International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Modelling and Simulation of Two PV Arrays in Mismatched Environmental Conditions based Inverter with Grid Connection

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ABSTRACT

A Three phase grid connected transformer less photo voltaic (PV) inverter which can operate either in buck or in boost mode, and can extract maximum power simultaneously from two serially connected sub arrays while each of the subarray is facing different environmental conditions, is presented in this paper. As the inverter can operate in buck as well as in boost mode depending on the requirement. As a result power yield from each of the subarray increases when they are exposed to different environmental conditions. The topological configuration of the inverter and its control strategy are designed so that the high frequency components are not present in the common mode voltage thereby restricting the magnitude of the leakage current associated with the PV arrays within the specified limit.

Key words: PV Array, MPPT, Buck-Boost Converter, Three Phase Inverter

I. INTRODUCTION

THE significant worry of a photo voltaic (PV) system is to guarantee ideal execution of individual PV modules in a PV cluster while the modules are presented to various natural conditions emerging because of distinction in insolation level and additionally contrast in working temperature. The nearness of befuddle in working state of modules significantly lessens the power output from the PV cluster [1]. The issue with the confused natural conditions (MEC) moves toward becoming significant if the quantity of modules associated in arrangement in a PV cluster is enormous. So as to achieve wanted size for the info dc interface voltage of the inverter of a grid associated transformer less PV system, the necessity of arrangement associated modules turns out to be high. In this manner, the power output from a grid associated transformer less (GCT) PV system, for example, single stage GCT (SPGCT) inverter-based systems got from H-connect [2], [3] and nonpartisan point cinch (NPC) inverter based systems [4], [5] get influenced significantly during MEC.

II. PHOTO VOLTAIC ARRAY

For efficient inexhaustible electricity age PVA is applied to create power from daylight-primarily based mild. because the load request is expanding little by little the strength age additionally should be increased, however because of the conventional method for power age is inflicting an unnatural weather change, because of this the proficiency of the PVA need to be elevated through along with silicon surface the board and moreover, utilize the MPPT techniques to track maximum severe strength amid any light and air conditions. The outline of PVA is completed in MATLAB with Simulink.

Voltage of PVA totally is based upon solar-orientated illumination (S_x) and surrounding temperature (T_x). PVA (picture voltaic showcase) is a mix of association and parallel sun powered cells orchestrated in a cluster to produce the desired voltage and contemporary. each association mix of cells may be considered as photograph voltaic module. Increment in association cells expands the voltage and increment in parallel cells builds the cell limit. Detailing for voltage of each cell is given below

$$V_c = \frac{AkT_c}{e}\ ln\left(\frac{I_{ph}+I_o-I_c}{I_o}\right) - R_s I_c \qquad (1)$$

Where, k = Boltzmann constant (1.38×10^{-23} J/K).

I_c = cell output current, Amp.

I_{ph} = photocurrent

I_o = reverse saturation current of diode

R_s= series resistance of cell

T_c= reference cell operating temperature

V_c= cell voltage, V.

The DC-DC converter utilized as a part of the MPPT can be either a Cuk converter or a buck boost converter. The voltage yield of the PVA both need to be accelerated or faded as for the produced power of the PVA. The converter makes the voltage steadily with the adjustment inside the temperature or the light. The control structure can provide an obligation cycle esteem which is contrasted with the triangular waveform and heartbeat is produced fed to the transfer gave. The responsibility cycle is created by way of utilising the underneath calculation.

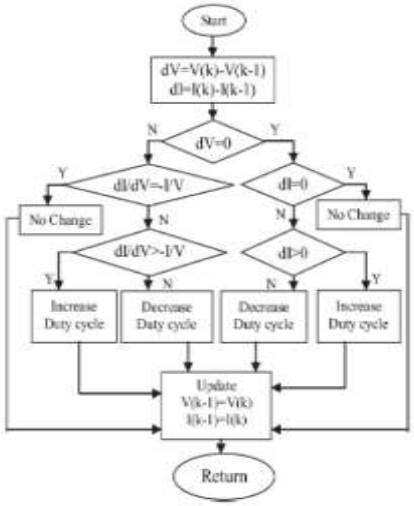

Fig. 1: MPPT algorithm

The control technique used to govern the VSI (Voltage source Inverter) utilizes IRP (immediately reactive power) hypothesis. This control method figures the specified responsive energy that must be infused to repay the need of the load. It takes a criticism of the load cutting-edge and furthermore supply voltage to persuade the DG to synchronize to the matrix. by growing the reference of the modern the system produces six heartbeats for six switches utilizing PWM (Pulse width regulation) strategy.

