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Towards a Converter Topology for Bidirectional Power Flow

Ch. Santhosh[1], D. Kumara Swamy[2]

[1]M. Tech Student, EEE, SVS Group of Institutions, Telangana, India
[2]Associate Professor, EEE, SVS Group of Institutions, Telangana, India

Abstract: ***This paper presents a built-in traction machine and ripper tools topology which has bidirectional power flow capacity between an electrical vehicle and also the electricity or ac supply or grid. The electrical power train system weight and size could be minimized with this particular approach. The idea continues to be examined with finite-element- combined simulation with dynamic analysis software. The interleaving technique has been utilized using the inductors to talk about the present and lower the ripper tools switching stresses. Ripper tools reconfiguration concept is helpful in minimizing the dimensions and parts within the power train of the electric vehicle. The device-ripper tools combined simulation results demonstrated the integrated ripper tools can be used as the ability transfer with flexibility without considerably extra power elements. The ripper tools performance could be examined using the combined simulation of FEA software along with a dynamic simulation tool.***

Keywords: Integrated traction machine Electric vehicle, Machine-converter coupled simulation, Inductors, FEA software.

1. Introduction

The multipurpose utilisation of the power electronic ripper tools within the drive train of the electric vehicle is becoming a fascinating subject for minimizing the machine size, weight, and price. During an essential part during the day, most automobiles remain idle within the parking area once the integrated power ripper tools may use the traction motor and it is drive to transfer capacity to the grid. Several research activities for integrating battery charging system using the traction drive happen to be reported. In a single approach, the traction motor windings happen to be utilized as the inductors for that ripper tools to build up the charging system with no additional component. The 3-phase supply is associated with each phase from the machine and also the battery is definitely attached to the electricity bus. The study demonstrated using a poly-phase machine for that charger. Within this paper, a built-in motor ripper tools is suggested you can use because the traction motor drive, battery power charger, along with a power ripper tools to transfer energy from vehicle-to-grid (V2G) through reconfiguration from the inverter topology using relays or contactors. The traction inverter using the suggested reconfiguration method may also transfer power in the vehicle to some electricity grid and from the electricity grid towards the vehicle while using traction motor windings using the appropriate relay configurations. A gentle starter method using PWM control has been utilized to lessen the beginning current overshot when hooking up to some electricity grid. Inside an electricity grid connected mode, the current drop over the inductor would be the distinction between the inverter output current and also the electricity grid current. The electricity grid current provides more stable current to combat the speed of change of inductor current and also the current ripple is controlled inside a better fashion inside an electricity grid connected mode. Three phase machine windings and also the three inverter phase legs may be used by having an interleaved configuration to distribute the present and lower the ripper tools switching stresses. Battery current is elevated within the boost mode for an output reference current level inside the limits from the machine ratings. The suggested ripper tools reconfiguration technique is beneficial for lowering the size and element of the electrical power train while supplying bidirectional power flow capacity with connections either to electricity or ac supplies.

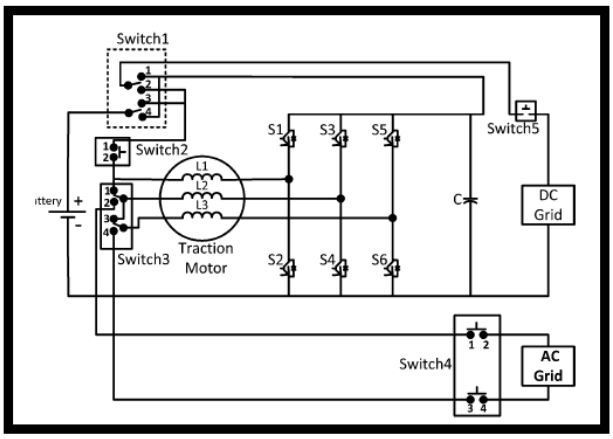


Figure: An overview of converter with switches able to interface with both ac and dc

2. Methodology

The weight and dimensions from the ripper tools are challenging issues within the situation of on-board chargers which otherwise offers the versatility of charging the automobile anywhere. The automobile isn't driven throughout charging, and therefore, the traction motor and inverter from the power train can be used a fundamental element of the ripper tools. The windings from the traction motor may serve as the inductors from the power ripper tools together with power products from the traction inverter to transfer power. The ability ripper tools from the electric vehicle can draw power in the grid. If this requires, as well as delivers capacity to the grid within the peak time once the grid needs power. An on-board integrated charger continues to be suggested with

