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A Boosted Gain Using Dc/Dc Converter With Dual Coupled Inductor

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ABSTRACT

There are various application in industries that are based on dc/dc converter with low voltage stress, less duty cycle, and to produce a high input current gain and low current ripple. In this paper an input is given in parallel and output is produced in series for high current gain using dc/dc converter with dual coupled inductor. Here a capacitor and diode are used for solving the reverse recovery voltage .

In combine with boost converter and dual coupled inductor a voltage doubler is added to satisfy the high power applications and low input current ripple. The dual coupled inductor primary winding is connected in parallel ,the input current is divided so that it can reduce the current ripple .

The secondary of it is connected in series to compensate the parallel input current. It also has the advantage of series capacitor connection it reduces the voltage stress, reduces output voltage ripple. only at zero current the switches are turn to switch ON.The recycling of leakage inductance energy is done.

INTRODUCTION

In order to handle high input current and reduce current ripple a normal boost converter also can improve the input voltage but the duty cycle produced is high these high duty cycle will cause a serious affect and cause a reverse recovery problem of diode and increase current ripple by this conduction loss may occur the voltage stress of diode may equal to the output voltage of conventional converter . In practical voltage gain can be limited by using a power electronic devices, capacitor and inductor.

Another method of using a single switch converter that includes fly-back converter and tap-inductor booster that makes use of turns ratio of the transformer . these converters requires huge turns of transformer ratio to reach high voltage.

To solve this problem an integrated boost fly back converter is used this gives a high voltage and the leakage inductance energy is recycled at is switch off duration. Further a disadvantage is added with this is when a low input voltage is applied then a input current and current ripple is also allowed to pass through the single switch for dc/dc conversion . This increases the conduction loss further .so, single switch converter is not suitable for high input step up dc/dc conversion production .

The three-state switching cell based on interleaved control is introduced in boost converters. In this model the voltage gain is based on duty ratio. Here also the voltage stress produced by power electronic devices is again equal to the output voltage .

Due to this the duty ratio is large hence the voltage stress is also high and output reverse recovery problem also occur .

In diode-capacitor cells the problem cause by three state switching converter can be overcome. It requires large number of diodes capacitor are needed to store the dc/dc converted voltage .A voltage doubler is used to multiply the output voltage gain of dc/dc converter.

EXISTING SYSTEM

Conventional step-up converters, such as the boost converter and fly-back converter, cannot achieve a high step-up conversions with high efficiency because of the resistance of element or leakage inductance; also ,the voltage stress are large . A boost converter(step-up converter) is a DC to DC power converter with an output voltage greater then its input voltage . It is a class of switched –mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element, a capacitor , inductor , or the two in combination . Filters made of capacitors (Sometimes in combination with inductors) are normally added to the output of the converter to reduce output voltage ripple.

PROPOSED SYSTEM

This paper proposes an input-parallel output-series boost converter with dual coupled inductors for high step up and high power application . this configuration inherits the merits of High voltage gain, low output ripple and low voltage stress across the power switches . moreover, the presented converter is able to turn ON the active switches at Zero current and alleviate the reverse recovery problem of diodes by reasonable leakage inductance of the coupled inductors.

