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Design and Implementation of Smooth Switching Technique for Dc-Dc Converter to SWPS

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Abstract: Now a day, lot of power shortages is to be observing over the world especially country like India. Also the power generated from fossil fuels are becoming so less. The fossil fuels used like coal, lignite, oil and gases. So due to its uneconomical and hazardous to environment, the renewable based energies like solar, wind, biomass, tidal etc. are to be used , which does not cause any pollution to the environment. In this paper the simulation and analysis of boost converter design and simulation also performed. Here in this paper, the input voltage to the boost converter is given as 12 volts and receives output voltage 25 volts.

Keywords: Step up DC-DC converter, photovoltaic system, solar energy, Spice software.

I. INTRODUCTION

History –
Agriculture field is the most important part of our country. Despite the focus on industrialization, agriculture remains a dominant sector of the Indian Economy. Over 70% of rural households depend on agriculture as their principal means of livelihood. In this paper we are focusing on one type of problem concern with farming. The "Energy-demand" is one major thread for our country.
A Electrical power is the basic need for economic development of any country. The renewable energy sources like solar, wind, natural gas and oil etc. contribute about 92% of total power generation in world. As we know sun is considered to be the only never ending source of energy, the solar energy is the best solution for our future energy requirements .An conventional type of PV array is serial connection of the panels to obtain the high DC voltage.[1]

About Pspice:
Spice is a general purpose circuit program that simulates electronic circuits. SPICE can perform various analyses of electronic circuits. The operating (or the quiescent) points of transistors, a time-domain response, a small-signal frequency response, and so on. SPICE contains models for common circuit elements, active as well passive and it is capable of simulating most electronic circuits. It is a versatile program and is widely used in both industries and universities. The acronym SPICE stands for Simulation Program with Integrated Circuit Emphasis**.**

II. BLOCK DIAGRAM OF SYSTEM

It contains the components like PV module, DC to DC converter (Chopper) and DC load. The PV module or panel is placed in sun light to collect the more and more rays emitted by the sun. This collected rays converted into DC voltage in PV cell and this voltage is stored in battery. This voltage is up to 12V. The energy stored in battery is applied to the DC to DC converter. In this converter the DC voltage is applied is step up to value required by the load.

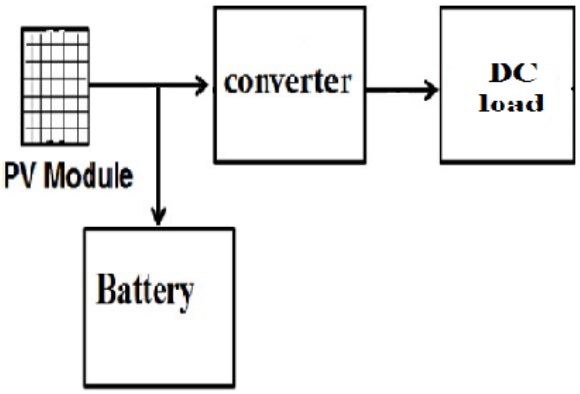

Fig1. Block Diagram of system

2.1 Solar Photovoltaic System:
The solar energy conversion into electricity takes place in a semiconductor device that is called solar cell. A solar cell is a unit of that delivers only a certain amount of the electrical power. In order to use solar electricity for practical devices which require a particular voltage or current for their operation, a number of solar cells have to be connected together to form a solar panel, also called a PV module. For a large scale generation of electricity, the solar panels are connected together into a solar array.
The solar panels are only a part of a complete PV solar system. Solar modules are the heart of the system and are usually called the power generators. The output of a pv module depends upon sunlight intensity and cell temperature.[1]

The common materials used for construction of PV cells are:
a) Non-crystalline silicon
b) Polycrystalline silicon
c) Amorphous silicon.

2.2 Battery:
The simplest means of electricity storage is to use the electrical rechargeable batteries, especially when pv

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modules produce the DC current required for charging batteries [2]. The batteries used in pv system are lead acid battery and nickel-cadmium battery. Most of batteries used in pv systems are lead acid batteries. The Ni-cd batteries are more expensive than Lead-acid batteries but advantageous to that of lead-acid batteries. Some advantages are long life, high energy density, good performance under low temperatures.

