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DESIGNING OF THREE SWITCHES ISOLATED DC-DC CONVERTER WITH SOLAR APPLICATION

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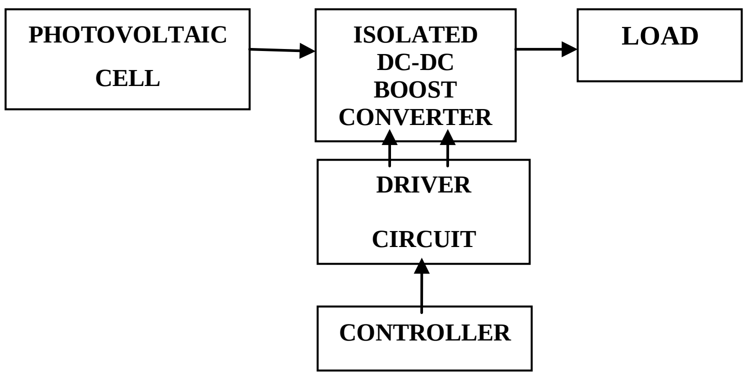
ABSTRACT

This project documents a new three-switch, isolated boost DC-DC converter. The major features of the proposed converter are as follows: 1) continuous input current; 2) reduced one active switch, one additional diode, and one additional capacitor; 3) unchanged primary and secondary voltage waveforms of the transformer when the duty cycle is changed; and 4) removal of the snubber circuit. This paper presents the operating principles, analysis, parameter design guidelines, and simulation results for the proposed converter. To verify the performance of the proposed converter, a 400 W prototype was constructed with a 40-60 V DC input. A PID controller was used to maintain the DC output voltage at 400 V. The simulation and experimental results matched those of the theoretical analysis.

INTRODUCTION

The utilization of sustainable power source has as of late gotten overall consideration in perspective of the persistent development in vitality utilization and the squeezing requirement for lessening carbon discharge to the climate. Photovoltaic (PV) control has been a promising sustainable power source because of its zero contamination (both air and commotion), capacity to work with substantially less limitation on area, and simplicity of upkeep. Step up DC-DC change methods are required in numerous applications, for example, energy units (FCs), sunlight based photovoltaic (PV) frameworks and uninterruptible power supplies (UPS). For these applications, a high step up voltage proportion with high effectiveness is vital. In this paper a step up dc-dc has been implemented with one reduced switch. The input supply for this proposed model is a combination of serially connected photovoltaic(PV) cells.

