http://www.jctjournals.com ISSN(ONLINE):2278 – 3814

Volume-6, Issue-12, Dec., 2017
JOURNAL OF COMPUTING TECHNOLOGIES (JCT)
International Journal
Page Number: 05-10

Voltage Ripple Reduction for DC-DC converter in AC Motor Drive by using Feed Forward Controller

Nikky Kumari[1], Dr. Jitendra Singh Shakya[2]
[1]P.G Scholar, SATI Engineering College, Vidisha, M.P, India.
[2]Asst.Professor, SATI Engineering College, Vidisha, M.P, India.
[1]nikky7747@gmail.com, [2]jitendrasinghshakya@gmail.com

ABSTRACT – In this paper, the common power electronics system is used to study about dynamic behaviour of Ac fed drive. This power electronics switching circuit is examined for the presence of complete disorder and confusion. Due to complete disorder exhibited in the various general non-linear briefly along with properties. Analytical design for practical value of inductor and capacitor for (six pulse inverters), boost converter is present. This is the model which is based on feed forward control to repress the beat of voltage ripple induced by inverter of the motor during operation. The continuous conduction mode of inductor current is verified experimentally. Higher gain can achieve low duty cycle. Another advantage is there is no external circuit needed to limit capacitor voltage. In compare to traditional control scheme; the feed forward scheme is more superior.

***Keywords*— Fuel cell, battery, boost converted, Inverter, induction motor, Hysteresis control, Indirect vector control.**

I. INTRODUCTION

In switching of power electronics can induce some harmonics in dc link voltage of electric motor drive. Although low frequency harmonics also suppress by step forward control of dc/dc converter usually in drive with the help of more than one energy storage device. In this paper a model is based on close loop control for reduction of voltage harmonics induced by inverter operation of a motor. An extended analysis is present through about this fault which is reduced by the simulation work. The combination of theoretical and simulation work make this paper perfect information for researchers. The energy management recommended a set point at which value of voltage or current is defined, according to this predefined value, result of the experiment must be matched with standard value. If value of voltage or current exceed then control it by using dc-dc converter. The applied dc link voltage is equal for all loads. Semiconductor switching process is done for reduces losses at minimum point. The dc link voltage ripple is might be interfere with component of controller can induces undesired harmonics in the motor. Therefore, the voltage ripple has to be limited to certain level in order to provide a sufficient dc-link. The dc link filter is used to reduce dc link voltage ripple. This paper is deal with the sufficient work of dc/dc converter for ac drive in which motor is operated under six step mode. After this anew simulation has been doing that is based on feed forward control operation to achieve significant speed of ac motor drive at desire ripple.

A. Fuel cell

A type of cell that produces electricity without combustion by combining hydrogen and oxygen to produce water and heat is called fuel cell .Therefore it also known as electrochemical device.

$$2H_2O\ (Gas) + O_2\ (Gas) \rightarrow 2H_2O + Energy$$

They convert hydrogen or hydrogen containing fuels, directly converted in to electrical energy plus heat through the electrochemical reaction of hydrogen and oxygen into water. The process showing in above equation of electrolysis because hydrogen and oxygen gases are electrochemically converted into water, fuel cells have

many advantages over heat engines. The two principle reaction in the burning of any hydro carbon fuels are the formation of carbon dioxide and water. Whenever fuel increases the amount of hydrogen increase at that condition formation of water becomes more useful, due to formation of water there is low emission of carbon Dioxide. It seems a natural progression the fuel will tend to 100% hydrogen. In simulation work PEMFC fuel cell is prefer to use. This uses an easiest reaction of other fuel cell.

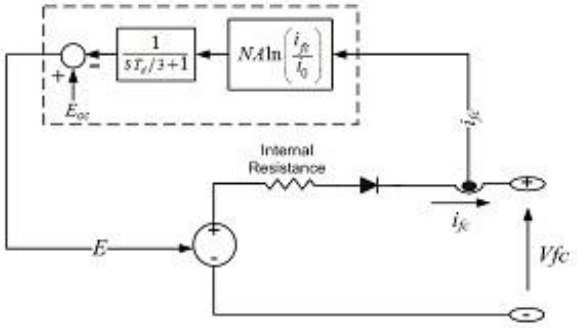

Fig.1. Model based on equivalent circuit of fuel cell stack.

