Switched Capacitor based High Gain DC-DC Boost Converter

M.Arul prasanna, D.Arun Prasad, R.Baladhandapani, K.Shanmuga priya

Abstract: ***A switched-capacitor (SC) - based High gain DC to DC boost converter is suggest in this work. This work uses switched capacitor based double switch converter for attaining the huge Voltage gain with minimum duty cycle. Hence in turn it reduces the Voltage stress and the on state losses on the influence electronic switches. Here the working principles and the design parameters are presented for the converter in both Conduction modes. Also the developed topology is going to be validated towards the conventional non-isolated converters both in simulation and in hardware prototype. Also the simulated DC-DC Boost Converter a research center model is structured and the outcomes are approved for its functionality.***

Keywords: Switched capacitor, High Gain, Full Bridge Converter, Voltage Multiplier

I. INTRODUCTION

On account of the exhaustion of the worldwide fossil-vitality sources, the improvement of sustainable power source is the best arrangement. Be that as it may, the accessible sustainable power sources, for example, wind, sun oriented, and energy components are dependent on the climate circumstance, and their yield voltages are less and different. To associate them to the private loads, the double-organize control transformation framework that is appeared in Figure. 1 is broadly utilized. In the principle organisation, a huge advance-up dc to dc converter is utilized to transfer over a lesser V into a steady dc to transport voltage. Some advance up dc to dc converters have been suggest and examined to acquire a huge-voltage .For the separated construction [3, 4], a large-recurrence transformer is utilized to protect the information what's more, the yield with a two-arrange dc-air conditioning dc control change. For the non-secluded construction, different huge-advance up DC to DC converters without, with a integrate inductor have been suggest. The integrate inductor depend huge advance up converters are suggest. To build voltage yield; nonetheless, the spillage inductors of the integrate inductor is a non positive effect of the integrate inductor based converters. The unintegrate inductor converters can accomplish a large voltage yield with a huge productivity and a powerful thickness since they need attractive parts. Figure. 2 demonstrates the suggest Switched capacitor depend double switch converter with the large V yield. It comprises of single inductor (L), 3 capacitors (Co– C2), 4 power diodes (D0– D3), two power switches (S1 and S2), and a load (R). Figure. 3 demonstrates the waveforms of the suggest switched capacitor with dual switch converter working on the both modes. The two switches, S1, S2, are switched on and switched off at the same time. To streamline the circuit investigations of the suggest converter in the conduction modes, the accompanying suppositions were made: 1) Every gadgets are perfect also, low loss; 2) The value of the capacitors (C) is sufficiently huge to keep up the steady capacitor voltage; and 3) The present stream to the L increments or abatements directly.

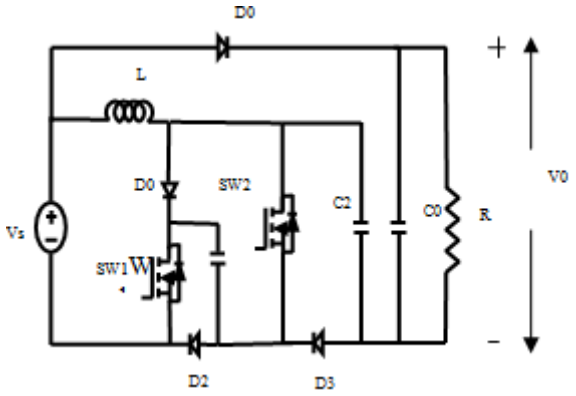

Fig. 1 Existing diagram

High voltage gain is achieved by using larger capacitors which are larger in size and posses d_q/d_t ratio. Because of the hard exchanging of the dynamic switch and the expensive turn around recuperation loss of the diode the efficiency is low. Charge equalization is an another problem to be focused .The voltage balancing will be an another issue between capacitors.

An Switched Capacitor(SC) -based double-switch high-boost DC to DC converter is implemented. It achieves a large-voltage yield with a low obligation cycle of the decline of the on state loss of the power switches, and a low-voltage weight on the metal oxide semiconductor field effect transistor and Diodes. The converter can be worked in both CCM and DCM Mode.

Modes of Operation

There are two modes of operation are available. Mode 1 operation is CCM and mode 2 is DCM. Mode 1 consists of two modes of operation and mode 2 consists of three modes of operation.

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Continuous Conduction Mode

In mode 1 operation, S_1, S_2 are switched ON is shown in figure 3.2. Then the capacitors c_1 and c_2 are discharge while the inductor gets charged. The D_0 is forward-biased, while the D_1, D_2, and D_3 diodes are reverse-biased.

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In mode 2 work, S_1,S_2 are turned "OFF". Then the D_0 diodes are reverse-biased while the D_1,D_2 and D_3 diodeS are reverse-biased. While this mode, capacitors c_1 and c_2 are charged while the inductor l gets discharged.

