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Various Methods of Step-Up Converter for Photovoltaic System

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ABSTRACT

The paper deals with the various methods of step up converter which can be use to increase output and performance of photovoltaic system. The non renewable energy sources like natural gas, oil, coal, fossil fuel are present in limited amount and they have certain limitations, due to this the importance of renewable energy sources like tidal, solar, wind, etc increases . Out of these renewable energy sources, photovoltaic system plays vital role in the generation of energy. But the energy output of this system is low. Hence this paper deals with the various methods of step up converter which are use to increases the output of photovoltaic system.
Keyword: - Photovoltaic system, Step up converter, Hysteresis current control technique

1. INTRODUCTION

The values of sources of renewable energy growing rapidly because they are found in limitless amount and also they does not produce any harmful effect on the environment. They are the clean source of energy. These are the two main advantages of renewable energy sources over the non renewable energy sources. Hence the whole world is now concentrating on the maximum use of this renewable energy sources. The various renewable energy sources are sun, wind, tidal energy etc. Out of this renewable energy source solar energy has the great importance as the sun is giant source of energy. So the photovoltaic system plays an important role in the renewable energy source generation. But this system has main disadvantages that the output of this system is very low. So we need to improve the output of the system for the better results.

To increases the output of the system, various types of step up converter are used. The details of the various types and control methods of step up converter converters, also their merits and demerits for the photovoltaic system is discussed in this paper.

2. BLOCK DIAGRAM:

The photovoltaic system has four main parts namely consist solar module, high step up dc-dc converter, inverter and the load. The solar module has very low voltage output. As solar module is connected to step up converter, the output of solar module is acts as input to high step up converter. This step up converter increases the output voltage. The high valued output voltage is then given to the inverter to convert it into alternating voltage. This alternating voltage is then given to the load for the use.

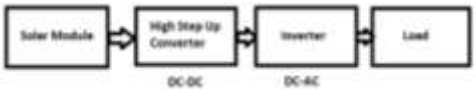

Fig.2.Block Diagram for the photovoltaic system

3. VARIOUS TYPES OF BOOST CONVERTER SYSTEM:

The dc-dc converters are of various types like buck converter, boost converter ,buck-boost converter, boost flyback converter, cuk converter. The input is same for all the dc-dc converters i.e. dc input. But they differs in outputs as some converters increases dc ouput voltage and some decreases dc output voltage.

3.1 Conventional Boost Converter System:

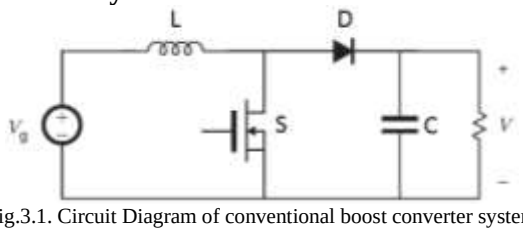

Fig.3.1. Circuit Diagram of conventional boost converter system

Boost converter is a DC to DC power converter for which output voltage is larger than input voltage. It consists of at least two semiconductors elements i.e. diode and transistor. Also it consist of at least one element for storing of energy like capacitor, inductor or the combination of both capacitor and inductor. Generally, the switch can be MOSFET, IGBT or BJT. Power can be supplied to a boost converter by using suitable DC source such as solar panel, batteries , DC generators or rectifiers. Sometimes a boost converter can also be called as Step-up converter as it increases or steps up the output voltage.

3.2 High Step Up Converter With Voltage Multiplier Module:

The converter combines the advantage of both boost converter and fly back converter. The system contains the voltage multiplier module which consist of two inductors which are coupled and the boost converter. The inductors which are coupled have primary windings and secondary winding. Primary windings contains Np turns and they are used for decreasing the ripple in input current. Secondary winding contains Ns turns and they are used to increase gain in the voltage. Also, '.' and '*' is used for referencing the coupling of coupled inductors. The turns ratio are same in coupled inductors. As shown in fig.3 , S1,S2 are the switches, Lk1 ,Lk2 indicates leakage inductors, Lm1,Lm2 denotes magnetize inductors, Cb indicates the capacitor for lifting the voltage and Ns/Np is ratio of turns which is indicated by n. The operation of the converter is performed by using both methods.

The operation is performed in six modes. These modes are as follows,
Mode I (t0-t1): Here both switches S1,S2 are in ON, So diodes are in reverse bias. Hence due to this ,the magnetize Lm1,Lm2 and leakage inductors Lk1,Lk2 now charged by Vin.