Advantages over conventional energy sources

They produce zero or very low emission especially greenhouse gases depending on the fuel used. It can be utilized for combined heat and Power Purposes, further increasing the efficiency of energy production. These also include: high efficiency, virtually silent operation and if hydrogen is fuel, there are no pollutant emission.

B .Battery

Battery is the main source of electricity before the development of electric generator and electrical grid around the end of nineteenth century. Batteries are used to start engines and auxiliary power units, to provide emergency backup power for essential avionics equipment, to assure no- break power for navigation units and fly-by-wire computers, and to provide ground power capability for maintenance and pre-flight checkouts.

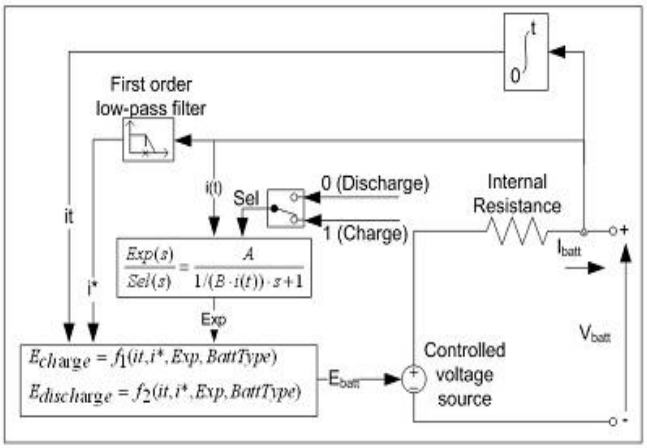

Fig.2 model based equivalent lead acid battery

Many of these functions are mission critical, so the performance and reliability of an aircraft battery is of considerable importance. Other important requirements include environmental ruggedness, a wide operating temperature range, and ease of maintenance, rapid recharge capability, and tolerance to abuse.

TABLE I
classification and comparison of battery

Primary cell Non Recharging	Secondary cell Recharging
Lower initial Cost, Lower life cycle cost, Replacement readily available, Usually lighter and smaller, Not suited for emergency back-up, hybrid vehicle, etc	Higher initial cost, Higher life cycle cost, Replacement while available, are not produced in the same absolute as primary battery, application.

C .Dc/ dc converter

In this work .with the help of boost converter increase the power of fuel cell adding battery. In other word boost converter is applied as a regulator to regulate a drive to obtain desire value of output. The fundamental circuit for a boost converter or step up converter consists of an inductor, diode, capacitor, switch and error amplifier with switch control .A connection which connects a rectifier and a inverter. The dc link especially found in converter circuit. The DC link usually has a capacitor known as the DC link Capacitor. This capacitor is connected in parallel between the positive and the negative conductors. The DC link usually has a capacitor known as the DC link Capacitor. This capacitor is connected in parallel between the positive and the negative conductors.

Boost converter operation the operation of the boost converter is relatively straight forward. When the switch ON position, the inductor output is connected to ground and the voltage V in is placed across it. The inductor current increases at a rate equal to Vin/L. When the switch is placed in the OFF position, the changes and is equal To V out -Vin Current that was following in the inductor decays at a rate equal to (V out-Vin)/V out.

D. Motor model

Ac drive is superior due to control mechanism of motor is simple, economical and comparatively less complex as compared to dc motor. Induction motor is the type of motor which couldn't possess the constant speed characteristics. By power electronics switching is deployed to make its efficient, also saves precious energy while attending the mechanical attributes that's why the motor is driven smoothly with good tolerant capacity .PWM switch is reduce the chances to failure. In this system a dc link voltage is require to reduce ripple of voltage to make the drive constant value of speed. Low

order harmonics shows the effect on motor torque. The dc current in an inverter is depend on types of load connected and applied switching for power electronics system. After discussed all these main motive of this paper to run this drive at maximum constant speed with less ripple with respect to time at 50Hz frequency. Input fed through the output of inverter.