The PVA likewise makes use of a MPPT calculation to govern the yield of the PVA. The MPPT (maximum strength factor monitoring) makes use of Incremental conductance approach to create regular strength from the PVA even with the alternate in sun-based totally illuminations levels.

On the off chance that PV sun powered boards are constructed from individual photovoltaic cells related together, at that point the sun Photovoltaic Array, moreover stated just as a solar Array is a machine made up of a meeting of sun-based boards related together. A photovoltaic show off is on this way numerous solar-orientated boards electrically stressed together to frame a considerably bigger PV establishment (PV system) called a cluster, and all in all the bigger the mixture surface territory of the exhibit, the extra solar-oriented strength it's going to create. The framework interconnected PVA using MPPT is regarded within the fig. 1.1 underneath.

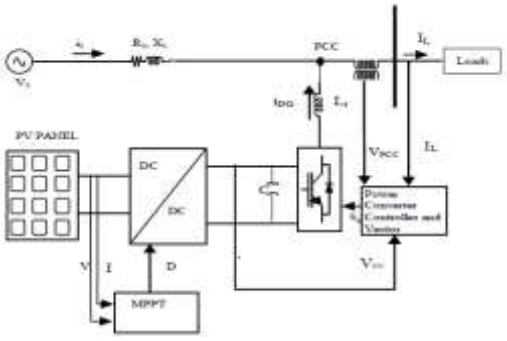

Fig. 2. System configuration with PVA

An entire photovoltaic machine utilizes a photovoltaic cluster as the number one hotspot for the era of the electric strength deliver.

The measure of sun powered power brought by means of a solitary photovoltaic board or module is not enough for trendy make use of most fabricates create trendy PV boards with a yield voltage of 12V or 24V. by means of associating numerous single PV forums in arrangement (for a better voltage necessity) and in parallel (for a better contemporary prerequisite) the PV cluster will supply the coveted electricity yield.

Photovoltaic cells and boards alternate over the sun powered power into coordinate modern (DC) power. The association of the sun-oriented boards in a solitary photovoltaic showcase is identical as that of the PV cells in a solitary board. The boards in an exhibit may be electrically related collectively in both an arrangement, a parallel, or a blend of the 2, but for the maximum element an arrangement affiliation is given an elevated yield voltage. as an

example, whilst solar-based totally forums are stressed out collectively in arrangement, their voltage is doubled even as the present day maintains as earlier than.

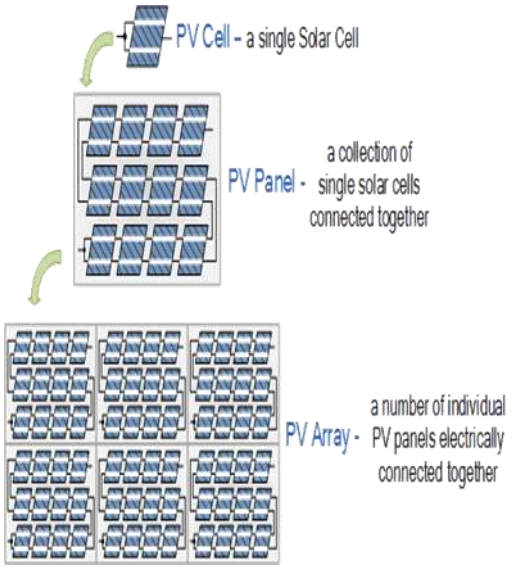

Fig.3. A Photovoltaic sun Array

The span of a photovoltaic show off can incorporate of multiple character PV modules or boards associated collectively in a city area and set up on a housetop, or can also comprise of a big number of PV forums interconnected collectively in a field to deliver power for an entire town or community. The adaptability of the secluded photovoltaic showcase (PV gadget) permits architects to make sun-orientated energy systems that could meet a extensive assortment of electrical wishes, irrespective of how extensive or small.

