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Closed Loop Voltage Matching Control of Soft Switching High Voltage Gain Buck-Boost Converter

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Abstract:

The high voltage gain buck boost converter fed voltage doubler circuit. The bidirectional converter based on coupled inductor and voltage cell is used and generate high and low voltage. The dual active half bridge converter is integrated with buck boost converter for reducing the voltage stress. The PI based phase shift control is to regulate the control power flow and decreasing the switching losses. The non isolated buck boost converter is designed by the passive diode in step down converter. The pulse width modulation controller is to enhance the voltage ratio. The bidirectional converter based dual active bride has step up the voltage from the dc supply. The performance and characteristics of dual active bridge is analyzed and implemented in MATLAB/ Simulink environment.

Keywords: Bidirectional Converter Coupled Inductor, Dual Active Bridge.

Introduction

The bidirectional converter fed bridge circuit has similar characteristics of buck boost converter. The utilization of power electronics converter is increasing nowadays. To enhance the power generation and also improve the performance of converter [1-3]. Such electronic gadgets for the most part contain a few sub-circuits, that are not the same as that provided by the battery or any outer supply, may be higher or lower than the supply voltage. Moreover, the battery voltage reduces as its stored energy is decreased. Switched DC-DC converters offer a strategy to increase voltage from a halfway battery voltage, along these lines spare the space as opposed to utilizing a no: of batteries. Most DC-DC converters will control the power. High productivity LED control sources, belong to the kind of DC-Dc converters, which manages the current through the LEDs, and the charge pumps will double or triple the input voltage [4-5].

A bidirectional DC-DC converter is utilized for dc-dc conversion process. The control converter has two full bridge converters, one act as inverter and other as rectifier. This bidirectional DC-DC converter is reasonable for electrical vehicle applications [6]. The bidirectional has used to control the power flow in both forward and reverse direction. The pulse width modulation to generate the switching pulse to increase the voltage [7-8].

Proposed Methodology

The block diagram of proposed method is shown in figure 1. The bidirectional converter has coupled inductor, primary and secondary winding. The integration of buck boost bidirectional converter fed voltage doubler circuit. The proposed inverter has to increase the voltage by using the switching configuration [9].

