

PV SYSTEM UNDER PARTIAL SHADING CONDITION TO IMPROVE THE GENERATING POWER BY USING SINGLE SENSOR BASED MPPT

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Abstract—Power processing converters and voltage equalizers have been proposed and used for photovoltaic (PV) string comprising multiple modules/substrings connected in series in order to preclude negative influences of partial shading in differential method. The single-switch voltage equalizer using multi-stacked special converters can significantly reduce the necessary switch count compared to that of conventional topologies, achieving simplified circuitry. However, multiple current sensors are necessary for this single-switch equalizer to effectively perform equalization. In this paper, a current sensorless equalization technique (ΔV -controlled equalization) is presented. The equalization strategy using the ΔV -controlled equalization is explained and discussed on the basis of comparison with current-controlled equalization strategies for improved the output power. Experimental equalization tests emulating partial-shading conditions were performed using the single- sensor based mppt and its equalizer employing the ΔV -controlled equalization. Negative impacts of partial-shading were successfully precluded, demonstrating the efficacy of the proposed special converters is used.

Keywords— Photovoltaic Modules; Special Converters; Sensors; and So on

1. INTRODUCTION

Photovoltaic (PV) systems are usually composed of series-parallel arrangements of PV modules, each module consisting of a string of series-connected PV cells, as shown in Fig. 1(a). It is well known that mismatches due to manufacturing tolerances, partial shading, dirt, thermal gradients, or aging result in losses in energy captured by a PV system. The mismatches have disproportional effects on the overall available power due to the reduction in current through the series-connected cells. Typically, bypass diodes are connected in parallel with groups (substrings) of cells, as shown in, to prevent cell failures due to hot spots induced by power losses on reverse-biased cells operating in breakdown. However, the efficiency losses with the bypass diodes are still significant, as reported in. Furthermore, mismatched PV modules or systems exhibit nonconvex output power versus output voltage characteristics with multiple maxima that hinder operation of maximum power point (MPPT) tracking algorithms and result in the need to operate PV system power electronics over a wider range of MPPT voltages

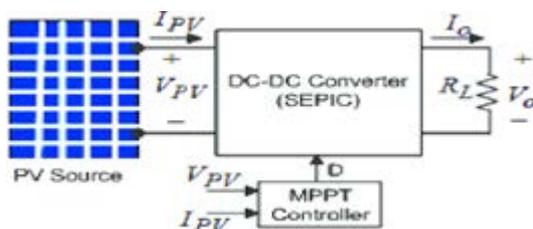


Fig 1 pv system with mppt

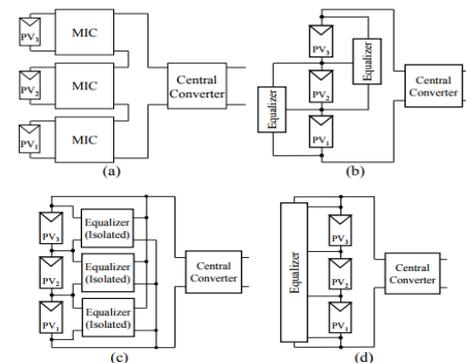


Fig. 2. PV system architectures using (a) module-integrated converters, (b) adjacent module-to-module equalizers, (c) isolated equalizer, and (d) string-to-module equalizer.

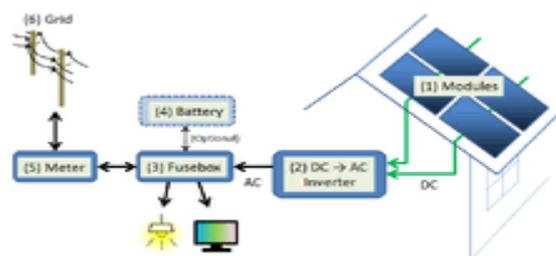
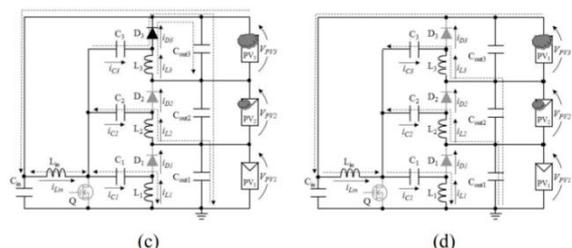
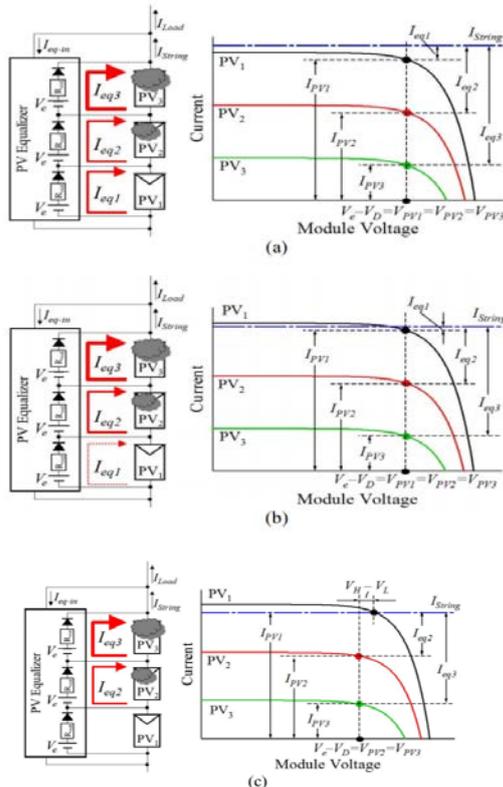
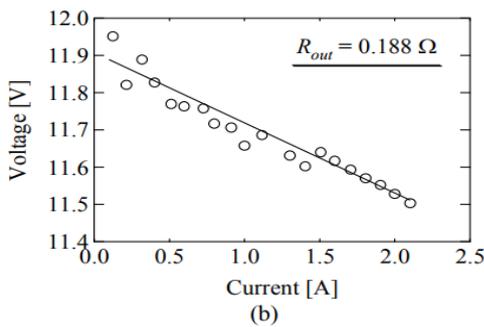
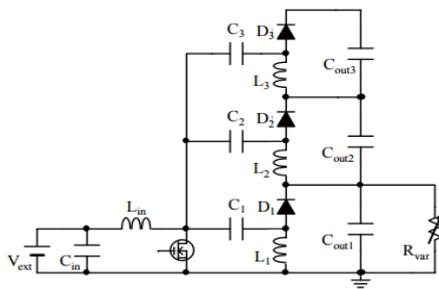
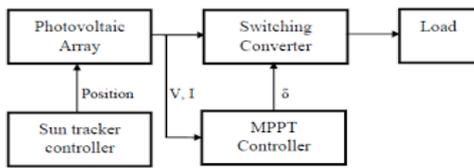