It's far important to take note of that photovoltaic forums or modules from various makers ought now not be blended in a solitary showcase, regardless of whether their power, voltage or present-day yields are ostensibly comparable. this is on account of contrasts in the I-V trademark bends of the boards and also their ghostly reaction is probably going to motive extra befuddle misfortunes within the cluster lessening its effectiveness

III. SIMULATION RESULT AND DISCUSSION

the proposed inverter a PV array consisting of two PV subarrays while each of the subarray having four series connected modules considered. The MPPT parameters of each are as follows: Vpv1 = Vpv2 = 107 V, Ipv1 = Ipv2 = 10 A and Ppv1 = Ppv2 = 1070 W. The parameters which are used to simulate the proposed inverter are indicated in Table I. MatlabSimulink platform is utilized to simulate the performance of the proposed inverter.

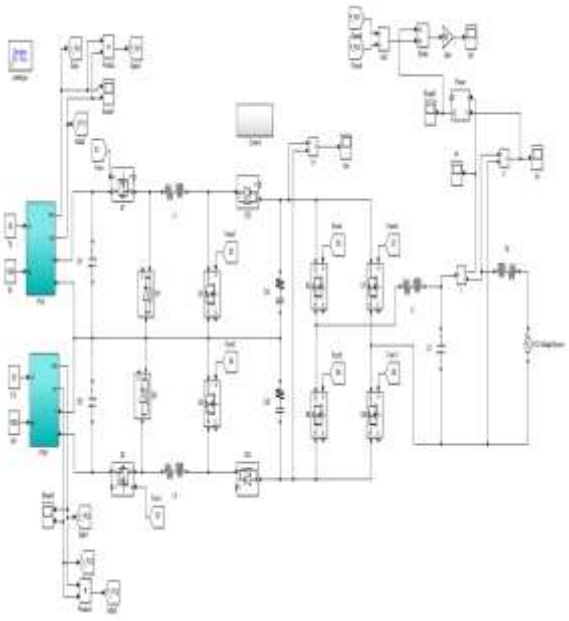

Fig. 4 Buck Boost converter with Single Phase Grid Inter-connection

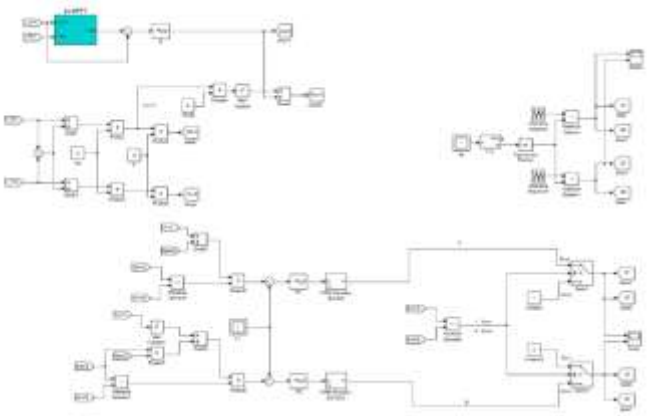

Fig. 5 Control structure of buck boost converter and single-phase inverter

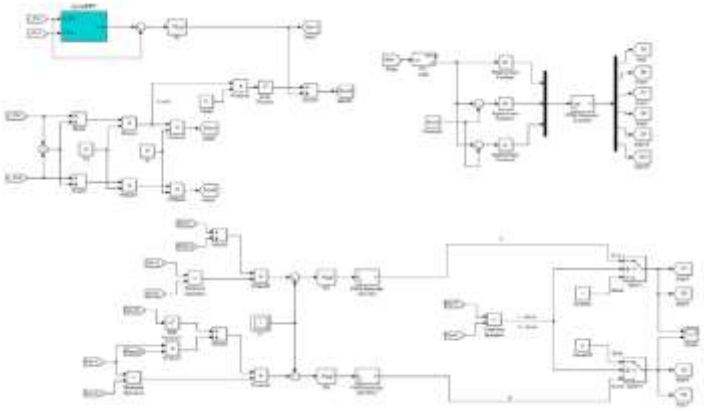

Fig.5 Control structure of buck boost converter and three phase inverter

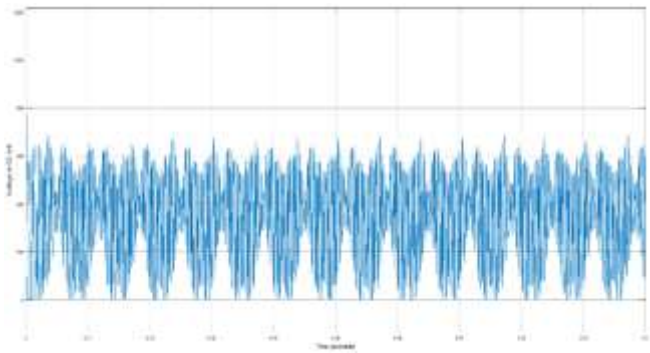

Fig.6 DC voltage output of buck boost converter

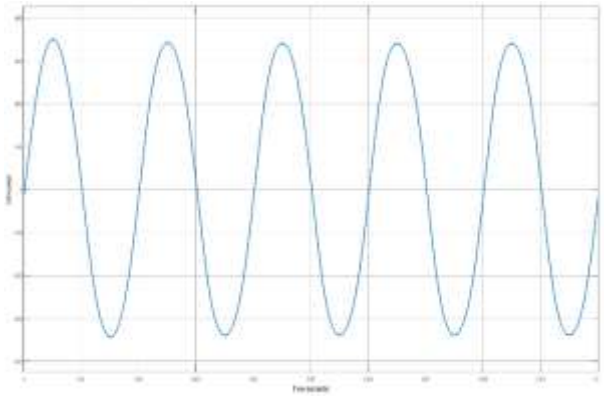

Fig.7 Single phase inverter output of Buck boost converter

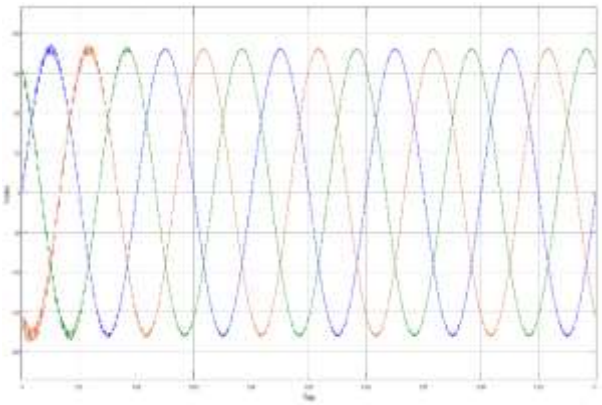

Fig.8 Thee phase inverter output of buck boost converter

