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KY Converter for Renewable Energy Systems

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ABSTRACT: Renewable energy is derived from renewable resources and is the source that humanity turns to in order to generate electricity while fossil fuels are being depleted more quickly. In order to serve the load correctly, the power is obtained frequently requires DC good DC conversion. Currently, boost converters are utilized for chopper control in solar and wind power systems. By substituting a KY converter for the boost converter, response qualities can be enhanced. KY converters is set up dc to dc converters that operates in CCM continuously, has a transient response, non-pulsating current, and a lower voltage ripple than a traditional boost converter. Within this topology, where on is paired with a buck boost converter; however, DCM is also feasible in this topology. To compare the operations of the converters, MATLAB software simulates the operation of a KYs converters and a typical boost converter. In order to investigate the converter's practical operation and confirm that it may be used in renewable energy systems, the KY converter was developed in hardware. In the modern world, DC-DC converters are a typical part of portable electronics such as laptops, cell phones, and digital still camera (DSCs). to separate the volt ages of the battery into several voltages' bands. the power supply systems using low voltage batterie elevating from low voltages to highs voltage is typically necessary. Usually, a buck boost converter is used, but the voltages ripple it produces is substantial due to its pulsating output current.

KEYWORDS: KY converter, DC-DC Converter, comparison of Boost and KY converter, Renewable energy system, Buck-Boost Converter.

I.INTRODUCTION

In the modern world, DC-DC converters are a typical part of portable electronics such as laptops, cell phones, and digital still camera (DSCs). to separate the volt ages of the battery into several voltages bands. the power supply systems using low voltage batterie elevating from low voltages to highs voltage is typically necessary. Usually, a buck boost converter is used, but the voltages ripple it produces is substantial due to its pulsating output current. Furthermore, the boost converter's transient response and converter stability are hampered by its right-hand plane zero. The KY converters is a voltage boosting converter that was recently proposed. This converter has several benefits when it operates in continuous conductions mode such as non pulsating current, instead of using a buck boost converter, a KY converter, with its higher o/p response, can be employed since it has a better load transient response and less output ripple, both of which can help with the problems the boost converter had.

Therefore, power can be delivered to the grid via this KY converter. The DC voltage is supplied by a solar panel, and the battery stores this DC power. The battery stores this voltage, which is subsequently supplied to the KY converters to increase its voltages level. After that, the load receives the output of the KY converters circuit directly. This allows for the production of a continuous o/p with fewer ripples. It is possible to design the KY converter circuit with a diode, capacitor, resistors, and inductors. Thus, employing a KY converter can result in a better transient response. Thus, it is

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possible to achieve a ripples free output with a relatively high efficiency, which can be used for the previously indicated low-power applications.

Power delivery to the grid can be accomplished with a KY converter. The battery stores the DC voltage that is supplied by a solar panel. The battery stores this voltage, which is subsequently used to increase the voltage level of the KY converter. Subsequently, the load receives the output directly from the KY converter circuit. A continuous output with fewer ripple counts can be achieved in this way. It is possible to build a KY converter circuit with a diode, capacitors, resistors, and inductors. Thus, employing the KY converter can result in a better transient response. As a result, a relatively high-efficiency, ripple-free output can a produced, which can used for the previously stated low powers applications.

