DESIGN AND PERFORMANCE ANALYSIS OF DIFFERENT TYPES OF FILTER USING INTERLEAVED STEP UP CONVERTER

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Abstract:- *Renewable energy sources are easily available into environment. In application interleaved boost converter are used for to increase output and reduce output ripple. Generally renewable sources are include solar, photovoltaic cells, fuel cell. In this paper the interleaved boost converter are used for renewable energy sources. The interleaved boost converter are compared with convectional boost converter and find better efficiency less output voltage ripple and better performance. In this paper we studied different types of filter using interleaved boost converter. Comparing all these filter using IBC and find out which filter is better for renewable energy. The waveform of all output voltage, settling time are observed by using Simulation in MATLAB*

Keywords: Interleaved Boost Converter, Filter, MATLAB.

I. INTRODUCTION

Now a days the world virtually depend on the fossil fuels but now the fossil fuels are running out. Renewable energy is naturally return from the resources such as wind, sunlight, rain, tides and geothermal heat. Thirty nations around the world already have renewable energy contribution in the national level.For this application interleaved boost converter can be used. Interleaved boost converter increased output voltage and decrease output voltage ripple and give better efficiency and improve electromagnetic emission. In high power application interleaved boost converter is used rather than conventional boost converter because it has low ripple in input side and output side. We use uncoupled inductor circuit with C filter, LC filter, Pi filter and C filter. In this paper investigate which circuit is having less ripple, more output voltage and less ripple and inductor ripple. We compare all four types of waveforms secure in simulation on MATLAB. Simulation on MATLAB have been perform to validate the concepts.

II. OPERATION OF INTERLEAVED BOOST CONVERTTER

The IBC consists of many boost converters which we connect in parallel. The interleaved boost converter are 180o connected two branches is parallel because phase shift is provided depend upon the number of phases given by 360/n, as the number of phases are two results in decrease in output voltage ripple and input current ripple is also decrease by two phase Interleaved Boost Converter.

A. Operation of Interleaved Boost Converter

The boost converter output voltage is greater than the input voltage. IBC operation are divided into two parts Mode 1 and Mode 2. In mode 1 MOSFET is in short circuit condition and diode in open circuit condition when switch is on the current flow through inductor and switch as the inductor initially charge. Mode 2 when MOSFET is in open condition and diode in short circuit condition input current flows through the resistive load.

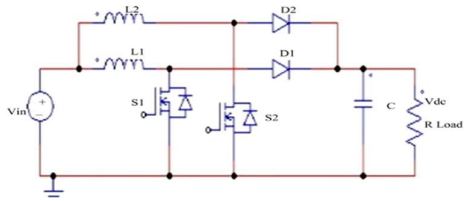


Fig. 1 Basic Circuit diagram of Interleaved boost converter

In this paper we use voltage as an input voltage of 20V to the interleaved boost converter and desire output voltage is 40 V. D is duty ratio and D is taken as 0.5.

III. DIFFERENT TYPES OF FILTERS

By using the filter circuit reduce the ripple content present in the system. Filter circuit is a combination of capacitor (C), Inductor (L). To passed capacitor permits AC only and Inductor permits DC only. The L and C circuit filter out the AC component from the rectified wave.

Types of filters are given below.

A. Inductor Filter

B. Capacitor Filter

C. LC Filter

D. Pi Filter

IV. DESIGN METHODOLOGY OF UNCOUPLED IBC

The interleaved boost converter design procedure require a choice of actual values of power semiconductor device, capacitor, and inductor. The step require in the process for designing the uncoupled interleaved boost converter are as follows:

1)Decision of duty ratio and number of phases

2)Selection of inductor and capacitor values

3)Selection of power switches

4)Output filter

1) Decision of duty ratio and number of phases

There would be fewer ripple contents if we employed more phases. We employ a two-phase interleaved boost converter in this work. The quantity of inductors, diodes, and switches are equivalent to n phases[1].

$$\frac{Vin}{L}\left(\frac{2-3DT}{D}\right)\frac{T}{N}$$

2) Selection of inductor and capacitor values

For the selection of the selection of capacitor and inductor the design equation part for uncoupled IBC is given below

a) Inductor

The value of inductor for uncoupled IBC is

$$L=\frac{VinDT}{\Delta Iph}$$

Where Vin is input voltage, D is duty ratio

2) Selection of power devices

Due to its many advantages over other conventional boost converter, IGBT is the power semiconductor devices for two phase uncoupled interleaved boost converter. It has a lofty reduced state resistance during switching operations.

