ISSN : 2455-9679
SJIF Impact Factor : 6.008

IJRTSM
INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

"MODELING AND SIMULATION OF CONSTANT VOLTAGE PHOTOVOLTAICS INCLUDING CUK CONVERTER AND PWM CONTROL INVERTER"

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ABSTRACT

The synchronous cuk converter is designed to monitor the performance of photovoltaic systems. In the Cuk converter concept, both conduction losses and switching losses are reduced. Replacing diodes with MOSFETs reduces conduction loss. The recent increase in demand for photovoltaic systems is due to the fact that they produce electricity by converting solar energy directly into electricity without harming the environment. We design a circuit that provides a constant DC boost to the load. We study the open-loop behavior of photovoltaic arrays as a function of temperature and irradiance. Then we combine several PV arrays with the Cuk converter, for example, the changes in the current and voltage of the converter follow the characteristics of the PV array turning on. Depending on the difference in insulation, the load changes and the input voltage and current of the Cuk converter also changes accordingly. It is worth noting that the change in input voltage and current follows the open circuit characteristics of the photovoltaic array.

Key Words: : *pv array, cuk converter, dc to ac converter.*

I. INTRODUCTION

The Conventional sources of energy are rapidly depleting. Moreover the cost of energy is rising and therefore photo voltaic system is a promising alternative. They are abundant, pollution free, distributed throughout the earth and recyclable. The hindrance factor is it's high installation cost and low conversion efficiency. Therefore our aim is to increase the efficiency and power output of the system. It is also required that constant voltage be supplied to the load irrespective of the variation in solar irradiation and temperature. PV arrays consist of parallel and series combination of PV cells that are used to generate electrical power depending upon the atmospheric conditions (e.g. solar irradiation and temperature). So it is necessary to couple the PV array with a Cuk converter. Moreover our system is designed in such a way that with variation in load, the change in input voltage and power fed into the converter follows the open circuit characteristics of the PV array. Our system can be used to supply constant stepped up voltage to DC loads. Solar energy has been harnessed by humans since ancient times using a variety of technologies.

II. SOLAR ENERGY SYSTEM & CONVERTER SYSTEM

Renewable energy resources and significant opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency, and technological diversification of energy sources, would result in significant energy security and economic benefits. As of 2011, small solar PV systems provide electricity to a few million households, and micro-hydro configured into mini-grids serves many more. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond, and some 120 countries various policy

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targets for longer-term shares of renewable energy, including a 20% target of all electricity generated for the European Union by 2020. Some countries have much higher long-term policy targets of up to 100% renewable. Outside Europe, a diverse group of 20 or more other countries target renewable energy shares in the 2020–2030 time frame that range from 10% to 50%. Renewable energy often displaces conventional fuels in four areas: electricity generation, hot water/space heating, transportation, and rural (off-grid) energy services.

The efficiency of solar PV system used in space satellite mainly depends on the efficiency of DC-DC power conditioning process. High efficient DC-DC converter has to be designed which is more suitable in solar PV application. Unfortunately, the performance of solar PV system is affected due to non-linear dynamics in DC-DC converter used in system, and leads to undesirable operation in solar PV System. Also DC-DC converter used in solar PV system should be stable and the input voltage is kept within the specified range under disturbances at the source voltage and the change in irradiation. With above motivation, the PV powered DC-DC.

III. About CUK Converter

The Ćuk converter is a type of DC/DC converter that has an output voltage magnitude that is either greater than or less than the input voltage magnitude. It is essentially a boost converter followed by a buck converter with a capacitor to couple the energy. The non-isolated Ćuk converter can only have opposite polarity between input and output. It uses a capacitor as its main energy-storage component, unlike most other types of converters which use an inductor. It is named after Slobodan Ćuk of the California Institute of Technology, who first presented the design. There are variations on the basic Ćuk converter. For example, the coils may share single magnetic core, which drops the output ripple, and adds efficiency. Because the power transfer flows continuously via the capacitor, this type of switcher has minimized EMI radiation. The cuk converter allows energy to flow bi-directionally by using a diode and a switch.