II.SYSTEM MODEL

KY CONVERTER

Block Diagram of Proposed System: -

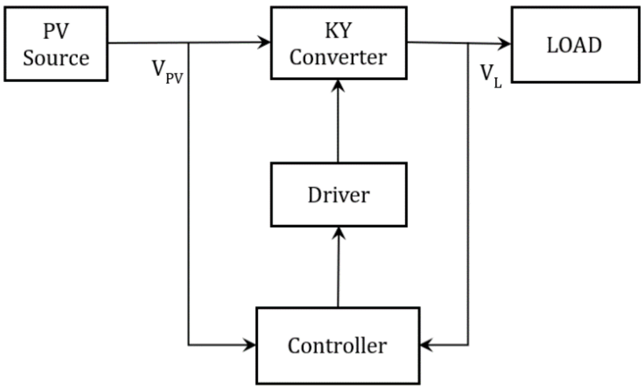

Figure 2.1 : Block diagram of proposed system

The proposed PV system based on the KY converter is shown in Figure 1 with its block diagram. The load voltage and the output voltage of the PV panel provide feedback to the controller. To compensate for variations between the desired and actual voltages, the controller generates PWM pulses. In order to establish the necessary separation between the low-power controller circuit and the high-power converter circuit, a driving circuit is required. When developing the KY converter, consideration will be given to the load and PV panel rating. It is advised that the output voltage of the KY converter be managed via PI control. This controller will regulate the output voltage by changing the duty cycle of the PWM pulses.

KY Converter Hardware Description: -

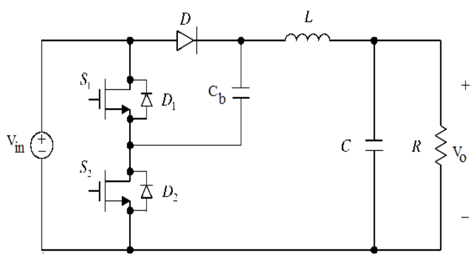

Figure 2.2 : Basic KY converter

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Figure 2.2 shows the KY boost converter. It is constructed with two semiconductors switching devices S_1 and S_2, a diode D, energy transferring capacitor C_b, output inductor L, and the output capacitor C. The working of KY converter can be explained in two modes as follows:

Mode 1: S_1 = ON, S_2 = OFF

In this mode, the inductor L is magnetized as the voltage across inductor L is,

$$V_L = V_{in} + V_c - V_O$$

Neglecting voltage drop across diode D,

$$V_C = V_{in}$$

$$\therefore V_L = 2V_{in} - V_O$$

Here the capacitor Cb is discharges.

Mode 2: S_1 = OFF, S_2 = ON

In this mode, the inductors L is demagnetized as the voltage across inductor is,

$$\therefore V_L = V_{in} - V_O$$

Here the capacitor Cb is quickly charges to the input voltage level in very short interval.

The voltage gain is thus given as

$$\frac{V_O}{V_{in}} = 1 + D$$

III.MODELING ANALYSIS

For case study, a KY converter is designed for the specifications as mentioned in table 1.

Particulars	Specification
Input Voltage (Vin)	12V
Output Voltage (Vo)	20V
Frequency	10Khz
Power	50W

Table 1: KY converter rating

The output current of KY converter is,

$$I_o = \frac{P_O}{V_O} = \frac{50}{20} = 2.5A$$

The input current of KY converter is,

$$I_{in} = \frac{P_{in}}{V_{in}} = \frac{50}{12} = 4.16A$$

The voltage gain is

$$A = \frac{V_O}{V_{in}} = \frac{20}{12} = 1.66$$

Therefore, the duty cycle of converter is calculated as,

$$A = 1 + D$$

$$\therefore D = 0.66$$

For calculating inductor value, the voltage across inductor is considered.

By KVL, the voltage across inductor is,

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$$V_L = 2\,V_{in} - V_o = 4V$$

The basic equation of inductor is,

$$V_L = L\frac{di}{dt}$$

$$\therefore L = V_L\frac{dt}{di}$$

Here, the interval dt is,

$$dt = \frac{D}{f}$$

The current di is ripple current of the inductor. It is assumed that the inductor ripple current is 30%
The inductor current is,

$$I_L = 2\,I_{in} = 2 * 4.16 = 8.32\ A$$

$$\therefore di = 0.40 * 8.32 = 3.33\ A$$

Substituting these values in the equation of inductance,

$$L = V_L\frac{dt}{di} = V_L\frac{D}{f.di} = 4\frac{0.66}{10000 \times 3.33} = 79\mu H$$

The current through capacitor C_b is,

$$I = C_b\frac{dV}{dt}$$

$$C_b = I\,\frac{dt}{dV} = I_{in}\frac{D}{f\,dV}$$

Assuming dV, the ripple voltage across capacitor to be 2% of the source voltage,

$$dV = 0.01 \times 12 = 0.24$$

$$\boxed{C_b = I_{in}\frac{D}{f\,dV} = 4.16\frac{0.66}{10000 \times 0.24} = 1100\ \mu F}$$