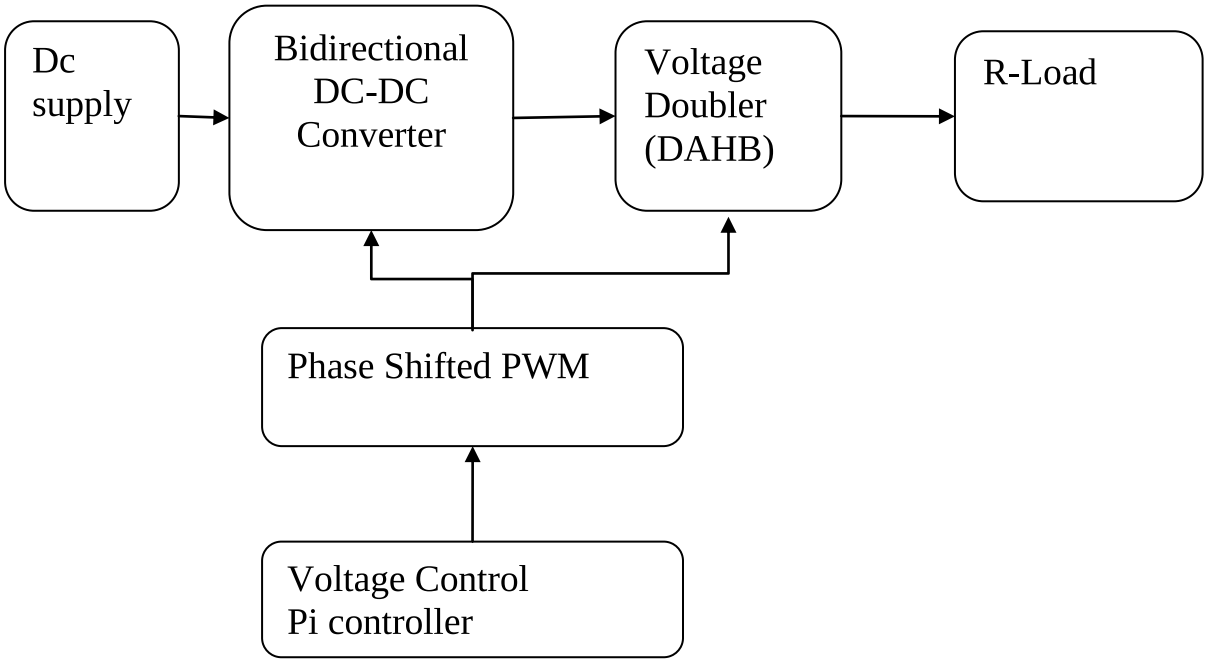

Fig 1: Proposed Block Diagram

The conventional method the boost ratio is less and it is improved by coupled inductor. The voltage across the dual active bridge are matched by tuning the coupled inductor turns ratio and it will reduce the circulating current. The high power generation is achieved and efficiency is attained by the proposed method [10]. The leakage inductance of the coupled inductor The circuit diagram of proposed circuit diagram is shown in figure 2.

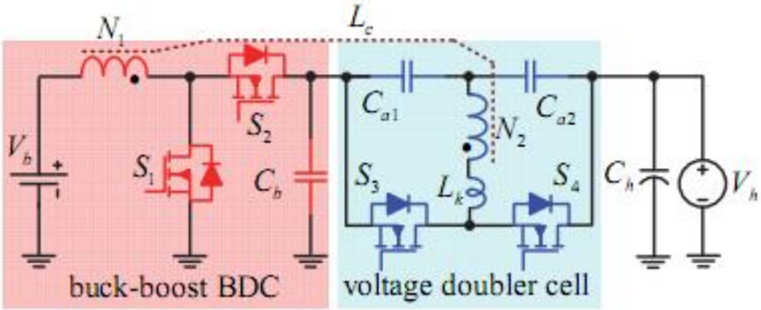

Fig 2: Circuit Diagram of Proposed Method

The PID controller is used in dual active bridge converter fed system. The utilization of coupled inductor is greatly increased the power and used in high power application. The PID control diagram is shown in figure 3.

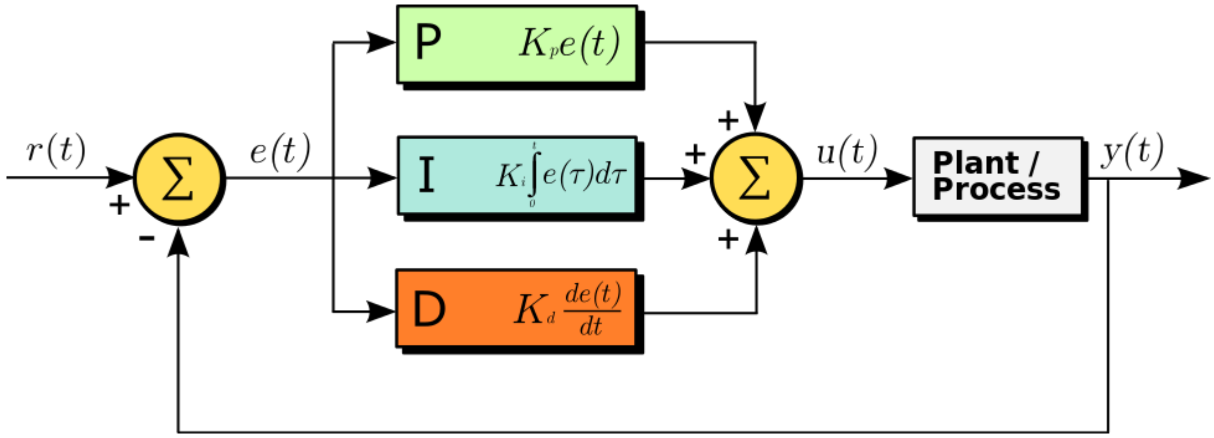

Fig 3: PID Control Method

Simulation Result

The bidirectional converter based dual active bridge is implemented in both open loop and closed loop control method. The overall simulation circuit in open loop system is shown in figure 4. The input voltage waveform of BDC is given in figure 5. The output voltage and current waveform of high step up converter is shown in figure 6 and 7. The switching performance of high step up converter is shown in fig 8.

