DESIGN AND ANALYSIS OF 4.30 KW BUCKCONVERTER

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ABSTRACT

Buckconverters are commonly used power electronics apparatus. All DC converters are called step down converter or step up converter, but thesedependsupon the input and output operating condition. This paper represents the design, modelling and simulation of 4.65 KW buck converter.

This analysis is performed with buck converter input the voltage profile of experimental results which is shown by simulation with the help of buck converter we can reduce the ripple in the distribution system. If we talk about the ripple is affected by the current input source.

Key Words-DC-DC Converter, Model of Dc Converter, Buck Converter Design

1. INTRODUCTION

Most of the modern electronics equipments are made up of high density to provide high speed, response and smooth acceleration.In the case of buck converter the output voltage will be (310 V) which is less than the input voltage (750 V).The circuit diagram of a buck converter using a power MOSFET is shown in the figure and this is like a step down converter.The circuit operation is given into two modes. Themodel begins when the MOSFET is switched on at T=0,the input current rises and flows through Inductor,Capacitor filters and through the load resistor.Mode2 comprises of the MOSFET switch off condition at $T=T_1$ the freewheeling diode conducts because of the energy stored in the inductor that's why current flows through an inductor (L), capacitor(C),the load resistor(R_L) and diode (D).The inductor current conducts until MOSFET is switched on again for the next cycle.

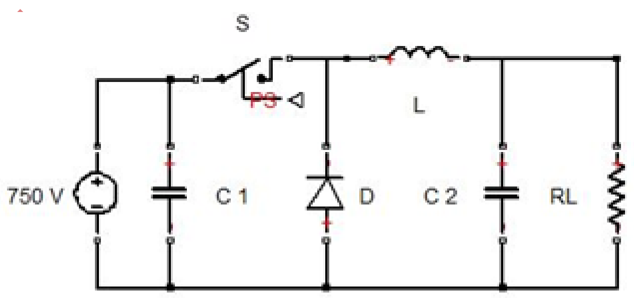

Fig1: Basic Diagram of Buck Converter

II MODEL OF THE 4.30 KW BUCK CONVERTERS

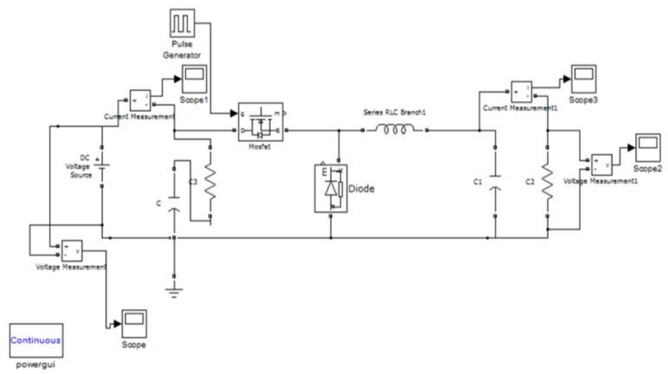

Fig2: Modelling of 4.30 KW buck converter

III CALCULATION

Assume these ratings-

V_{in}= 750volt, Vout=310volt,

I_{LOAD} = 15AmpF= 400 KHz, P=4.65KW

Calculation for duty cycle-

Duty Cycle (D) = V_{OUT} / V_{IN} = 310/ 750 = 0.413

Calculation for ripple current-

I_{RIPPLE} = 0.3*15(typically 30%)

=4.5 Amp

Calculation for an Inductor-

$$L = \frac{(V_{in} - V_{out}) \times \frac{D}{F_{SW}}}{I_{Ripple}} = \frac{(750-310)\,(.413/400\times10^{3})}{4.5} = 100.9\ \mu h$$

