HIGH STEP-UP CONVERTER VOLTAGE MULTIPLIER MODULE FOR PHOTOVOLTAIC SYSTEM

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ABSTRACT—A novel high stride up high-proficiency interleaved converter with voltage multiplier module for sustainable power source framework, is proposed in this paper. A new voltage multiplier module made which is having exchanged capacitors and coupled inductors, with its blend a regular interleaved help converter acquires high stride up pick up without working at outrageous obligation proportion is composed. This proposed converter diminishes the present anxiety and furthermore lessens compels the info current swell, which diminishes the conduction misfortunes what's more, protracts the lifetime of the information source. Subsequently, substantial voltage spikes over the fundamental switches are lessened, and consequently the proficiency will be moved forward. Indeed the low voltage stretch makes the low-voltage-evaluated MOSFETs be embraced for diminutions of conduction misfortunes and cost. The proposed circuit planned with 10-V input voltage, 98.5-V yield. The most astounding effectiveness is 97.1%.

File Terms—Boost–flyback

Keywords: Boost flyback converter, voltage multiplier module, High step-up, photovoltaic system.

Introduction

Due to the large use of conventional sources for electricity production has produced a larger environmental hazards. This has given rise to the use of renewable energy sources such as wind, solar and tidal energy. Among this solar energy and wind energy are used on a large scale. The voltage output give by these renewable energy sources is very low thus a high dc-dc step-up converter are extensively used in these renewable energy sources. Photovoltaic system is gaining a large importance in producing electricity in recent years. In this system light energy is converted into electrical energy. This energy output can be converted in high voltage using step up dc-de converter using grid by grid inverter or storage energy in battery. A typical photovoltaic system that consists of a solar module, a high stepup converter, a charge-discharge controller, a battery set, and an inverter. The high step-up converter performs importantly among the system because the system requires a sufficiently high step-up conversion.

Literature review:

This system helps us use the renewable energy resources for our day to day need of electricity and thus reduces pollution and thus indirectly keeps the environment clean. This system uses PIC 16F877A. A voltage multiplier module is presented in this system for converting the low voltage output of renewable energy sources in a high voltage level so that the energy can be used for proper functioning of the equipments. The low output restricted the use of the renewable sources this system gives advantage that the sources can be used as the output can be converted into high voltage level.

PROPOSED SYSTEM:

In this paper, a deviated interleaved high stride up converter that joins the upsides of the previously mentioned converters is proposed, which consolidated the benefits of both. In the voltage multiplier module of the proposed converter, the turns proportion of coupled inductors can be intended to expand voltage pick up, and a voltage-lift capacitor offers an additional voltage transformation proportion.

BLOCKDIAGRAM:
BLOCK DIAGRAM EXPLANATION:

- **Input supply:** AC
- **Rectifier:** It is converted into AC TO DC Supply.
- **Driver circuit:** It can be used to amplify the 5V pulses to 12V for using transistor technology and provided isolations for using opto coupler. It has two functions,
  - Amplification
  - Isolation
- **Pulse generator:** Here we have used PIC microcontroller (PIC 16F877A) to make a switching signal.
- **Voltage Multiplier:** A voltage multiplier is an electrical circuit that converts AC electrical power from a lower voltage to a higher DC voltage, typically using a network of capacitors and diodes
  - **RECTIFIER:**
    Here in our project for full wave rectification we use bridge rectifier. From the basic bridge configuration we see that two diodes (say D2 & D3) are conducting while the other two diodes (D1 & D4) are in off state during the period t = 0 to T/2. Accordingly for the negative cycle of the input the conducting diodes are D1 & D4. Thus the polarity across the load is the same.
  - **FILTER:**
    In order to obtain a dc voltage of 0 Hz, we have to use a low pass filter. So that a capacitive filter circuit is used where a capacitor is connected at the rectifier output & a dc is obtained across the filtered waveform is essentially a dc voltage with negligible ripples & it is ultimately fed to the load.
  - **VOLTAGE MULTIPLIER:**
    A voltage multiplier is a specialized rectifier circuit producing an output which is theoretically an integer times the AC peak input, for example, 2, 3, or 4 times the AC peak input. Thus, it is possible to get 200 VDC from a 100 V peak AC source using a doubler, 400 VDC from a quadrupler. Any load in a practical circuit will lower these voltages.
  - **CONTROLLER-PIC:**
    PIC stands for Peripheral Interfacing Controller. We are using PIC 16F877A for producing switching pulses to multilevel inverter. The Pic microcontroller are driven via the driver circuit so as to boost the voltage triggering signal to 9V. To avoid any damage to microcontroller due to direct passing of 230V supply to it we provide an isolator in the form of optocoupler in the same driver.
  - **DRIVER CIRCUIT:**
    The driver circuit forms the most important part of the hardware unit because it acts as the backbone of the inverter as it gives the triggering pulse to the switches in the proper sequence. The driver unit contains the following important units.
    - **OPTOCOUPLER**
    - Totem pole
    - Capacitor
    - Supply
    - Diode
    - Resistor

**SOLAR PANEL**

The term solar panel is best applied to a flat solar thermal collector, such as a solar hot water or air panel used to heat water, air, or otherwise collect solar thermal energy. But 'solar panel' may also refer to a photovoltaic module which is an assembly of solar cells used to generate electricity. In all cases, the panels are typically flat, and are available in various heights and widths.

