Simulation of Interleaved Flyback Converter with Incremental Conductance MPPT for Solar PV Array using MATLAB/SIMULINK

Jebitha J, R G Nirmala

Abstract: The simulation of an interleaved flyback converter with solar system as input source is discussed in this paper. The interleaved flyback converter topology is adopted to prevent the generation of excess heat in devices, to avoid large voltage ripple in the load and also to minimise the size of the filtering elements. The control of the converter circuit is performed using Maximum Power Point Tracking (MPPT) controllers to get maximum power from the solar panel. In Maximum Power Point Tracking we used incremental conductance algorithm. This method is widely implemented because it has the higher steady-state accuracy and environmental adaptability. Simulation was performed with different duty cycle to study the output voltage variations thus the results obtained can be analysed. The design has been tested through simulation in MATLAB/SIMULINK model.

Keywords: Incremental Conductance (InC) algorithm, Maximum Power Point Tracking (MPPT).

I. INTRODUCTION

Nowadays Solar Energy have caught the attention of many as One of the most important sources of renewable energy and it is through harnessing this energy that we are meeting some of our energy demands. We know that recently non-renewable resources are on the verge of termination. On the other hand, renewable energy sources i.e., the solar energy is plentiful and it is available compared to other energy sources.

Solar energy is emissions free, clean since it does not produce pollutants or by-products harmful to environment therefore nowadays it took major part of research, where new and more efficient method for harnessing solar energy is a great challenge. It must have high input current, low input voltage and limited input current ripple.

On the other hand the cost of solar cells manufacturing is very high and about 20-25% is their efficiency.

Therefore we want to use the maximum potential of solar panel that is; Maximum Power Point (MPP)should be there in the operation of the system. Usually due to the changes in the weather and illumination on the solar cells MPP varies for each instant Due to this the output power of solar cells decreases.

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Thus, to get required output power it is needed that the MPP is tracked. For this we use a MPPT converter which is used to track MPP at any instant.

The Incremental Conductance MPPT algorithm gets the maximum power point quicker than the Perturb and Observe algorithm and has improved efficiency as well as accuracy. In this paper, interleaved flyback converter with incremental conductance MPPT for solar PV array is discussed.

The simulation of proposed system has been done in MATLAB R2018a.

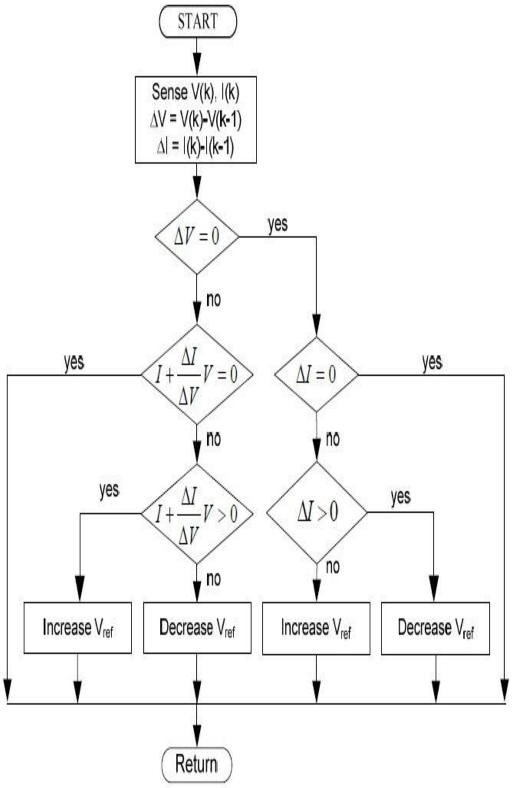

Fig. 1 incremental Conductance Method

II. INTERLEAVED FLYBACK CONVERTER

The flyback converter is connected parallel as interleaved manner in order to boost up the output power and also minimise the ripple in the input current.

Two converter are connected parallel to achieve the required output power and to achieve the reduction of the input current ripple the two converters are operated with the phase shift of 180 degree.

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The proposed circuit consist of two power electronics switches, two coupled inductors, two diodes and the capacitor. The two switches are operated with the phase shift of 180 degree. The value of the load resistor R is 210Ω.

The proposed converter with the PV array is modelled in MATLAB R2018a.

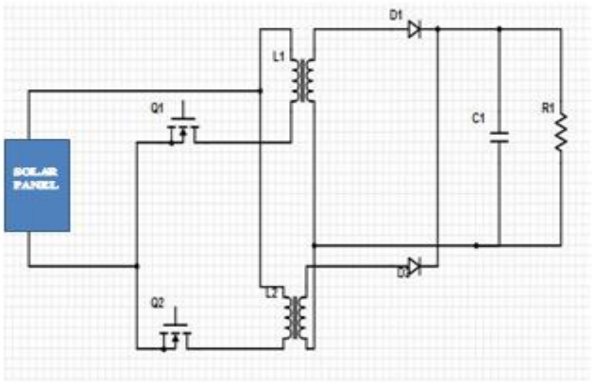

Fig. 2 Interleaved Flyback Converter

The PV module voltage, current is get by the MPPT algorithm block and modify the reference signal accordingly.

