Ultra Step up DC-DC Converter With Gain Output Voltage Using Modified SEPIC Converter For Renewable Applications

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Abstract- *The performance analysis of modified SEPIC DC-DC converter with low input voltage and wide output voltage range. The operational analysis is done for the 380w power output of the modified converter. The simulation results of modified SEPIC converter are obtained with PI controller for the output voltage. The result obtained with the modified converter are compared with the basic SEPIC modified converter topology for the rise time, peak time, settling time and steady state error of the output response for open loop.*

Keywords- DC-DC power conversion, PI controller and solar power generation.

I. INTRODUCTION

A high power rectifier suitable for universal line based on a modified version of single ended primary inductance converter(SEPIC). The voltage multiplier technique is applied to the classical SEPIC circuit, obtaining new operation characteristics as low switch operation and high static gain at low line voltage. The new configuration also allows the reduction of the losses associated to the reverse recovery current, and soft communication is obtained with the simple regenerative snubber circuit. The theoretical analysis and experimental analysis obtained with the proposed structure are compared with the classical boost topology.

II. SYSTEM METHODOLOGY OF MODIFIED SEPIC CONVERTER

Existing system: When a step up ratio is necessary for the first power stage , the usual solution is the use of isolated dc-dc converters. The power converter use with renewable energy sources must present a high efficiency due to the high cost of energy source, as photovoltaic module or fuel cells. Only part of the power processed by the converter is transferred to the output through the coupling inductor and another part of the power is transferred directly by the non isolated converter, reducing the weight, volume and losses of the transformer. The leakage inductance is the problem for the single switch isolated dc-dc converters resulting in the switching overvoltage and the energy stored in the leakage inductance must be dissipated in the snubber or clamping circuits.

Proposed system: The continuous conduction mode operation of the modified sepic converter with magnetic coupling and output diode clamping presents five operation stages. all capacitors are considered as a voltage source and the semiconductors are considered ideals for the theoretical analysis.

III. BLOCK DIAGRAM OF MODIFIED SEPIC CONVERTER

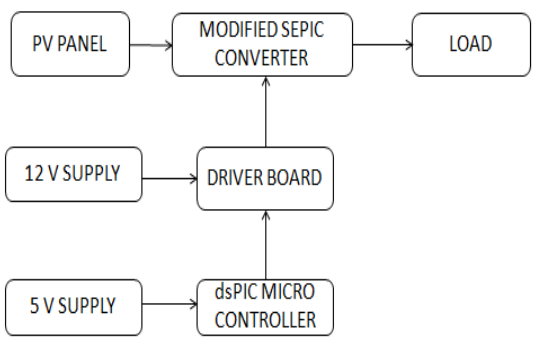
Input supply : solar energy

Driver circuit: it can be used to amplify the 5v pulses to 12v for using transistor technologies and providing isolations for Optocoupler. It has two functions,

- Amplification
- Isolation

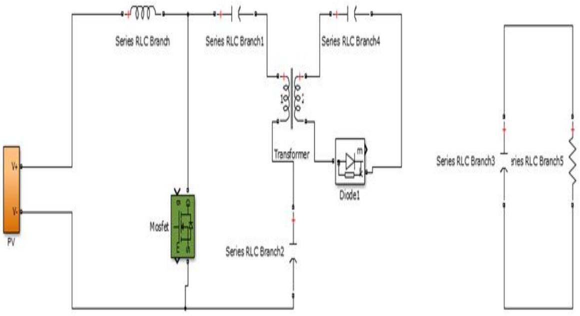
Pulse generator: A Pic microcontroller (Pic16F877A) is used to make a switching signal for controlling the inverter.

Converter: it is used to convert the dc voltage to ac voltage.

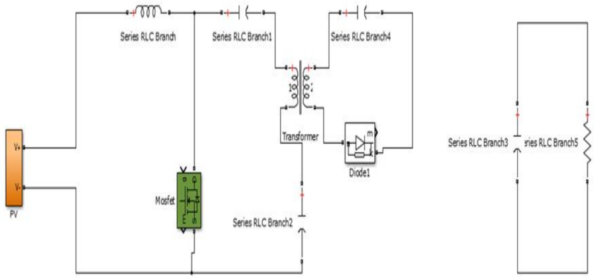


III . OPERATION OF PROPOSED SYSTEM

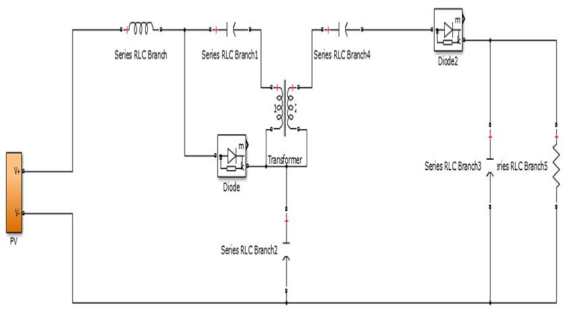
A. **first stage [t0 - t1]** – the power switch s is conducting and the input inductor l1 stores energy. The capacitor cs2 is charged by the secondary winding l2s and diode dm2. The leakage inductance limits the current and the energy transference occurs in a resonant way.



