appeared in Fig.5and the simulink display for P&O calculation is appeared in Fig.6.

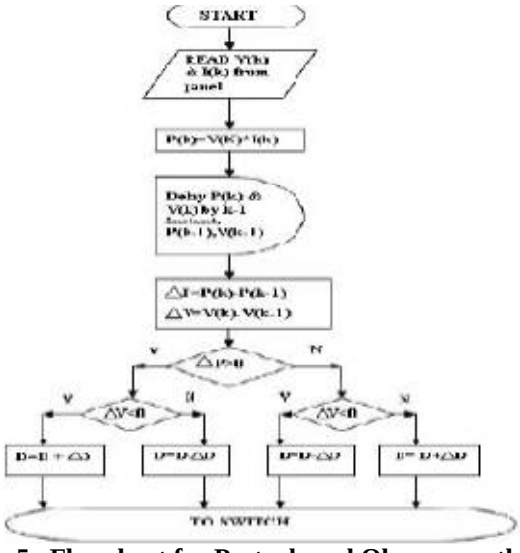

Fig.5.. Flowchart for Perturb and Observe method

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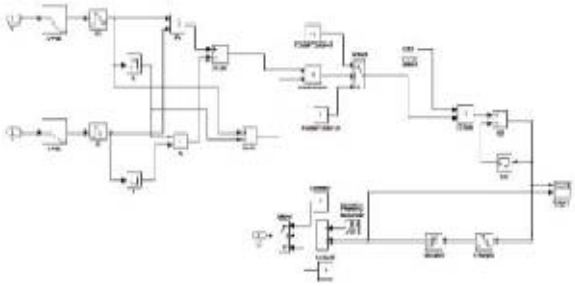

Fig.6. Simulation Diagram of P&O algorithm

III. BOOST CONVERTER

In boost converter the output voltage is greater than input voltage. In this model a power IGBT is considered in boost converter as shown in Fig.7.output of the boost converter as shown in fig.8.

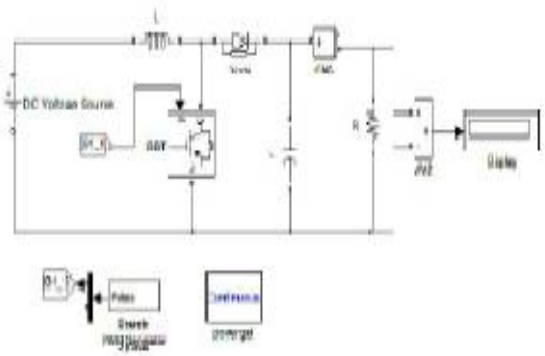

Fig.7. Simulink model for boost converter

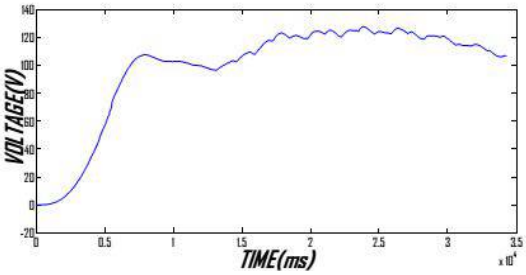

Fig.8.Output voltage of boost converter

IV. SYMMETRIC CASCADED H-BRIDGE MULTILEVEL INVERTER

This paper focuses on an asymmetric topology which uses only two DC sources i.e. the first bridge voltage value is V/2 and the second bridge voltage value is V then the output will be a seven- level voltage waveform. The proposed topology consists of two H-bridges as shown in Fig.9. By appropriately opening and closing the switches of H1, the output voltage V1 can be made equal to - Vdc , 0, + Vdc. Similarly the output voltage V2 of the second bridge H2 can

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be made equal to - 0.5Vdc, 0 , 0.5Vdc .Therefore, the output voltage of the MLI have the values of -1.5 Vdc, -Vdc, -0.5Vdc,