III. SIMULATION AND EXPERIMENTAL VERIFICATION

Simulation is done with MATLAB 2018a, in the simulation diagram the dc link capacitor is added in between the PV array and the proposed converter.

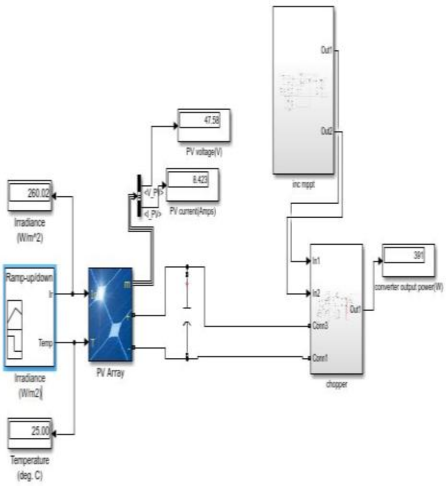

Fig. 3 Simulation Diagram of the Proposed System

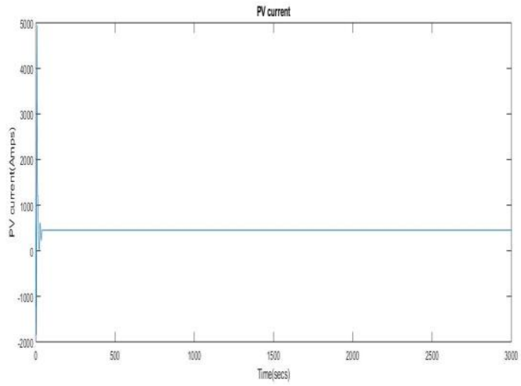

Fig. 4 PV Current Waveform

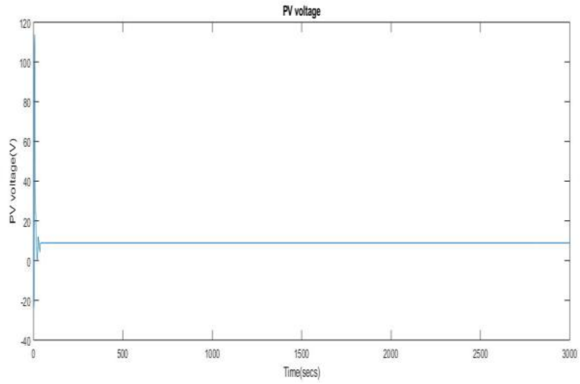

Fig. 5 PV Voltage Waveform

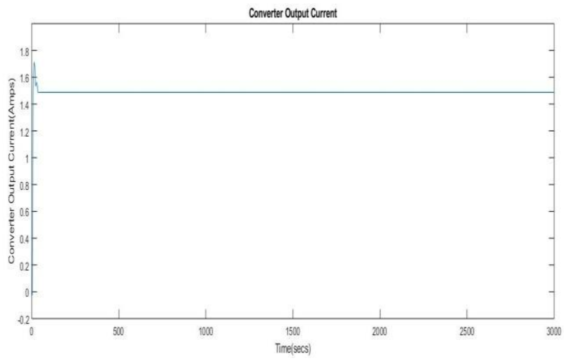

Fig. 6 converter Output Current Waveform

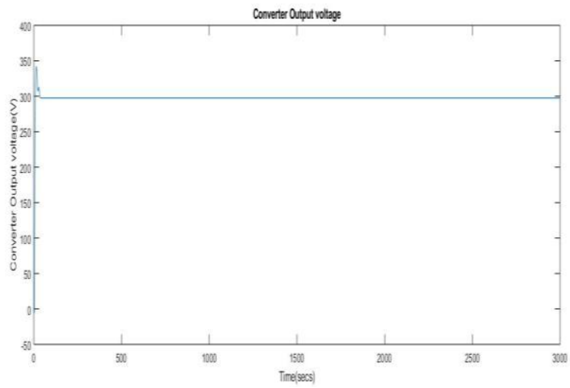

Fig. 7 Converter Output Voltage Waveform

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Table.1 Efficiency of the Proposed System at Different Test Condition

CASE	TEST CONDITION	PV OUTPUT POWER	CONVERTER OUTPUT POWER	EFFICIENCY
1	Irradiance=251.68 W/m2 Temperature= 25°C	398.9 Watts	389.3 Watts	97.59%
2	Irradiance=491.14 W/m2 Temperature= 40°C	395.8 Watts	378.7 Watts	95.6%
3	Irradiance=960.09 W/m2 Temperature= 40°C	422.9 Watts	403.3 Watts	95.5%
4	Irradiance=960.09 W/m2 Temperature= 27°C	454 Watts	433.6 Watts	95.5%
5	Irradiance=260.02 W/m2 Temperature= 25°C	400.8 Watts	391 Watts	97.75%

IV. CONCLUSION

Simulation of interleaved flyback converter with incremental conductance MPPT for solar PV array using matlab/simulink is discussed in this paper. Thesimulation of the paradigm is done and the outputs are analysed. The analysed report gives the efficiency of the proposed system is 95-97% and also the ripple in the input current and the ripple in the output voltage as too less.

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