

Discontinuous Conduction of Dual Interleaved Boost Converter

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ABSTRACT: Nowadays Converters are used in many of the electronic equipments and especially globally considered solar panel .In India it promising field. Here a review and structural analysis is made for discontinuous conduction\current mode function of dual interleaved boost converter[1]. An IPT(that is Inductive power transfer transformer)or coupled inductors are for equal splitting of current installed this equipment.

KEYWORDS: IPT

I. INTRODUCTION

In daily day to day life we come across many different form of latest technology ,this mainly due to fast innovations in basics electronics for example DC-DC converter. Emerging areas of scientific innovations is aircraft, fuel cell for electric vehicle and energy conversion (i.e DC into AC or vice versa) etc.

DC-DC converter which is a chopper which help in time regulated control ,later from choppers fly back converters were formed .Buck and boost converters are also considered for ac source. it is found that in conventional or basic DC-DC converter bi-directional capability is possible due to the presence of energy storage elements Inductor and capacitance. Here in this topic ewe are going to review or highlight the importance of interleaving techniques for DC-DC converter. Energy storage element such as inductor or capacitance can also help in these in interleaving techniques as it produces phase shift . Interleaving techniques is mainly based on time delay between two or more pulses. The space between two pulses is adjusted just that there is portion when one pulse is on the other pulse is of time duration of micro or milli seconds

.It is in this portion the DC-DC converter is said to function and corresponding waveform are obtained . but the waveforms can be used for the operating analysis where a quick CRO at between the energy storage elements and switches help identifying the fault in the DC-DC converter .

The presence of inductor which act as a filter removes ripples thus resulting in reduction of size and weight of the filter The availability of this option has the following advantages.

(i)Easy installation and less cost in transportation

(ii) Usage of feedback is not required due to the presence of energy storage elements (i.e, bi-directional is nature)

(iii) Removal of ripples due to presence of filter.

(iv) Simple analysis will give account of a brief and comprehensive operating analysis

Interleaving techniques can be used for multi utilities of high power rating .These also help in the improvement of the power factor that enhances the power flow in the circuit.Interleaved buck and boost converter is showing in the figure 1 below the block diagram Where asource is connected to an IPT transformer through an filter inductor is used along with inverted semi-converter or rectifier and the output is taken out from the capacitor through a resistive load[2]

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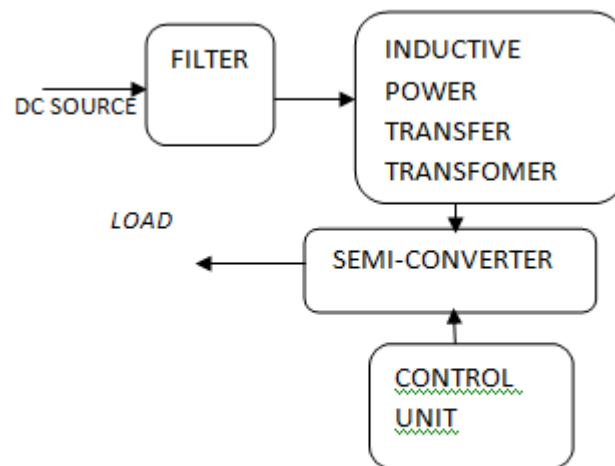


Figure1 Block diagram of interleaved boost converter

Nowadays to ensure the equal sharing of current to each branch of diversion IPT or wireless transformer is used that is inductive power transfer without the physical contact between the source and load .The IPT is used in distribution panel where the current are divided between each line of transfer[3]

PWM techniques is used in the triggering of the switches which can be any power transistor like Mosfet ,IGBT ,JFET etc. For the application of PWM techniques an control circuit is used which can a be microcontroller. PWM technique is highly used in latest technologies hence its highly gone through a large coverage of application sand further modification can be referred

.Nowadays renewable resources are being limited in usage due to availability. The solar panel which uses sunlight to store energy in the battery is converted into DC voltage with the help of d capacitor , leading to a boost converter which is used for the step-up of DC voltage .

Interleaved Buck and boost converter can be used here for the solar panel .the source sunlight is focused on the dielectric converted into fluctuating DC voltage the given to the interleaved boost and buck converter . The block diagram is given below in figure 2

Here we are going to see the review of discontinuous mode of operation of the dual and interleaved buck and boost converter. The presence of ripple is due to the discontinuous mode of operation of the inductor.