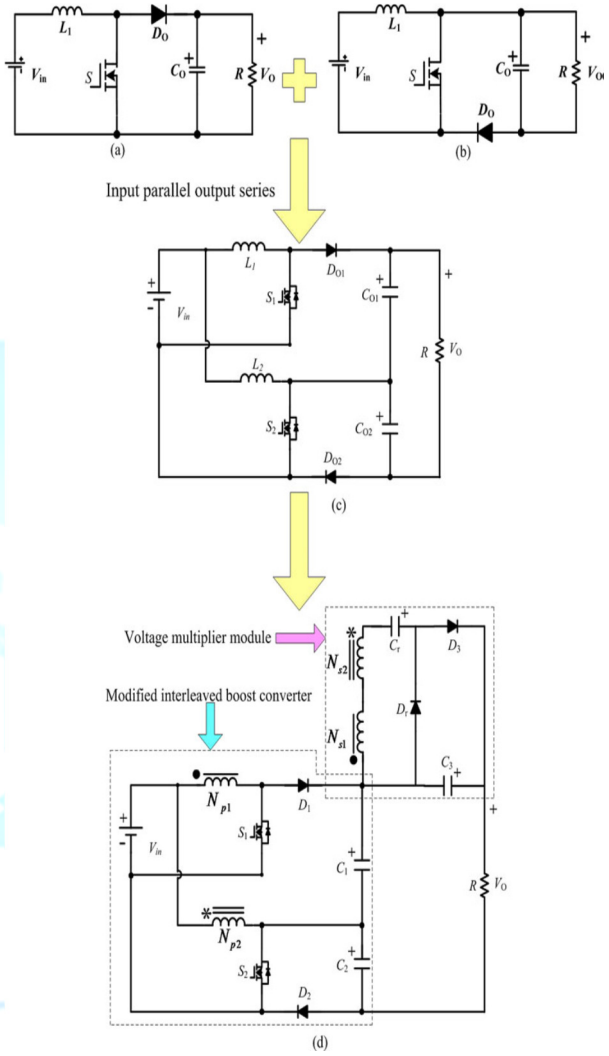
A.TOPOLOGY AND OPERATION OF PROPOSED SYSTEM

The topology and operation of the proposed system is explained further. Here the proposed system is further divided into

two block they are as follows 1)interleaved dc/dc boost converter and 2) voltage doubler circuit with dual coupled inductors circuit .

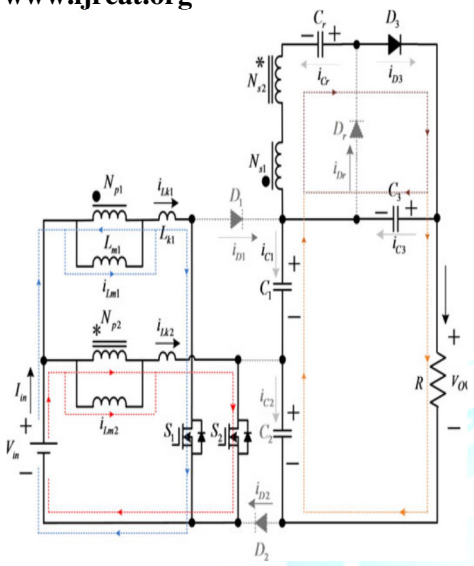
In this modified dc/dc converter for high gain input parallel output series with dual couple inductor input current is boost in two different boosting stages they are based on control with various functions: They are low voltage switch stress , low current ripple , high gain current.

The two independent inductor that are in interleaved boost converter block are separated by primary windings that are further used for energy storage and filter process. The secondary winding of the dual couple inductor are arranged in series with voltage doubler circuit to produce a multiplied voltage of output of dc/dc converter.

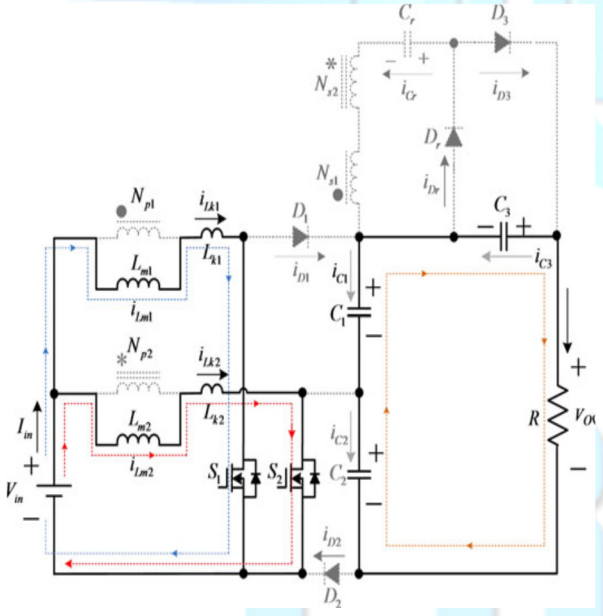


First Stage [t0-t1]:

At t=t0 the switch s2 is ON condition then the switch S1 is switched ON due to leakage inductance all the diodes are in OFF condition while the output diode D3 is conducting . diode D3 falling rate of current can be controlled by leakage inductance which eliminate the reverse recovery problem of diode.



