Design and Analysis of Buck-Boost Converter

Project synopsis submitted in partial fulfilment

for the Award of

CERTIFICATION

in

Electric Vehicle Course

by

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INTRODUCTION

Project Overview:

The main aim of this project is to design the Buck-Boost-Converter which is an electrical device which used to either step-up or step-down the DC voltage in reverse polarity. In an Electric Vehicle buck-boost converter has wide range of applications. For instance, it is used in Charging a Battery of the Electric Vehicle.

Objectives:

The goal of this project is to design and analyse the Buck-Boost-Converter using MATLAB by focusing step-up or step-down voltage regulation and its impact on efficiency in different operating conditions.

Significance:

This assignment helps to understand about the importance of Buck-Boost-Converter which is very essential device in the Electric Vehicle technology in various kind of applications like Battery Charging and also in other systems where the voltage should be either step-up or step-down in the reverse polarity.

Tools and Materials

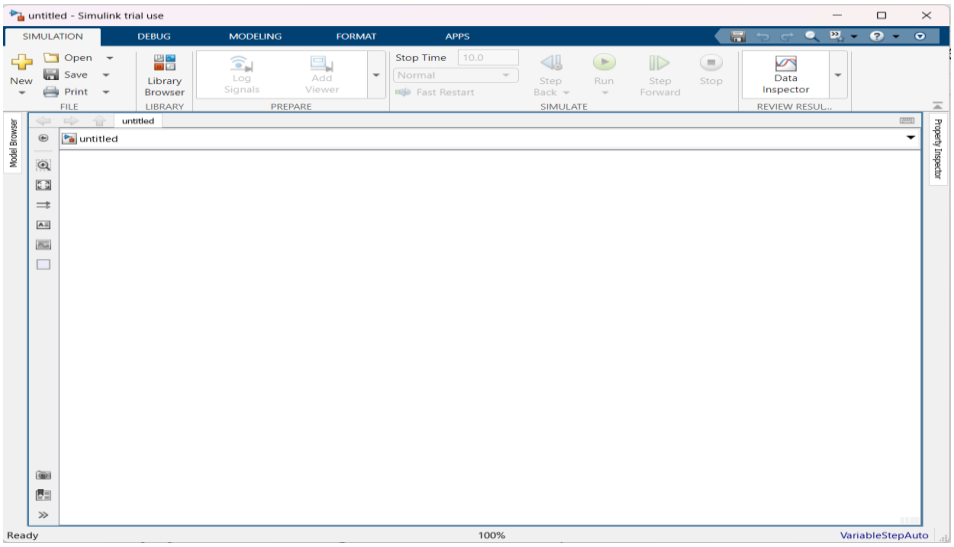
Software Tools:

The Buck-Boost converter is designed by using MATALAB software of version R2023B. The Simulink environment in the MATLAB is more used for the design and analysis of buck-boost converter.

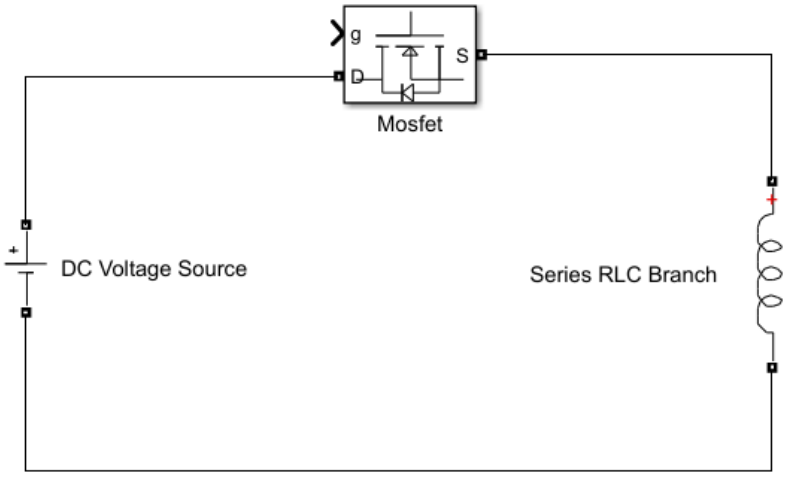
METHODOLOGY

Designing Procedure:

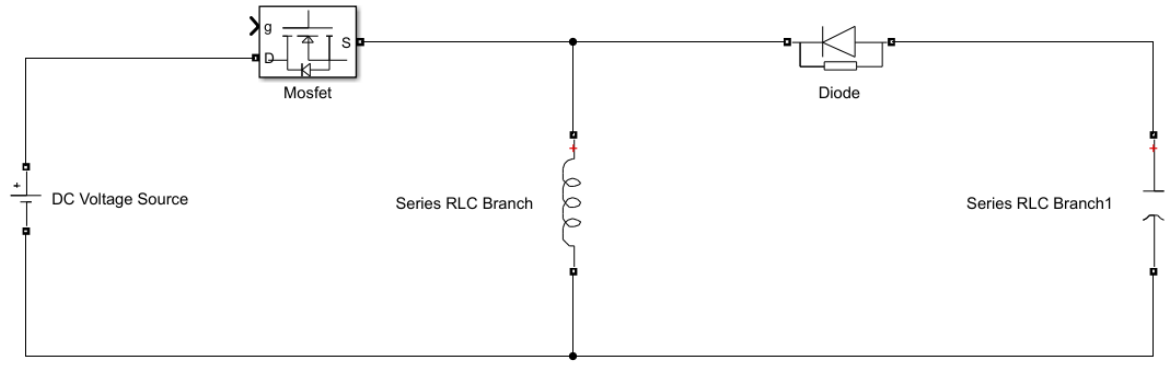
Step 1: Open the Simulink environment in the MATLAB Software.



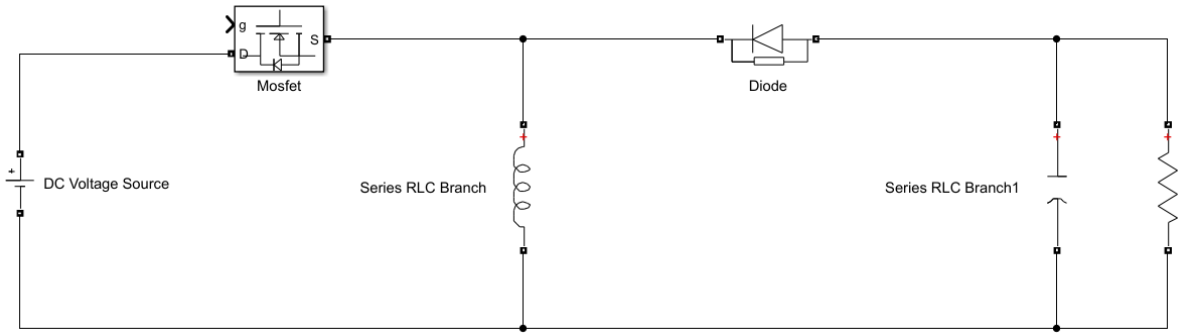
Step 2: Make the Connections of the DC voltage source, Inductor, MOSFET as shown.



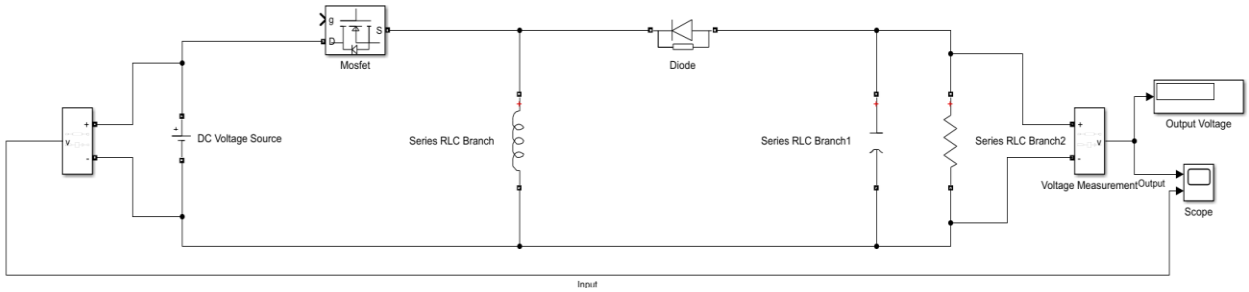
Step 3: Connect the Diode to the Capacitor and connect this assembly to the node of MOSFET and Inductor Connection as shown below. This makes the basic circuit of the Buck-Boost converter.