II. MODELLING

(1)Induction motor*:* In other words it also called Asynchronous motor. This motor is less expensive and more easily spread so called squirrel cage motor. Along the rotor axis the wire that connects at the end of metal ring resulting in a short circuit. There is no current supply needed from outside the rotor to create magnetic field. When rotating at the speed of stator frequency the stator phase creates a magnetic a air gap. A current induces due to changing field in cage wire. Then results in the formation of a second magnetic field around the rotor wires. As a result the forces created by these two fields, the rotor starts rotating in the direction of the stator field but at a slower speed . If the rotor revolved at the same frequency as the stator, then the rotor field would be in phase with the stator field and no induction would be possible. The difference between the stator and the rotor frequency is called slip frequency (slip= 1-). There are several ways to control an induction motor in torque, speed or position, which can be categorized into two groups: there are scalar and vector control methods. Because of its outstanding robustness among all AC Motors,

(2)Hysteresis current controller*:* In these techniques, the Hysteresis band is used very frequently due to lucidity of implementation and quick response current and robust system .This band is used to track the line current references. The error between measured and reference current value used to develop three valid switching states of inverter leg by the hysteresis band controller.

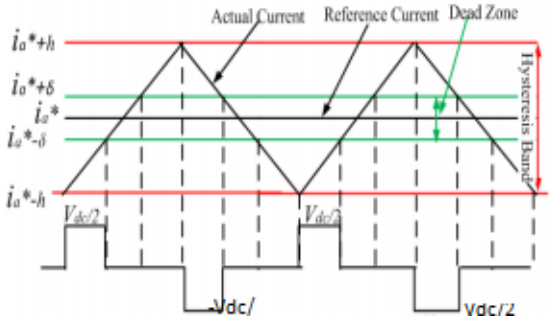

Fig.3.hysteresis current control

A switching scheme develops for inverter. At appropriate instant the zero voltage applied .As a result of this successive instant the switching logic must be sure that the transition between Vdc/2 and –Vdc/2.This shows the frequency of switch in increasing order. A ∂ is dead zone and hysteresis current h to avoid switching towards given scheme due to sampling error is in finite condition .When the error becomes not detectable or tends to zero, the opposite polarity can follows resulting this scheme. Although, the introduction of dead zone increases error tracking, for best sampling speed chosen the minimum value of error.

Figure 2 a shows current either in lower band or higher band (through 0,-1condition). Here U=1 switch is Vdc/2 states, U=0 switch is in zero states. If U=-1 switch is in –Vdc/2 states. By this method we are able to inverter b-phase and c-phase switching function three voltage source inverter.

3) Indirect vector control: This technique is used to control the dynamic speed of induction motor. Direct vector control, indirect vector control both is different from each other but the unit vector is generated in an indirect form. This is also called field oriented control or variable frequency control method. In this method three phase current of stator in Ac motor drive are identified by using two orthogonal components. One is magnetic flux of motor and other is torque. Proportional integral (PI) control is used to measure the value of current in motor with given reference and by using PID controller switched to the obtained output current through PI controller. It was originally applicable for high performance motor.

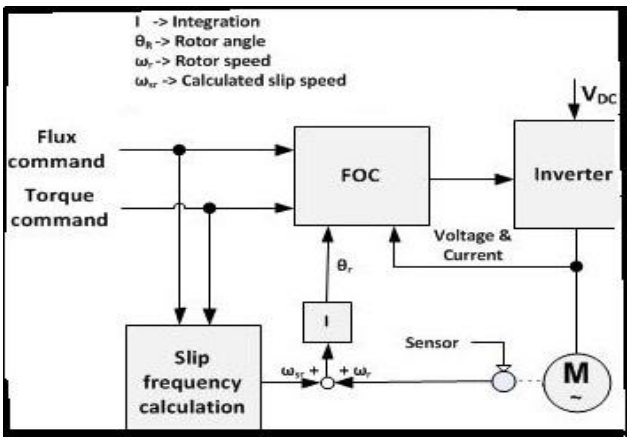

Fig. 4. Indirect vector control block diagram

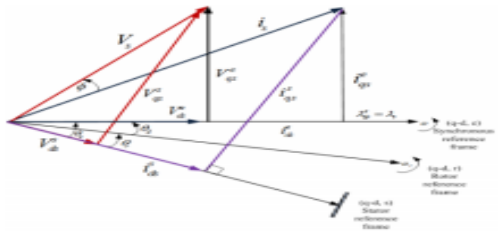

Fig 5.Indirect vector control phaser

ISSN(ONLINE):2278 – 3814

III. Simulation work

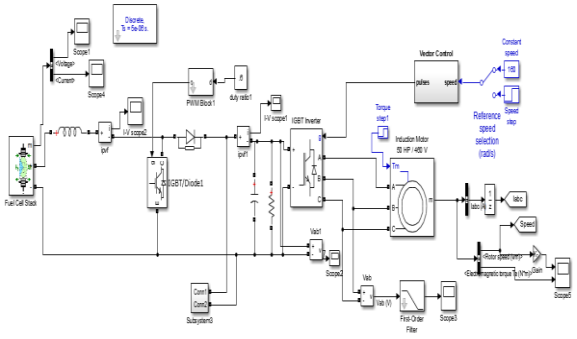

Fig.6. Simulink Model of close loop control model of DC- DC converter.

