International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

Control and Optimal Design of Dc – Dc Converter of Electric Vehicle Fed by Bldc Motor Drive

S. Dineshkumar, Gn. Sachinamreiss

Abstract: ***The proposal of paper is to present EV based DC –DC converter system, where is possible to convert battery supply voltage to drive system which is more gainful. In this method Zeta converter is utilized for energy converting platform. It is because more advantage than other converter topology .Major intension is to propose this converter for acceleration and braking of EV drive is done by single converter. Two conversion formerly imperative involvement from other technical aspect. During acceleration, converter is boosting up the energy input to drive; fast and accurate study is used in order to improve power train efficiency. Second evaluation is for braking of drive is typically maintaining same potential & it can be lower voltage than supply input. This process is developed for better tuning and validation of converter which is for manage energy to drive. So, that degree of efficiency is succeeding on the proposed system. The simulation result delineation is show the concert of DC – DC converter. This upgrading of system will show the approach to substandard operating costs of EV and give an end result as lower energy exploitation and it improve life time of battery. System is more affordable than other converter topology.***

Index Terms: EV drive,DC-DC converter,Zeta converter, BLDC motor drive, Power drain.

I. INTRODUCTION

In recent years the development of vehicle with energy as a important role in design aspect keeps top notch. Electric vehicle is not easy task to run in optimum and rate parameter level. So, basically the converter design is necessary for the development of normal working environment. But the designing of the converter is quite an tedious process in order to co-ordinate with the application. Basically there is normal buck, boost converters, CUK, LUO, SEPIC converters are the order of the day. [1,3]

The choice of converter is quite based on the application that easy to merge with drive system. So, in our design we implement the Zeta converter.[2] On comparing with the other types of converter, if has higher efficiency and polarity changes are not here as we expect as a serious problem in other converter. The efficiency of the system is about 90% and also it is possible to desire the electrical vehicle operating parameters, such as maintaining the nominal voltage ratings of the system.[6]\

And here instead of operating the system with our application it is being operated with the loads such as Dc motor, Ac motor. After which the testing of results that co-ordinates with our application can be evaluated for series of testing of loads. Such that we can implement the converter system with our application. Here it is implement in the Electrical vehicle. Using the converter elevated as Zeta converter.[10]

The major application design is for the increasing global warming scenario[5], we are in argue to design and develop environmental friendly design. So Electric vehicle is for the eco-friendly vehicle. Voltage change in input is also analzed and that converter response due to change in voltage as boost of voltage as requirement of BLDC motor.Motor reponse is a analzed acceleration is explained in figure 1.

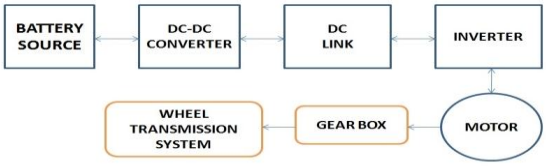

Figure 1.Block diagram for proposed EV drive system

II. STATE MODEL OF PROPOSED DC-DC CONVERTER

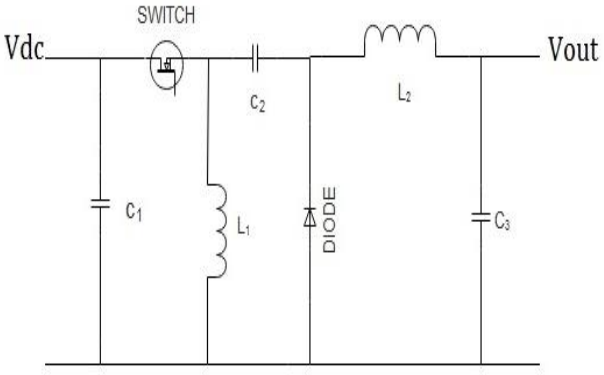

Figure 2.Circuit diagram for proposed DC-DC converter [1]

Revised Manuscript Received on 22 May 2019.

***** Correspondence Author

GN.Sachinamreiss*, ,Department of EEE, / M.Kumarasamy college of Engineeering, Karur,India

S.Dineshkumar, ,Department of EEE, / M.Kumarasamy college of Engineeering, Karur,India.

