A VECTOR CONTROL BASED HYBRID VEHICLE FED FROM BMDIC

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ABSTRACT

An advanced power electronic components interfaces play an excellent role for the future controlling and clean vehicle topologies. The proposed novel integrated power electronics interface (IPEI) for the battery electric vehicles (BEV's) in order to get effective performance from the power train. The proposed integrate power electronic interface is responsible for developing for the power-flow control management for the each and every operating stage of the inverter. In this we are designed by using the integration of the dc-dc converter based on dc charger and dc-ac inverter mixed together to produce the high performance from the BEV power train. The implemented strategy can enhance the system reliability and efficiency of the power train, it can minimizes the voltage current ripples by using the active and passive components in the BEV drive system it leads to reduced size compare to conventional technologies. Additionally lower electromagnetic interface and low stress in the power switching is implemented to improve performance of the system. In the MATLAB/SIMULINK we can observe the implemented control strategy and design alignment is analyzed and modeled. The simulation results of this proposed system is researched and presented and explained in this project. Finally, the suggested control strategy is experimentally tested and validated with proper results are generated from the developed prototypes those are designed and developed and integrated in our laboratory.

Index Terms: Battery Electric Vehicles (BEV's), On Board Dc Charger, Dc-Dc Converter, Dc-Ac Inverters, Power Train Control Strategies, Power Train Modeling and Small Signal Designing

I. INTRODUCTION

Now a day we are facing too many concerns about environmental issues, such as damaging the urban and rural pollution as well as energy problems, automobile and industrial sectors are forced to shift their attention towards to clean vehicle technologies.

Recently battery electric vehicle (BEV's) system arrangements are adapted to the internal cultivation and combustion of engine vehicles because to enhance in battery topologies power electronic devices interfaces (PEI) arrangements and control implementation strategies. In general the BEV are get powered by electric vehicles, in which those are necessary to be charged with power supply electricity from the grid.

Additionally the BEV system can maintained and provided an excellent ideal solution to minimize the environmental effects of transportations and reduced the energy dependency problems because they have reduced electromagnetic energy consumption and zero local losses from the emissions. In other words, BEVs are compensated the zero –emission problems to the electric vehicles. Even though the BEVs are used still we have some challenges so we have to implement the control strategies in that manner to solve problems and reach the targets. These challenges are conditioned driving range capacities manner, battery life time, charging capability and power electronic component usage and their performance and the initial cost depending up on these parameters consideration is essential to reach the challenges effective manner.

In the limited research technology is functioned on the basis of to integrate the power electronics interface has been identified to interface the energy system of low-voltage (such as battery systems, super condensers and fuel cells) to electric motor (EM) in electric vehicles (EV) and plug in hybrid electric vehicle (PHEV) power trains.

From the invention of technology proposing in that ZSI is proposed for electric vehicle features in that ZSI is worked like an emerging technology for the conversion of dc-ac to inverters, because of its boosting capability it corresponds the major drawback of the ZSI is very difficult to control because of its single stage operation also there is a chance to produce over currents and produces the stress from the inverters.

Additionally we required the boost ration is less performance checking with other strategies due to these reasons ZSI is still working to rectify that drawback. PEI research development started to develop the vehicular based applications purpose by using number of power electronic components.

In this paper we are concentrated the performance, size, cost and efficiency of the implemented system and the design parameters alignment is explained as follows by using the power electronic interface (PEI) arrangements we can construct the strategies.

The major parameters requirements and their functionality in the BEV is explained below with detailed manner-

1) Bidirectional dc-dc converters required which is interfaces with the less-voltage energy system arrangements like as fuel cells, super capacitors and batteries.

2) Bidirectional ac-dc converters are necessary to charge the batteries for the electric vehicle applications purpose these are used to associate with the battery to the grid at the time of charging and discharging stages of the batteries.

3) Bidirectional dc-ac converters are necessary to use because to work our applications purpose i.e. to transfer the dc-link energy from the electric traction induction motor i.e. three phase induction motor.