For output capacitor,

$$I = C_o\frac{dV}{dt}$$

Assuming dV, the ripple voltage across capacitor to be 1% of the output voltage,

$$dV = 0.01 \times 20 = 0.2$$

$$\boxed{C_o = I_{out}\frac{D}{f\,dV} = 2.5\frac{0.66}{10000 \times 0.2} = 825\ \mu F}$$

Table 2 summarizes the component specifications of the KY converter

Duty cycle	66%
Inductance (L)	79µH
Capacitor (Cb)	1100µF
Capacitor (C)	825µF
MOSFET	IRF 250

Table 2: KY Converter Components Specification

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IV.RESULTS AND DISCUSSION

SIMULATION RESULTS

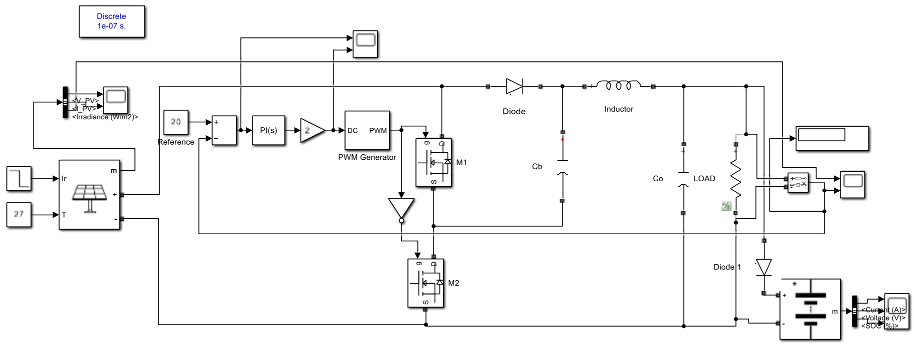
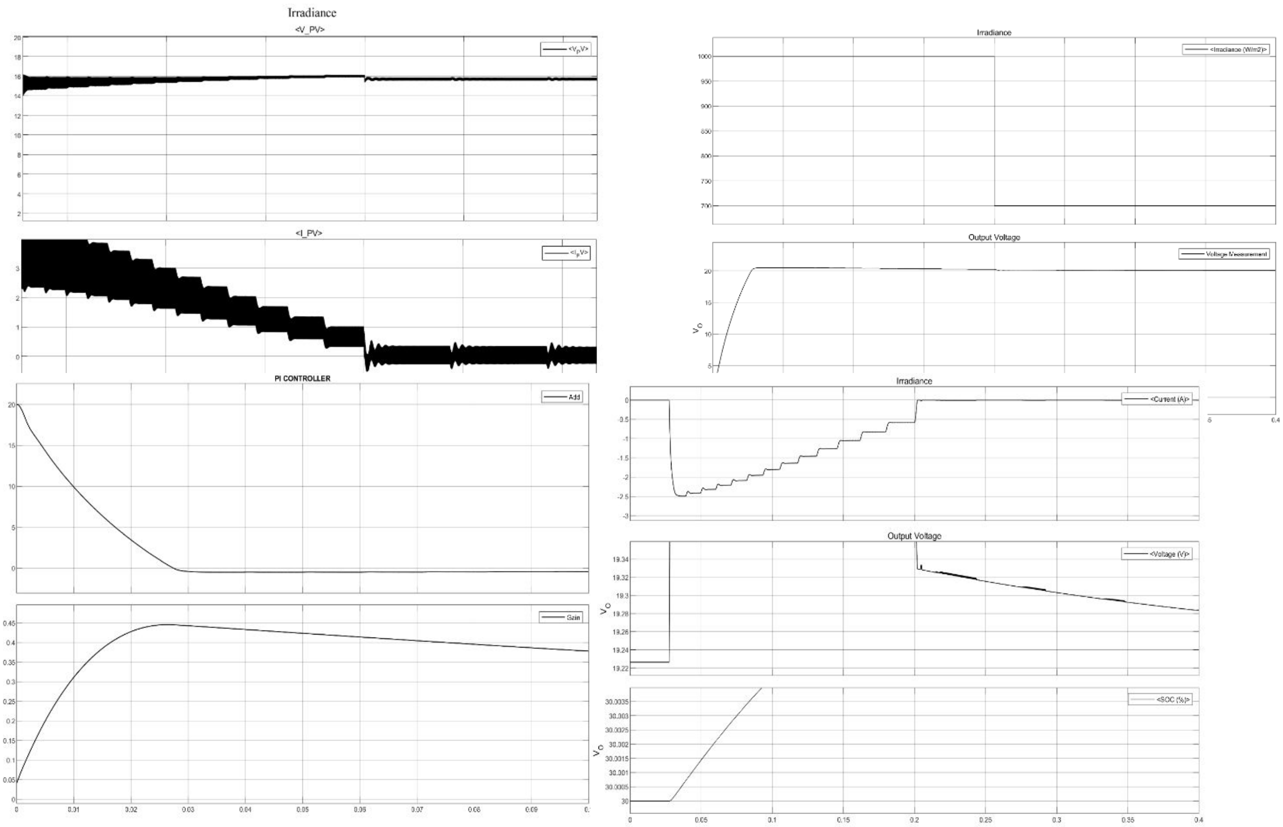