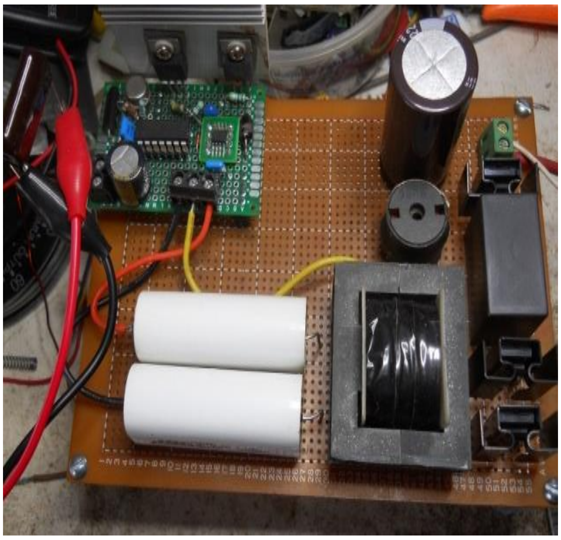
BLOCK DIAGRAM



PHOTOVOLTAIC CELL

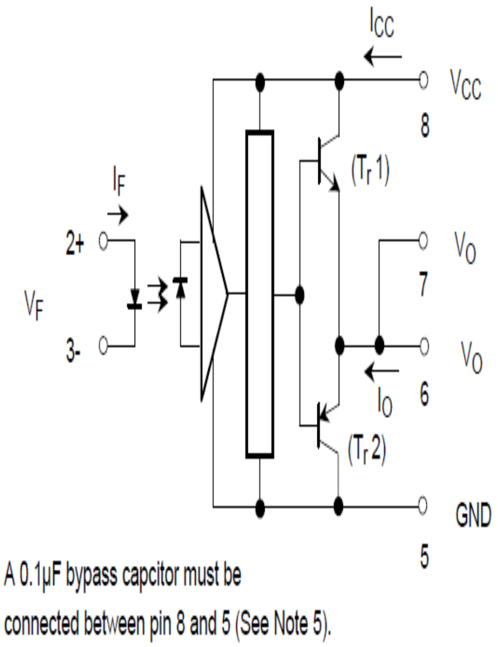
A photovoltaic cell (PV cell) is a particular semiconductor diode that proselytes noticeable light into coordinate current (DC). Some PV cells can likewise change over infrared (IR) or bright (UV) radiation into DC power. Photovoltaic cells are a fundamental piece of sun oriented electric vitality frameworks, which are ending up progressively critical as elective wellsprings of utility power.Large sets of PV cells can be associated together to shape sun powered modules, clusters, or boards. The utilization of PV cells and batteries for the age of usable electrical vitality is known as photovoltaics. One of the real focal points of photovoltaics is the way that it is non-contaminating, requiring just land (and a sensibly bright atmosphere) keeping in mind the end goal to work. Another preferred standpoint is the way that sun based vitality is boundless. Once a photovoltaic framework has been introduced, it can give vitality at basically no cost for a considerable length of time, and with insignificant upkeep.

ISOLATED DC-DC BOOST CONVERTER



Separated converters are alluring in the DC-DC control change applications where disengagement or an expansive voltage venture up pick up is required. Conventional detached DC-DC converters either use numerous changes to accomplish high effectiveness or utilize few switches which result in low proficiency. This paper proposes another single-switch disconnected DC-DC converter for most extreme power point following (MPPT) control and voltage direction of sun oriented photovoltaic (PV) framework. The proposed DC-DC converter has the upside of utilizing less number of switches than other existing confined DC-DC converters. The working standard and parameter outline of the converter are portrayed in the paper. Reproduction contemplates are completed in MATLAB to check the hypothetical examination and demonstrate that the proposed converter is successful for MPPT for PV frameworks. Exploratory outcomes additionally approve the reenactment considers. The proposed converter is equipped for following the greatest power purpose of the PV board in various time.

DRIVER CIRCUIT



In hardware, a driver is an electrical circuit or other electronic part used to control another circuit or component.They are normally used to direct momentum moving through a circuit or to control different factors, for example, different segments, a few gadgets in the circuit. The term is frequently utilized, for instance, for a particular incorporated circuit that controls high-control switches in exchanged mode control converters. An intensifier can likewise be viewed as a driver for amplifiers, or a voltage controller that keeps a joined segment working inside an expansive scope of info voltages. Normally the driver stage(s) of a circuit requires distinctive attributes to other circuit stages. For instance in a transistor control enhancer circuit, regularly the driver circuit requires ebb and flow pick up, frequently the capacity to release the accompanying transistor bases quickly, and low yield impedance to keep away from or limit mutilation.

CONTROLLER

A controller, in a registering setting, is an equipment gadget or a product program that oversees or coordinates the stream of information between two elements. In processing, controllers might be cards, microchips or separate equipment gadgets for the control of a fringe gadget. In a general sense, a controller can be thought of as something or somebody that interfaces between two frameworks and oversees interchanges between them.

LOAD

An electrical load is an electrical part or segment of a circuit that devours (dynamic) electric power.This is against a power source, for example, a battery or generator, which produces power.In electric power circuits cases of burdens are apparatuses and lights. The term may likewise allude to the power devoured by a circuit.

The term is utilized all the more comprehensively in gadgets for a gadget associated with a flag source, regardless of whether it expends power.If an electric circuit has a yield port, a couple of terminals that delivers an electrical flag, the circuit associated with this terminal (or its information impedance) is the heap.