Discontinuous Conduction Mode

In mode 1 operation, S_1 and S_2 are switched ON. Then the c1 and c2 is discharge while the inductor L are discharged. The d_1,d_2,d_3 are reverse biased while the D_0 forward biased.

In mode 2 operation, second mode of the DCM ends when the inductor current is reduced to 0.

In mode 3 operation, S_1 , S_2 are switched OFF then the I_L is 0. The stored power in the Co is released to theresistance. The voltage of the inductor in this mode is 0.

II. PROPOSED METHOD

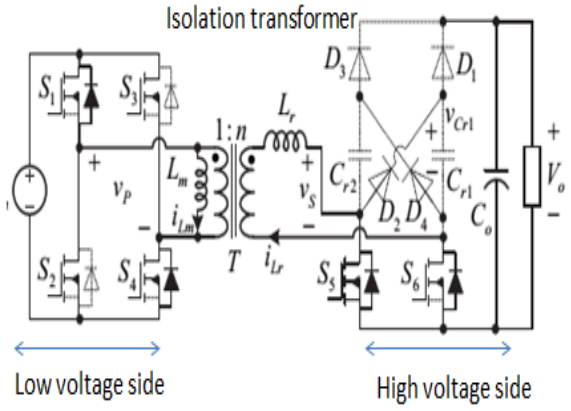

Fig. 2 Circuit diagram for Proposed System

In order to make the converter more efficient , a dc to dc converter based on the resonant technique is been proposed .A the isolated resonant converter is proposed .The proposed system can be operated in the buck as well as the boost modes.

There are five blocks are available. Full bridge converter, Isolation transformer, resonant tank, Voltage multiplier, load.

Input

The input voltage for the system is (0-50)v Here voltage source is connected for the source of the system.

Full Bridge Converter

The FBC consists of four switches. It is used to convert dc source to ac source.

Isolation Transformer

The confinement transformer is utilized to exchange electrical power from a source of substuting current(AC) power to some hardware or gadgets while sepersting the fueled device while detaching the controlled gadget from the power source, for the most part for a security reasons.

Resonant tank

A resonant tank, or tuned, circuit combines an inductor and capacitor to make a circuit that is responsive to a frequency.

Voltage multiplier

Voltage multiplier is used to double the information voltage. It is an electrical circuit that converters air conditioning electrical power from a lower voltage to a higher dc voltage, regularly utilizing a system of capacitors and diodes.

Issues in existing system

High voltage gain is achieved by using larger capacitors which are larger in size and posses dq/dt ratio. Because of the hard exchanging of the dynamic switch and the huge invert recuperation loss of the diode efficiency is low. Charge equalization is an another problem to be focused. The voltage balancing will be an another issue between capacitors

Proposed topology

A resonant converter with resonant doubler rectifier (VDR) for a high gain is designed A fixed frequency variable obligation cycle control scheme between the primary and the secondary controls are designed. Because of the constant frequency switching that equals the frequency of the combination of L and C tank reduces magnetic simplicity. The proposed system can operate under both buck and the boost modes .

A front end full bridge dc-dc converter followed by a isolated resonant voltage multiplier is proposed. The resonant converter is operated to control the separate sources that deliver power to the isolation stage The isolation stage has a active bridge that is followed by resonant converter and a isolation transformer resonant capacitor (RC) with resonant doubler rectifier (VDR) is operated with a constant frequency phase-shift control.Zero Voltage Source (ZVS) for every switches and Zero Current Source (ZCS) for every diodes can be achieved between broad voltage and range of the loads. The converter can worked in buck or boost mode, it is intertrested to obtain huge productivity in a broad range.

This design has a Cr1, Cr2 resonant capacitors, Lr a resonant inductor, D1and D3are output diodes, D2and D4are regenerative diodes, Tis a high frequency transformer.S1and S2are the dynamic switches via which the power yield can be directed. The full tank is compries of 3 gadgets, Cr1, Cr2 and Lr .The converter can be operated in buck or boost mode based on the input voltage .

The inductor Lm is the polarizing inductor of the transformer, and primary from the n secondary turns ratio of the transformer T. The resonant capacitors Cr1and Cr2are not only utilized as a region of the full tank, additionally utilized to twice the yield voltage, it is same to the voltage doubler rectifier.variable obligation cycle control procedure is working to direct the V_0 and power.

In boost mode working of the converter, primary side switches operate in a fixed duty ratio. The secondary side duty cycle and phase delay is utilized to direct the V_0. Based on the vin the modes are selected. With the operating states can be classified in to five , the operation of the boost converter is simple as the conventional interleaved boost converter .The capacitors Cr1,Cr2 and the diodes on the secondary side forms the voltage multiplier As the voltage on the primary is switched and passed through the transformer provides the voltage isolation.