Vswitch= $Vin\frac{1}{1-D}$

Where Vin is input voltage, D is duty ratio

Output filters

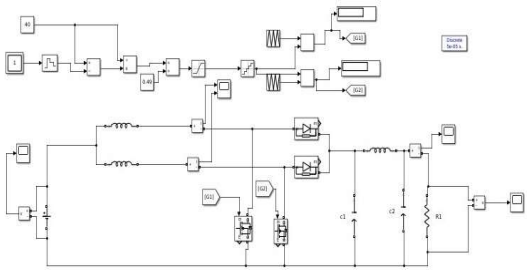
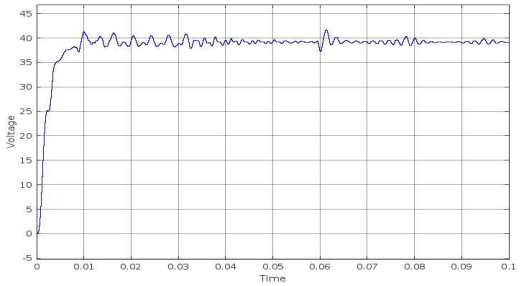
Filter is use to reduce ripple at laod side.

$$C=\frac{Vo\ DT}{R\Delta Vo}$$

V. SIMULATION RESULTS

As per equation number 1,2,3 and 4 from above two phase IBC with uncoupled inductor are simulated in MATLAB Simulation. The values of uncoupled IBC are L=2.5 mH, F=2.5 KHz, C=78ɥF, R=3.2 ohm, duty ratio D=0.5, input is Vin=20V and otput voltage is Vout=38V.

Table 1. simulation of IBC and output with different types of filter

Sr. No	Simulation	Result
1	 **Fig. 6 Circuit Diagram of IBC with Pi Filter**	 **Fig. 7 Output voltage waveform for IBC with Pi Filter**