In general the integration of the converters is dc-dc and dc-ac converters are an excellent arrangement for the hybrid electric vehicles in order to function the power train is proper manner. So, we have to choose the effective proper selection of the converters maintained to integrate together it plays an excellent role for producing better performance and enhanced efficiency for the BEV and PHEVs applications.

As mentioned earlier battery chargers are another important element necessary for recognition and appearance of BEV and PHEVs. Particularly an on-board battery charger is necessary to maintained very small and light weight. So, the different bidirectional power electronic converters of ac-dc technologies can be used in the on board charging applications purpose also the PHEVs and BEVs are recharged by the outlets those available at home applications such as garages or at working applications. The availability requirement of charging places flexibility can increase the possibility of the PHEVs and BEVs.

The major issue of the integrated power electronic interface efficiency, reliability, size of the active and passive elements, and minimized in size and less harmonic distortion content and improved power factor and the ripples are presented in the input/output are reduced by the proper selection of power electronics. Additionally the IPEI quality is directly influenced the performance raises to improve the characteristics of the battery arrangements. But the performance of the battery life time is depended on the ripple content influence so we have to maintain ripple free in the system then the life time of the battery is enhanced.

In this paper the main theme is to implement and regulate the power electronic components by the IPEI and to verify the probability for BEV application features. The developed IPEI consisting of the features of the bidirectional multi device dc-dc converter with interleaved (BMDIC) and six-switch three phase inverter (SSI) is presented. The implemented power electronic interface can functioned with the each and every operation stage for the BEVs like as regenerative stage, traction stage and charging and discharging applications of the batteries from the grid.

To test the performance of the implemented paper we have to design the control strategies necessary to control the total operations of the converters. In these we designed control strategies by using the indirect field oriented controller (IFOC) based on the PWM modulation control technique, particle swarm based optimization (PSO) technique and dual loop control apparaochment for the BMDIC control and PWM current control depended pi controllers for high charging and discharging application modes of operations. The designed control strategies and results corresponding technologies are discussed in detailed manner.

II. EXISTING SYSTEM

The developed project consisting of the power train with the proper selection of power electronic devices. Here we can discuss the existed block diagram parameters and their function is explained. The battery is associated to the dc-link capacitor to the BMDIC in this two inductor elements are used and also it consisting of the eight power electronic switches IGBTs they are designed in anti parallel arrangement diodes has the capability to minimize the size of the components those are like as inductors and capacitors and also decreased amount of the input/output EMI filters by maintain the controlling the frequency of the rippled inductor current and rippled voltage with less switching frequency conditions .

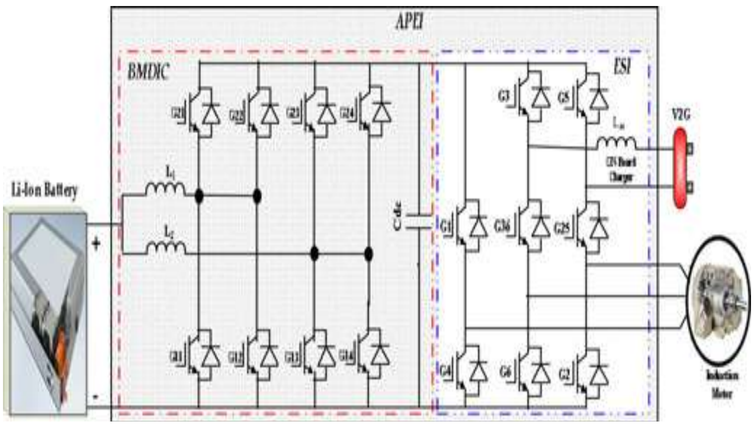

Fig.1. Detailed Circuit Diagram of the Existed IPEI

The schematic block diagram for the existing system is illustrated in the above mentioned fig 1.To reach the desired control strategy for the electric vehicle before that we need to maintain the proper performance by the BMDIC, it consisting of phase-shift interleaved regulated between the phases of anti parallel connected power electronic switches those are used to generate the firing pulses to this converter.

These switching patterns are changes by $360^{\circ}/(n \times m)$, here n is the required number of phases per port and the m is for the number switches required for the each phase.