Load influences the execution of circuits as for yield voltages or streams, for

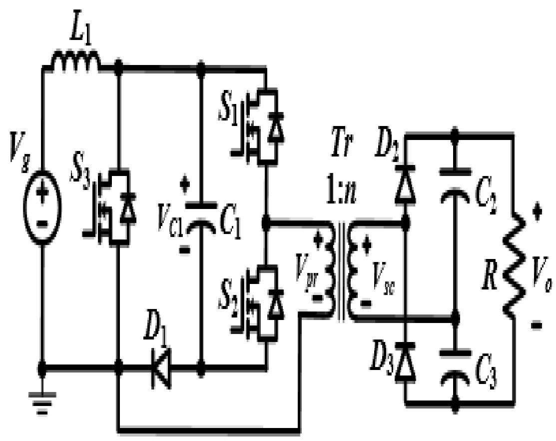
example, in sensors, voltage sources, and intensifiers. Mains electrical plugs give a simple case: they supply control at consistent voltage, with electrical apparatuses associated with the power circuit by and large making up the heap. At the point when a powerful machine switches on, it significantly diminishes the heap impedance.

In the event that the heap impedance isn't particularly higher than the power supply impedance, the voltages will drop. In a local domain, exchanging on a warming machine may make radiant lights diminish perceptibly.

DISADVANTAGES OF EXCISTING SYSTEM

Utilize a more number of transformers and switches, which expands the misfortune and cost of the general framework.

PROPOSED SYSTEM



A three-switch isolated boost DC-DC converter is proposed.

The low-voltage side consists of a boost inductor (L1), three switches (S1, S2 and S3), a capacitor (C1), a diode (D1), and the primary winding of the transformer (Tr). The high-voltage side consists of the load (R) and the secondary winding of the transformer (Tr) connected to the voltage double rectifier (VDR) implemented by two diodes (D2 and D3) and two capacitors (C2 and C3).

The input DC current is continuous with low ripple, whereby a decoupling capacitor bank or an LC input filter at the front end (typically used to protect the energy source such as the fuel cell) is unnecessary.

It uses one less active switch, one extra diode and one extra capacitor than the conventional isolated boost DC-DC converter

.The primary and secondary side voltage waveforms of the high-frequency transformer are unchanged when the output voltage is controlled.

This facilitates the ease of the design of the high frequency transformer; and the snubber circuit is not used because the voltage spike is limited by clamping the capacitor C1 voltage.

