International Journal on Recent Researches In Science, Engineering & Technology
(Division of Computer Science and Engineering)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. It is an absolutely free (No processing charges, No publishing charges etc) Journal Indexed in JIR, DIIF and SJIF.
Research Paper
Available online at: www.jrrset.com

ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
Volume 3, Issue 6
June 2015.
JIR IF : 2.54
DIIF IF : 1.46
SJIF IF : 1.329

A High Step-up Power Electronic Conversion System Integrating Boost and Flyback Unit with Voltage Doubler Circuit

S.Raja[1], M.Sakthikumaran[2], G.Sivashankar[3]
[1,2,3]Assistant Professor, Department of Electrical and Electronics Engineering,
Mahendra Engineering College (Autonomous), Namakkal, Tamilnadu, India

Abstract:
The hybrid boost and fly back converter has designed and analysis the performance of output voltage with minimum duty cycle. The voltage gain and efficiency during steady state using the inductor, capacitor balance and fewer ripples for continuous conduction mode of operation. The advantages of boost converter has to enhance the voltage gain and used in high voltage application. The high duty ratio will leads to system complexity thus the system complexity is reduced by the integration of boost and fly back converter based on voltage doubler circuit. The voltage gain is attained and implemented in MATLAB/simulink environment.
Keywords: Boost converter, Flyback converter, snubber circuit and MOSFET.

Introduction

In industry application the ripple free and high voltage converter is preferred and utilized in recent days. The high duty cycle operation is affects the transient response and increase the conduction losses [1]. The isolated or coupled-inductor-based converters can be utilized to high-voltage gain, where the turn's proportion of coupled-inductor can be utilized to expand the voltage profile. However inherent leakage inductance of coupled-inductor may not just generate high-voltage spikes over the power switch when it is turned off, yet additionally distribute enormous energy losses [2-3]. Active clamp circuit or isolated clamp circuit are used to reuse the leakage inductor energy and attract voltage spike over the power switch. Boost– flyback converter, as designed to reduce the voltage ripple of energy switch and exchange leakage inductor power to the load when switch S1 is in off condition [4-5]. Tragically, the supply current of coupled-inductor-based converter has high current ripple. Particularly when the turn's ratio of coupled-inductor or tapped-inductor is increased to broaden the voltage transformation ratio, input current swell moves toward becoming bigger [6]. By utilizing a mirror ripple circuit, a zero supply current ripple step up converter for power device applications is implemented although, additional active switch is required, which increase the transformer less boost converter. The transformer-less high-step up converter can achieve input current swell cancelation at a selectable duty cycle [7-8].

Proposed Methodology

The integration of boost fly back converter fed power drive is implemented and the corresponding block diagram is shown in fig 1. The advantages of both fly back and boost converter are integrated and increased the performance and generate high voltage gain. The coupled inductance is designed as a magnetizing inductor, leakage inductor and ideal transformer with a turn ratio. The

converter has attained the zero voltage switching during turn on the switches. The current across the switch is zero when the switch is in off condition. The fly back converter has generated more voltage at the output by using the transformer circuit [9-10]. The high voltage stresses across the switch and endure the reverse recovery of diode rectifier. The circuit diagram of proposed system is shown in fig 2.