2.3 Charge controllers /Charge regulators:

Charge controllers are the link between the PV module, battery and load. They protect battery from overcharge or excessive discharge. Charge and discharge limits should be carefully selected to suit the battery type and operating temperature, High temp. Tends to reduce battery life because they accelerate corrosion and self-discharge. PV modules that are used to charge batteries usually operate at an approximately constant voltage, which is selected to suit the load temperature. However some pv systems regulators employs a maximum power point tracker (MPPT), which automatically permits the pv modules to operate at the voltage that produces maximum power output.

2.4 DC-DC Converter:

A DC-DC switching converter converts voltage directly from DC to DC and is simply known as a DC Converter[3].Power electronics converter in general and DC-DC converters in particular have a great importance and efficiency of energy production process based on renewable energy sources.

Requirements for selecting converter:

For selection of converter, the following requirements are considered in order to ensure the maximum efficiency and minimum cost of the power generation system.

1) Control of output voltage according to a given reference,
2) Deliver current with ripple and harmonic content,
3) High efficiency in the whole operating range.

The common features of high step up DC-DC converter are as follows:

1) High Efficiency
2) High step-up voltage gain.

The efficiency of DC-DC converter is mainly depending upon the two factors such as large input current and high output voltage.

DC converters are widely used for traction motor control in electric automobiles, trolley cars, marine hoists, forklifts trucks, and mine haulers. They provide high efficiency, good acceleration control and fast dynamic response. They can be used in regenerative braking of DC motors to return energy back into the supply. This attribute results in energy savings for transportation systems with frequent steps. DC converters are used in DC voltage regulators; and also are used, with an inductor in conjunction, to generate a DC current source, specifically for the current source inverter.

Below figure shows a simplified schematic of the boost power stage converter. The inductor L and capacitor C make up the effective output filter. Resistor RLoad represents the load at the output side of supply.

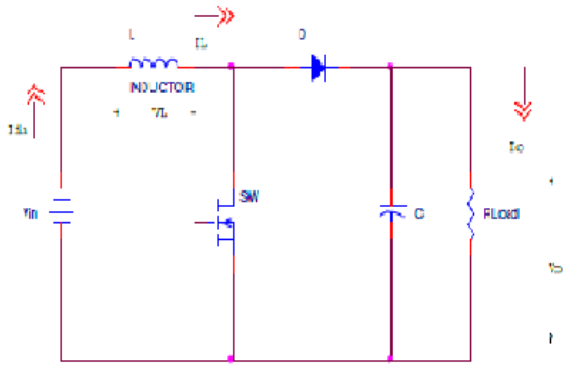

Fig 2.DC-DC boost converter

Operation of circuit:

The mosfet is acts as a switch. When switch SW is ON, energy is added to the inductor. When SW is OFF, the inductor and the input voltage source deliver energy to the output capacitor and load.

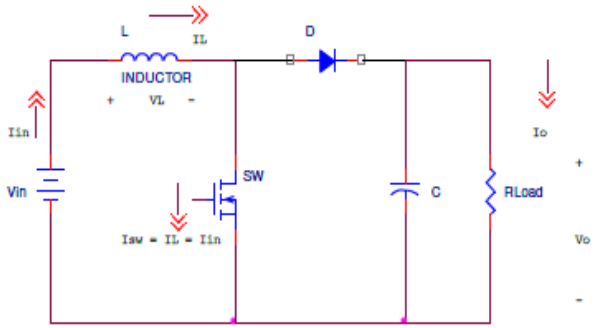

Fig. 3: Boost Converter during Switch ON time

With the help of setting the on time of switch SW as shown in figure 3, the output voltage is controlled. The amount of energy delivered to the inductor is increases as the on time of switch SW is increase. Then during off time of switch SW, more energy is then delivered to the output resulting in an increase in the output voltage. When the switch is ON for a time duration DT, the switch conducts, the inductor stores energy. This results in a positive voltage across the inductor. This voltage causes a linear increase in the inductor current IL.