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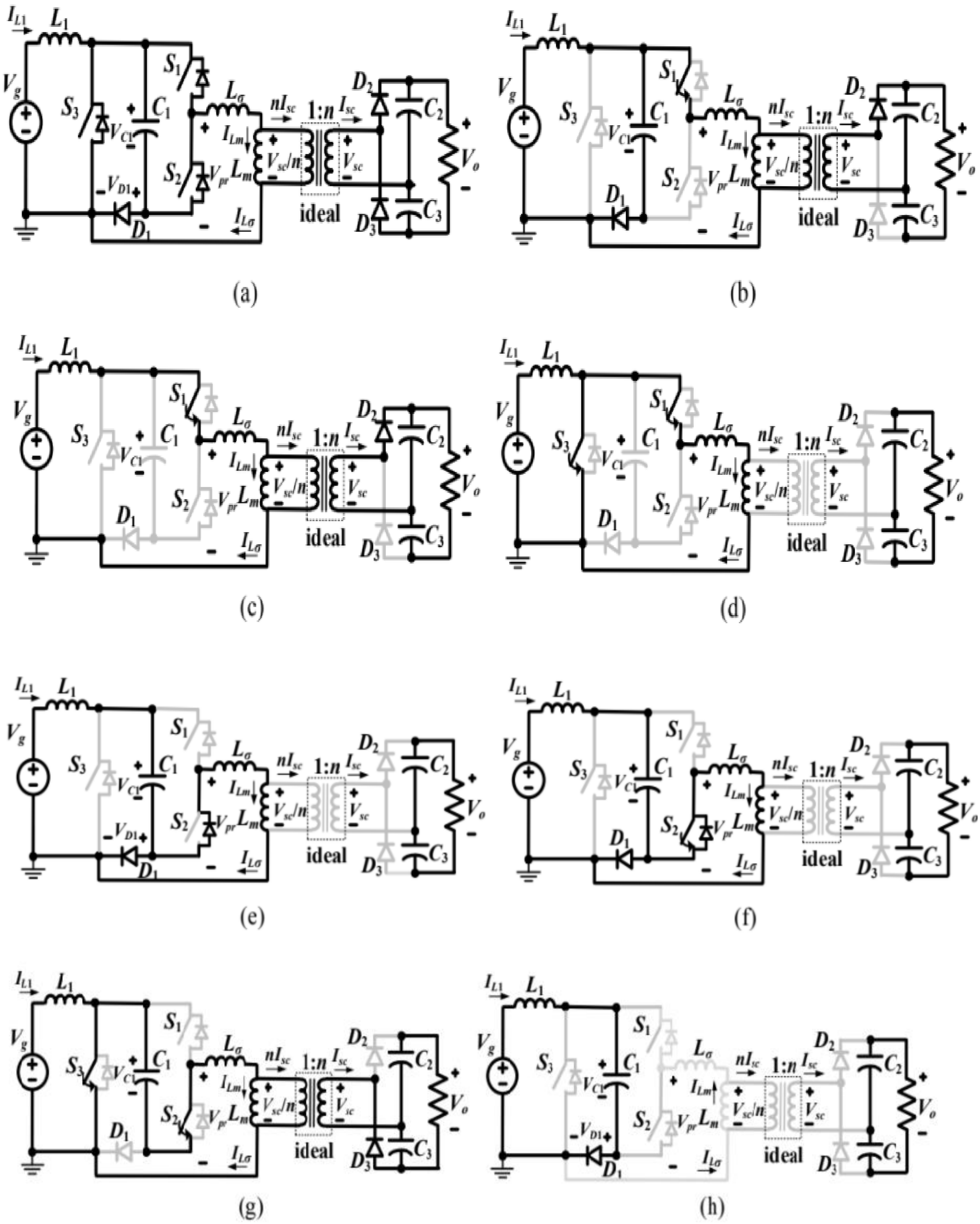
And the proposed system is explaining by the few modes of operations.

The modes of operation can be explain in the seven stages.It clearly shows the process of proposed system.

ADVANTAGES

Reduces switching loss.Increases efficiency. Snubber circuit is not needed in the proposed converter.

MODES OF OPERATION



STAGES:

Stage 1:
S1 is turned "ON", while S2 and S3 are turned "OFF". The inductor L1 is discharged, while the leakage inductor of the transformer and the capacitor are charged. The D1 and D2 diodes are forward-biased, while the D3 diode is reverse-biased. The primary voltage of the transformer is Vc1. The secondary side of the transformer generates a positive voltage. The secondary current of the transformer increases linearly from zero to the peak value.

Stage 2:
When the primary winding current is charged to the inductor L1 current, the D1 diode is reverse-biased. The leakage inductor of the transformer is discharged. Because the leakage inductor of the transformer is changed from the stored energy state in stage 1 to the transferred energy state in stage 2, the primary voltage of the transformer is lower than Vc1. The secondary side of the transformer still generates a positive voltage.

Stage 3:
This mode is inserted into the zero states, where the winding voltages of the transformer are zero, such that the voltage waveforms of the transformer are unchanged. In this mode, S1 and S3 are turned "ON", while S2 is turned "OFF". The inductor L1 is charged. The primary winding of the transformer is short-circuited by S1 and S3. All diodes are reverse-biased and the secondary voltage of the transformer is zero.

Stage 4:
S1 and S3 are turned “OFF” and S2 remains turned “OFF”. The inductor L1 current is freewheeling through D1, while the primary winding current freewheels through the body diode of S2.