IV. Proposed Model

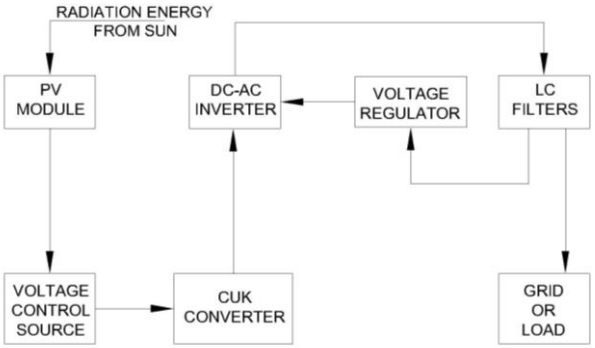

Fig. 1 Block diagram of pv system with cuk converter

V. Optimization of CUK Converter System

- This study includes the Cuk converter as a system. The purpose of the research work is as follows:
- Model solar photovoltaic modules and study the temperature and irradiance of photovoltaic modules operation.
- Analyze, simulate and use Cuk converters using solar photovoltaic modules.
- Use and compare the effectiveness of different control systems in preventing fluctuations in the circuit of solar photovoltaic powered Cuk converter system with good working condition, reducing maximum electromagnetic interference and improving conversion efficiency.
- Study and manipulate nonlinear dynamics, such as chaotic nonlinearity, through experiments in solar photovoltaic systems based on Cuk converters.

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- Design the electronic equipment to adjust the output voltage of the solar photovoltaic module so that the electrical equipment of the solar photovoltaic system based on the DC-DC Cuk converter is chaos-free and can be adjusted according to changes in irradiance. The stability of the solar photovoltaic system based on DC-DC Cuk converter against interference from electrical equipment is examined.