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II. CONVERTER DESCRIPTION

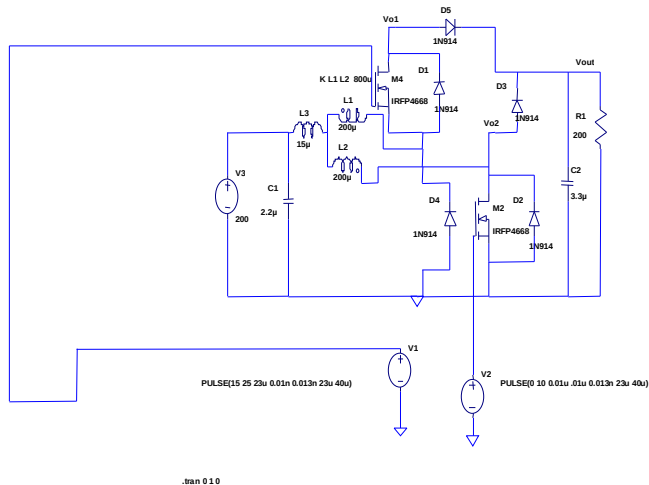


Figure2.Schematic diagram of interleaved boost converter

CIRCUIT DAIGRAM

The converter consists of two switches along with parallel diodes which formed the dual boost converter .The above circuit diagram shown is an interleaved boost circuit diagram. The duty ratio is considered for to be 0.556 where interleaving technique is achieved and the output is more than the input voltage.

III. WORKING PRINCIPLE

The voltage passes through the filter inductor and coupled inductor passes through the switches and diodes .at initial stage when current passes through the filter it is at low potential and diode D1 and switch M4 and is fed back to and the output is taken[6].

When times starts to increase the voltage is at high potential the switch M4 is on and diode D6 is forward biased and the output through these two terminals. The pulse are in an interleaved manner which makes the high output gain.

SUB-CIRCUIT 1

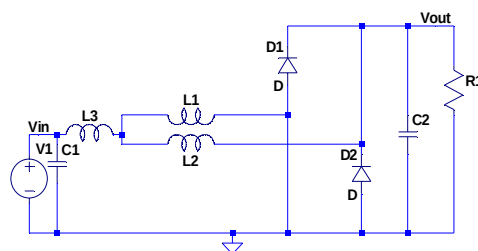


Figure 3sub-circuit 1

The module circuit consists of diodes D1,D2,D3 and D4 which consists of the components which constitute the discontinuous current mode in this circuit which is shown in figure 7

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The diodes D2 is forward biased, diode D1 conducts in reverse bias. The output is taken across the resistor,
SUB-CIRCUIT 2

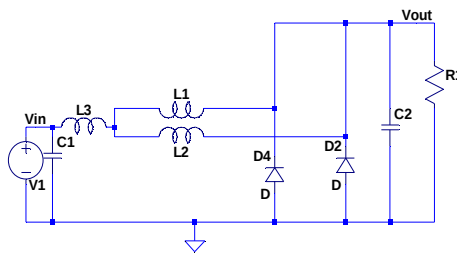


Figure 4 sub-circuit 2

During the second stage diodes D4 D2 diodes conduct it is found that the voltage potential is low at diodes D4 and D2. The output is taken from resistor. In figure 4 both diodes are in forward bias and has the least output in discontinuous mode
SUB-CIRCUIT3

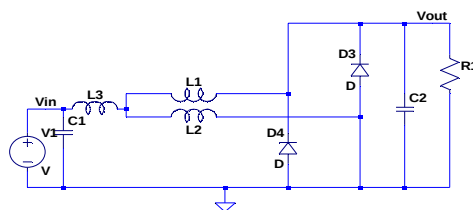


Figure 5 sub-circuit 3

During the third stage the voltage potential is low at diode D3 and diode D4 conduct with lower potential when compared with D3. Hence the output is obtained from the resistor

It is found that in the output waveform of these sub-circuit the ripples are found in less magnitude
SUB-CIRCUIT 4

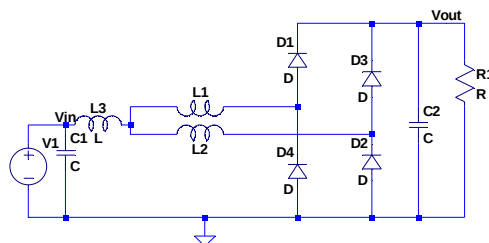


Figure 6 sub-circuit 4

At this instant the voltage passes through the diodes. The diode D4 and D2 at low potential while diodes D1 and D3 is at higher potential
SUB-CIRCUIT 5