A)First stage



B) Second stage

Second Stage [t1-t2]:

During this stage both the switch s1 and switch s2 are switched ON. While these diodes are remains reverse bias. The leakage inductance and magnetizing inductance are energized by input voltage. The switch S2 is remaining OFF at this stage.

Third Stage [t2-t3]:

At this duration the switch S2 is switched OFF this makes diode D2 to conduct the stored energy of magnetizing inductance is pass through the secondary side . The current flowing through diode and capacitor is calculated by leakage inductance.

Fourth Stage [t3-t4]:

Now the diode D2 will turned OFF automatically this is because of total energy of leakage inductance that was stored in a capacitor C will release it completely the diode D2 has no reverse recovery problem. The Switch S1 will carry a current that is equal to the current flowing in two inductance Lm1 and Lm2 .

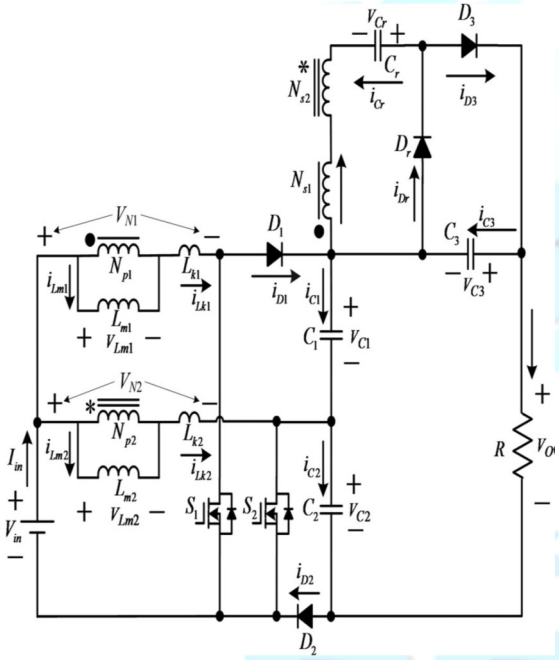
Fifth Stage [t4-t5]:

When t=t4, at zero current Switching the switch s2 will switched ON with soft – switching condition. The switch S1 continuous in remaining ON state this is because of leakage inductance. The current through the diode is controlled by leakage inductance Lk1 and Lk2 . this can eliminate the reverse recovery problem of diode.

Sixth Stage [t5-t6]:

At this operating stage all the diodes will be in switch OFF mode. The leakage

inductance and magnetizing inductance are charged by input voltage in linear manner. The diode D1 has a voltage stress which is equal to the voltage in capacitor C1. The diode D2 has a voltage stress which is also equal to the capacitor C2 holding voltage. The diode D3 voltage stress is same as the subtraction of output voltage and all capacitance voltage.

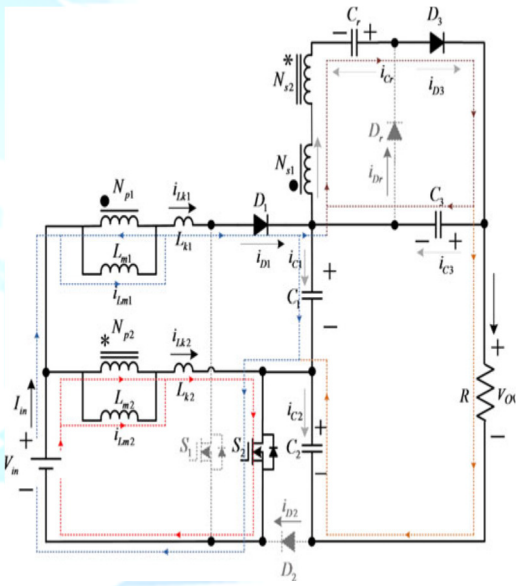


Seventh Stage [t6-t7]:

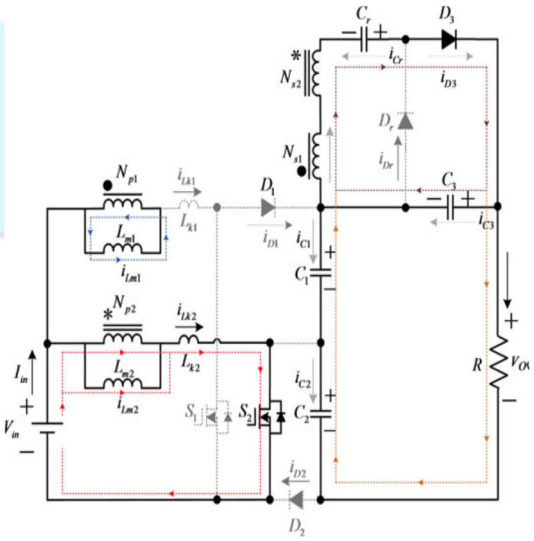
Here the switch S1 is switched OFF this makes diode D1 and D3 are switched ON. The given input source voltage ,leakage inductance Lk1and magnetizing inductance Lm1 produce a energy this energy will stored in another leakage inductor Lk2 of secondary side.

Eighth Stage [t7-t0]:

As the capacitor C1 and diode D1 will completely absorb the total leakage inductance all the Switches will turn OFF. This magnetizing current will straightly transferred to coupled inductor secondary side .



C) Seventh stage.



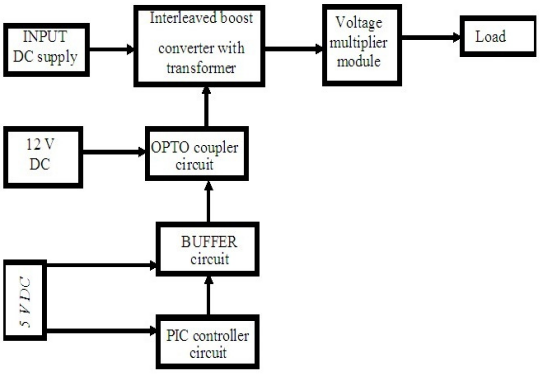
D) Eighth stage.

B.BENEFITS OF HIGH GAIN DC/DC CONVERTER:

- It can achieve a much higher voltage gain and avoid operating at extreme duty cycle and numerous turn ratios.
- The input current can be automatically shared by each phase and low ripple currents are obtained at input.
- The current falling rates of the diodes are controlled by the leakage inductance so that the diode reverse-recovery problem is alleviate

C.BLOCK EXPLAIN FOR PROPOSED SYSTEM

Block diagram:



EXPLANATION

Here the input dc supply is given to the primary of the interleaved boost converter . A transformer is used to step down the dc power required. There are various circuits that are use for various conversion they are: Drive circuit, opto – coupler circuit and main circuit.

Drive-circuit:

Here the drive circuit contains a PIC controller , buffer and AND gate .the capacitor is used to store a required voltage for PIC controller. The rating of PIC controller voltage is 5V. A voltage regulator is used for regulating a voltage in the capacitor for storage.