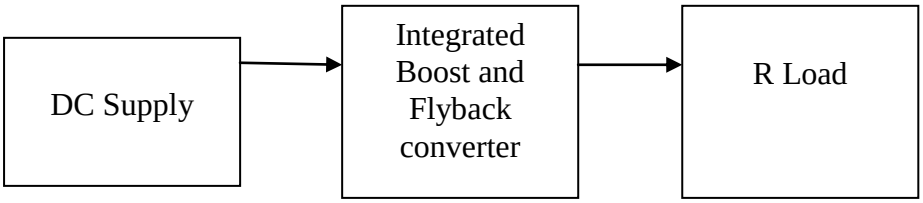

Fig 1: Block Diagram of Proposed Circuit

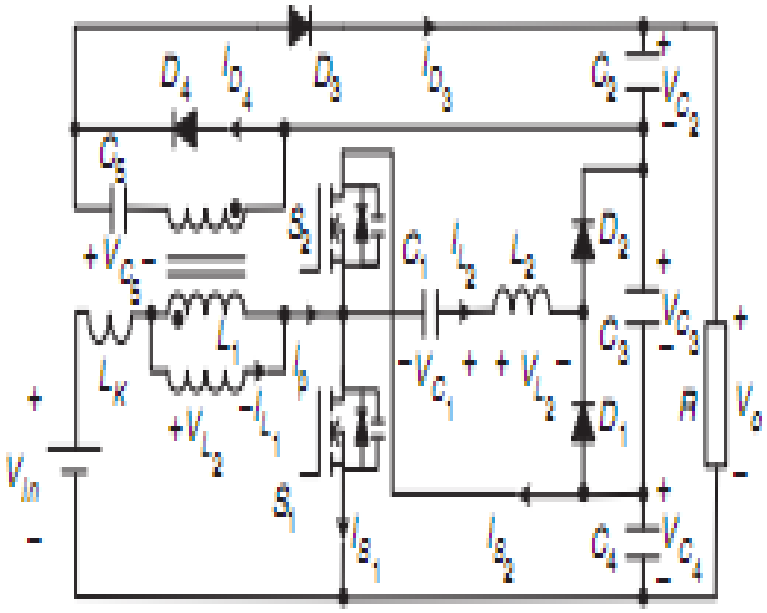

Fig 2: Circuit diagram of interleaved boost flyback converter

The integrated boost and flyback based voltage doubler circuit has operated in various modes of operation. In mode 1 the voltage across the capacitor of switch 1 is reduced to zero when the switch is on. The magnetic inductors are charged by input voltage. The diode 1 and 4 are reverse biased. The mode 2 the diode 1 are forward biased, inductor current decreased to zero and switch is off. In mode 3 the capacitor is charged and diode current starts to decrease. In mode 4 the switch s2 is turned on and diode D2 and D3 are turned on and capacitor C4 is charged by switch s2. In mode 5 the capacitor C4 is discharged and voltage across the leakage inductance is negative. Reducing the leakage inductance and capacitor is discharged when the switch s2 is off. The switch s1 is turned on at zero voltage the capacitor C2 is charged and the capacitor C1 is discharged.

Simulation Result

The isolated inductor based interleaved boost flyback converter is shown in figure 3. The output voltage of the converter is shown in fig 4.