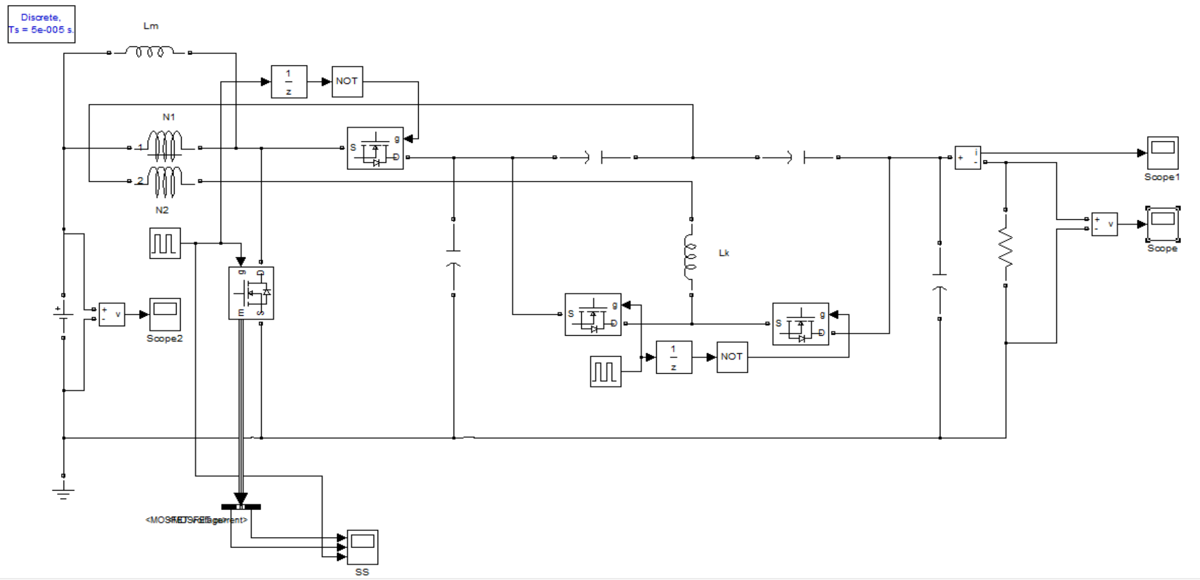

Fig 4: Matlab Implementation Circuit of Proposed High Step up Converter System in open loop