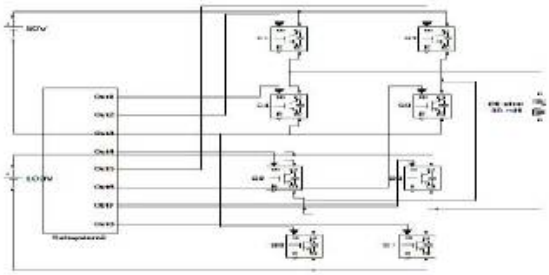

Fig.9. Asymmetric (7- level) cascaded multilevel inverter

V. PHASE DISPOSITION PWM TECHNIQUE FOR CASCADED MULTILEVEL INVERTER

It is by and large acknowledged that the execution of any inverter, with any exchanging procedure can be identified with the symphonious substance of its yield voltage. There are many control systems revealed in writing for fell multilevel inverter. In any case, the prominently utilized tweak strategy is the multicarrier PWM method. Stage Disposition (PD) PWM procedure is the for the most part utilized strategy in fell multilevel inverter as it gives a diminished THD.In this paper, settled recurrence transporter based PWM is proposed which utilizes the customary sinusoidal reference flag and the bearer signals with same frequency[13]-[14]. To actualize a m-level inverter, (m-1) transporters are utilized. There are six unmistakable bearers with same recurrence and with similar extents; the distinction between the transporters is that they are altogether dislodged by an arrangement of DC counterbalance. From the six transporter flags each will have same recurrence. The transporter signals C1 to C6 have same recurrence. The beats are produced when the abundancy of the balancing signal is more noteworthy than that of the transporter motion as appeared in fig.10. Produced beat example of unbalanced MLI with same recurrence as appeared in fig.11.

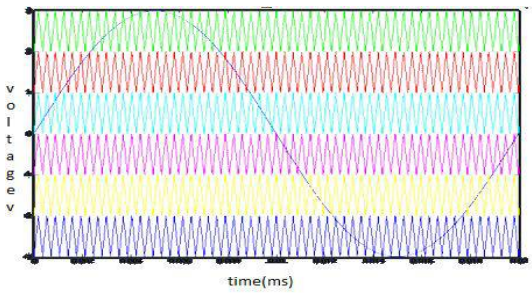

Fig.10. Carrier and reference sine waveform for fixed frequency carrier based modulation technique

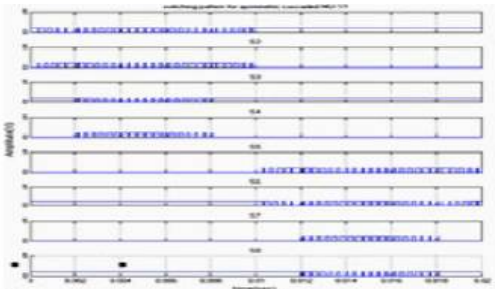

Fig.11. Pulse pattern of asymmetric MLI with same frequency

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VI. SIMULATION RESULTS

Fig.12 and fig.13 shows the MATLAB/SIMULINK diagram and output waveform of the proposed single phase PV based seven-level asymmetric cascaded multilevel inverter. The FFT spectrum of the load voltage and current is found using the FFT analysis tool is shown in Fig.14 and fig.15 respectively and the THD of voltage and current are 19.27%,7.33% respectively.fig.16. and fig.17. shows current THD, voltage THD vs modulation Index graph.

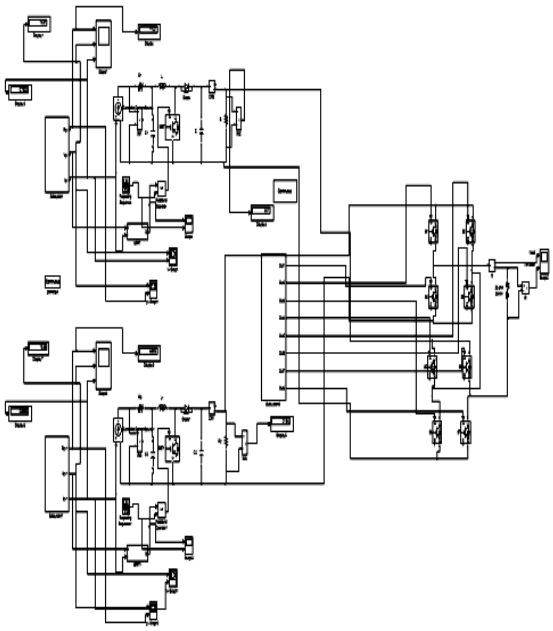

Fig.12. Simulation Diagram of 7-level asymmetric multilevel inverter interfaced with PV