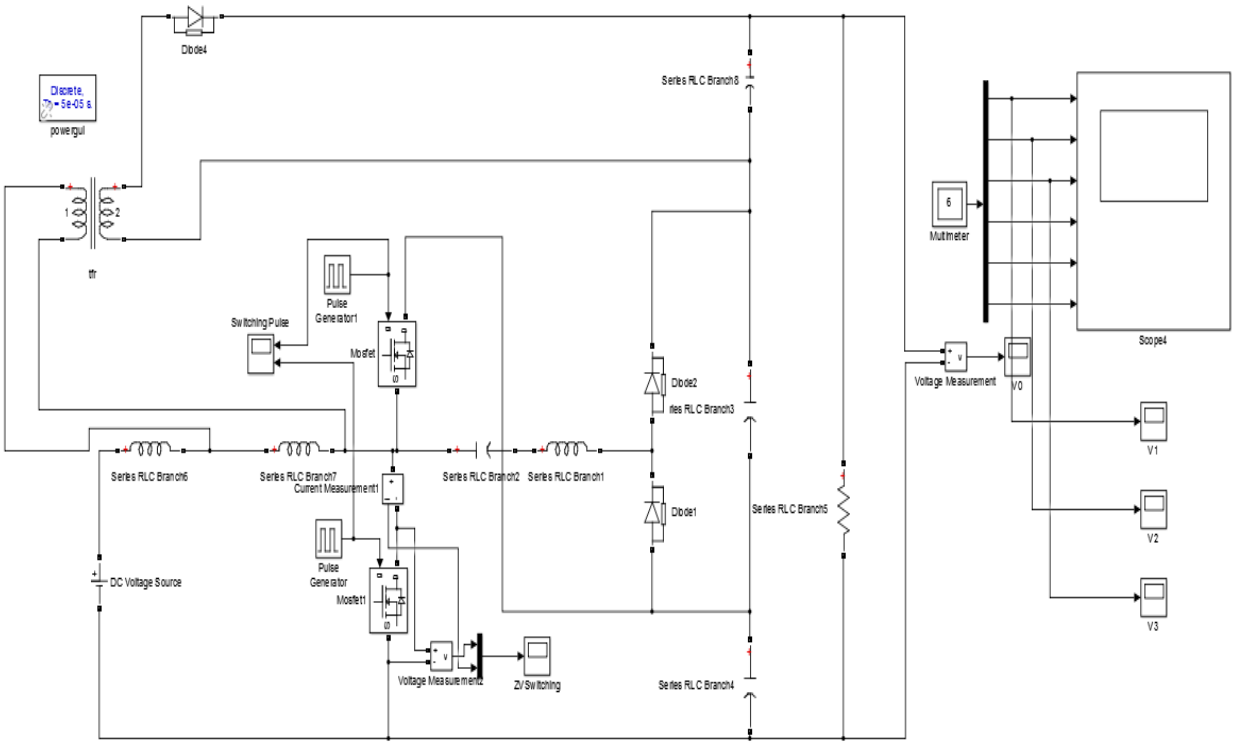

Fig 3: Overall Simulation of Interleaved Boost Flyback Converter

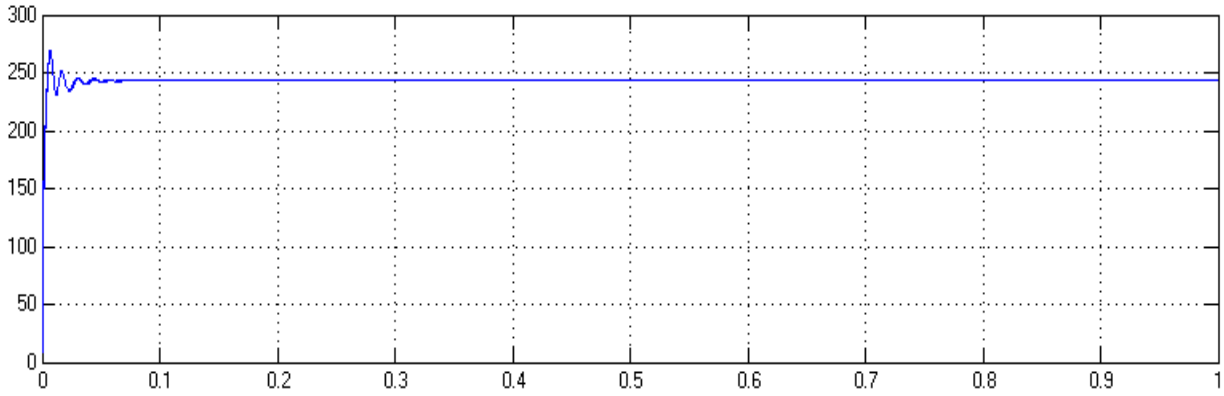

Fig 4: Output Voltage Waveform of Integrated Voltage Doubler Circuit

Conclusion

The hybrid converter such as boost and flyback converter is implemented. The high voltage generation based on dual inverter fed leakage inductor. The voltage stress is reduced; frequency of magnetizing inductor is twice the switching frequency. The zero voltage and zero current switching dc-dc converters with high gain and high efficiency.

Reference

[1] Hsieh, Yi-Ping, Jiann-Fuh Chen, Tsorng-Juu Liang, and Lung-Sheng Yang. "Novel high step-up DC-DC converter for distributed generation system." IEEE Transactions on Industrial Electronics 60, no. 4 (2013): 1473-1482.

[2] Hsieh, Yi-Ping, Jiann-Fuh Chen, Tsorng-Juu Peter Liang, and Lung-Sheng Yang. "Novel high step-up DC–DC converter with coupled-inductor and switched-capacitor techniques for a sustainable energy system." IEEE Transactions on Power Electronics 26, no. 12 (2011): 3481-3490.

[3] Changchien, Shih-Kuen, Tsorng-Juu Liang, Jiann-Fuh Chen, and Lung-Sheng Yang. "Novel high step-up DC–DC converter for fuel cell energy conversion system." IEEE Transactions on Industrial Electronics 57, no. 6 (2010): 2007-2017.

[4] Hu, Xuefeng, and Chunying Gong. "A high voltage gain DC–DC converter integrating coupled-inductor and diode–capacitor techniques." IEEE transactions on power electronics 29, no. 2 (2014): 789-800.
[5] Park, Ki-Bum, Gun-Woo Moon, and Myung-Joong Youn. "High step-up boost converter integrated with a transformer-assisted auxiliary circuit employing quasi-resonant operation." IEEE Transactions on Power Electronics 27, no. 4 (2012): 1974-1984.
[6] Araújo, Samuel Vasconcelos, Peter Zacharias, Benjamin Sahan, René P. Torrico Bascopé, and Fernando LM Antunes. "Analysis and proposition of a PV module integrated converter with high voltage gain capability in a non-isolated topology." In Power Electronics, 2007. ICPE'07. 7th Internatonal Conference on, pp. 511-517. IEEE, 2007.
[7] Uno, Masatoshi, and Koji Tanaka. "Single-switch multioutput charger using voltage multiplier for series-connected lithium-ion battery/supercapacitor equalization." IEEE Transactions on Industrial Electronics 60, no. 8 (2013): 3227-3239.
[8] Liang, Tsorng-Juu, Jian-Hsieng Lee, Shih-Ming Chen, Jiann-Fuh Chen, and Lung-Sheng Yang. "Novel isolated high-step-up DC–DC converter with voltage lift." IEEE Transactions on Industrial Electronics 60, no. 4 (2013): 1483-1491.
[9] Sanjeevikumar, Padmanaban, Gabriele Grandi, Patrick W. Wheeler, Frede Blaabjerg, and Jelena Loncarski. "A simple MPPT algorithm for novel PV power generation system by high output voltage DC-DC boost converter." In Industrial Electronics (ISIE), 2015 IEEE 24th International Symposium on, pp. 214-220. IEEE, 2015.
[10] Rajeev, Mini. "An input current shaper with boost and flyback converter using integrated magnetics." In Power Electronics and Drive Systems, 2003. PEDS 2003. The Fifth International Conference on, vol. 1, pp. 327-331. IEEE, 2003.