The phase sequence of the running signals are very significant to get the doubled ripple frequency in the inductor current at the same switching patterns of the developed system and also maintained the interleaved control arrangement between the inductors as well as power electronic switches. The higher system band-width to the he phase is maintained by controlling arrangement of power electronic bidirectional switches in that four IGBTs are connected to the four other external diodes.

Additionally, this control strategy can reach the dynamic response for this paper is developed and designed for the BEV application purpose. In this the power train, the SSI is associated to transfer the power to the revolving parameter called as induction motor to the dynamic and breaking applications for the process of charging and discharging application manner.

The developed IPEI in builds the ESI and BMDIC for the applications of electric vehicles are explained those are helped to enhance the power electronic converters reliability of the power train compatibility of the power electronics will reducing the length of the converters size of the passive and active components like as inductors L, capacitances C and filters.

The BMDIC consisting of the power electronic switching elements are functioned by using the interleaved apparoachment topology which leads to reduce the current content because there is the current is share between these controlling switches.

As a result the current ratings are reduced it means that the converter compatibility is increases and reduced the stress between the power electronic switching parameters and electromagnetic filters usage is also minimized especially at the time of transients.

Furthermore the consistency of the system is very effective manner compare to the conventional converters and operating stages of the BMDIC are discussed as follows.

The existed BMDIC operation is consist of four stages of operation to produce the desired accurate response for the BMDIC to the electric hybrid vehicle application features.

1) In the first stage the ESI is performed to operate the dc-ac inverter to transfer the energy from the capacitor i.e. dc link to the three phase induction motor, while the BMDIC performed as a boost converter to the low-voltage battery applications to the high voltage applications.

2) In the second stage of operation the ESI functioned as a PWM ac- ac converter operation to converter the energy from the motor dc link to the dc-dc converter in this stage the SSI opera as a buck mode operation to produce the energy from the high voltage dc link voltages to the battery charger arranged patterns.

3) In third stage of operation the ESI performed as a single-phase inverter i.e. ac-dc converter in this the battery is charged from this stage of ESI inverter and the BMDIC is performed like as a buck mode of this state in order to get the energy to the battery pack from the dc-link capacitor .

4) In the fourth stage the ESI performed like as a dc-ac inverter to transmit power from the dc link capacitor block to the power stored consumers block i.e. ac grid side by maintain the maximum peak load application while BMDIC converter working to this stage boost stage of operation to maintain the enhancing of the power factor.

In order to maintain and execute power train will effective manner we are developed this control strategy but in this modes of operation the execution ESI is not performed effective results that reason the investigation started to find the better solution for the power train.

III. PROPOSED SYSTEM

In this we are implemented the new design apparoachment in this model consisting of the major parameters are explained as follows. The block diagram of the proposed implemented diagram is illustrated in below mentioned figure 2. The bidirectional multi device dc-dc interleaved converter (BMDIC) is proposed in the strategy for to maintain the buck mode of operation it very better approaching to reduce the ripples in the input and output parameters so there reduction in the usage of EMI filters in this strategy and also it required two inductors and one capacitor . The usage of passive components size is also decreased due to this reason the total size is reduce for this system and the cost of the system is somewhat minimized. The harmonic contents are neutralized due to this reason the filter content requirement reduced and also by the placing of diodes there is reduction in the reverse current and total current is reduced and hence the quality of the system will improves. In this we are used dc-ac inverter in this it contains six power electronic switches (SSI) those are bidirectional anti parallel connection is obtained. The usage six switches performed as a boost inverter they produce the output the required sufficient manner by maintain and controlling of the firing pulses to the SSI. The SSI produced the effective performance because reduced the usage of switches compare to conventional topologies then the switching losses are reduced also the usage filter components are also minimized then the performance and reliability of the system is enhanced.

