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A Dual Output DC - DC Boost Converter using MPPT Control

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ABSTRACT: Nowadays the PV system act as the major source of in the distributed generating system. Since a single PV panel gives a single cell voltage at the output. It is not sufficient to drive any high voltage loads. So a boost converter is cascaded with the panel. Traditional boost converter cannot be used here because it can't give high voltage gain at the output without moving in to extreme duty cycle. The extreme duty cycle operation leads to serious reverse recovery problem in power devices. So without moving extreme duty cycle to get high voltage gain here proposed a single input multiple output high step up gain dc dc converter with MPPT control. The proposed converter has capability to give two levels of high voltages at the output side. The MPPT control has the advantage as follows. They are simplicity to implement, it also extracts the maximum power from the panel, It also improve the efficiencies of the panels.

KEYWORDS:PV, MPPT, Single input High Voltage Dual Output dc dc converter.

I.INTRODUCTION

Day today life energy demand increases beyond our expectation. This will leads to over exploitation of non renewable energy. Hence as an alternative of this renewable energy recourse come in to the picture. Among the renewable energy resources solar energy is the ambient one. The PV panel provides only low voltage and it is not sufficient to drive any load at the output is the one major limitation. To overcome this problem a boost converter is cascaded with the PV panel. Traditional boost converter is not used here because of this converter is not capable to boost it in to the high voltage without moving in to extreme duty cycles. The extreme duty cycle operation of the converter leads very serious reverse recovery problem in the power electronic switches. So here a high step up gain single input dual output dc dc boost converter is used. Here proposed a high step up gain dc dc boost converter with MPPT control is proposed here. It has the additional advantage like simplicity of implementation and it also extracts maximum power from the solar radiation regardless of the solar radiation variation.

II.A HIGH STEP UP SINGLE INPUT DUAL OUTPUT DC DC BOOST CONVERTER

The high step up single input dc-dc boost converter as shown in fig 1.This converter mainly consist of three active switches S_1,S_2,S_3,three diodes namely D_1,D_2,D_3,two inductors L_1,L_2 and two capacitors C_1 and C_2 at the output. This converter is able to perform well and able to produce two high voltage levels at the high voltage output terminal 1 and moderately low voltage at the output terminal 2.This converter has two operating modes. They are as follows

[1] Mode 1(whenS_1,S_2,$S_3$are turned ON)

[2] Mode 2(when S_1,S_2,$S_3$are turned OFF)

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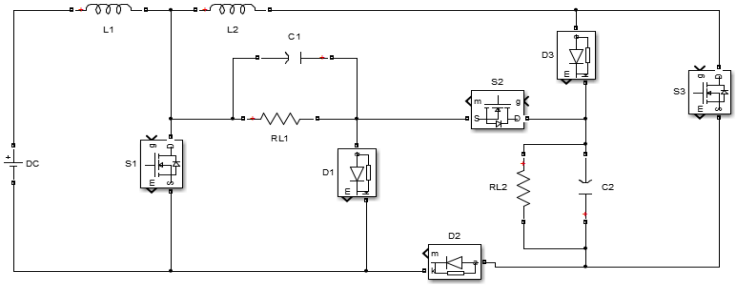

Fig.1 Circuit Diagram of Single Input Dual Output High Step up DC DC Boost Converter

III.MODE 1OPERATION

In this mode of operation all the controlled switches are turned ON , which cause the diode D_1,D_2,D_3 are reversed biased. As a result of this capacitor C_1,C_2 along with the input voltage V_{inp} are Energised the inductor and supply power to the load.The fig.2 shows below the circuit diagram of mode 1 operation.