Stage 5 :
Because the current flows through the body diode of S2, the direction of the current of S2 reverses and S2 is turned "ON" with zero-voltage switching (ZVS). The inductor L1 current freewheels through D1 and decreases linearly. The primary winding of the transformer is in a short-circuit situation through S2 and D 1. The secondary voltage of the transformer is zero, the D2 and D3 diodes are reverse-biased, and the primary current of the transformer is unchanged.

Stage 6:
S3 is turned "ON", while S1 remains "OFF" and S2 remains "ON". The inductor L1 is charged, while the capacitor C1 is discharged. The primary voltage of the transformer is -Vc1. Also, the secondary voltage of the transformer is -nVc1. The D1 and D2 diodes are reverse-biased, while the D3 diode is forward-biased.

Stage 7:
The current of S2 is zero, and S2 is turned "OFF" with zero-current switching (ZCS). The inductor L1 current still freewheels through D1. The drain-source voltage of S2 increases from zero to VC1, while the drain-source voltage of S1 decreases from VC1 to zero. The time interval in this stage is very short
.

ADVANTAGES

Reduces switching loss.Increases efficiency. Snubber circuit is not needed in the proposed converter

CALCULATIONS

Frequency=10khz

Inductor =1mH

Capacitor = 150µF

Vin Min = 40V`

Vout Min = 350V

Iout = 0.7A

To Find The Value Of Capacitor :

Let us Assume Vripple = 0.4V

Capacitor = Iout/(Vripple*Freq)

So That Capacitor = 150µF

To Find The Value Of Inductor :

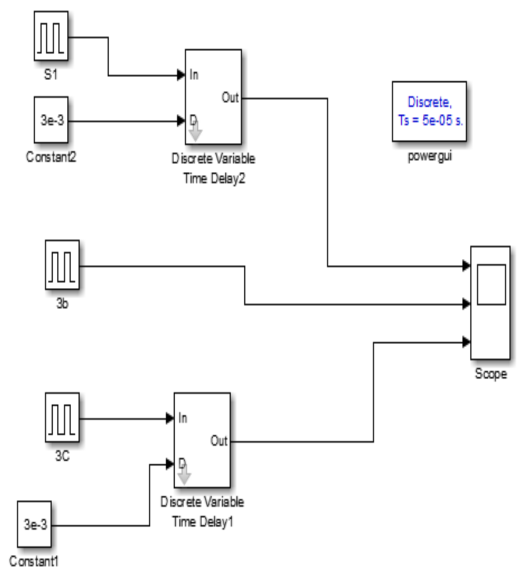
Let us Assume Inductor Current Δ I L = 3.5A

Inductor (L) = Vin * (Vout - Vin)/(Δ I L * Fs * Vout)