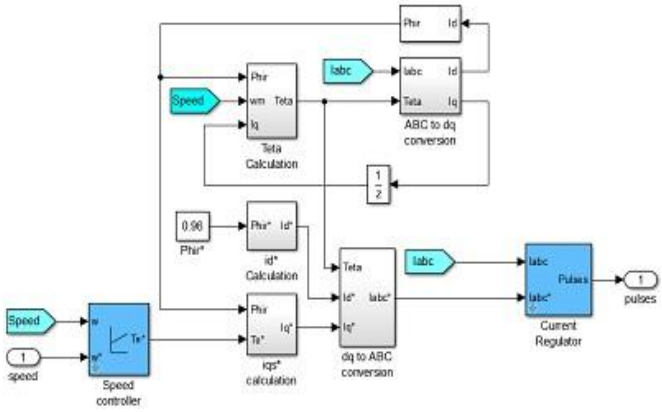

Fig.7. simulation model of hybrid control

In this work, simulation model is prepare with the help of battery, fuel cell work as a source. A fuel cell can never be provided the required amount of power to run Asynchronous machine at desire speed .Battery is lead acid used to their low cost, availability, ease of cost. This lead to one of the efficiencies encountered due to the difference in charging and discharging voltage in order to rate by current and time. A typical five cells lead acid battery charge at 80-90 v and discharge at 60-70v; typical energy efficiency stands at 75% with an example of optimized system achieving 83% of average. Lithium battery has one advantage; has much reduced voltage range between charge and discharge. Battery power helps to start the drive with high torque.

Generally Ac drive doesn't operate at constant speed using either fuel cell or battery. Fuel cell has no enough power to exert high torque and battery having not enough power to run long time at very high speed. Therefore much efficiency improved to using both battery as well as fuel cell system with the help of boost converter. After that a boost converter with the help of IGBT and Diode in which capacitor and Inductor are join parallel to feed the sufficient amount of power in inverter fed Ac motor drive The main role of mosfet / IGBT under the boost converter therefore proper controlling of IGBT by PWM control technique.

Descriptions	value
No. of fuel cell	300
No. of battery	100
DC-DC high side capacitance	600 micro farad
DC-DC equivalent inductance	10 micro H
Switching frequency	100kHz
motor pole pair	2

Boost converter for low power improving as per as advice desired speed of Ac drive. Inverter for Dc-Ac power for advice of drive and for controlling purpose vector control for induction motor and Hysteresis control to inverter gate signal to current control. If voltage and current control give proper reduction of voltage ripple or not applied in directly. Although current disturbance is provide then both control scheme called hybrid control presented for implementation of feed forward control model. When motor at different speed, the control can simply switched off.

IV. Result

The work shows very less ripple for high-speed Ac drive. Both control schemes is completely differ from traditional control. This paper represents a best

quality of DC link voltage proper operation done for all part. For meet the desire performance of drive, work at different speed. Peak-peak ripple cut with increase the motor speed. The impedance of open loop system as well as forward controller shows weak bounding for impedance of traditional controller .This result shows another definition of this model known as linearized model. Because this model in voltage control mode in order to determine the feed forward model to repress he ripple caused by motor current. The speed of drive is showing constant speed at 1200 rpm with a short beat of ripple in time domain.