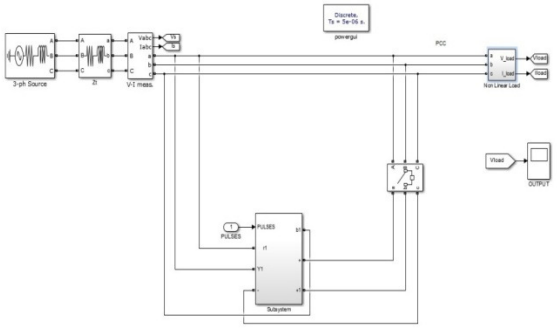
Opto-Coupler :

The opto-coupler is used for boosting purpose. A separate supply connection using capacitor are used for proving input voltage .the voltage required for opto-coupler is 12v. this voltage is regulated by using voltage regulator.

Voltage Doubler Circuit:

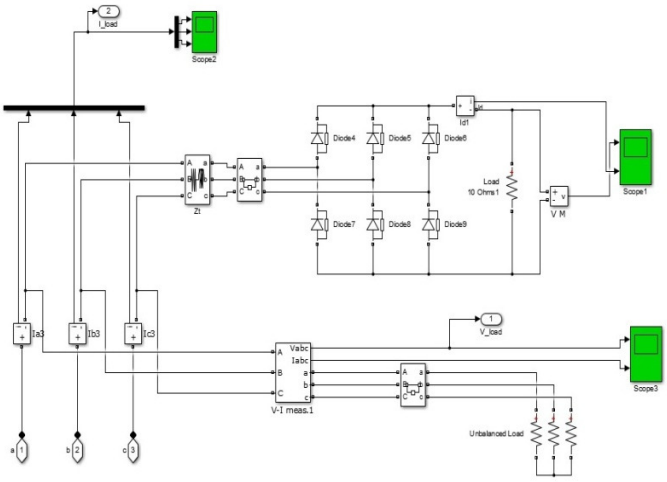
The output voltage of the inductance is multiplied using a voltage doubler. This multiplied voltage is stored in a separate capacitor .

D.STIMULATION USING MAT LAB

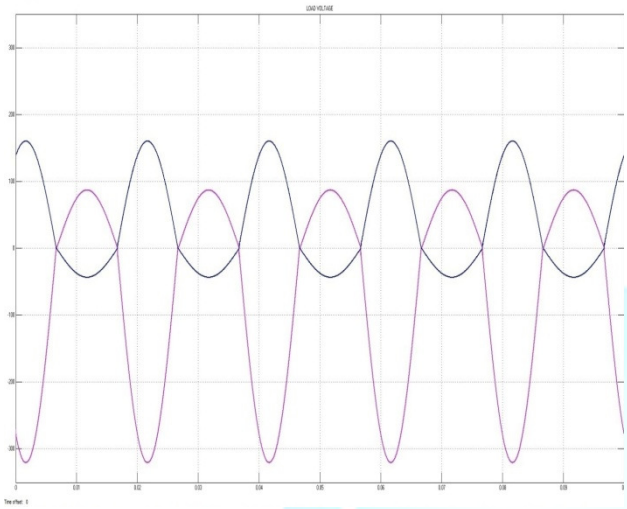


The stimulation for high input gain using a MAT LAB Stimulation .Here a three phase supply is drawn and given to a voltage and current indicator . The non-linear load are connected to the supply .The three phase input are connected in parallel to share a input current by that it can reduce a input

current ripple. These parallel input current is then given to the non-linear RLC load .



Initially the dual coupled inductance are at open stage so any of the non-linear load are not connected to the parallel input current source . After that when dual coupled inductor are closed then the current is passed through the connected load. The scope 3 gives the equal inductance duty ratio of capacitor and inductor.



Due to this leakage inductance and magnetizing inductance in high gain input parllell output series DC/DC converter with dual couple inductor the duty ratio is reduced . from this figure it is clear that the duty raio of the parallell input is uniform.

CONCLUSION

To achieve a low switch voltage stress and low current ripple using a step up conversion with low duty ratio this paper has successfully achieved by high gain input parallel output series dc/dc converter with dual coupled inductor method. The topology , waveform, benefits , characteristics and block diagram describe the usage of proposed converter.