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reconfiguration from the stator windings of the special electric machine. The interleaving strategy is another interesting approach utilized in creating electricity-electricity converters for reduced switching stresses and elevated efficiency. The approach cuts down on the size and power rating from the ripper tools passive components. Low EMI and occasional stress within the switches should be expected in the interleaved ripper tools phase legs. This paper is definitely the analysis, design, and experiments from the integrated traction drive and power ripper tools for electric/ hybrid vehicle programs. The electrical machine continues to be examined using combined simulation of finite-element and dynamic analysis software. The suggested ripper tools system may also be used for moving power from a single-phase ac grid and also the vehicle either in direction with no extra component. The ranked conditions from the motor and utility interface are very similar. The inverter has the capacity to regulate the motor phase current within the entire speed range. Thinking about the operating conditions using the grid, motor inductance could be enough to handle grid connected modes of operation. Also, within the blocked rotor condition, motor magnetizing inductance dominates and plays a role in the phase inductance considerably. For top enough inductance needed just in case of ac grid, the rotor could be locked that will give high inductance within the blocked rotor condition. Within the charging mode, the device is thermally stable without any electromechanical power flow with the air gap from the machine. Various kinds of topologies happen to be produced for electric automobiles for battery charging and bidirectional power flow between your battery and also the power. However, the traction inverter uses the conventional six-switch configuration which has elements of the several power ripper tools topologies. The normal traction inverter and it is controller is made to have sufficient bandwidth to manage the motor phase power with reasonable ripple in it. The current that seems over the motor inductances relies upon the inverter electricity bus current, quantity of motor inductance, motor back EMF current, and also the switching frequency from the controller. Once the inverter switches towards the grid connection mode, the result of back EMF current is changed through the grid current and also the relaxation from the elements would stay near to the motor operation. Actually, current regulation during traction at low speed is a lot more challenging compared to grid connected operation because the back EMF current is very small at low speeds. Therefore, the device inductance could be appropriate for the operating modes, as it is only the configuration from the winding from the machine, and also the machine inductances are usually large values.

3. An Overview of Proposed System

A built-in motor ripper tools is suggested you can use because the traction motor drive, battery power charger, along with a power ripper tools to transfer energy from vehicle-to-grid through reconfiguration from the inverter topology using relays or contactors. The traction inverter using the suggested reconfiguration method may also transfer power in the vehicle to some electricity grid and from the electricity grid towards the vehicle while using traction motor windings using the appropriate relay configurations. Three phase machine windings and also the three inverter phase legs may be used by having an interleaved configuration to distribute the present and lower the ripper tools switching stresses. Battery current is elevated within the boost mode for an output reference current level inside the limits from the machine ratings. The suggested ripper tools system may also be used for moving power from a single-phase ac grid and also the vehicle either in direction with no extra component. The ranked conditions from the motor and utility interface are very similar. The inverter has the capacity to regulate the motor phase current within the entire speed range. The device ratings are within limits in most the operating modes as there's only electric loading, with no magnetic loading except during traction operation. The present limit is greater in ripper tools modes in comparison towards the traction mode current limit. Suggested ripper tools reconfiguration technique is beneficial for lowering the size and element of the electrical power train while supplying bidirectional power flow capacity with connections either to electricity or ac supplies. The suggested ripper tools topology utilizes the traction inverter combined with the switches employed for reconfiguration needed for various modes of procedures. A number of different designs could be acquired by appropriate positioning from the switches, which leads to a manuscript methodology for bidirectional power transfer from a vehicle battery and electricity or ac grid. This power ripper tools could be operated in five different modes: 1) power flow in the battery towards the electricity grid, 2) power flow in the electricity grid towards the battery, 3) traction mode, 4) power flow in the battery to single-phase ac grid and 5) power flow from one-phase ac grid towards the battery. The reconfiguration switches could be recognized with relays or contactors with respect to the ratings from the power. Individual's relays and contactors are controlled inside a matched method to accommodate the various modes useful. The contactors with optimum current capacity should be employed to minimize how big the contactor. How big the contactor needs to be covered in line with the current rating selected.