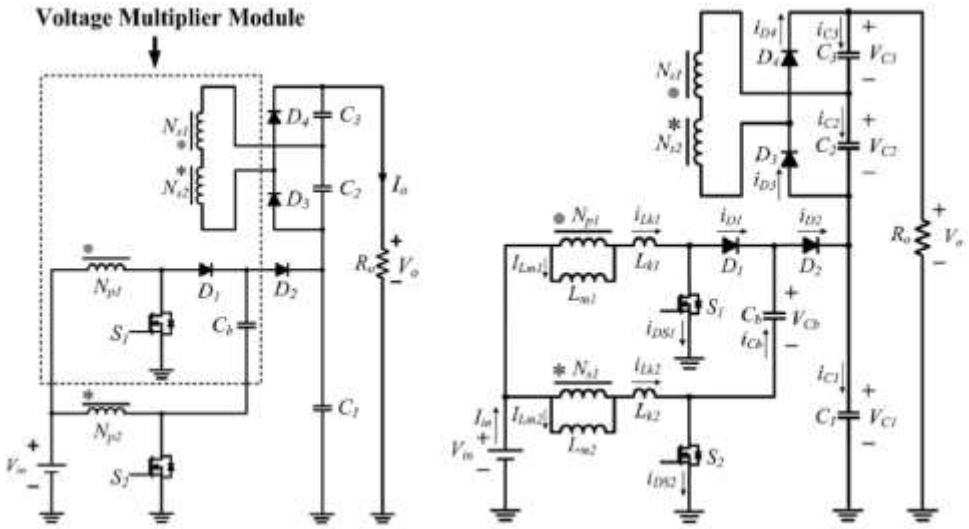

Fig.3.2.Circuit Diagram of Converter With Voltage Multiplier Module

Mode II(t1-t2): Here switch S2 is OFF, So diodes D2 ,D4 are in ON state .are in reverse bias. Hence due to this ,the magnetize Lm1,Lm2 and leakage inductors Lk1,Lk2 now charged by Vin.
Here switch S2 OFF state and due to this, both the diodes i.e.D2 ,D4 gets turned into ON state. Due to this, Lm2 shift the energy which is stored in it to other side which then charge C3 . Due to this Vin, Lk2, Lm2 and Cb delivers energy to C1 through diode D2 , it increases the voltage of capacitor C1 .

Mode III (t2-t3): When t=t2,the whole energy of Lk2 is delivers to C1.Due to this D2 gets turned into OFF state. Here, the Lm2 shift energy to other side which then charges C3 through diode D4 up to the time of t3 .

Mode IV (t3-t4): When t=t3 ,S2 gets turned into ON state. Hence, each one of the diodes gets turned into OFF state. The operation of mode 4 is nearly same to that of the mode 1 operation.

Mode V (t4- t5): When t=t4 ,S1 gets turned into OFF state and due to this both diodes i.e.D1 ,D3 gets turned into ON state. Hence, Lm1 delivers the energy which is stored in it to other side which then charge C2 .Due to this, both Vin and Lm1 delivers energy to Cb through the diode D1 ,hence more energy gets accumulate in Cb.

Mode VI (t5-t0): When t=t5 ,the whole energy of Lk1 is delivers to Cb. Due to this,D1 gets turned into OFF state. Here Lm1 delivers energy to the other side which then charges C2 through diode D3 up to the time of t0.

4. HYSTERESIS CONTROL METHOD

In the given fig., θ indicates phase angle. The value of θ can be find out by using phase locked loop. For vg greater than 0 ,there is state 1-state 2 combination. The algorithm for the control of converter is used to find out inductor current correctly for stabilizing the input power of states 1-state 2 union. States 1-state 2 combination is for boost mode. Also, By using product of Gv output and PLL output, controller produces iL12 ∗.Gv consist of PI compensator. The designing of Gv is done in such a way

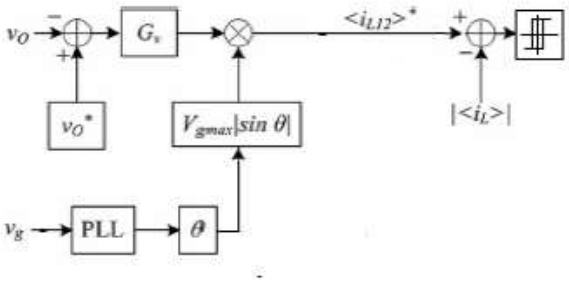

Fig 4 Hysteresis Control Method

that it is suitable for operation modes. This method is suitable for high rating applications. This is the main reason for selecting this method

5.CONCLUSION

In this paper ,various types of boost converter system are described .Also working of high step up converter with voltage multiplier module is described which can be use to increase output of photovoltaic system. So that we can extract maximum solar power which is abundant source of energy. Also introduction of Hysteresis control method is given.

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