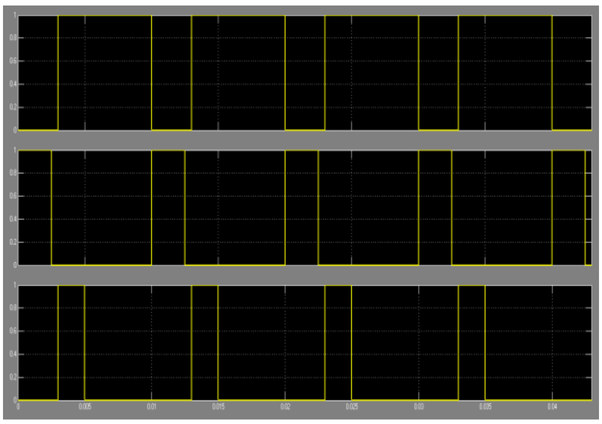
Inductor (L) = 1Mh

SIMULATION RESULTS

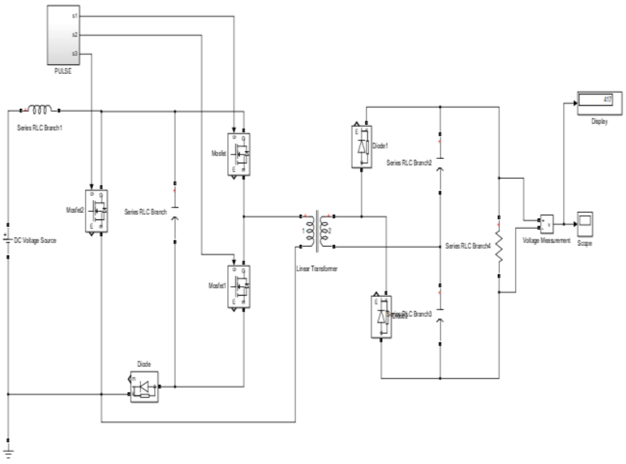
MATlab simulink of pulse generation



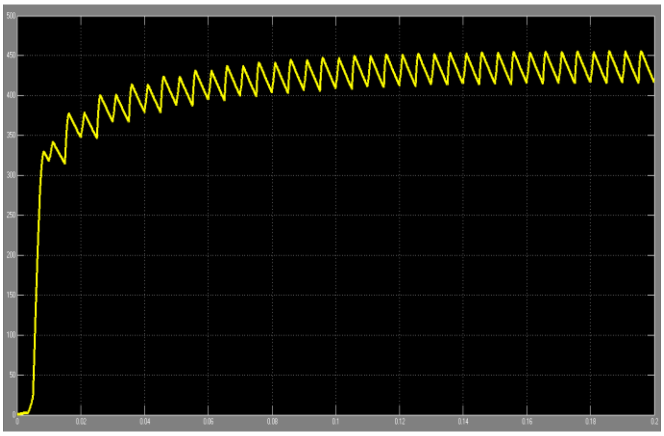
Generated pulse for all the switches in the proposed converter



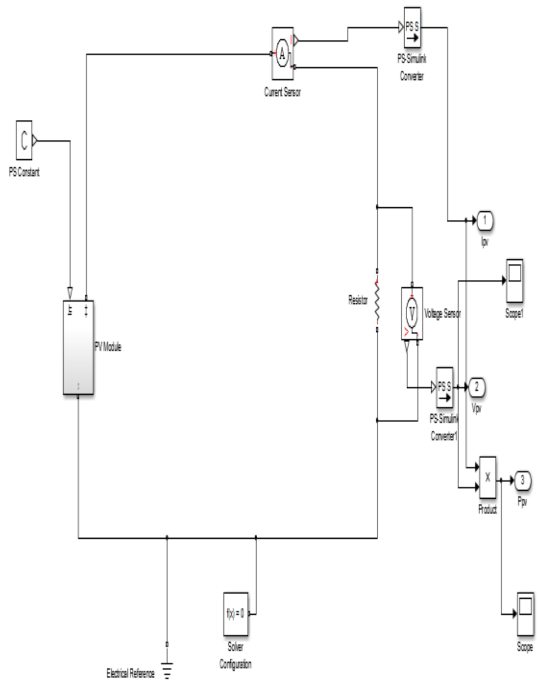
Simulation of proposed ,Three Switch isolated boost DC-DC converter



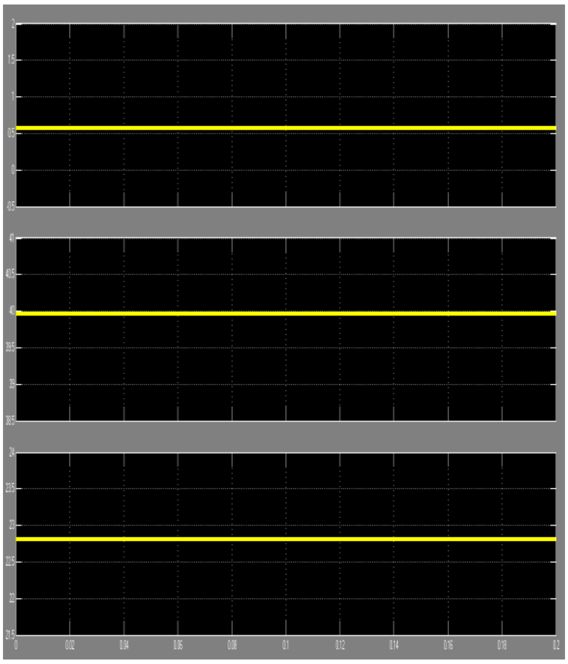
Output voltage waveform of proposed three-switch, isolated boost DC-DC converter