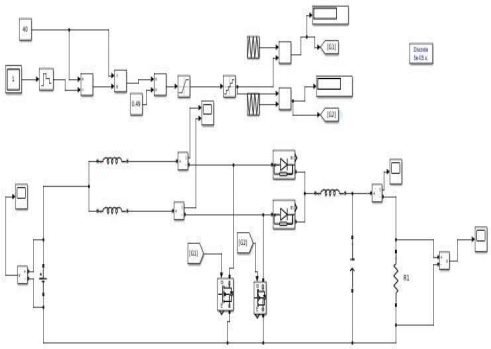
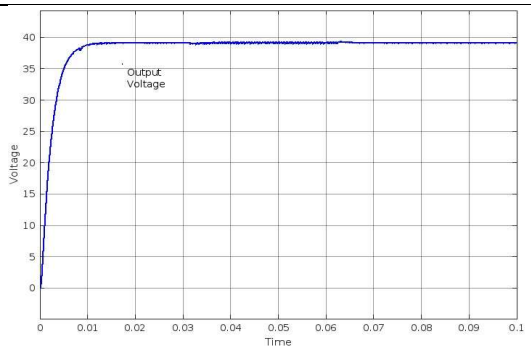
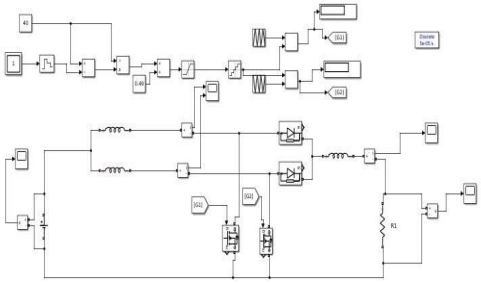
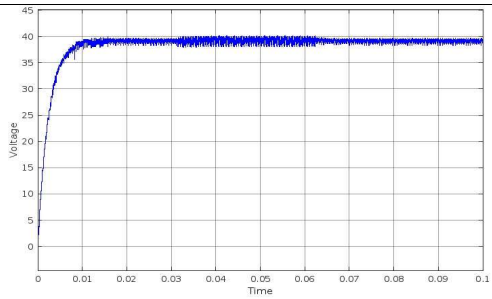
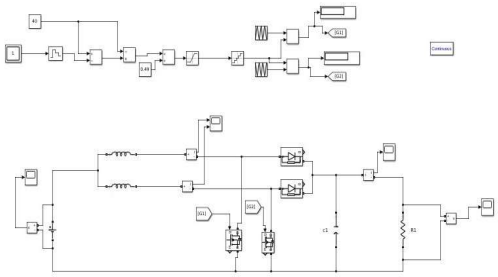
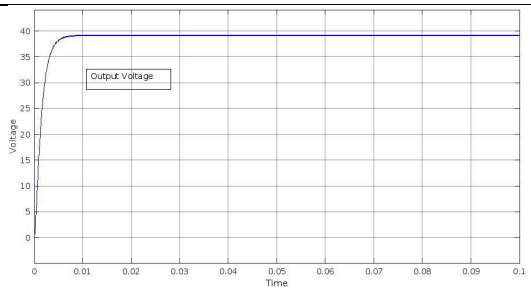
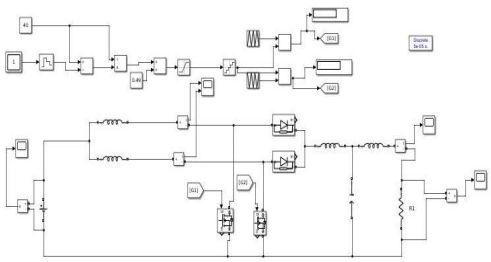
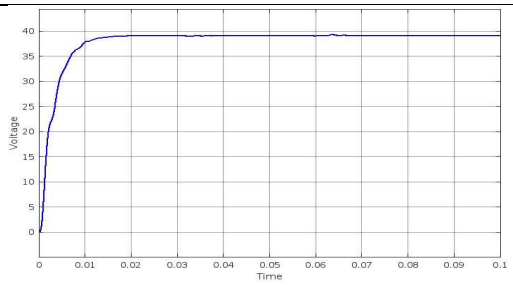
2	 Fig. 8 Circuit Diagram of IBC with LC Filter	 Fig. 9 Output voltage waveform for IBC with Pi Filter
3	 Fig. 10 Circuit Diagram of IBC with L Filter	 Fig. 11 Output voltage waveform for IBC with Pi Filter
4	 Fig. 12 Circuit Diagram of IBC with C Filter	 Fig. 13 Output voltage waveform for IBC with C Filter
5	 Fig. 14 Circuit Diagram of IBC with T Filter	 Fig. 15 Output voltage waveform for IBC with T Filter

Table 2. Comparative analysis of different types of filter

Types of Flter	Pi Filter	LC Filter	L Filter	C Filter	T Filter
Input voltage	20V	20V	20V	20V	20V
Output Voltage	38.58V	38.58V	38.44V	38.10V	39.26V
Output current	12.06A	12.01A	12.25A	11.9A	11.96A
Output Power	465.27 W	463.34W	470.89W	453.39W	469.54W

VI. CONCLUSION

We utilized interleaved boost converters for renewable energy applications because they have numerous advantages over other converters. We employ uncoupled IBC that has Pi, L, C, and LC filters installed.

All four filters performance parameters were calculated using their equation, and the MATLAB simulation results were compared to an uncoupled IBC with L, LC, and Pi filters, it is concluded that an interleaved DC-DC converter with a C filter efficiently lowers the overall settling time and increases the large output voltage.

Reference

[1] Mr. Sandeep Apte, Payal Suhane "To Study Different Types of Filter on Uncoupled Boost Converter for Renewable Energy Sources"IEEE on 2015 978-1-4799-7678.

[2] J.S.Anu Rahaavi, T.Kanagapriya, Dr.R.Seyzhai "Design and Analysis interleaved boost converter for renewable energy source"IEEE Trans.ICCEET 2012 page no. 447-451.

[3] Ishan Kar, Shubham, T.m Thamizh Thentral "Comparative Study of Outputs Genrated by Different Filtering Circuits" vol. 6, Issue 3 in International Journal of Engineering and technology.

[4]Newlin, D.J.S. ; Ramalakshimi, R. ;Rajasekaran, S. "A performance comparison of interleaved boost converter and conventional boost converter for renewable energy application" IEEE trans.(ICGHPC) 2013 page no.1-3.