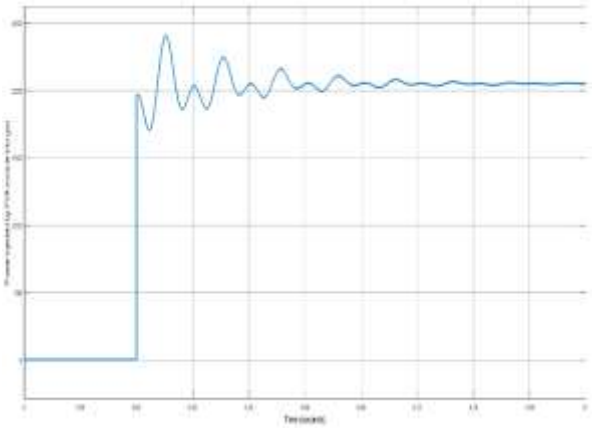

Fig.3.8 Power injection from PVA to grid of single-phase inverter

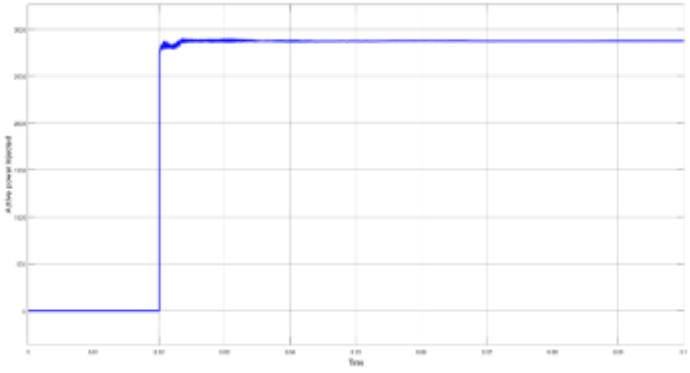

Fig. 9 Active power injected from PVA to grid of three phase inverter

CONCLUSION

A three -phase grid connected transformer less buck and boost-based PV inverter which can operate two sub arrays at their respective MPPT was proposed in my thesis. Here two pv sub array are two different located so that output power will be maintain.

in the power injection from three phase inverter is more stable compared to single phase inverter and also the power injected is more for three phase inverters. Single phase power is 2kW and three phase inverter power is 2.8kW

References:

[1]. T. Shimizu, O. Hashimoto, and G. Kimura, “A novel high-performance utility-interactive photovoltaic inverter system,” IEEE Trans. Power Electron., vol. 18, no. 2, pp. 704-711, Mar. 2003.

[2]. S. V. Araujo, P. Zacharias, and R. Mallwitz, “Highly efficient single-phase transformerless inverters for grid-connected photovoltaic systems,”

IEEE Trans. Ind. Electron., vol. 57, no. 9, pp. 3118-3128, Sep. 2010.

[3]. B. Ji, J. Wang, and J. Zhao, "High-efficiency single-phase transformerless PV H6 inverter with hybrid modulation method," IEEE Trans. Ind. Electron., vol. 60, no. 5, pp. 2104-2115, May 2013.

[4]. R. Gonzalez, E. Gubia, J. Lopez, and L. Marroyo, "Transformerless single phase multilevel-based photovoltaic inverter," IEEE Trans. Ind. Electron., vol. 55, no. 7, pp. 2694-2702, Jul. 2008.