Calculationfor diode current-

$I_D = (1- D) \times I_{LOAD} = (1 – 0.413)\times 15 = 8.805$ Amp

Calculation for ESR-

$V_{0} =$ Vin$+ (Iin - Iload) \times ESR$

$310 = 750 + (6.195 - 15) \times ESR$

ESR= 49.97Ω

Calculation for Input Capacitor (C_1)-

$C_1 = I_{Load} \times \sqrt{(Vout/Vin)} \times (1 - Vout/Vin) = 15\sqrt{0.412}$

$C_1 = 1.23\mu F$

$\Delta T = 1.04\mu s$

Calculation for output Capacitor (C_2)-

$\Delta I = I_{out} - I_{min} = (15 + 10\% of\ I_{out})$

=15+10%×Iout =1.5+1.5

=3Amp

$\Delta V = ((D \times Vout))/100$

$= (.413 \times 310)/100)$

=1.28volt

Assume, ΔT=1.04μs,

$C_2 = (\Delta I \times \Delta T)/[\Delta V - (\Delta I \times ESR)]$

$= 3 \times 1.04 / [1.2 - (3 \times 49.97)]$

$C_2 = 0.02F$

IV SIMULATION RESULT

MATLAB 2010 is used in Buck converter simulation. Firstly, we find the element's value of the buck converter by calculation and with the help of these values we findthe output waveform.

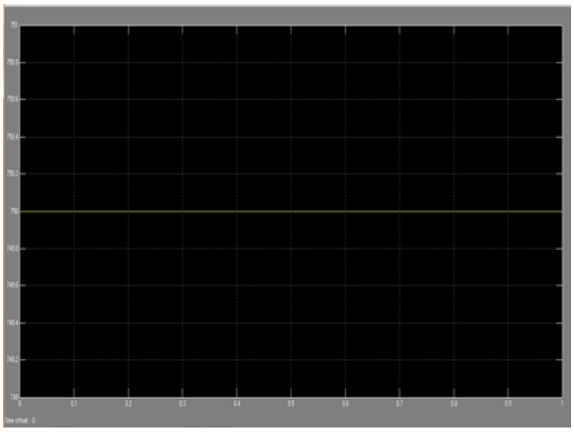

Fig3: Input Voltage Waveform of Buck Converter

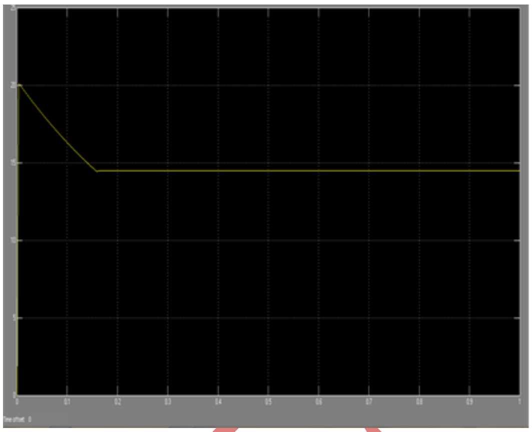

Fig4: Output Current Waveform 0f Buck Converter

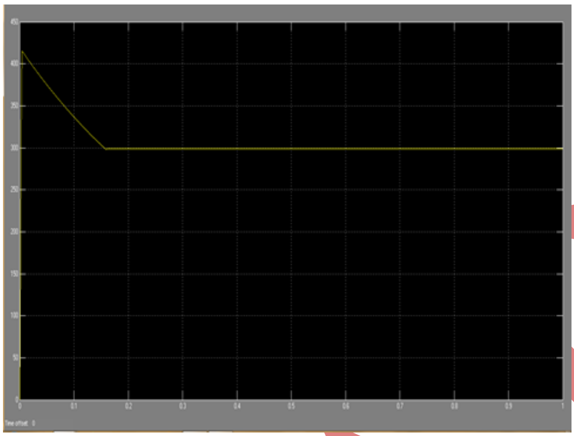

Fig5:output voltage waveform of buck converter.

V CONCLUSION

DCconverteruse for the both Boost and Buck converter and the function of these converters, depending upon the input and output operating condition.In this paper, we use the Simulation of the 4.30 KW buck converter which have a high frequency. So by using the simulation of4.30 KW buck converter we can verify the performance of the buck converter. We get the lower losses and we can minimize the ripple current by this simulation.

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