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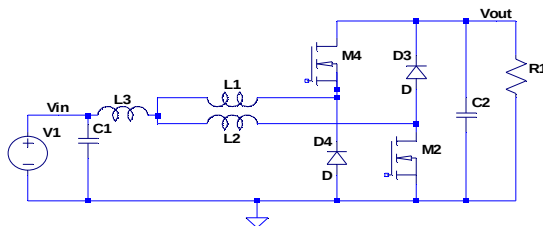


Figure 7 sub-circuit 5

When the diode D1 and diode D2 are reversed biased .The voltage passes through the resistor and the output is taken During this stage the switches are triggered switch M4 is at low potential and switch M2 is at high potential .The pulses given to this switches are in an interleaved manner .the output obtained is at high value when compared with the input value.

The switches corresponds to two boost circuit connected in parallel. Hence by applying volt –sec balance

We get

Boost circuit 1 where switch M4 is turned on

$$(V_1/2)T + (V_1 + V_1/4)t_{on} + (1/4)V_1T = V_0T \dots (1)$$

Divide the above equation (1) by T

$$V_1(1/2 + 1/4) + (5/4)V_1(t_{off}/T) = V_0 \dots (2)$$

$$t_{on}/T = D \dots (3)$$

Substitute (3) in (2) equation

$$(3/4)V_1 + (5/4)V_1D = V_0 \dots (4)$$

$$(3+5D)/4 = V_0/V_1 \dots (5)$$

Boost circuit 2

$$V_1T + ((1/2)V_1 - (1/4)V_1)t_{off} + (V_1/4)T = V_0T \dots (6)$$

Divide the above equation(6) by T

$$(V_1 + V_1/4) - (3/8)V_1(1-D) = V_0 \dots (7)$$

$$V_1(5/4 - (3/8)(1-D)) = V_0 \dots (8)$$

$$(7+3D)/8 = V_0/V_1 \dots (9)$$

Multiply and divide equation(5), then we get the equation

$$(6+10D)/8 + (7+3D)/8 = V_0/V_1 + V_0/V_2 \dots (10)$$

$$(13+13D)/8 \dots (11)$$

IV. SIMULATION RESULTS

The simulation result is obtained using LT spice .The obtained waveform obtained is in accordance with the calculated output. The output is found to be double the input value

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The converter is given to an input of 200 volt and the output is found to be in accordance with the calculated output. The input value is kept constant

The inductor waveform is obtained when the input voltage value is 200 V. The switching frequency is 24.7 khz. The output voltage is found to be around 420 volts. The source is a DC source

PLOT X axis-1unit-20us, Y axis-1unit-0.1A

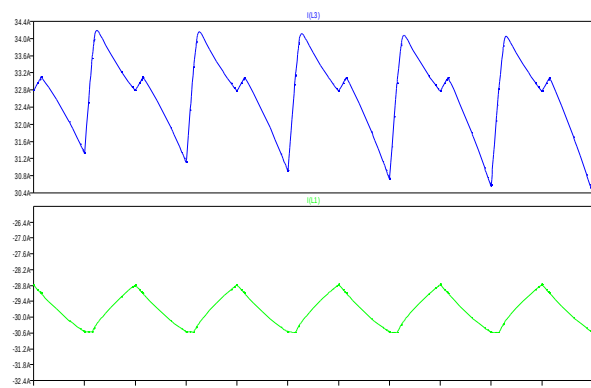


Figure 9. Current across the filter inductor and coupled inductor L2

PLOT X axis-1unit-10u, Y axis-1unit-40V

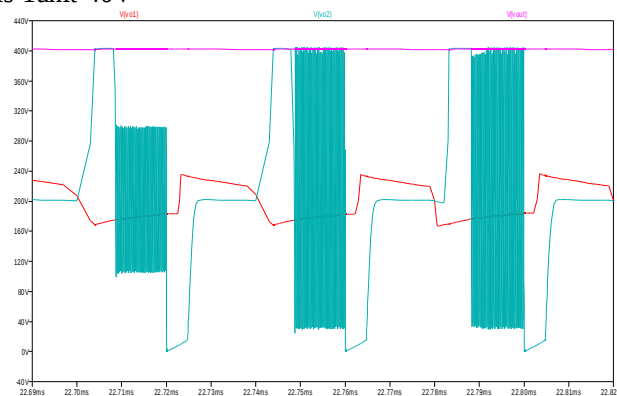


Figure 10 The output Waveform

V. CONCLUSION

The interleaved boost converter has the less ripples when compared with the interleaved buck and boost converter and high power factor resulting in good regulation.

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