[5]. H. Xiao and S. Xie, "Transformer less split-inductor neutral point clamped three-level PV grid-connected inverter," IEEE Trans. Power Electron., vol. 27, no. 4, pp. 1799-1808, Apr. 2012.

[6]. A. Bidram, A. Davoudi, and R. S. Balog, "Control and circuit techniques to mitigate partial shading effects in photo voltaic arrays," IEEE J. Photovolt., vol. 2, no. 4, pp. 532-546, Oct. 2012.

[7]. N. D. Kaushika, and N. K. Gautam, "Energy yield simulations of interconnected solar PV arrays," IEEE Trans. Energy Convers., vol. 18, no. 1, pp. 127-134, Mar. 2003.

[8]. H. Patel, and V. Agarwal, "Maximum power point tracking scheme for PV systems operating under partially shaded conditions," IEEE Trans. Ind. Electron., vol. 55, no. 4, pp. 1689-1698, Apr. 2008.

[9]. D. Nguyen, and B. Lehman, "An adaptive solar photovoltaic array using model-based reconfiguration algorithm," IEEE Trans. Ind. Electron., vol. 55, no. 7, pp. 2644-2654, Jul. 2008.

[10]. G. V.-Quesada, F. G.-Gispert, R. P.-Lopez, M. R.-Lumbreras, and A. C.-Roca, "Electrical PV array reconfiguration strategy for energy extraction improvement in grid-connected PV systems," IEEE Trans. Ind. Electron., vol. 56, no. 11, pp. 4319-4331, Nov. 2009.

[11]. L. F. L. Villa, T.-P. Ho, J.-C. Crebier, and B. Raison, "A power electronics equalizer application for partially shaded photovoltaic modules," IEEE Trans. Ind. Electron., vol. 60, no. 3, pp. 1179-1190, Mar. 2013.

[12]. P. Sharma, and V. Agarwal, "Maximum power extraction from a partially shaded PV array using shunt-series compensation," IEEE J. Photovolt., vol. 4, no. 4, pp. 1128-1137, Jul. 2014.