An array is an assembly of solar-thermal panels or photovoltaic (PV) modules; the panels can be connected either in parallel or series depending upon the design objective. Solar panels typically find use in residential, commercial, institutional, and light industrial applications.
Solar-thermal panels saw widespread use in Florida and California until the 1920's when tank-type water heaters replaced them. A thriving manufacturing business died seemingly overnight. However, solar-thermal panels are still in production, and are common in portions of the world where energy costs, and solar energy availability, are high.

Recently there has been a surge toward large scale production of PV modules. In parts of the world with significantly high isolation levels, PV output and their economics are enhanced. PV modules are the primary component of most small-scale solar-electric power generating facilities. Larger facilities, such as solar power plants typically contain an array of reflectors (concentrators), a receiver, and a thermodynamic power cycle, and thus use solar-thermal rather than PV.

COMPONENT LIST:

PIC Details
1 PIC PCB Board  PIC16F877A
2 Step down Transformer  230/12v
3 Bridge Rectifier  1 Amps
4 Capacitors  470uF, 10uF
5 Regulator IC  7805 IC
6 LED  Red 3.3v
7 Crystal Oscillator 10MHZ
8 Push Switches
9 Pot Resistor  5K ohm

Driver Circuit Details
1 Transistor  CK100
2 Transistor  2n2222
3 opto coupler  TLP250
4 Diode  IN4007
5 LED  Red 3.3v
6 Driver PCB Board
7 Zener Diode  15.5v
8 Capacitors  1000uF

Main Circuit
1 Solar Panel  12v, 5w
2 Step down Transformer  230/24v
3 Bridge Rectifier  6 Amps
4 Capacitors  1000uF & 100uF
5 MOSFET Switches  IRF840
6 Transformer  12v-6v-12v
7 inductor  1mH
8 Diode  IN4007
9 General Purpose Board
10 Multimeter  1
PRACTICAL CIRCUIT:

Working PRINCIPLE:

The proposed high walk up converter with voltage multiplier module. A customary lift converter and two coupled inductors are arranged in the voltage multiplier module, which is stacked on a lift converter to outline an unbalanced interleaved structure. Fundamental windings of the coupled inductors with \( N_p \) turns are used to decrease enter current swell, and discretionary windings of the coupled inductors with \( N_s \) turns are related in game plan to increase voltage get. The turns extents of the coupled inductors are the same.

The equivalent circuit of the proposed converter is showed up in Fig. where \( L_{m1} \) and \( L_{m2} \) are the polarizing inductors, \( L_{k1} \) and \( L_{k2} \) address the spillage inductors, \( S_1 \) and \( S_2 \) mean the power switches, \( C_b \) is the voltage-lift capacitor, and \( n \) is defined as a turns extent \( N_s/N_p \). The proposed converter works in persevering conduction mode (CCM), and the commitment cycles of the power switches in the midst of relentless operation are interleaved with a 180° stage move; the obligation cycles are more critical than 0.5.

The input is given from the pv panel used. The obtained DC output is then given to the high step up converter voltage multiplier module. First, the power switches \( S_1 \) and \( S_2 \) are turned ON. All of the diodes are reversed-biased. Magnetizing inductors \( L_{m1} \) and \( L_{m2} \) as well as leakage inductors \( L_{k1} \) and \( L_{k2} \) are linearly charged by the input voltage source. The power switch \( S_2 \) is switched OFF, thereby turning ON diodes \( D_2 \) and \( D_4 \). The energy that magnetizing inductor \( L_{m2} \) has stored is transferred to the secondary side charging the output filter capacitor \( C_3 \). The input voltage source, magnetizing inductor \( L_{m2} \), leakage inductor \( L_{k2} \), and voltage-lift capacitor \( C_b \) release energy to the output filter capacitor \( C_1 \) via diode \( D_2 \) and \( D_4 \), thereby extending the voltage on \( C_1 \). Then diode \( D_2 \) automatically switches OFF because the total energy of leakage inductor \( L_{k2} \) has been completely released to the output filter capacitor \( C_1 \). Magnetizing inductor \( L_{m2} \) transfers energy to the secondary side charging the output filter capacitor \( C_3 \) via diode \( D_4 \) until \( t_3 \). Then the power switch \( S_2 \) is switched ON and all the diodes are turned OFF. The operating states of modes 1 and 4 are similar. Then the power switch \( S_1 \) is switched OFF, which turns ON diodes \( D_1 \) and \( D_3 \). The energy stored in magnetizing inductor \( L_{m1} \) is transferred to the secondary side charging the output filter capacitor \( C_2 \).

CONCLUSION:

This paper has exhibited the hypothetical investigation of relentless state, related thought, reproduction comes about for the proposed converter. The proposed converter has effectively actualized a productive high stride up change through the voltage multiplier module. The interleaved structure diminishes the info current swell and disseminates the current through every part. Whatmore, the lossless latent clasp work reuses the spillage vitality and compels a huge voltage spike over the power switch. In the interim, the voltage weight on the power switch is confined and much lower than the yield voltage. The most noteworthy productivity is 96. In this manner, the proposed converter is reasonable for high-control or inexhaustible vitality applications that need high stride up transformation.

REFERENCE:


