DC TO DC BOOST CONVERTER SIMULATION USING eSim

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ABSTRACT

This paper presents a novel hybrid non-isolated DC-DC converter leveraging voltage lifting technology. The circuit is developed by integrating a new switching inductance structure with an innovative voltage lifting configuration. The study focuses on the circuit's performance in Continuous Conduction Mode (CCM), analysing both voltage and current characteristics. A comparative analysis of the voltage gain between the proposed converter and other DC-DC converters operating in CCM mode is conducted. To validate the theoretical calculations, the proposed converter is simulated using Multisim, confirming the anticipated performance improvements.

Key Words: Boost, Multisim, DC-DC converter, voltage lifting

INTRODUCTION

In today's highly integrated technological environment, DC/DC converters are vital across many applications. With the rise in energy consumption of integrated circuits and the reduction of microprocessor output voltage from 3.5V to as low as 1V, efficient power management solutions are crucial. Traditional boost converters often face issues such as low voltage gain, high switching losses, and decreased efficiency at higher voltage levels, which limits their effectiveness in demanding applications.

To address these challenges, research is focused on developing improved high gain boost converters that provide higher voltage gains, better efficiency, and lower switching losses. This involves exploring new converter designs, innovative switching techniques, and advanced control methods. Simulations and experimental prototypes are used to validate these improvements, ensuring they meet the evolving needs of modern electronic systems.

WORKING PRINCIPAL

The improved high gain boost converter operates by utilizing a combination of advanced voltage lifting techniques and novel switching mechanisms. When the switch is closed, energy is stored in the inductor. When the switch opens, the stored energy is transferred to the output through a diode, significantly boosting the output voltage. The innovative topology minimizes switching losses and enhances efficiency by optimizing the energy transfer process. Advanced control strategies ensure stable operation and high performance, even under varying load conditions. This method allows for higher voltage gains compared to traditional boost converters, making it suitable for applications requiring substantial voltage conversion ratios.

Circuit Schematic

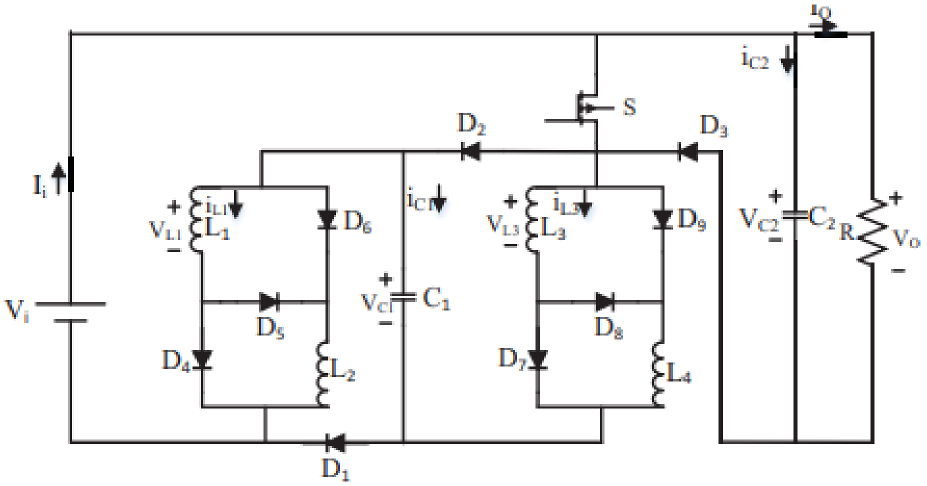

Figure 1: Improved DC to DC Boost Converter

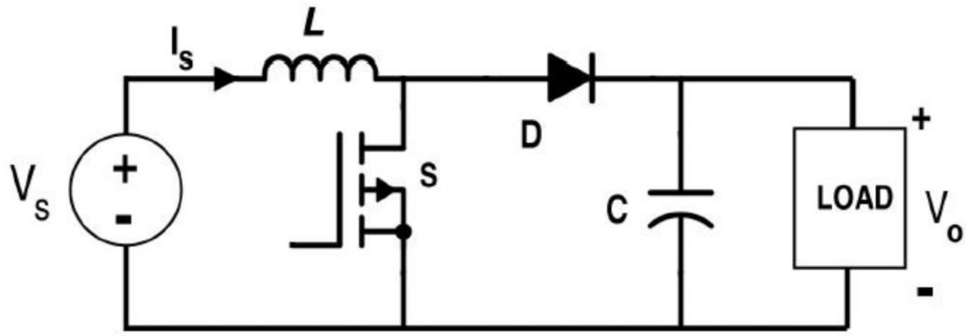

Figure 2: DC to DC Boost Converter

eSim Schematic

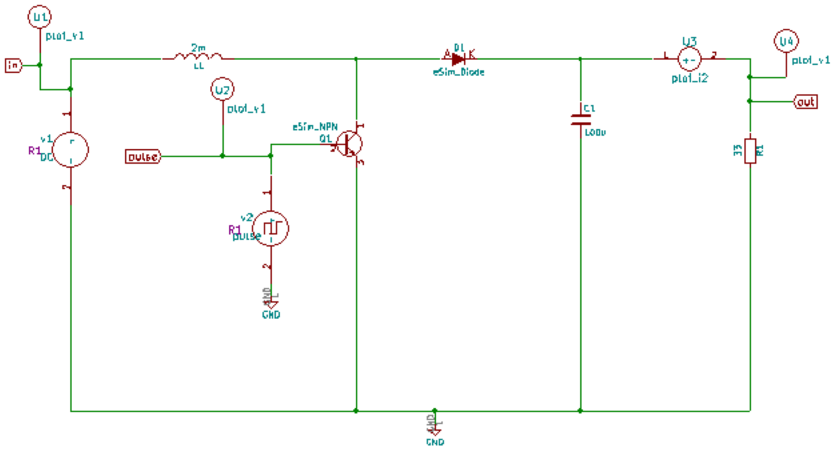

Figure 3: DC to DC Boost Converter Circuit Simulation Using eSim

Input Waveform

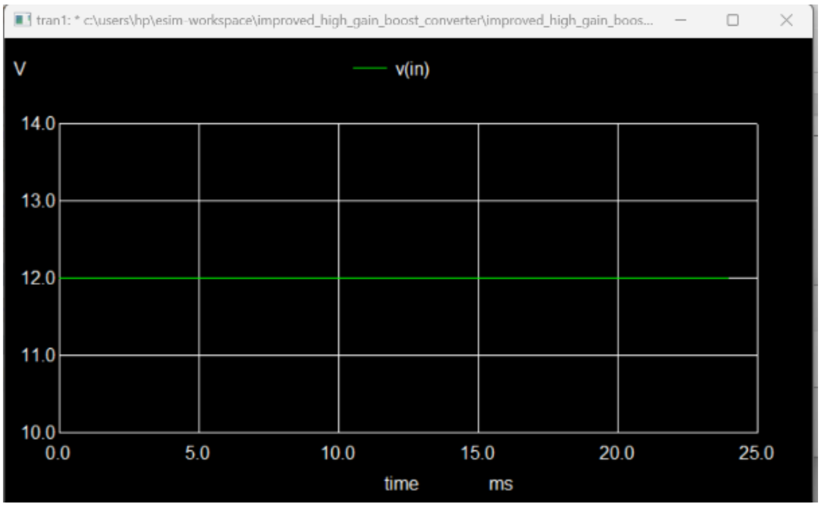

Figure 4:Input waveform of DC to DC Boost Converter

Output Waveform

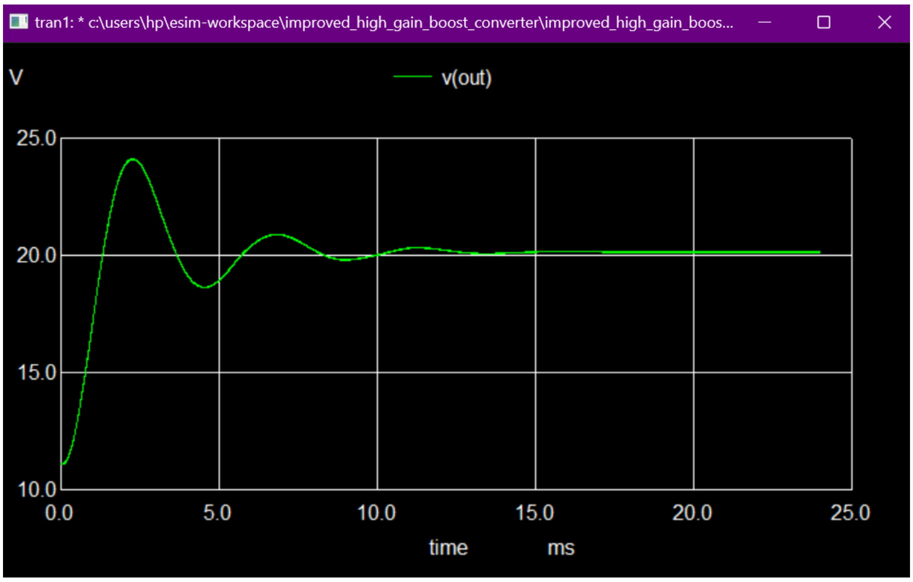

Figure 5: Output Waveform of DC to DC Boost Converter

Vin = 12

Duty ratio = 0.4

Vin = (1-d) vout

So here we get, **Vout = 20v**

Pulse Waveform

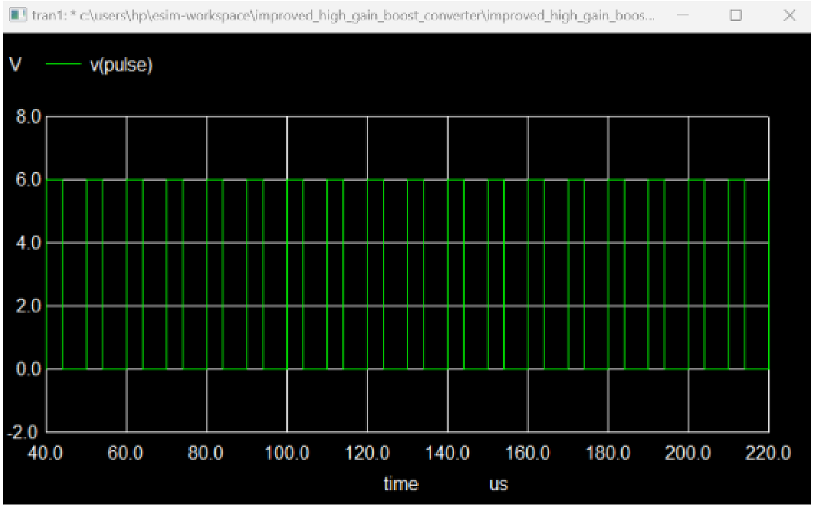

Figure 6: Pulse Waveform of DC to DC Boost Converter

Current Waveform

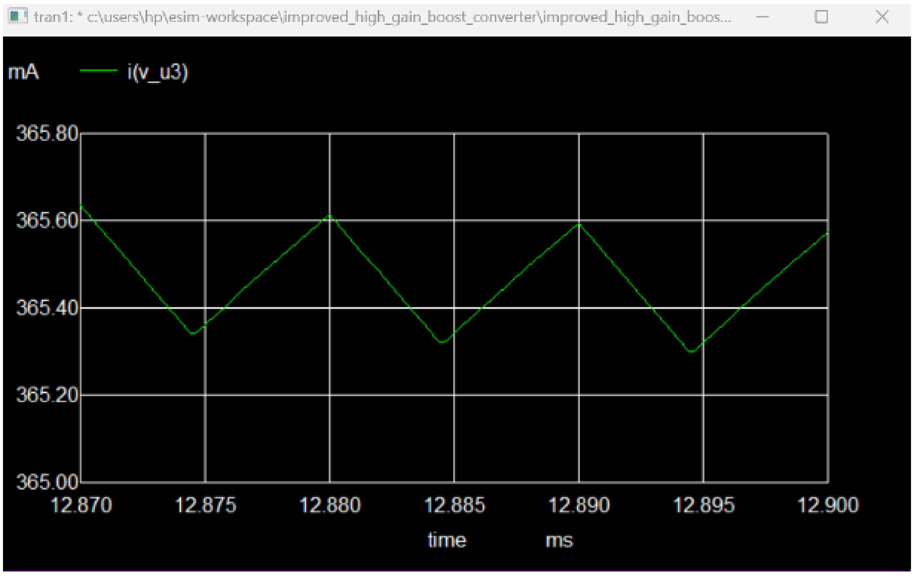

Figure 7: Current Waveform of DC to DC Boost Converter

Conclusion:

An improved high voltage gain boost circuit is analysed theoretically, with calculations of voltage gain and the variation in voltage and current for each component during operation. The analysis identifies the extreme points of voltage and current for the components, aiding in the selection of practical circuit elements. The findings indicate that the voltage gain of this circuit is (1+D) times higher than that of the original boost circuit employing voltage lifting technology. Compared to topologies using switched inductors and capacitors, this hybrid structure reduces voltage and current stresses on the components. The boost performance and the voltage and current values on each component are validated through simulation experiments.

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