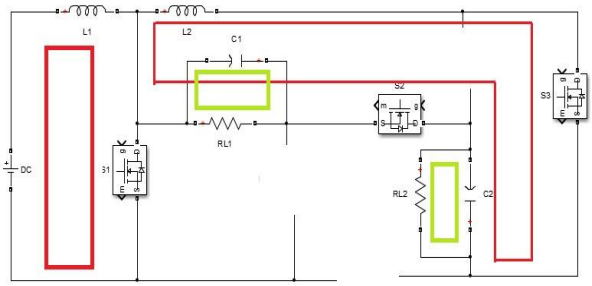

Fig.2 Circuit Diagram of Mode 1 Operation

Apply Kirchhoff's' voltage law across the inductors L_1 and L_2 at mode 1 operation we get as follows
Apply Kirchhoff's' voltage law across the inductors L_1 and L_2 at mode 1 operation we get as follows

$$V_{0L1} = V_{inp} \qquad (1)$$

$$V_{0L1} = V_{C1} + V_{C2} \qquad (2)$$

Apply Volt-Sec balanced equation we get

$$(V_{inp} - V_{c1})(1-\alpha)T_{sw} + V_{inp}\,\alpha T_{sw} = 0 \qquad (3)$$

$$V_{c1} = \frac{V_{inp}}{(1-\alpha)} \qquad (4)$$

IV. MODE 2 OPERATION

In this mode of operation the all controlled switches are turned OFF, which causes the diodes D_1,D_2,D_3 are forward baised. As aresult of this the capacitor C_1,C_2 along with the input voltage V_{inp} energised the inductor and supply power to the load. The fig.3 shws the circuit diagram of mode 2 operation.

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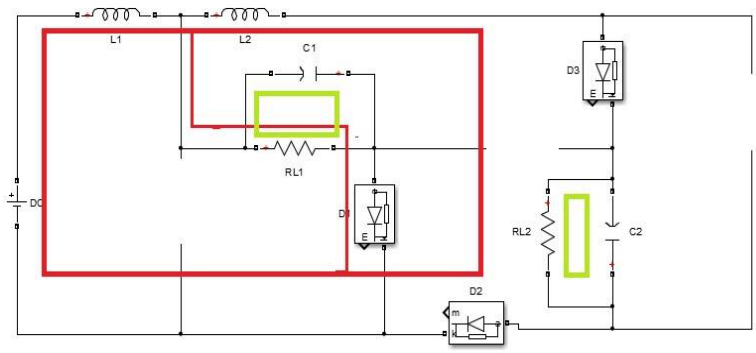

Fig.3 Circuit Diagram of Mode 2 Operation

V. PROPOSED SYSTEM

The proposed system consist a high step up single input dual output dc dc converter with MPPT control as shown below in the circuit diagram as shown in the fig.4 below.