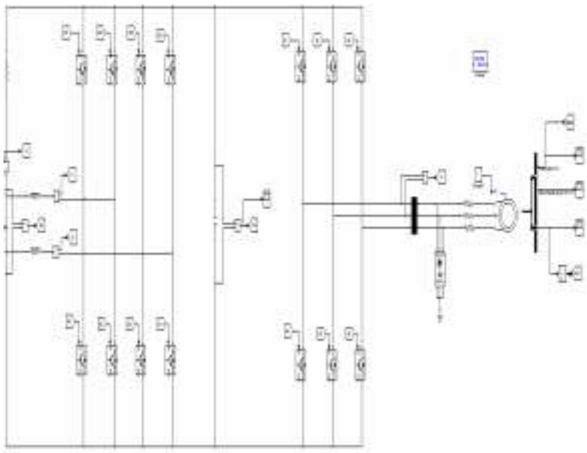

Fig.2. Schematic Block Diagram of the Proposed IPEI

The generated energy is delivered to the three phase induction motor. Here the motor is functioned like as a constant speed motor it is achieved by maintain and control of the firing pulses of the SSI and the BMDIC to get accurate and desired speeds from the induction motor.

IV. CONTROL STRATEGY

In this the BMDIC converter is controlled by the dual loop control and the SSI controlled by the vector control apparochment method we can control the converters In this dual control operation we have to find out the continuous transfer functions (*Gvd(s)* and *Gid (s)*) for the discredited using the zero order hold process (ZOH) we are verified the pole-zero differences then solve the errors by compensating the bilinear transformation methods. In these technology utilized the digital controller *H (z)* can be designed directly in the continuous time operations based in z-domains.the entire dual loop controller consist of voltage loop controller *Hv(z)*and current controller Hi(z)and the delay is measured by using the transfer functions method. The time delay is identified by the PWM control technique apparochment method to get required sufficient pulses to produce to operate BMDIC. SSI inverter is controlled by using the vector control method. It is also called as variable frequency drive control strategy in this the vector is identified by using the stator currents from the three phase inverter to identified as two orthogonal components that can be treated as a vector. In these two orthogonal one corresponds the magnetic flux of the induction motor and other is developed torque the control system functioned by calculating the torque and stator currents for a specified speed references. Additionally proportional integral controllers are included to sustain the measured components of current at their required reference values. The PWM control strategy is used to produce the firing pulses to operate the SSI converter to get the accurate results.

V. CONCLUSION

In this project implemented the innovative apparochment for the power electronic devices for the BEVs to get the high quality and reliability of the power train. The designed IPEI integrates the both BMDIC and SSI. The developed IPEI and its efficiency are tested and verified those are explained in detailed manner. Various control strategies are designed to check the better performance for the power trains in that we identified the IFOC by using the PWM strategy and hence IFOC control strategy is suitable solution for the EM for the traction purpose application features. Additionally the developed IPEI concentrated on the power factor improvement and maintained very low total harmonic distortion ripples in the input output side at that the time of charging and discharging of the battery from the ac grid. The implemented strategy can minimizes the ripples in both sides then the active and passive components requirement is reduces and also the usage of filter components are also reduces and hence the quality and efficiency of the proposed system is enhanced then the reliability of the system is very high. The implemented project corresponding Simulink models are tested and verified the results in MATLAB/ SIMULINK.

REFERENCES

[1] C. C. Chan, A. Bouscayrol, and K. Chen, “Electric, hybrid, and fuel-cell vehicles: Architectures and modeling,” IEEE Trans. Veh. Technol., vol. 59, no. 2, pp. 589–598, Feb. 2010.

[2] C. C. Chan, “The state of the art of electric and hybrid, and fuel cell vehicles,” Proc. IEEE, vol. 95, no. 4, pp. 704–718, Apr. 2007.

[3] A. Emadi, S. S.Williamson, and A. Khaligh, “Power electronics intensive solutions for advanced electric, hybrid electric, and fuel cell vehicular power systems,” IEEE Trans. Power Electron., vol. 21, no. 3, pp. 567– 577, May 2006.

[4] A. Emadi, Y. J. Lee, and K. Rajashekara, “Power electronics and motor drives in electric, hybrid electric, and plug-in hybrid electric vehicles,” IEEE Trans. Ind. Electron, vol. 55, no. 6, pp. 2237–2245, Jun. 2008.

[5] S. S. Raghavan, O. C. Onar, and A. Khaligh, “Power electronic interfaces for future plug-in transportation systems,” IEEE Power Electron. Soc Newsletter, vol. 23, Third Quarter 2010.

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