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Design of Boost Converter Using Matlab

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ABSTRACT- This paper present the simulation of DC-DC BOOST CONVERTER. A boost converter is the most popular application in the industry to step up the direct current (DC) input voltage. This study focuses on determining the suitable value of the inductor and capacitor for use in the circuit. Since, the proposed converter delivers high conversion efficiency, it can be selected for multilevel boost DC-DC converters. The adverse effects such as inductor, resistance and inductor size of the conventional converters are overcome by the proposed converter. Then, this design focuses on continuous mode operation, with different voltage inputs of 200V and 600V DC, where the switching frequency input is 25kHz using the MOSFET as a switching device. All aim, calculations, tests, data and conclusions have been documented within this report. Results of simulation show that the switching converter will boost voltage from 200volts to 600 volts with power conversion efficiency of 94.16 percent. m. The design of this circuit will be analyzed using MATLAB Simulink software to verify the results between simulation and theoretical.

KEYWORDS: Boost Converter, Input Voltage& Output Voltage, MATLAB Simulink.

I. INTRODUCTION

In many applications in industry, it is required to convert a DC input voltage into variable DC output voltage. The conversion voltage supply directly from DC voltage to a different DC voltage is called a DC converter. This converter is used to step the input voltage to desired voltage. A DC-DC switching converter converts voltage directly from DC to DC and is simply known as a DC Converter. A DC converter is equivalent to an AC transformer with a continuously variable turns ratio. DC converters are widely used for traction motor control in electric automobiles, trolley cars, marine hoists, forklifts trucks, and mine haulers. They provide high efficiency, good acceleration control and fast dynamic response. They can be used in regenerative braking of DC motors to return energy back into the supply. step up input DC supply from the power sources such as batteries, solar panels, the output of the rectifier, DC supply, or DC generator the boost converter is used. t 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. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter) .

II. OPERATION OF BOOST CONVERTER CIRCUIT

The basic circuit diagram of the operation boost converter shown in Figure The inductor used to provide a smooth input current, and some ripple components are included in the input current but considered as small, which can be ignored when the switching action is repeated at high frequencies. The process of energy transfer is carried out by various elements like inductor, power switch, diode and filter capacitor. The electronic switch taken here is mostly power MOSFET but studies also shows that IGBT can also be used for switching purpose. Generally for simple design circuits pulse width modulation techniques are used for switching purpose. There are two different modes of operation of Boost converter i.e Continuous conduction mode, CCM and Discontinuous conduction mode, DCM.
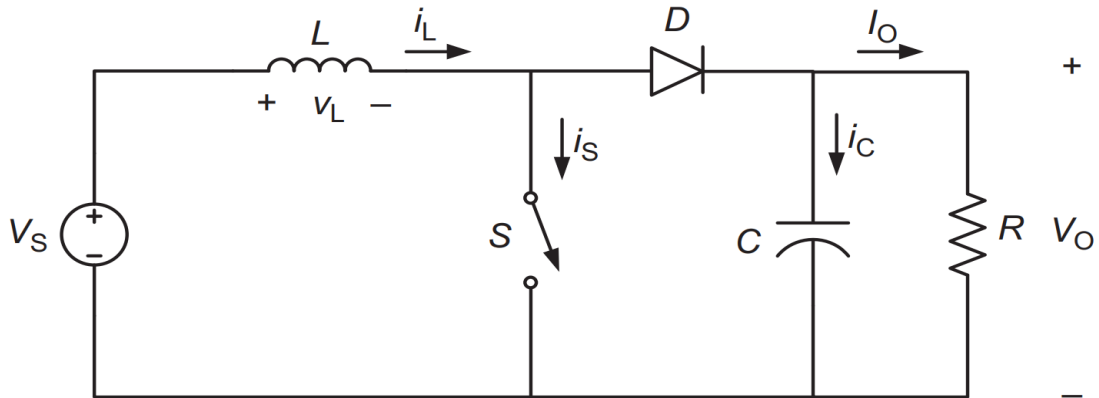
The circuit diagram of boost converter

Vin-Input voltage (200)

Vo- outout voltage (600)

Duty cycle = 1-Vin/Vo =1-200/600 = 0.666

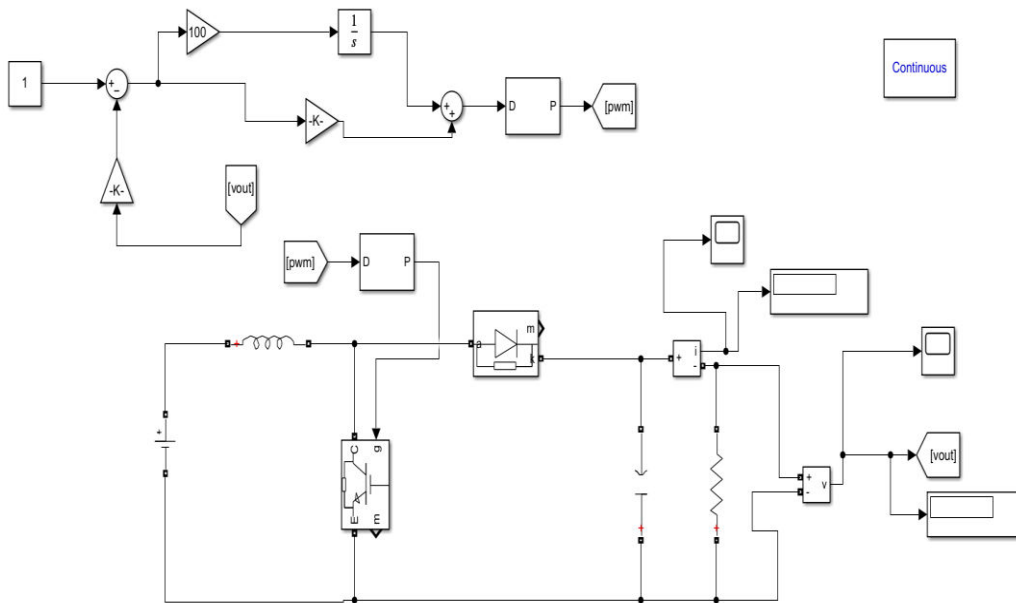(Inuctance) L = $\frac{Vs\,D}{fs\Delta I0}$ =2.131e^{-3} H