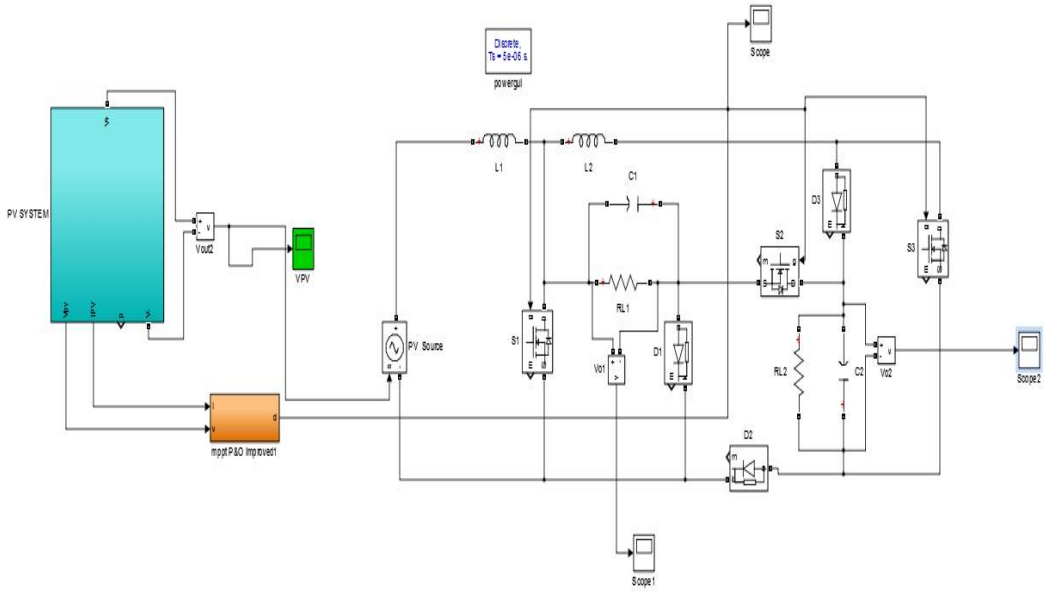

Fig.4 Simulation diagram of a high step up single input dual output dc dc converter with MPPT control

VI.MPPT P&O

The most commonly used MPPT algorithm is P&O method.This algorithm uses simple feedback arrangement and little measured parameters.In this approach, the module voltage is periodically given a perturbation and the corresponding output power is compared with that at the previous perturbing cycle.In this algorithm a slight perturbation is introduce to the system. This perturbation causes the power of the solar module various.If the power increases due to the perturbation then the perturbation is continued in the same direction. When the stable condition is arrived the algorithm oscillates around the peak power point.In order to maintain the power variation small the perturbation size is remain very small.The technique is advanced in such a style that it sets a reference voltage of the module corresponding to the

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peak voltage of the module.A PI controller then acts to transfer the operating point of the module to that particular voltage level.

VII.RESULT AND DISCUSSION

The simulation result of high step up single input dual output dc dc converter without MPPT as shown below. The fig 5 and fig 6 shows the voltage waveform at the high voltage side and low voltage side respectively. From the above both configurations it is observed that from the operation of the converter we can get higher voltage at the high voltage output of the converter when MPPT control is applied.

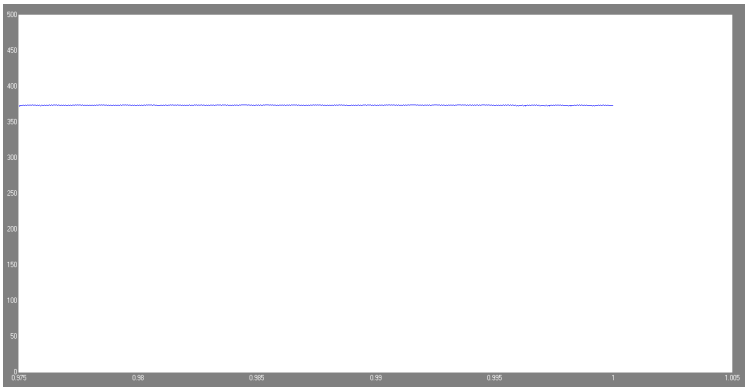

Fig.5 voltage waveform at the high voltage side of high step up single input dual output dc dc boost converter without MPPT

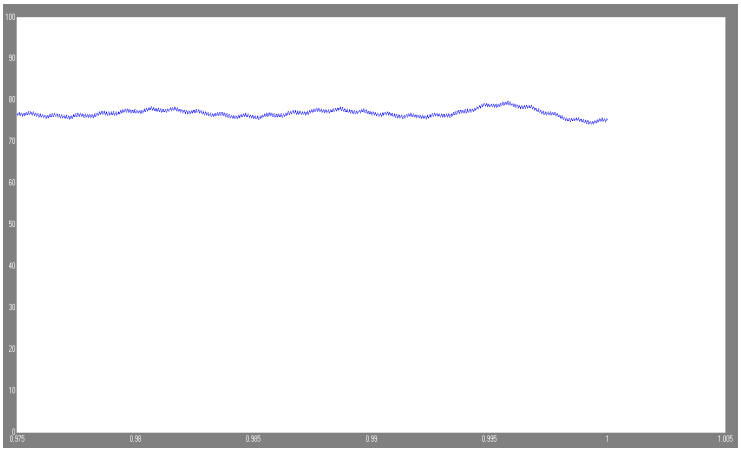

Fig.6 voltage waveform at the low voltage side of high step up single input dual output dc dc boost converter without MPPT

The simulation result of high step up single input dual output dc dc converter with MPPT as shown below. The fig 7 and fig 8 shows the voltage waveform at the high voltage side and low voltage side respectively.