III. SIMULATION RESULTS

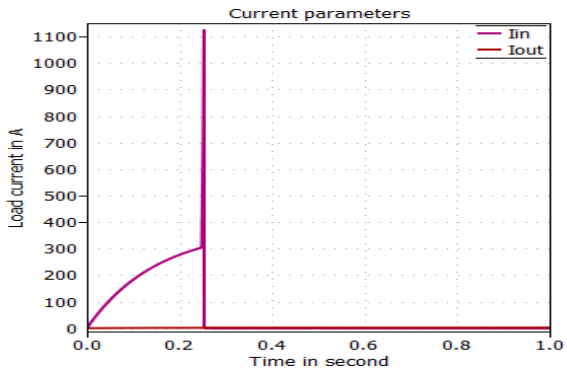

Fig. 3 I_{in} and I_{out} Diagram for Existing System

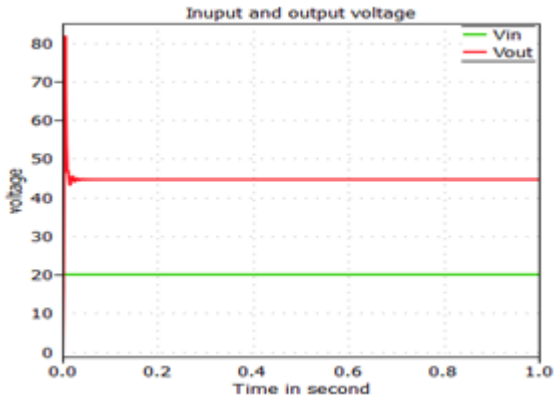

Fig. 4 Input and Output Voltage Diagram for Existing System

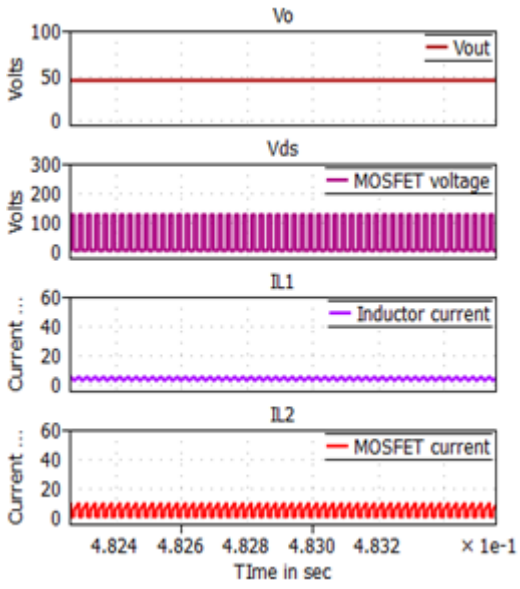

Fig. 5 Voltage and Current across MOSFET and Diodes

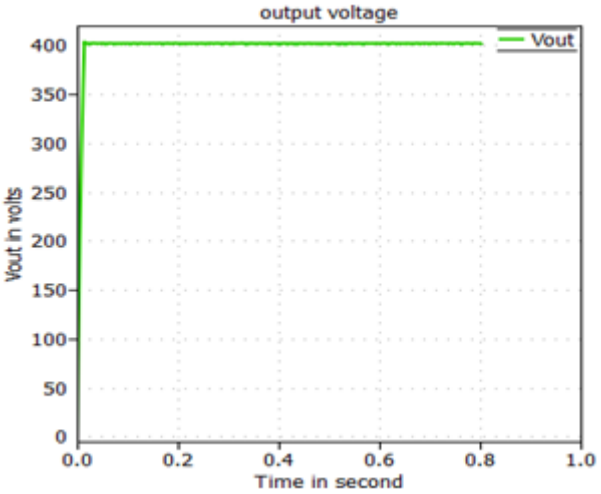

Fig. 6 Output Voltage Diagram for Proposed System

IV. CONCLUSION

In this paper the proposed work is carried out in a simulation platform so as to validate the performance of the suggest converter model. here a switched capacitor(sc) based high gain DC-DC boost converter is designed so as to attain a large voltage yield with minimum obligation cycle. This high gain reduces the voltage weight on the switching gadgets there by reduces the conduction losses. The proposed system is modeled and designed in the PLEXIM tool for better understanding on the working of the new topology. Also the pulse generation for the switches are designed using PLEXIM tool kit which ensures the expected output for the proposed system in the simulation platform.

The future scope of this paper the simulation work is about to be validated with an experimental hardware prototype in order to ensure the in capability of the simulation model. Also the hardware results are going to be compared with their respective simulation results for better understanding.

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