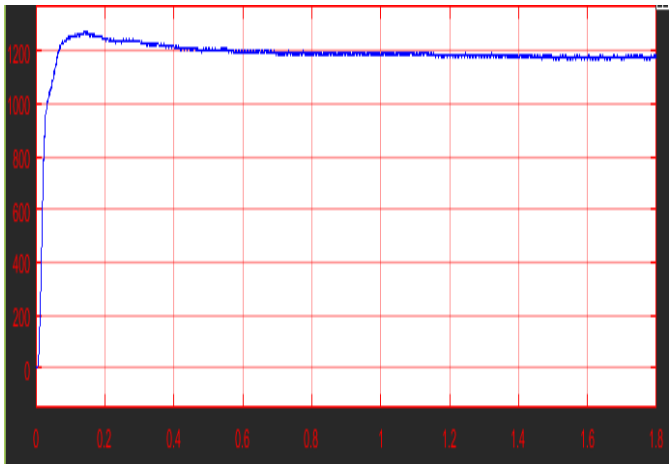

Fig. 6.Simualtion result of Speed at 1200 rpm

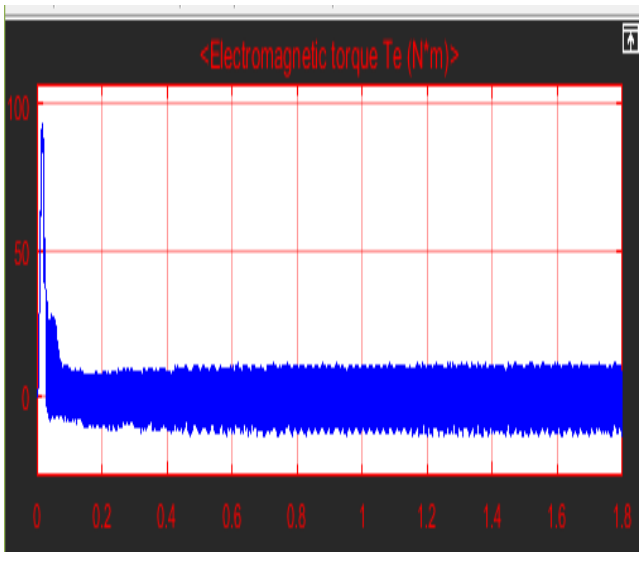

Fig. 7. Torque with a beat of ripple for high speed drive

V. CONCLUSION

This paper has analysis and study of dc/dc converter control in a fuel cell system on low frequency dc link voltage ripple. This type of ripple is caused by the motor inverter when operated at low switching frequency during high power application .Only voltage control is not suitable to reduce ripple of this system. Therefore to reduce the ripple control voltage and current of the configured system in feed forward way. Simulation result have shown that the proposed control scheme which meet preferable reduction of voltage ripple at maximum speed. The Causal Productions has used its best efforts to ensure that the templates have the same appearance.

REFERENCES

[1] Sagert1, Markus Walter and Oliver Sawodny "DC/DC converter control for voltage ripple reduction of electric motor drive" Conrad 2016 IEEE International Conference on Advanced Intelligent Mechatronics (AIM).

[2] Basic Calculation of a Boost Converter's Power Stage'' Brigitte Hauke SLVA372C–November 2009–Revised January 2014

[3] Amin, R. Bambang , A. Rohman , C. Dronkers , R. Ortega, and A. Sasongko , "Energy management of fuel cell/battery/super capacitor hybrid power sources using model predictive control," Industrial Informatics, IEEE Transactions on, vol. 10, no. 4, pp. 1992–2002,Nov 2014

[4] J. Larminie and A. Dicks, Fuel Cell Systems Explained (Second Edition), 2nd ed. John Wiley & Sons, Apr. 2003.

[5] C. Sagert , F. Bender, and O. Sawodny , "Electrical drive train model ingfor model predictive control of dc-dc converters in fuel cell vehicles ,"in American Control Conference (ACC), July 2015, pp. 4333–4338.

[6] J. T. Pukrushpan , H. Peng , and A. G. Stefan opoulou, "Control-oriented modeling and analysis for automotive fuel cell systems," Journal of dynamic systems, measurement, and control, vol. 126, no. 1, pp. 14–25, 2004.

[7] J. T. Pukrushpan, H. Peng, and A. G. Stefanop oulou, "Control-oriented modeling and analysis for automotive fuel cell systems," Journal of dynamic systems, measurement, and control, vol. 126, no. 1, pp. 14–25, 2004.

[8] W. Waag, S. Kbitz, and D. U. Sauer, "Experimental investigation of the lithium-ion battery impedance characteristic at various conditions and aging states and its influence on the application," Applied Energy ,vol. 102, no. 0, pp. 885 – 897, 2013..

[9] Indirect vector control of multilevel inverter fed induction motor using ANN estimator and ANFIS controller.

[10] John Jostins, Stuart Hilmansen, Kevin Kendall "Electronic integration of fuel cell and battery system in novel hybrid vehicle Peter Fisher" Journal of Power Sources 220 (2012) 114e121

[11] Modern power electronics and Ac drive - Bose