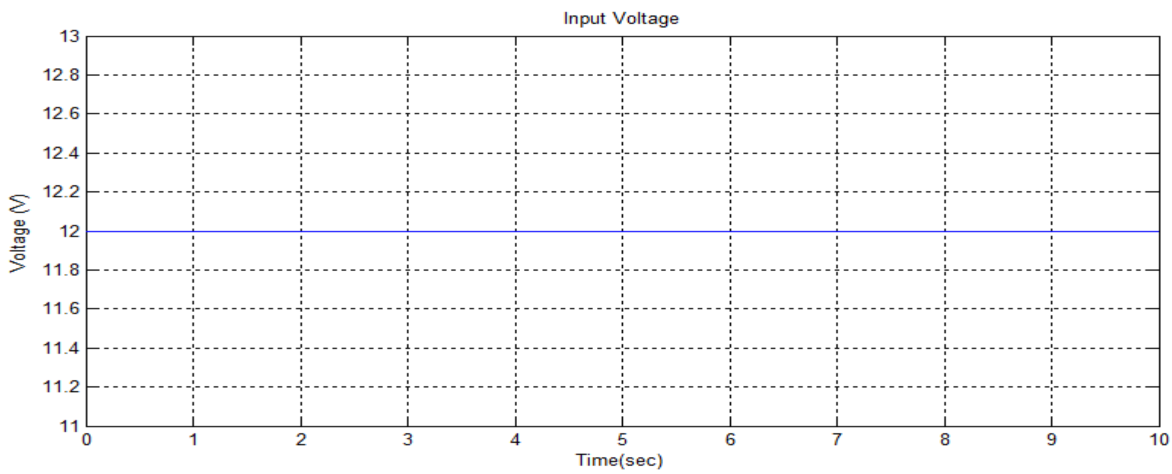

Fig 5: Input voltage of High step up converter in open loop

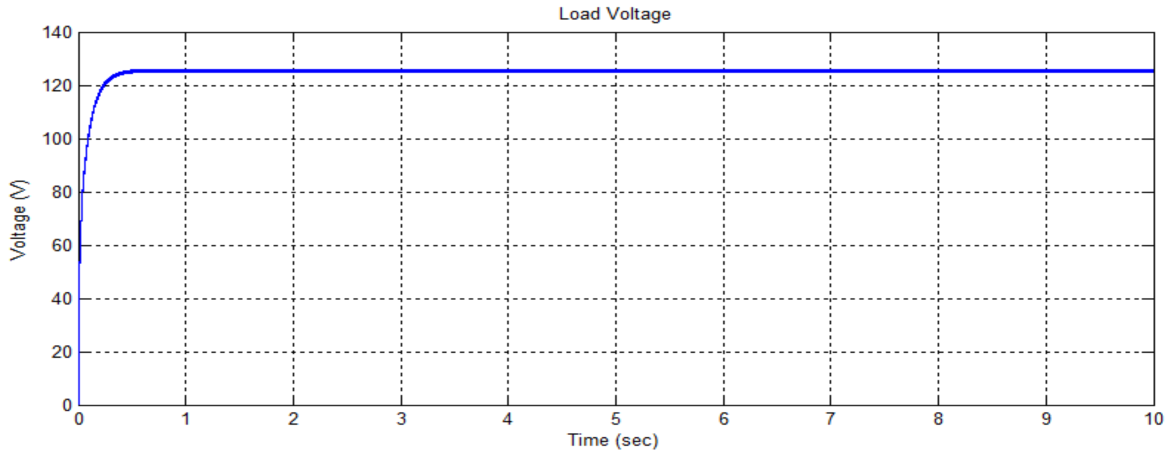

Fig 6: Load Voltage of High step up converter in open loop

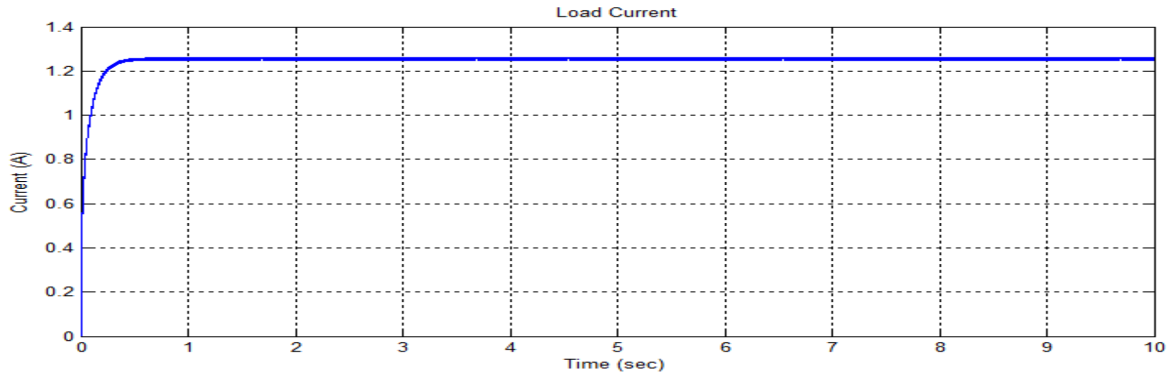

Fig 7: Load Current of High step up converter in open loop

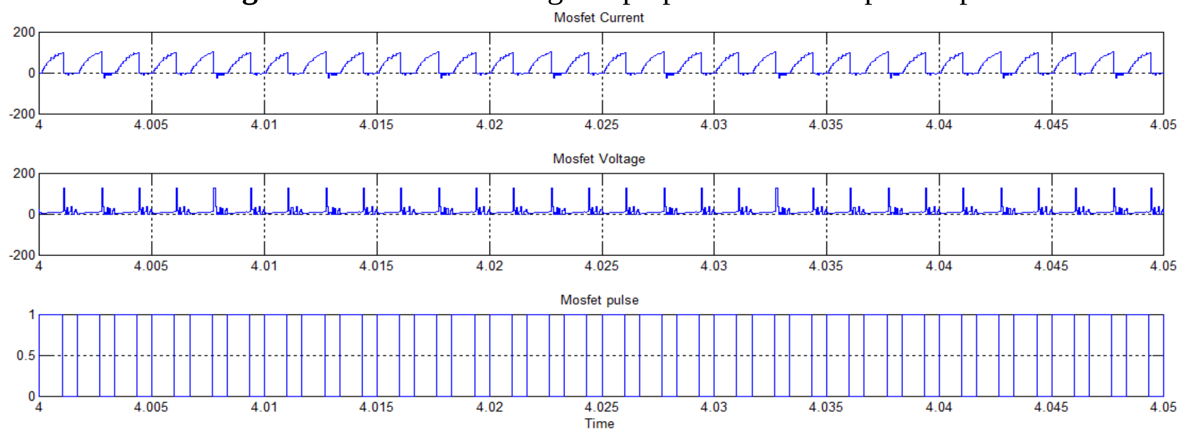

Fig 8: Soft Switching Performance of High step up converter in open loop