The proposed converter circuit is

$$\left(\frac{1}{SC_2}+SL_2\right)+\left(R//\frac{1}{SC_3}\right)$$

$$\frac{\left(1+S^2L_2C_2\right)\left(1+RSC_3\right)+RSC_2}{SC_2+S^2RC_2C_3} \quad (0.1)$$

$$\left(\frac{1}{SC_1}//L_1S\right)$$

$$\frac{L_1S}{S^2C_1L_1+1} \quad (0.2)$$

From equation

(0.3)

The torque ripple minimization and boost of Dc voltage is achieved based on input voltage .motor response is analyzeThe observable proposed converter is designed for motor drive system shown in figure 2. It seems Boost –Buck – Boost converter used for wide range of variation in input voltage can provide synchronized voltage output to drive. It has single switch, two inductor L1 is parallel to supply input voltage, inductor L2 is series with switch and capacitor C2.[7] The voltage across the capacitor is equal to output voltage of conventional DC-DC converter, the proposed converter output voltage is also equal voltage across that capacitor C3, during switch off mode diode D is in conduction mode and energy which is stored in inductor L2 is transfer energy to drive. Capacitor C1 is parallel to supply input voltage V dc.

When switch is on, reverse bias is occur in diode D, current flow inside inductors L1 and L2 is also increase. Inductor draws current from supply voltage source V dc .Dc link capacitor output is C out, output voltage from proposed converter is

$$Vo=Vin\left(\frac{D}{1-D}\right) \quad (0.4)$$

The switching frequency is exposed D , switch duty cycle is

$$D=\frac{Vdc}{Vdc+Vin} \quad (0.5)$$

Inductor L1 is derived from input supply voltage V in and switching frequency fs, current ripple Δ, current through inductor IL1

$$L1=\frac{Vin\times D}{fs\times\Delta\times IL1} \quad (0.6)$$

Inductor L2 is derived from input supply voltage V in and switching frequency fs, current ripple Δ, current through inductor IL2

$$L2=\frac{Vin\times D}{fs\times\Delta\times IL2} \quad (0.7)$$

$$\frac{S^4(RL_1^2L_2C_2C_3)+S^3(RL_1^2C3)+S^2L_1C_2(R+L_1L_2)}{S^5(RL_1L_2C_1C_2C_3)+S^4(L_1L_2C_1C_2)+S^3R(L_1C_1C_3+L_2C_2C_3+C_1C_2L_1+L_1C_2C_3)+S^2(L_1C_1+L_2C_2+L_1C_2)+SR(C_2+C_3)+1}$$

The current which flowing through inductor L2 is

$$IL2=\frac{Pdc}{Vdc} \quad (0.8)$$

The voltage across the capacitor equal to conventional DC-DC converter output voltage, the proposed converter output voltage is also equal voltage across that capacitor C3, during switch off mode Diode is in conduction mode.

The voltage across the capacitor isthe stator which is measured at 60 A[14]

$$Vc3=Vin\left(\frac{1}{1-D}\right) \quad (0.9)$$

Cost-cutting measure and fuel consumption as the criteria for recent development of EV .In EV electric motor and drive system are essential part. Here BLDC motor is utilized for EV application, it is free from issue cause by brushes. Working of motor is relatively high efficient, reliable, less EMI.[8,9]The control is also made by electronically communication, prospect is specially high speed variety. Permanent magnet are fixed in rotor, it provide low inertia in rotor and good dynamic response. But drawback is low flux density per unit volume.

BLDC motors are controlled by sensor less or sensor controlled method .hall sensor based control is adopted, more accurate[4]. Peak level torque is developed by interaction of stator magnetic field and rotor permanent magnets. Electrical steps are created in six steps to complete its electrical cycle. Conventional BLDC motor drive is provide work with converter topology. Wide variation in the Dc link voltage [8,9]and lower utilization of power is improving system performance.

III. RESULTS AND DISCUSSION

The system was done in simulation using MATlab.That overall system give details of boost operation of converter, based on output of proposed converter topology only machine speed ranges from 880 rpm to 920 rpm speed. it is obvious motor drive speed can be varied by control the output of proposed converter output.[10]

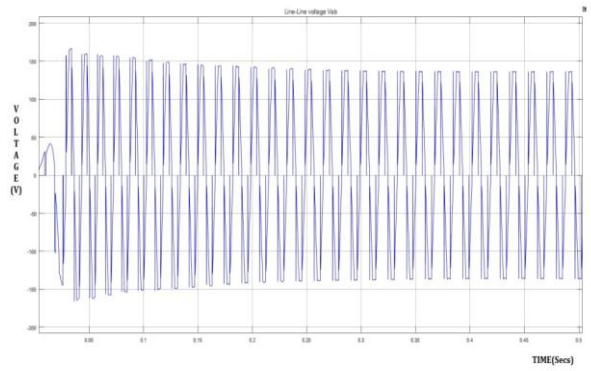

Figure 3.1.line to line voltage of BLDC motor

Output voltage of DC –DC converter is improved in that acceleration mode of operation. Input voltage source is improved from 100 v to 150 v range shown in figure 3.1. Before that settling time amount of voltage is go to peak and come back to settle.