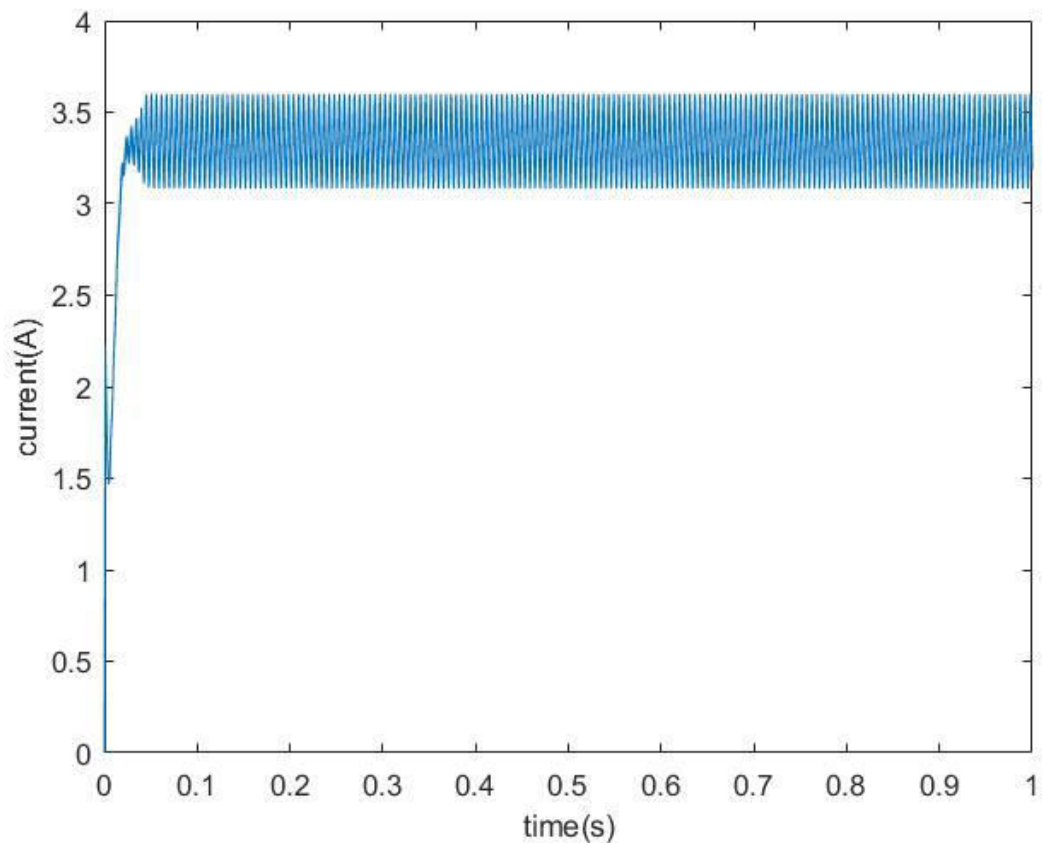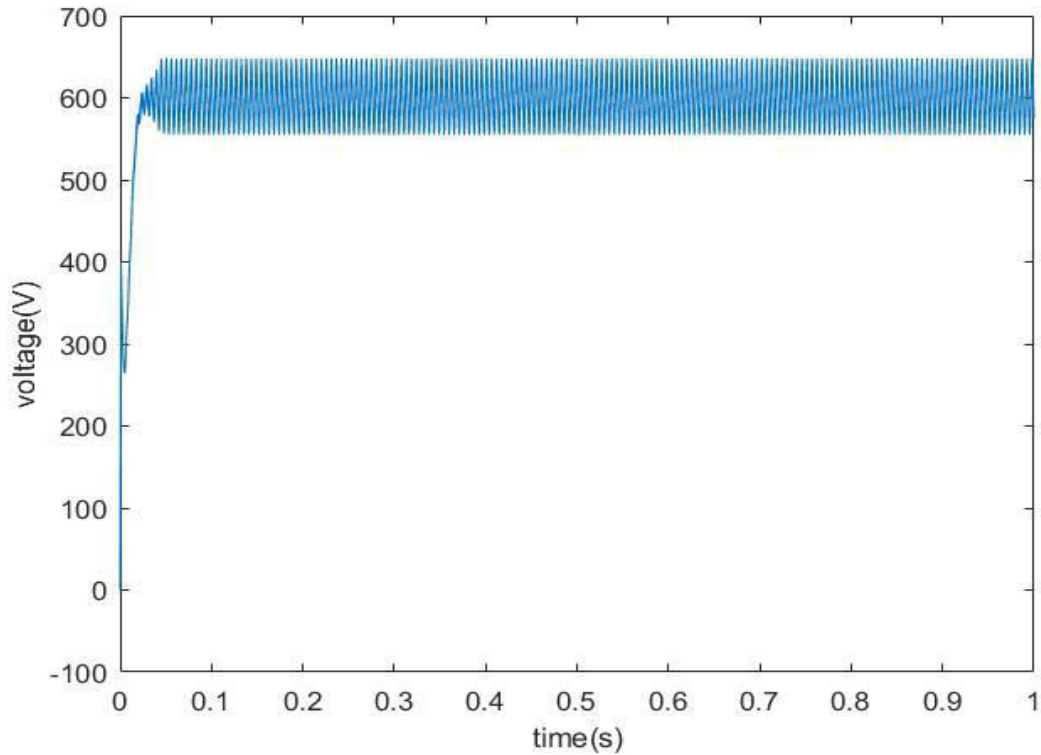f – frequency(25KHz)

(capacitance)C = IOD/fΔVO= 37.1e^{-6}

R= V^2/p =180ohm

CIRCUIT DESIGN -

SIMULATION RESULT-Voltage output in MATLAB

Current output in simulation

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III. RESULT AND DISCUSSION

A relation between the PWM based sliding mode controller, PID and PI controllers for a DC-DC boost converter is demonstrated. Performance analysis for controlling DC-DC boost converters are evaluated in simulation under line voltage variation, internal losses and parametric uncertainties. Sliding mode controller and PI controller have the same overshoot voltage but voltage drop is more when PI controller is used. PID controller has maximum settling time in comparison to SMC and PI controller. In order to test the robustness of the sliding mode control technique, the line voltage is changed from 200v to 600v.

IV. CONCLUSION

The average output voltage of the converter practically comes to be 200V as compared to the 600V form the Simulink. The efficiency of the converter comes out to be 95%. Practically there is a dip in output voltage waveform as compared to the Simulink output voltage waveform. PWM based sliding mode controller exhibits better performance than PID and PI controller having the lowest deviation from reference voltage under internal losses, parametric uncertainties and input voltage variations.

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