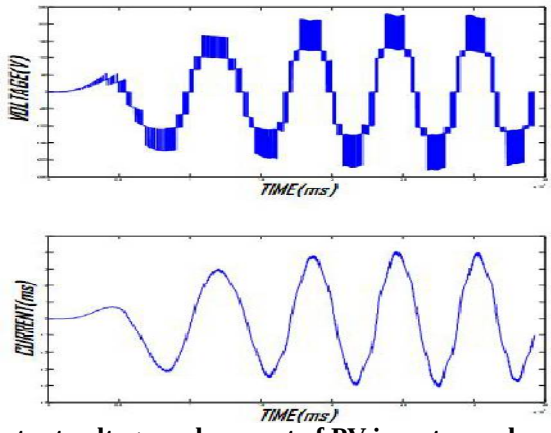

Fig.13.Seven level output voltage and current of PV inverter under open-loop condition

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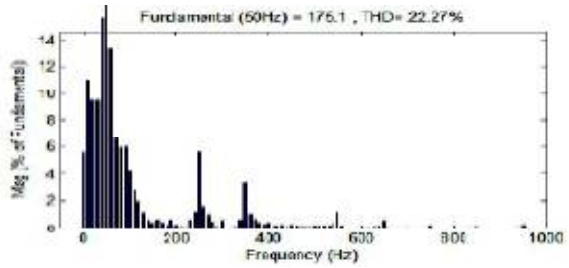

Fig.14. FFT Analysis of load voltage of seven level Inverter

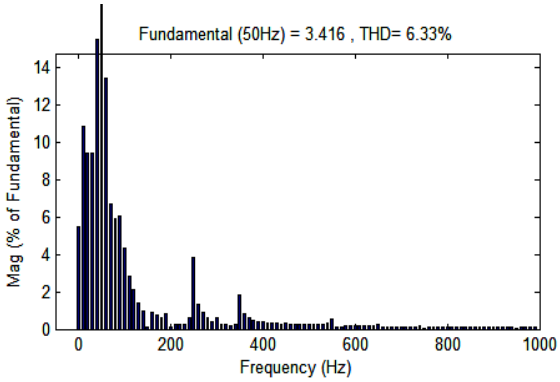

Fig.15. FFT Analysis of load current of seven level Inverter

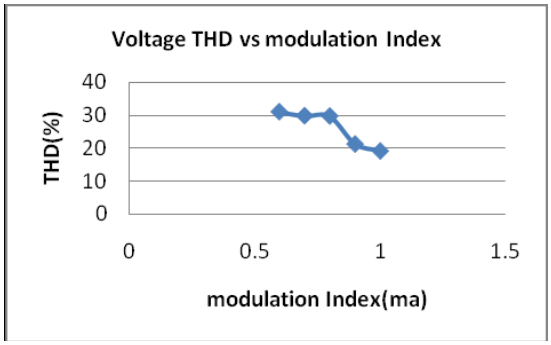

Fig.16.Voltage THD vs ma Graph for fixed frequency carrier based PWM

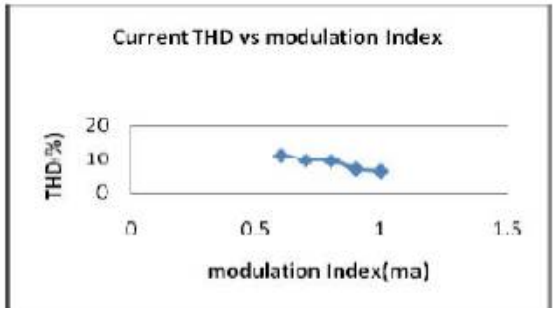

Fig.17.Current THD vs ma Graph for fixed frequency carrier based PWM

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VII. CONCLUSION

This paper examined about the reproduction of PV based seven-level topsy-turvy fell multilevel inverter with middle lift converter. The PV cluster yield control conveyed to the heap can be boosted utilizing P and O control calculation. The lift converter is permitted to work in constant mode and the exchanging grouping of multilevel inverter is chosen by a PWM generator which utilizes a PDPWM method. Add up to Harmonic Distortion examination was performed with various balance records for inverter yield voltage with open circle design. From the FFT investigation, it is watched that THD is less for the proposed PDPWM system and hence, awry multilevel inverter is an appropriate topology for photovoltaic applications.

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BIOGRAPHY

ANNA RANGANADH received his B.Tech in EEE at Krishnachaitanya Institute of Technology and Sciences in 2012. And P.G received in EEE at Prakasam Engineering College in 2014. He is currently working as a assistant professor in EEE dept at Gurunanak Institute of Technology, Hyderabad. He has total 3.5 years of teaching experience.