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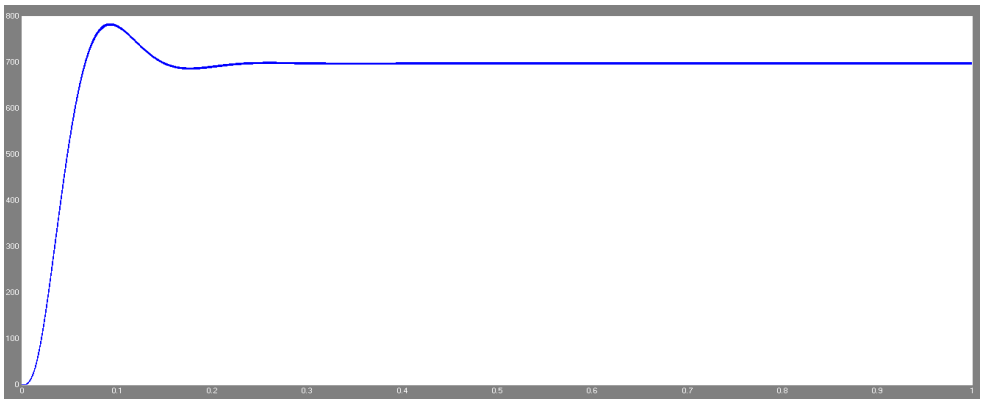

Fig.7 voltage waveform at the high voltage side of high step up single input dual output dc dc boost converter with MPPT

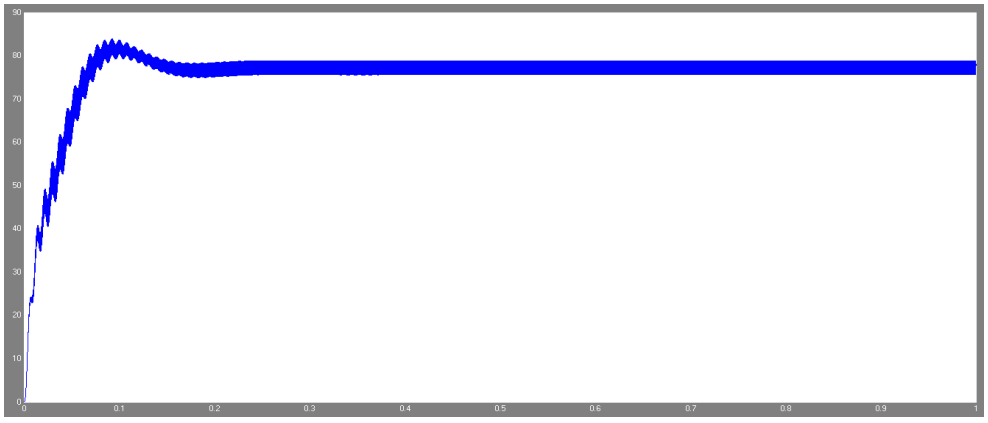

Fig.8 voltage waveform at the low voltage side of high step up single input dualoutput dc dc boost converter with MPPT

VIII.CONCLUSION

It is observed that from the modified system we can improve the output gain if we employ MPPT algorithm to the existing converter. From the simulation we can understood that we can improve the high voltage output from the 380 to 700 volt at the converter. Here also employed MPPT P&O method which is a very good method to extract maximum power from the PV panel. Easy implementation, and simplicity and good efficiency are the advantages of the converter.This algorithm uses simple feedback arrangement and little measured parameters.In this approach, the module voltage is periodically given a perturbation and the corresponding output power is compared with that at the previous perturbing cycle.

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