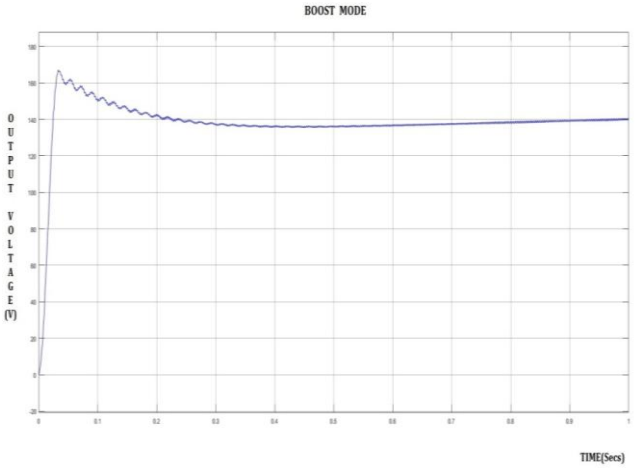

Figure 3.2.Output voltage of proposed Converter

Figure 3.2 shows the output voltage of proposed converter and Motor drive speed is ranges from 880 Rpm to 920Rpm ,the peak value of rotor speed from 1010 Rpm to come back to normal speed.

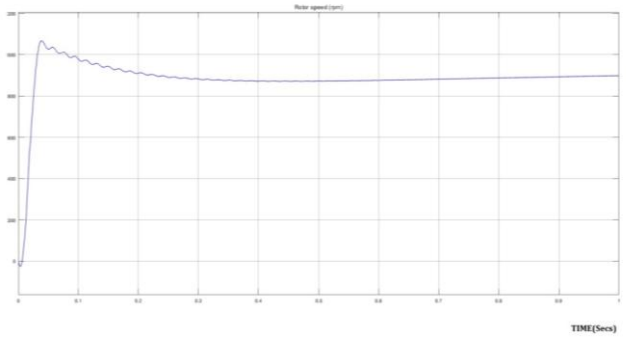

Figure. 3.3. Rotor speed of BLDC drive

The figure 3.3 shows the stator current for each phase , three set of phase current ia ,ib,ic are free from the current ripple present in each phase.

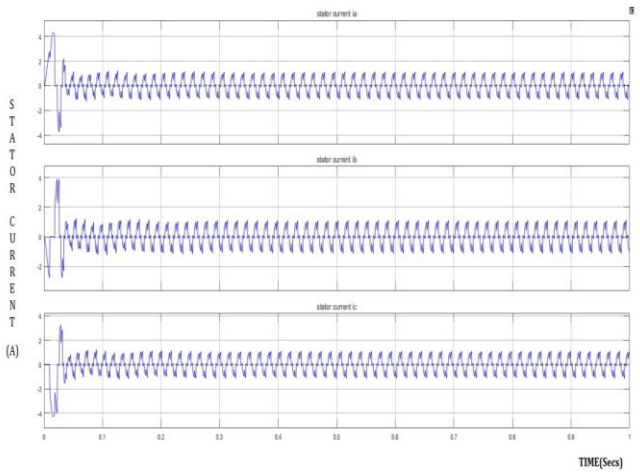

Figure 3.4.Stator current waveform of each phase of BLDC drive

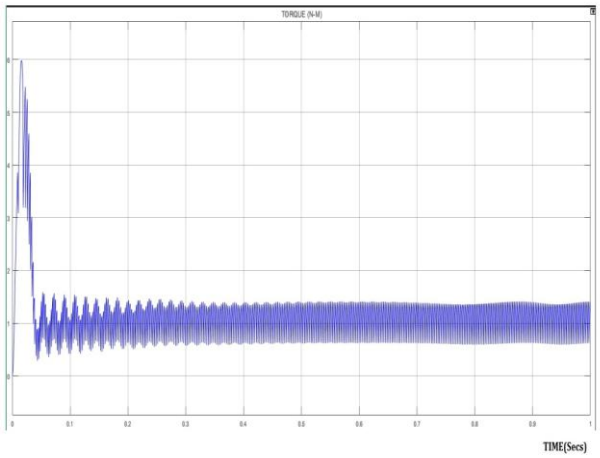

Figure 3.5.Torque waveform for BLDC drive

Compare with PV fed BLDC motor using zeta converter with minimized of torque ripple content because of DC link bulk size capacitor is create the torque ripple problem.Stator reactance and stator inductance problem is minimized in that paper.Get the good reponse of output torque in that machine .Output voltage also boosted by converter the results are shown in figure 3.4 and 3.5.