The overall simulation circuit in closed loop system is shown in figure 9. The input voltage waveform of BDC is given in figure 10. The output voltage and current waveform of high step up converter is shown in figure 11 and 12. The switching performance of high step up converter is shown in fig 13.

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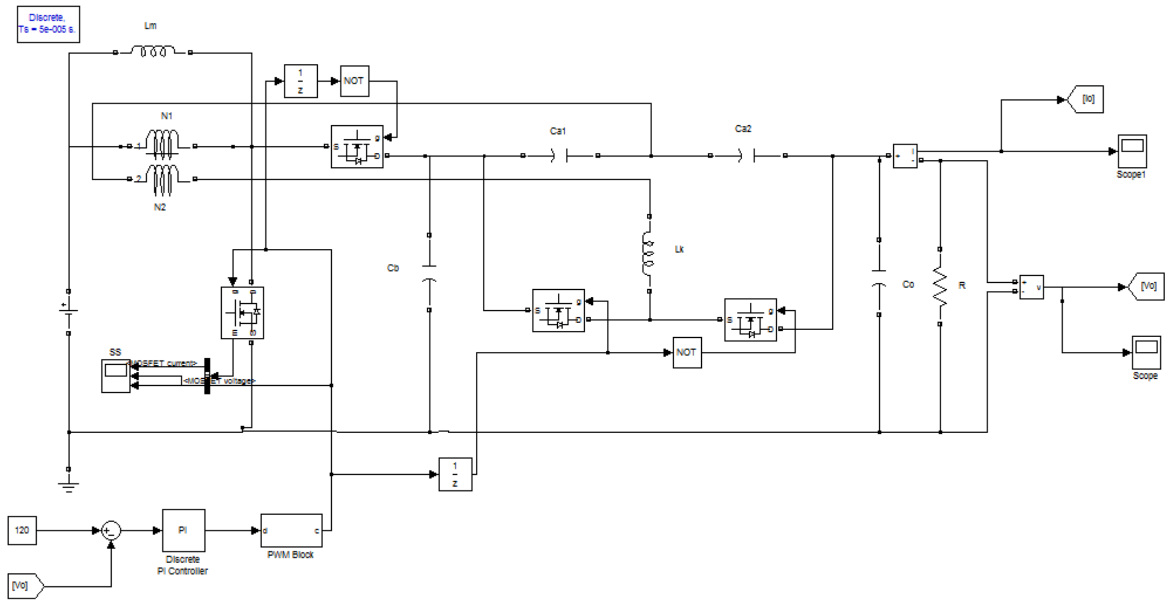