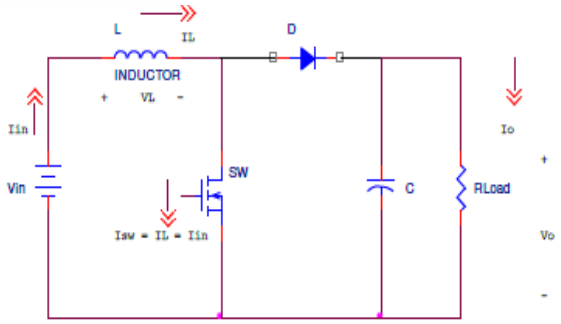

Fig 4.Boost converter during switch off time

Figure 4 shows a simplified schematic of the boost converter during OFF time. At the negative cycle, when the switch is turned OFF, because of the inductive energy storage, the input supply voltage and the energy stored in

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the inductor adds and delivers to the load. Until the switch is turn on, these current flows through diode. Therefore, a converter and its control should be designed based on both modes of operation.

The below figure shows typical waveforms of the boost converter. The waveforms for input – output voltage, Capacitive current, load current are shown below.

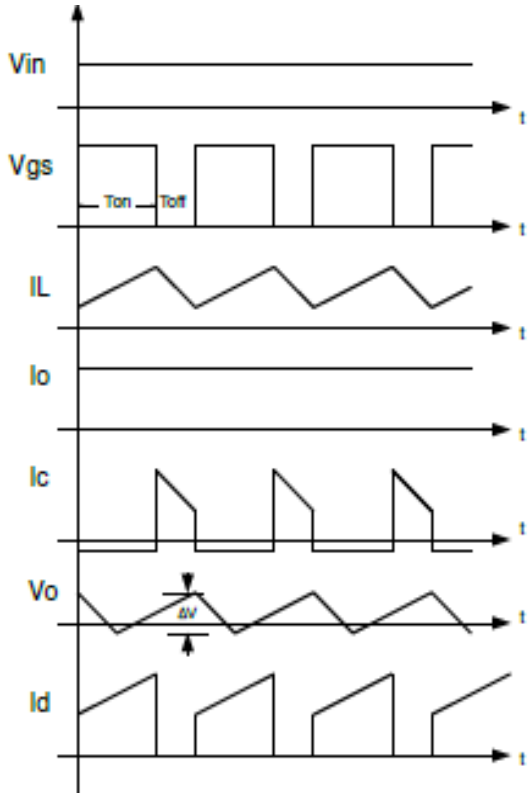

Fig5. Typical waveforms of the DC-DC boost converter

PSPICE Simulation result:

Below figure is a circuit diagram used for PSPICE simulation of boost converter. The purpose of this circuit is to increase the output voltage level at the load side.

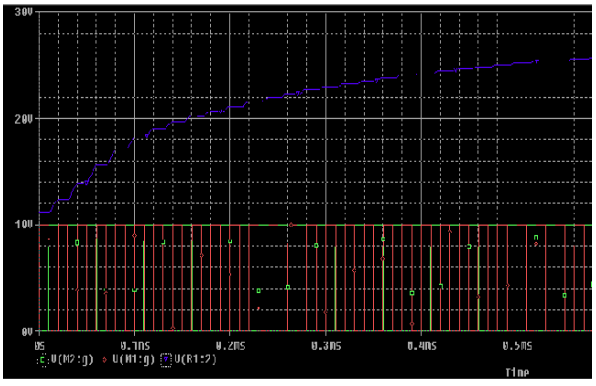

Fig.6 Result obtained by DC-DC converter

3. CONCLUSION

The energy generated from renewable sources is directly converted into electrical energy by using photovoltaic system . A DC-DC converter which converts voltage level from solar panel into a constant high DC voltage. As there is large amount of energy requirement, hence in this paper the DC-DC boost converter use in order to obtain the maximum output voltage. The system has been simulated with simulation tools like Pspice. The simulation of DC-DC converter shows that output voltage is constant irrespective of input voltage variations.

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