The main analysis of the proposed system DC/CD converter with dual couple inductor is as following :

1) It can produce high voltage gain with reduced duty ratio and also reduce in number of turns ratio of transformer.

2) The voltage stress of the three main switch is also reduced.

3) As the input current are connected to the primary of the dual coupled inductor in parallel so the current is divided in each and every phase thus by this input with low ripple current is achieved.

4) The switches are turned ON at zero current switching itself so the switching loss is reduced.

5) Here the leakage inductance are used so that the reverse recovery problem of diode also eliminated.

REFERENECE

[1] C.Cecati, F.Ciancetta, and P.Siano,"A multilevel inverter for photovoltaic systems with fuzzy logic control ," *IEEE Trans*. Ind. *Electron*, vol.57, no.12,pp. 4114-4125, dec, 2012.

[2] X.H.Yu,c,Cecati,T.Dillon, and M.G. simoes ,"The new frontier of smart grid " IEEE Trans, Electron . Mag., vol. 15, no. 3, pp.49-63,sep.2011.

[3] G.Fonties ,C.Turpin, S.Astier , T.A .Meynard,"Interaction between ful cells and power converters : Influence of current

harmonics on a fuel cell stack" IEEE. Trans. Power Electronics., vol . 22, np. 2 , pp 670-678,Mar 2007.

[4] J.Y .Lee and S.N.Hwang , "Non-isolated high –gain boost converter using voltage-stacking cell,"Electron.Lett,. vol.44, no.10 ,pp. 644-645 , May 2008

[5]Z.Amjadi and S.S.Williamson, "Power-electronics – based solution for plug-in hybrid electric vehicle energy storage and management systems," IEEE Trans.Ind.Electrom.,Vol.57 ,no. 2, pp. 608-616, Feb . 2010.

[6]L.Henrique , S.C.Barreto, P.P.Praca, D.S.Oliveria Jr., and R.N.A.L.silvia,"High – Voltage GAIN boost Converter based on three-State commutation cell for battery charging using PV panels in a single conversion stage ,"IEEE Trans.Power Electronics., vol.29 , no.1 ,pp.150-158 Jan.2014"

[7]F.boico B.lehman,and K.shujaee,"solar battery charges for NiMH batteries" IEEE trans.ind.electron vol.55,no.8pp.3012-3021,aug.2008.

[8]A.I.bratcu,Imunteanu,S.bacha,D.picault, and B.raison ,"cascaded dc-dc converter photovoltaic systems :power optimization issues ,"IEEE trans .ind.electron vol.58,no.2,pp.403-411,feb 2011

[9]Y.p. hsieh, J.F chen,T.J.Laiangand L.S yang,"novel high step-up dc-dc converter for distributed generation system "IEEE Trans .ind.electron vol.60no.4,pp,1473-1482,apr.2013

[10]H.tao,J.l..duarte,and M.A.Mhendrix,"line interactive ups using a fuel cell as the primary source"IEEEtrans .ind.Electron Vol.55,no.8pp 3012-3021,aug 2008.

[11] T.J liang and K.C Tseng "analysis of integrated boost_flyback stepup converter"IEEE proc .electr.power appl,Vol;152no.2 pp217-225 mar2005

[12]T.F wu, Y.s Lai ,J.c.hung,and Y.M.Chen,"boost converter with coupled inductors and buck boost type of active clamp,"IEEE Trans,.ind.electron.Vol.55,no.1 pp 217-255 Mar 2005

[13]G.V.T.Bascope,R.P.T.bascope,D.S .oliveira,jr. S.A.vasconcelos. F.l.M.antunes, and C.G.C branco,"a high step up dc-dc converter based on three state switching cell "IEEE proc.int.symp.ind electron ., 2006, pp 998-1003

[14]C.N.lai, C.T.Pan and M.C. cheng, "flight efficiency modular high step up interleaved boost converter for DC microgrid application,,"IEEE Trans,ind,appl..Vol.48 no.1,pp.161-171,Jan/feb 2012.