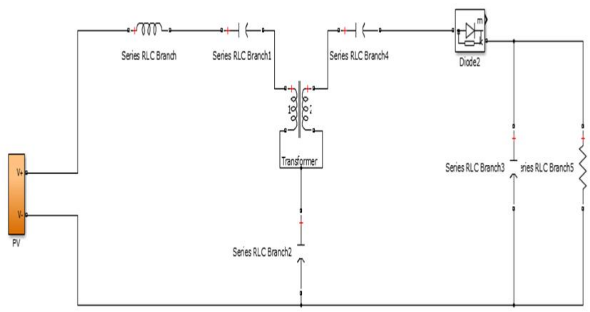
B. **second stage [t1 - t2]** – from the instant t1, when the diode dm2 is blocked, to the instant t2 when the power switch is turned off, the inductors l1 and l2 store energy and the currents linearly increase.



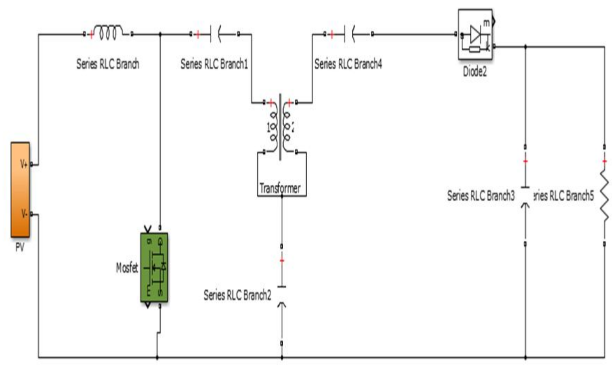
C. Third stage [t2-t3]: at the instant t2 the power switch s is turned off. The energy stored in the l1 inductor is transferred to the cm capacitor. Also there is the energy transference to the output thought the capacitors cs1, cs2 inductor l2 and output diode do.



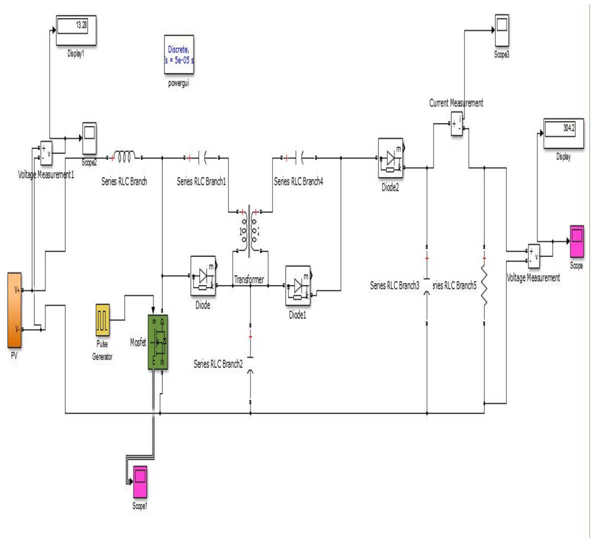
D. Fourth stage [t3 - t4] - at the instant t3, the energy transference to the capacitor cm is finished and the diode dm1 is blocked. the energy transference to the output is maintained until the instant t4, when the powerswitch is turned on.



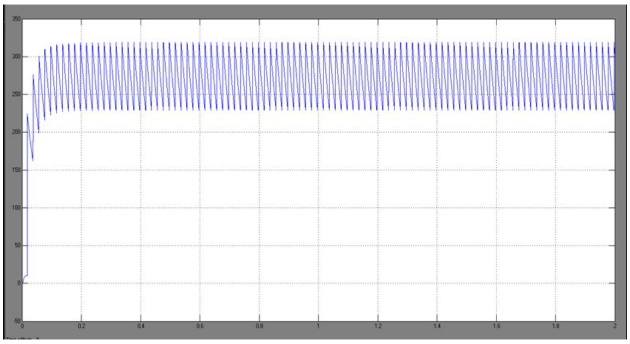
E. Fifth stage [t4 – t5] - when the power switch is turned on at the instant t4, the current at the output diode do linearly decreases and the *di/dt* is limited by the transformer leakage inductance, reducing the diode reverse recovery current problems. when the output diode is blocked, the converter returns to the first operation stage.