Fig 9: Matlab Implementation Circuit of Proposed High Step up Converter System in closed loop

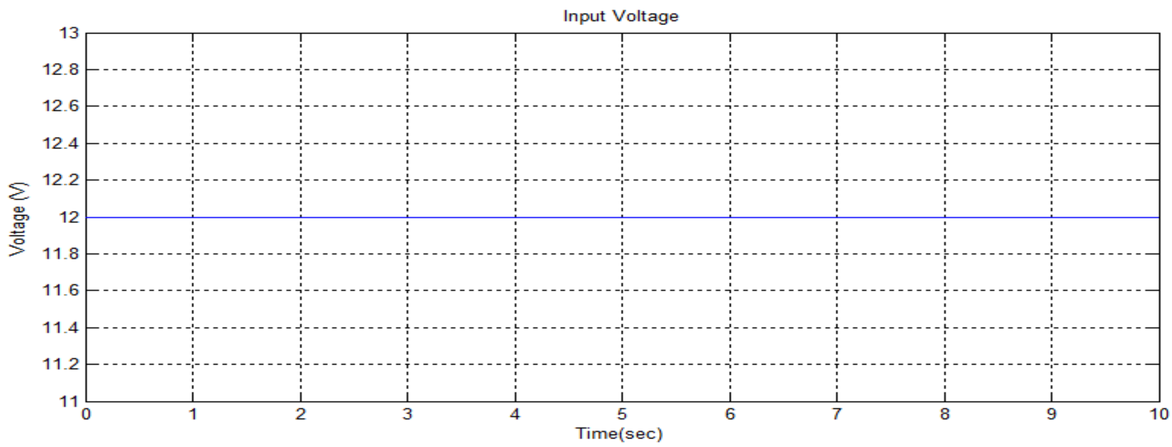

Fig 10: Input voltage of High step up converter in closed loop

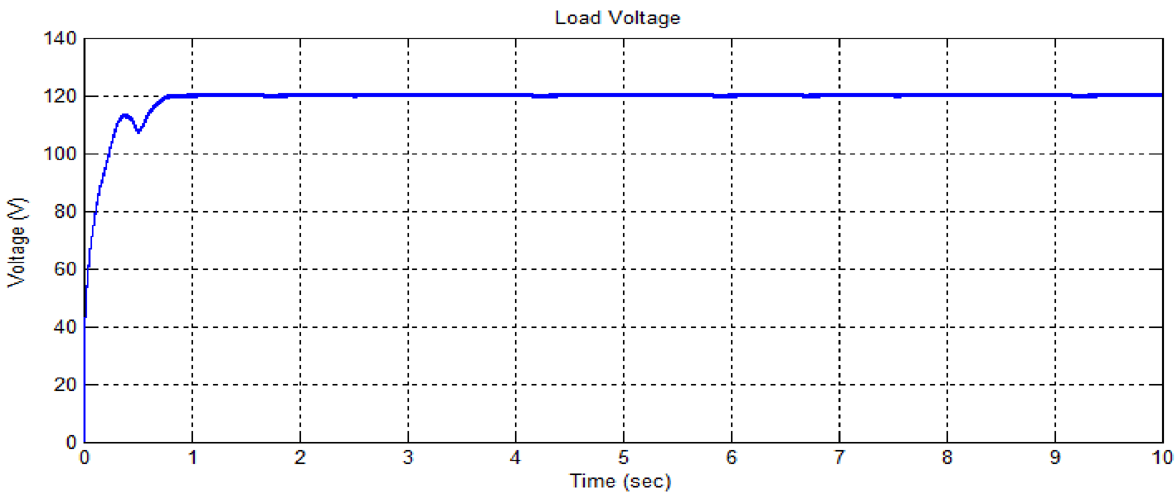

Fig 11: Load Voltage of High step up converter in closed loop

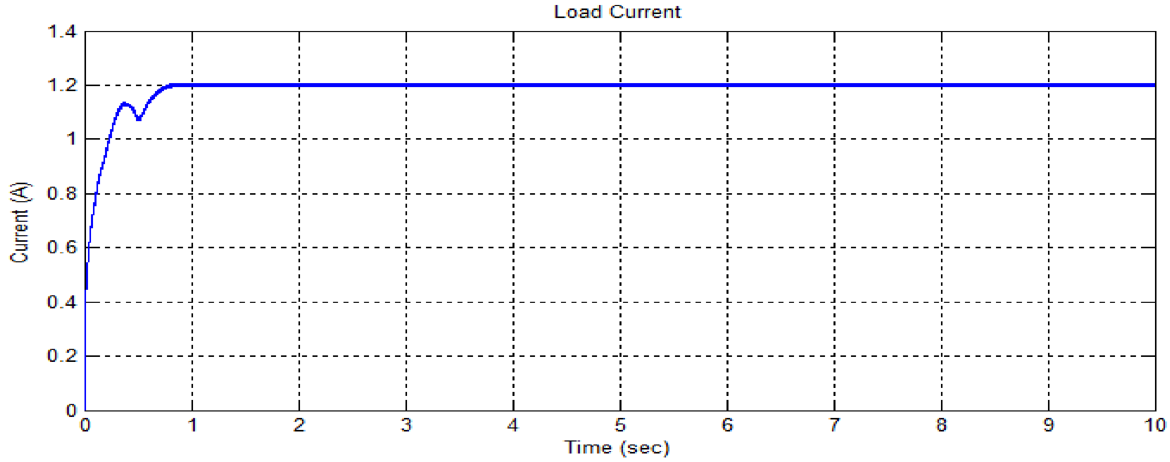

Fig 12: Load Current of High step up converter in closed loop

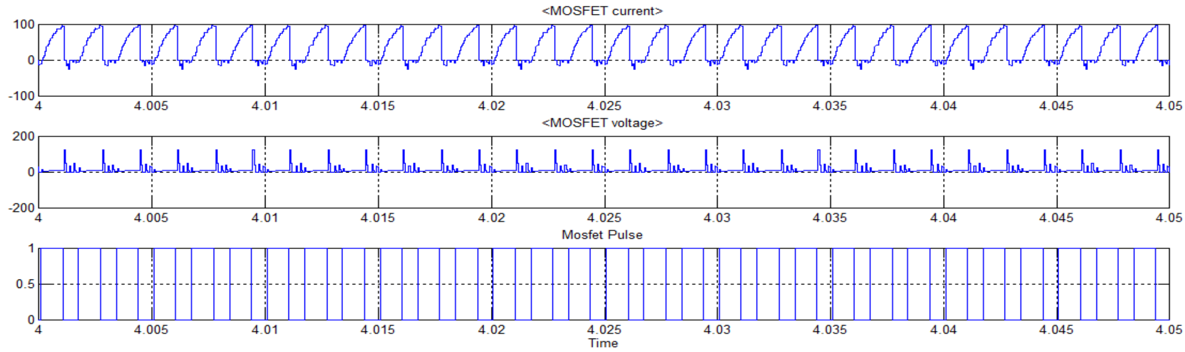

Fig 13: Soft Switching Performance of High step up converter in closed loop

Conclusion

The novel high effectiveness high step up/step down bidirectional DC-DC converter is proposed by employing a double active half-bridge (DAHB) BDC into the regular buck-boost BDC. The voltage balancing of switches have been eliminated and the voltage transformation proportion has been extended by associating the energy of the buck-boost BDC and the DAHB BDC in arrangement. Voltage control for the DAHB BDC is accomplished by managing the switches duty cycles of the both step up and step down BDC. Thus, the voltages on the two sides of the DAHB BDC are constantly maintained by reducing the conduction unbalance and enhance the voltage regulation of the DAHB BDC. Power flow control is maintained by phase shift control in DAHB BDC. Moreover, ZVS soft switching is recognize for all of the switches to lower the switching losses. At long last, the possibility of the proposed BDC topology and control is verified utilizing in MATLAB/Simulink platform. Simulation results indicate that the proposed solution is a good candidate for high efficiency energy storage system applications with steep voltage gain and wide battery voltage range.

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