Figure : Simulink model of KY converter

Output of the Simulation :-



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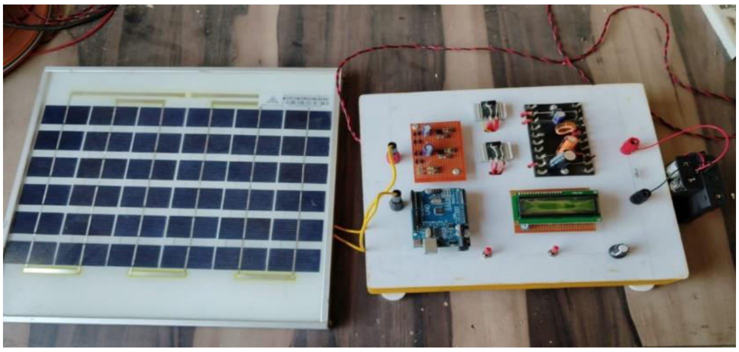
HARDWARE IMPLEMENTATION

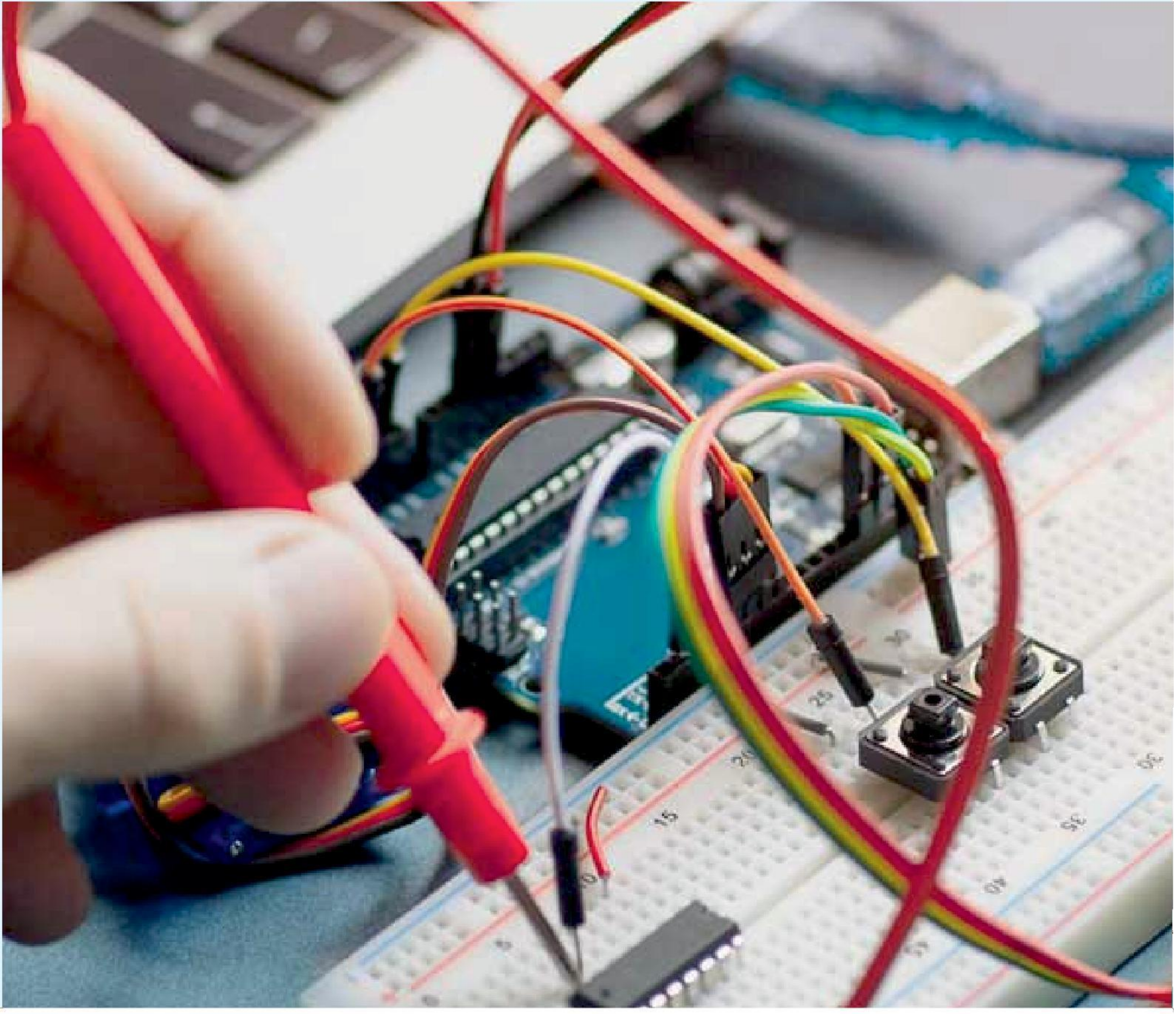


V.CONCLUSION

This study aims to reduce the o/p voltage ripples across the capacitors of the KY converter. The way the KY converters work differs from an isolate dc-dc converters in that they operate in continuous conduction modes. Because the output current in the continuous conduction modes is naturally non-pulsating, it minimizes output voltage ripples and current stresses on the output capacitors. The KY Converter can function well when there is no voltage ripple in the converter. A dc-dc converter changes one DC voltages level to another DC voltages level while minimizing energy loss.Therefore, the short comings of the current approaches are addressed by the suggested system with single-cycle control, which can be successfully applied to water pumping applications. electric cars, in which various electrical circuits run at various voltage levels. A DC voltage can be changed from one level to another using the DC-DC converter, an electromechanical device, or circuitry, depending on the needs of the circuit. It can be extended for future use in electric vehicle in that battery management system and charging operation.

REFERENCES

[1] "High Voltage-Boosting Converters Based on Bootstrap Capacitors and Boost Inductors," K. I. Hwu, C. F. Chuang, and W. C. Tu IEEE Trans. On Industrial Elec., June 2013, Vol. 60, No. 6.
[2] Richards, C., Nicolae D., and van Rensburg J. An enhanced transfer ratio boost converter, in Proc. IEEE IPEC, 2010, pp. 76–81.
[3] Ned Mohan and associates. Electrical power. 1989; John Wiley and Sons.
[4] Bhimra, Dr. P.S. Power Electronics. Publishers Khanna. India's New Delhi
[5] Voltage Gain Enhancement for a Step-Up Converter, Hwu, K.I.; Jiang, W.Z. (2014) Buck-Boost Converters and KY Built IEEE Transactions on Industrial Electronics, Volume 61, Issue 4 2014, publication year, page(s) 1758–1768.



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