IV. SIMULATION OF THE PROPOSED SYSTEM



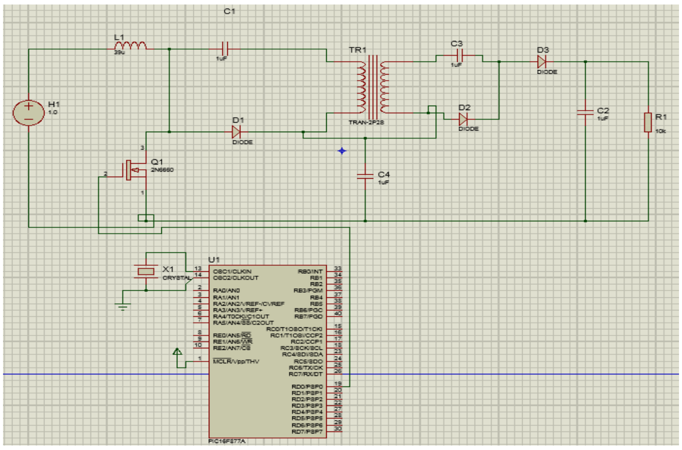
The current and voltage of the output diode is presented in the waveform given below. A diode reverse recovery current can be observed in the simulation circuit and the output diode voltage is clamped at the output voltage value.



Output Waveform of Modified SEPIC With Magnetic Coupling

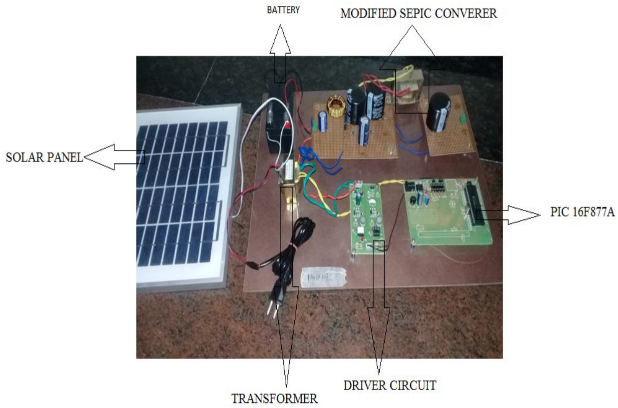
V. HARDWARE DESCRIPTION

The chapter deals with the hardware implementation of the project. The hardware consists of the following components discussed below. The various components along with their detailed description of the component have been discussed in this chapter.



Hardware Circuit Diagram Of Modified SEPIC With Magnetic Coupling

VI. EXPERIMENTAL ANALYSIS



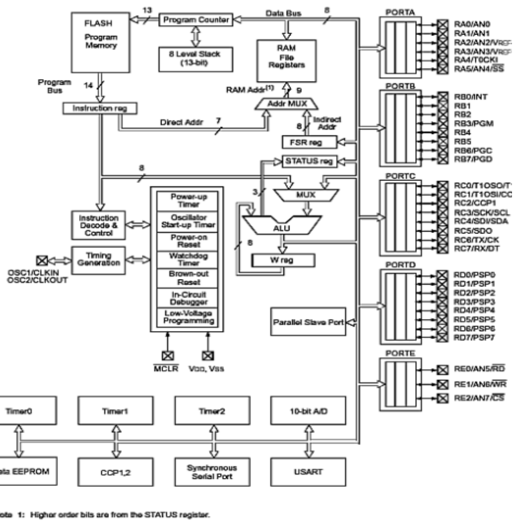
Hardware Snapshot

VII. CONCLUSION

Thus in this project the efficiency of proposed converter with magnetic coupling is equal to 92.2% operating with input voltage equal to 15V,output voltage equal to 300V and output power equal to 100W.The commutation losses of the proposed converter with magnetic coupling are reduced due to the presence of transformer leakage inductance and the secondary voltage multiplier that operates as a non dissipative clamping to the output diode voltage.

VIII. APPENDIX

PIC 16F877
Architecture of PIC16F877



Architecture Of PIC 16F877

Memory Organization of PIC16F877

The memory of a PIC 16F877 chip is divided into 3 sections. They are

- Program memory
- Data memory and
- Data EEPROM

Program memory

Program memory contains the programs that are written by the user. The program counter (PC) executes these stored commands one by one. Usually PIC16F877 devices have a 13 bit wide program counter that is capable of addressing 8K×14 bit program memory space. This memory is primarily used for storing the programs that are written (burned) to be used by the PIC. These devices also have 8K*14 bits of flash memory that can be electrically erasable /reprogrammed. Each time we write a new program to the controller, we must delete the old one at that time. The figure below shows the program memory map and stack.

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