Fig 3 pv to load sector

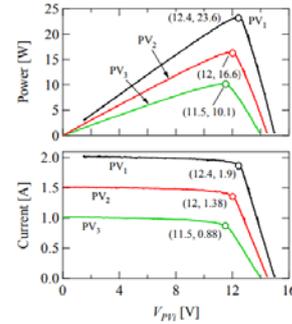




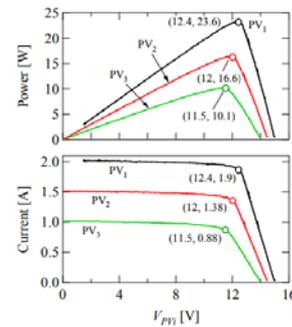
Equalization scenarios: (a) Over-equalization, (b) current-controlled equalization, and (c) current sensorless ΔV -controlled equalization.



(a) Experimental setup for output characteristic measurement and (b) measured output characteristic.



Individual module characteristics used for the first partial shading case.



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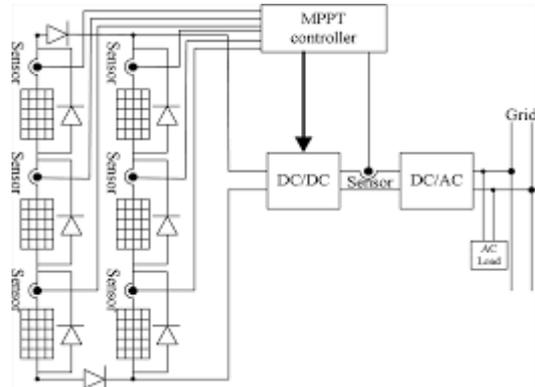


Fig 4 single sensor based mppt controller

2. LITERATURE REVIEW

The global maximum power point algorithm consists of a perturb and observe maximum power point tracker, global maximum power point tracking and duty cycle calculation for a DC/DC boost converter, and has been implemented in a single programming module of the microcontroller. The algorithm robustness has been tested under several partial shading conditions through simulation studies. An experimental model has been used to verify the proposed global maximum power point technique.

This paper presents an Artificial Neural Network (ANN) based multi stage voltage equalizer to the improvement of control performance in PV system to eliminate partial shading issues. In this paper single sensor base mppt used to power generation improvements in modern PV system using special converters problems then get the maximum energy from panels. Compare to conventional equalizer, these type of single switch topology has minimum size circuits and extract maximum power also. The proposed

voltage equalizer can be found by stacking capacitor-inductor-diode (CLD) filter on SEPIC converter. Here, Neural Network is simulated using MATLAB with ADALINE network is developed. In this paper an ANN based control circuit is developed to give equal power in all panels.

A hardware prototype with three PV panel is implemented. the equalization efficiency is higher than 98% equalization compared with the conventional analog control algorithm. Here, an ANN based multi stack voltage equalizer is simulated using MATLAB/SIMULINK software and verified with hardware results.

3. EQUALIZATION STRATEGY

In order to effectively preclude the negative impacts caused by partial shading, the equalizer needs to be properly controlled with minimizing power conversion loss in the equalizer. Although voltage equalization does not guarantee that all the modules operate at each MPP, the loss in energy yield is reportedly satisfactory small and less than 2% below the ideal individual MPPT. Hence, equalization strategy discussed in this section is aimed for voltage equalization. The proposed single-switch equalizer is basically a single-input multi-output power source with one control freedom (i.e., duty cycle). In order to equalize (or supply equalization currents to) multiple PV modules with single one control freedom, the equalizer should be operated with a proper equalization strategy

4. CONCLUSIONS

The single sensor based mppt single-switch equalizer presented in this paper can reduce the switch count compared to conventional topologies, achieving simplified circuitry. However, with a previously-employed current-controlled equalization strategy, the number of current sensors necessary is proportional to the module count, likely resulting in increased cost and complexity of a feedback circuit. ΔV -controlled equalization were compared and discussed. The ΔV -controlled equalization was concluded to be a preferable output power, because of the lack of current sensors while achieving a reasonable equalization performance. Experimental equalization tests emulating partial shading conditions were performed using the single-switch equalizer employing the proposed ΔV -controlled equalization. With the support of the equalizer, single sensor based mppt are used successfully eliminated and the extractable maximum power was significantly improved. All the module voltages were nearly unified, demonstrating the efficacy of the proposed current Sensorless ΔV -controlled equalization.

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