VI. SIMULATION DIAGRAM & RESULTS

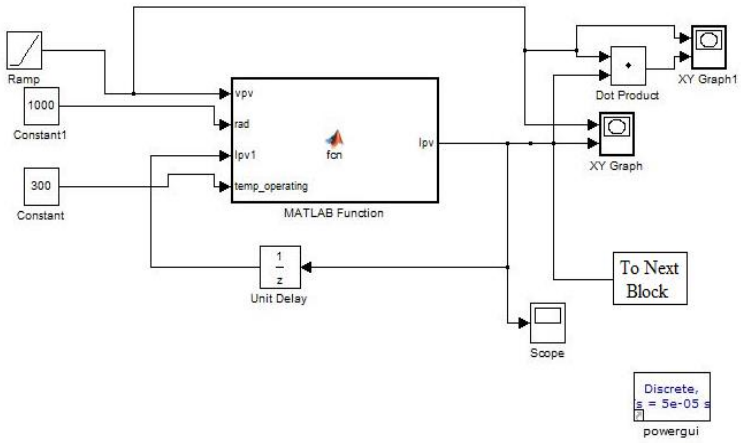

Fig. 2 simulation model of pv module

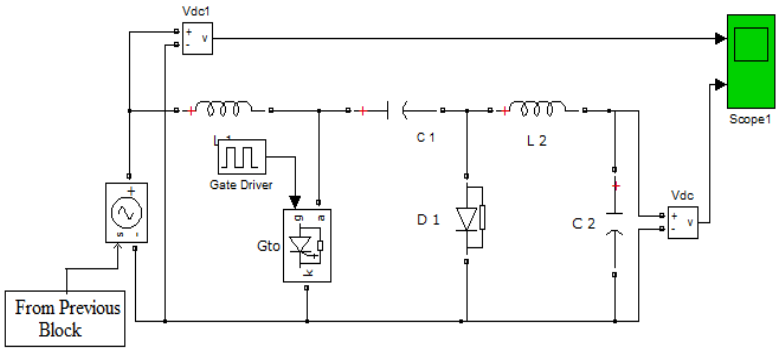

Fig. 3 simulation model of cuk converter block

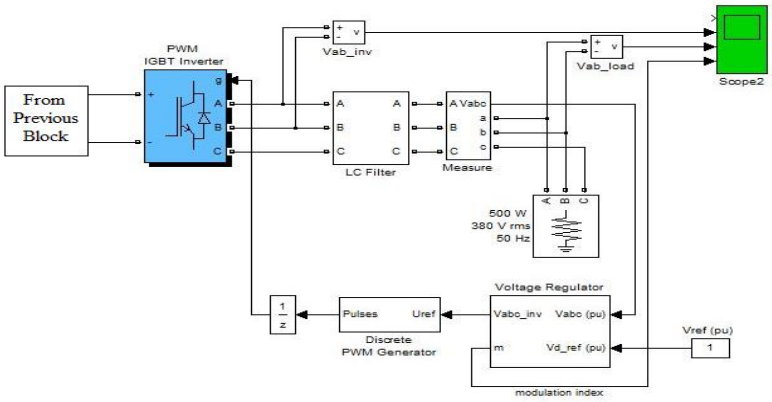

Fig. 4 simulation model of DC to AC converter with load

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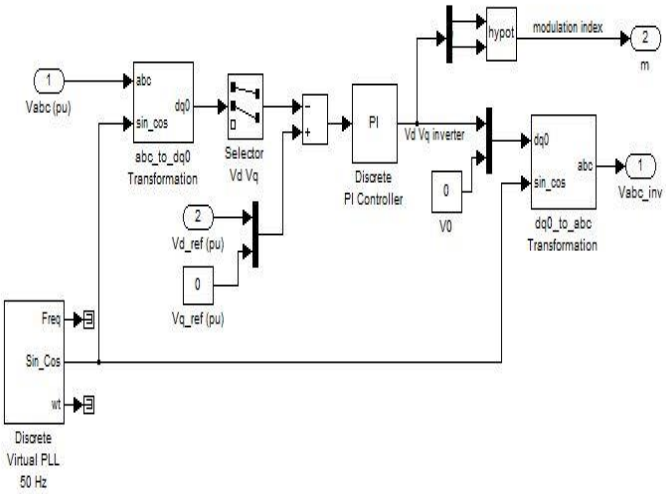
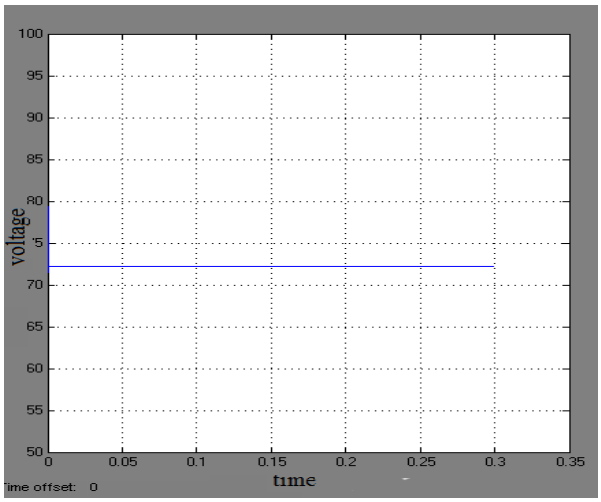


Fig. 5 simulation model of voltage regulator system



- Fig. 6 output voltage waveform of pv module

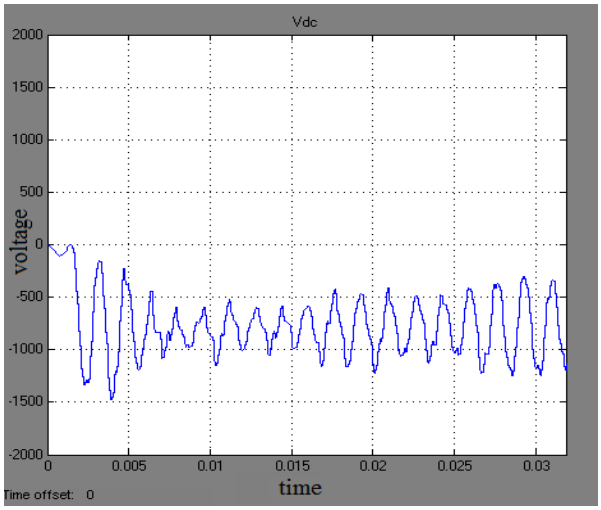


Fig. 7 output voltage waveform of cuk converter

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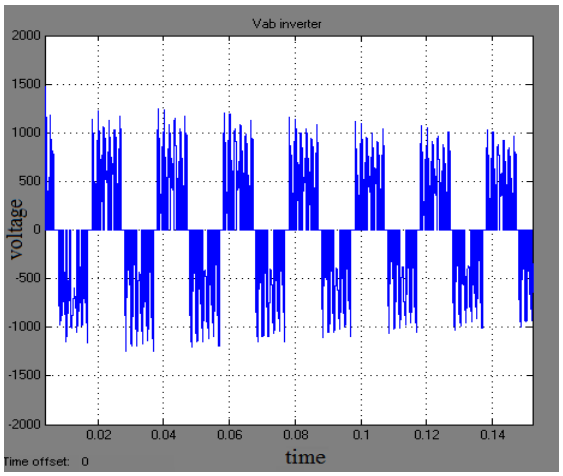

Fig. 8 output voltage waveform of inverter

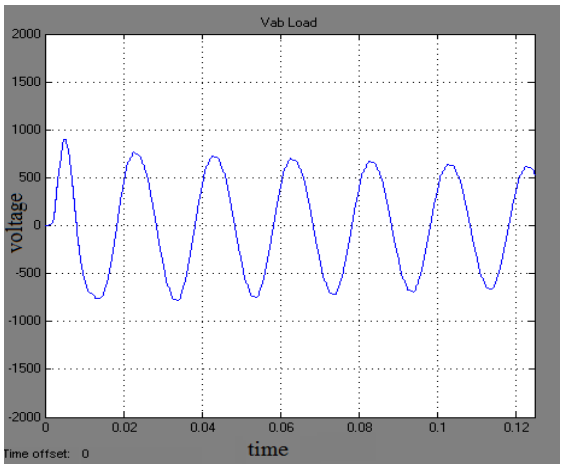

Fig. 9 output voltage waveform of filter system

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