IV. CONCLUSION:

The growth of electric vehicle need to attain self-determining emission cut from fuel . The proposed DC-DC converter performance is evaluated in that simulation, when converter work as augment power from Dc supply source to vehicle operating in acceleration mode. In this mode of operation vehicle need more energy level for pull motor drive. Motor pulling torque is attained required level. Coupling co efficient, phase current ripple is minimized as 0.06 .The overall current ripples reduces in that proposed converter. The response of output voltage of converter model is analyzed under various parameters.

Low rating Dc link capacitor provides good response due to that motor able to operate in rated torque and speed.

REFERENCES

1. Rajan Kumar ;and Bhim Singh ,(2014). "Buck –Boost Converter Fed BLDC Motor Drive for Solar PV array Based Water Pumping", *IEEE International Conference on Power Electronics, Drives and Energy Systems* , pp. 1-6,2014
2. Rajan Kumar ;and Bhim Singh, "BLDC Motor-Driven Solar PV Array Fed Water Pumping System Employing Zeta Connverter", *IEEE Trans. Industrial Applications*, vol. 52,no.3, pp. 2315-2322,2016
3. Rajan Kumar ;and Bhim Singh, "Solar PV Array Fed Cuk Converter-VSI Controlled BLDC Motor Drive for Water Pumping", *6thIEEE Power India International Conference*, pp. 1-7,2014
4. Swathikumari; A. Y. Lakxminarayana ;and S. Tarakalyani ,"Modeling and Simulation of BLDC Motor for Aiding and Opposing Loads", *IOSR Journal of Electrical and Electronics Engineering*, vol. 7, no. 4, pp. 59-67,2013
5. Zhou Xuesong.; Song Daichun.; Ma Youjie; and Cheng Deshu, "The Simulation and Design for MPPT of PV System Based on Incremental Conductance Method", WASE International Conference on Information Engineering(ICIE), vol.2, pp.314-317, 14-15,2010
6. Mohammed Ali Elgendy; Bashar Zahawi; and David John Atkinson , "Assessment of the Incremental Conductance Maximum Power Point Tracking Algorithm", IEEE Transactions on Sustainable Energy, vol.4, no.1, pp.108-117,2013
7. N. Soumya Smitha Raj; B. Urmila , "PV fed Zeta Converter", IJERA, vol. 3, Issue 4, pp.2692–2696,2013
   S. Dineshkumar; N. Senthilnathan, "Three Phase Shunt Active Filter Using Modified Algorithm For Interfacing
8. Renewable Energy Source With Main Grid" ,International Journal of Applied Engineering Research, No.55, Pages -3045-3049,2015
9. S. Dineshkumar; and N. Senthilnathan , "Three Phase Shunt Active Filter Interfacing Renewable Energy Source
10. with Power Grid", Fourth International Conference on Communication Systems and Network Technologies, pp. 1026-1031,Bhopal,2014
11. T Gowtham Raj, M Ramesh, S Dineshkumar, "Performance Analysis of BLDC Motor Using CUK and Luo Converter", Journal of Chemical and Pharmaceutical Sciences ISSN, Pages284-288,2017
12. Ahmad Saudi Samosir, Tole Sutikno, Abdul Halim Mohd Yatim, "Dynamic Evolution Control for Fuel Cell DC-DC Converter" Journal of TELKOMNIKATelecommunication Computing Electronics and Control), Vol 9, No 1: April 2011
13. Suresh p, "Novel Zeta Converter With Multi Level Inverter Connected To Grid" ,Indonesian Journal of Electrical Engineering and Computer Science,Vol 11, No 3: September 2018
14. G. Kannan, "A High Frequency Converter for EV Application" ,Indonesian Journal of Electrical Engineering and Computer Science,Vol 9, No 1: January 2018
15. G.N. Sachin Amreiss and S. Dinesh Kumar "Internet of Things Based Environmental Safety and Communication through Integrated Multi Sensors by
16. Esp8266 for Industries" **BBRC Journal(** Recent Trends in Biosignal Processing and Biomedical Instrumentation) Issue Vol 12 Number-3 May (2019)Pp:1-4

AUTHORS PROFILE

He is pursuing Ph.d degree in Anna University ,Chennai. His area of research is Power electronic converter,DC-DC converter and drives,Shunt active filter.He is an Assistant professor in M.kumarasamy college of engineering ,Karur. He presented 5 international and 5 national conference in reputed institutions and also published 16 journal papers in various reputed journals like Scopus and web of science.

G.N.SACHIN AMREISS is working as an assistant professor in M.Kumarasamy College of engineering, Karur. He effectively participated in 3 conferences during the period of (2015-Tillnow). His main area of interest is Power Electronics and Renewable Energy. He published about 15 international journals in reputed publications like Control Theory and Application and Journal of Advances in Chemistry. During August 2018 participated in International Conference on Intelligent and Advanced System (ICIAS) and proceedings published in IEEE explorer.

.