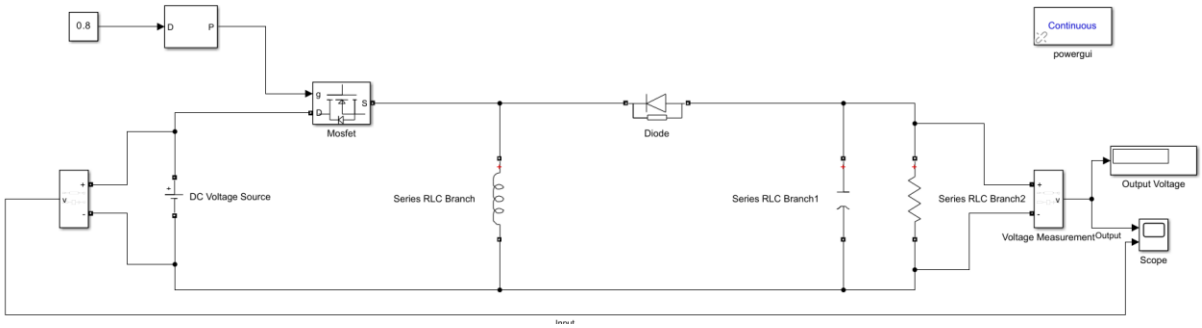
Step 4: Then connect load to the circuit as shown.



Step 5: Connect the voltage measurement block to the Load and DC voltage source to measure the input and output voltages. Also connect the scope and display blocks to identify the results.



Step 6: Connect the PWM Generator to the MOSFET as shown and provide duty cycle to the PWM generator with the help of constant block.



Step 7: Then Simulate the model and identify the output voltage.

RESULT AND ANALYSIS

Final Outcome:

The Design of the Buck-Boost Converter is achieved by following the steps which are mentioned above. The Input Voltage is given as 18V. The obtained results are shown below.

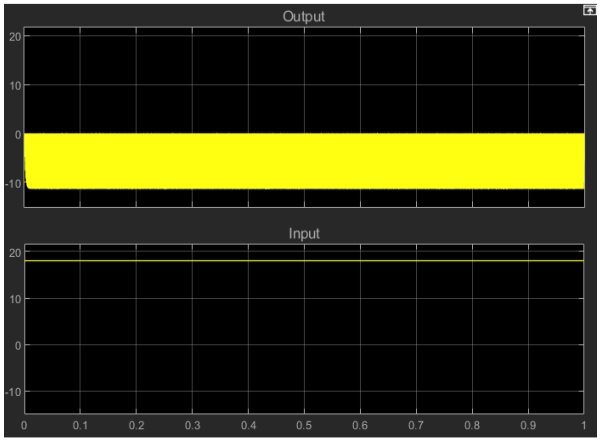


Fig - a

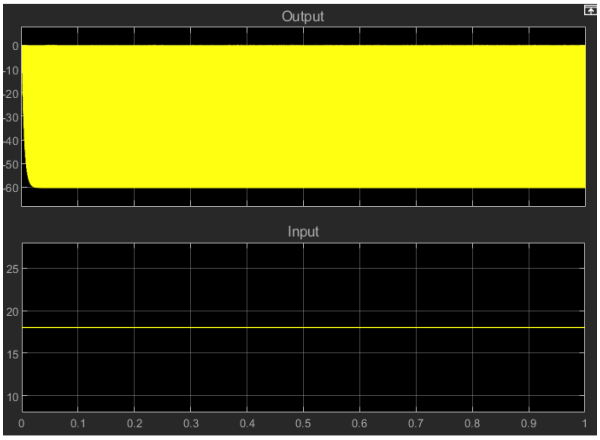


Fig - b

Result Analysis:

The Buck-Boost converter can able to boost-up or boost-down the voltage in the opposite polarity depends on the duty cycle. In Fig – a, the duty cycle is given as 0.4 where the 18V is stepped down to 11V whereas, in the Fig – b the duty cycle is 0.8 where the 18V input voltage is boosted to 60V. The ripples in the output can be minimised by using Filters.

CONCLUSION

Summary:

Since the aim of this project is fulfilled by Designing the Buck-Boost Converter which is an Electronic Device which is used to Step Up or Step Down the DC Voltage in opposite Polarity. The Results are also analysed to achieve the desired output.

Final Thoughts:

Through this project I have an idea of the significance of the buck-boost converter and the role of this converter in an Electric Vehicle. This Converter has wide variety of applications in Solar power systems, LED lights and Flash lights and also used while charging the Battery of an EV.

References:

Ajami, A., Ardi, H., & Farakhor, A. (2014). Design, analysis and implementation of a buck–boost DC/DC converter. *IET Power Electronics*, *7*(12), 2902-2913.