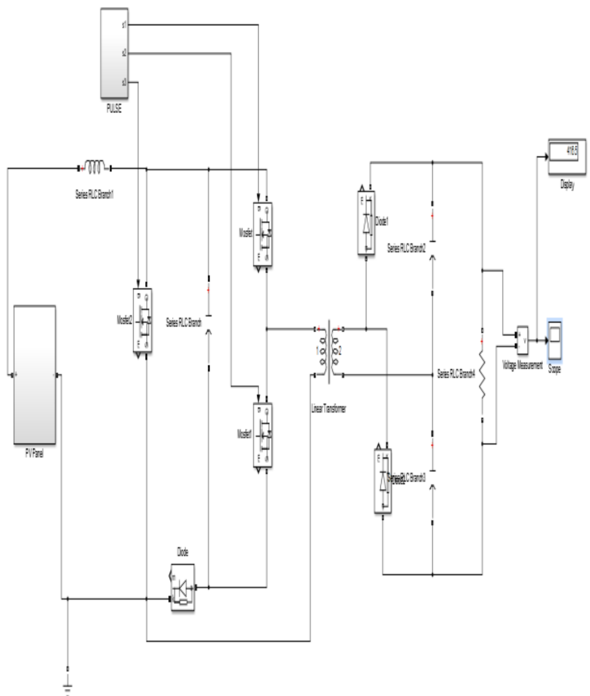
Simulation of PV source in Matlab



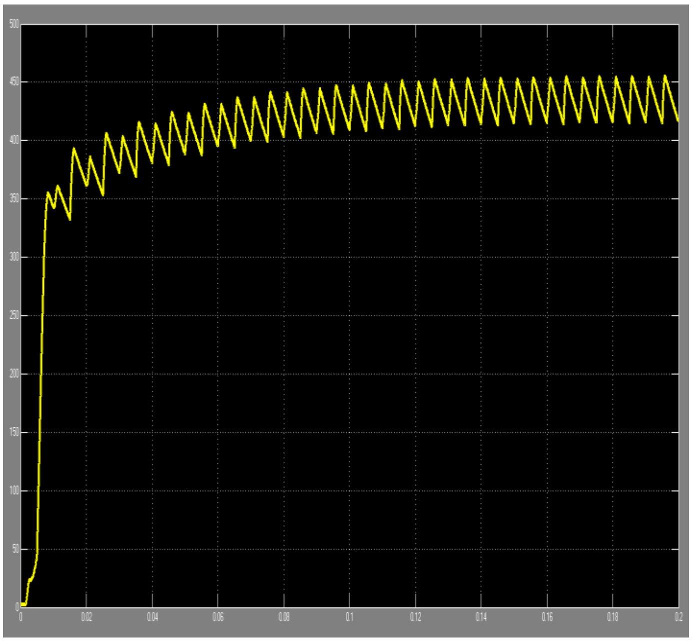
Output waveform of Current, voltage and power of the pv panel



Simulation of the converter with solar panel



Output voltage waveform of the converter with solar panel



CONCLUSION

Another three-switch isolated DC-DC converter was proposed in this paper. The proposed converter has the accompanying qualities: persistent input current, diminished one dynamic switch, unaltered voltage waveforms of the transformer, and no snubber circuit. The confinements of the proposed converter contrasted with the regular CFFB converter are as per the following: one additional diode and one additional capacitor are utilized, an increased input current ripple is required, and it is worked in hard-switching. The working standards, investigation, parameter plan rules, and simulation outputs are displayed. A lab model with a PID controller was built to check the working hypothesis of the proposed converter. The proposed converter is appropriate for power device applications in which a shifting low-dc input voltage is supported to a high settled dc output voltage with a persistent input current and galvanic isolation.

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