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Analysis of Harmonics in Buck & Boost Converter

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Abstract- *The voltage tracking of a de-de buck-boost converter is presented in this master report. The de-de Buck converter has three operating modes for tracking the output voltage. This master report includes DSpace-assisted open and closed loop control. When compared to other types of DC converters, the Buck-Boost converter offers a few advantages. The nonlinearity of the de-de Buck-Boost converter features, however, makes it challenging to manage with traditional techniques, like an open loop control system. This primary issue is addressed by developing a close loop control system with DSpace . The MATLAB-Simulink application is utilized to construct a simulation model in order to verify the efficiency of the proposed strategy. According to the simulation results, the suggested approach significantly improves control performance when compared to a* con (Step-Down Converter) Visional *converter.*

Introduction

DC-DC converters are electronic circuits that convert a DC voltage level into another. Among them, the Buck and Boost converters are the two most fundamental types.

Buck Converter – Step down the input.

Boost Converter - Steps up the input voltage.

Both are switch-mode power supplies.(SMPS) that use high-frequency switching, energy storage elements (inductor and capacitor), and semiconductor switches (MOSFET, diode).

1. Buck converter-

When the switch is ON, current flows through the inductor and load energy is stored in the inductor.

When the switch is OFF, the inductor releases its stored energy to the load via the diode.

Output Voltage

Vo = D × Vin

So, output voltage is always less than input voltage.

Applications- regulation in microcontrollers, sensors, and battery-powered systems.

Used in DC power supplies, LED drivers, and motor control circuits.

2. Boost Converter (Step-Up Converter)

When the switch is ON, the inductor stores energy from the input supply.

When the switch is OFF, the inductor releases its energy, adding to the supply voltage –resulting in higher output voltage.

Output Voltage - Vo Vin 1-D

So, output voltage is greater than input voltage.

Applications - Used in renewable energy systems (solar PV), battery-powered devices, and power factor correction circuits.

3. Buck Boost Converter

A DC to DC converter which steps up or steps down the input voltage level" is what a buck-boost converter is. The duty ratio determines whether the input voltage level is stepped up or down. The ratio of the circuit's output voltage to its input voltage is known as the duty ratio or duty cycle. A controlled DC output is provided by a buck-bust converter.

The output voltage that is obtained while it is in buck mode is lower than the input applied voltage. The output current exceeds the input current in this mode. Nonetheless, the input and output powers are equal.

Simulation:-

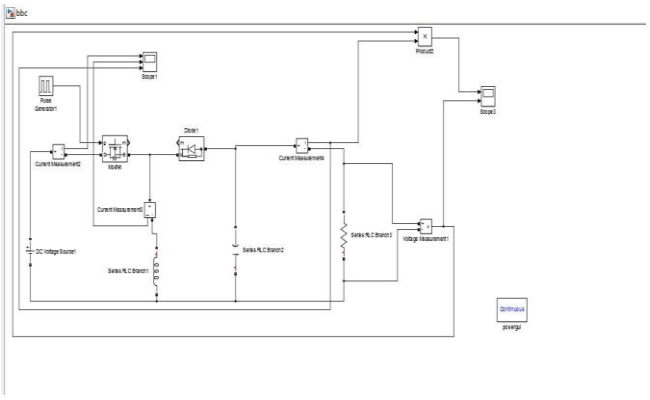
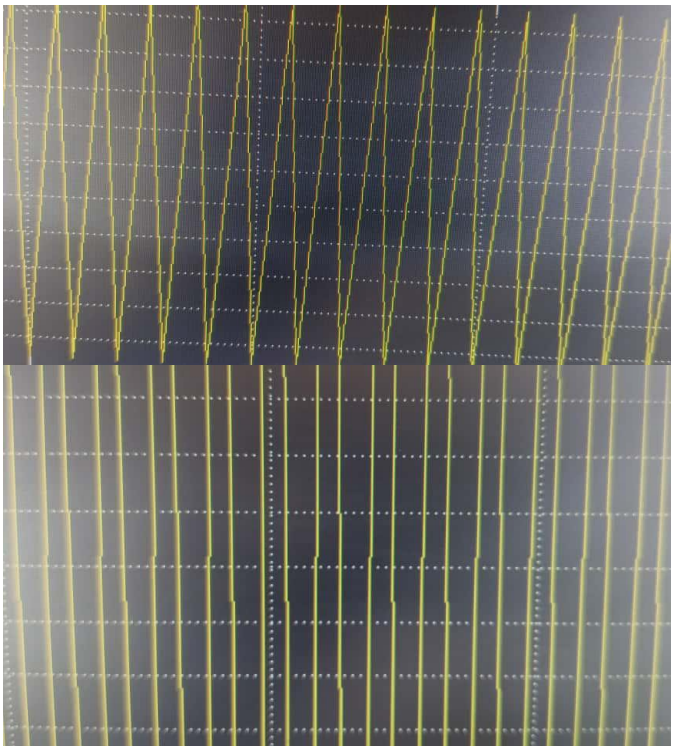


Fig -1: **Buck boost converter**

Analysis of the Result

We have successfully finished the design of a buck-boost convertor for this project, which can be utilized to obtain the output that is needed for the load to operate as intended.



FUTURE ASPECTS

In the near future, the converter can be further enhanced and its output voltage adjusted to determine which loads are most easily utilised. The converter is currently used to convert voltages between 5 and 18 volts. To make this project sustainable and for further use we can utilise it to adjust the range of conversion and use it for more practical uses and real world skills.

CONCLUSIONS

The Buck-Boost converter is a type of DC-DC converter that can increase or decrease the input voltage as needed. It is useful when we need a constant output voltage that may be higher or lower than the input. From the analysis, we see that the output voltage depends on the duty cycle and the circuit components. The converter is simple, efficient, and cost-effective, but it gives an output voltage with opposite polarity to the input.

Overall, the Buck-Boost converter is very useful in battery systems, solar power, and other electronic devices where variable voltage is required.

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REFERENCES

[1]BorRenLinandChienLanHuang.InterleavedZVSConverter withRipple-Current Cancellation", IEEE Transaction on Industrial Electronics, 55,(2008), 4, pp. 1576-1585

[2] High-Efficiency Modular High Step-Up Interleaved Boost Converter for DC-Micro grid Applications," Ching-Ming Lai, Ching-Tsai Pan, and Ming-Chich Cheng, IEEE Transaction on Industry Applications, Vol. 48, No. 1, January/February 2012

[3] LabVIEW Implementation of an Auto tuming PI regulator via Grey-predictor," by Chien-Ming Lee, Yao-Lan Liu, and Hong-Wei Shieln IEEE International Proceedings

[4] Singh, S. N., "Performance Analysis of Buck-Boost Converter," International Journal of Engineering Research & Technology (IJERT), Vol. 3, Issue 5, May 2014

[5] M. Iulian, "Topology for a positive buck-boost switching regulator," ed: Google Patents, 2010

[6] J. Ejury, "Buck converter design," Infineon Technologies North America (TFNA) Corn Desion Note, vol. 1, 2013.