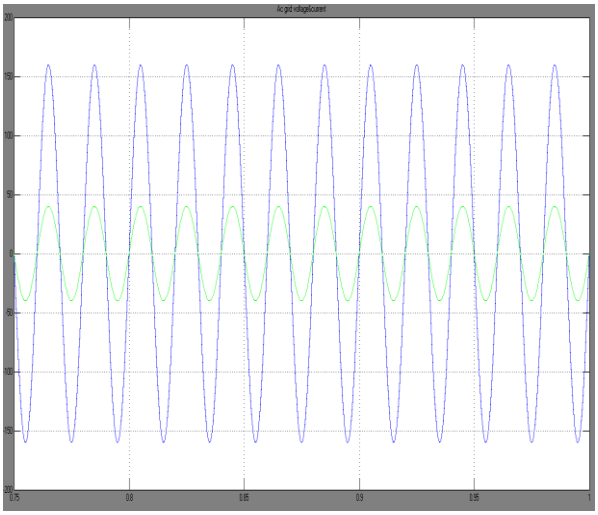


Table 3.1: Voltage and Current wave forms of Grid.

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To reduce the area and size the contactors, all of the switches could be built-into just one package. When the ripper tools are to hook up with an electricity grid, Switch 4 comes in Condition 1 to isolate in the ac grid. The ripper tools are to hook up with an ac grid, Switch 5 come in Condition 1 to isolate in the electricity grid. Thus, the traction ripper tools could be linked to whether electricity or perhaps an ac grid. If there's any fault in a single or multiple phases within the motor the ripper tools Configuration is going to be switched to Condition 1, and there won't be any power transfer between your grid and also the battery. The typical protection schemes for any traction inverter will require. The performance is dependent around the machine specifications. The utmost current limit is inside the thermal limit from the machine, and also the ripple in current is determined through the fixed inductance from the machine because the machine windings can't be altered. Public transit capacitor is chosen to handle current ripple and also the appropriate switching frequency is chosen past the acoustic selection of wavelengths. If there's a choice to create the device using the aim of using the suggested reconfigurable converters, then your machine could be made with greater current capacity for faster charging and greater winding inductance for minimizing current ripple without degradation of traction operation.

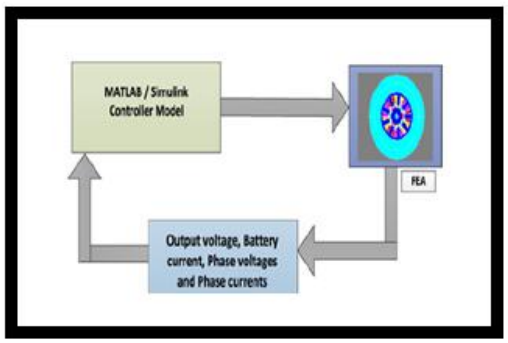


Figure: An overview of MATLAB/Simulink

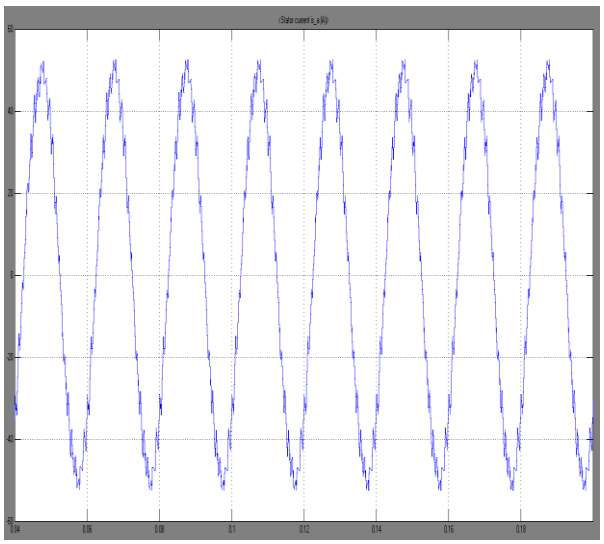


Figure 3.2: Stator current in Asynchronous mode of operation

4. Conclusion

A built-in machine-ripper tools topology and reconfiguration method happen to be suggested within this paper, where traction machine windings can be used the inductors from the ripper tools to transfer power from a vehicle battery and only a electricity or perhaps an ac grid. Suggested integrated ripper tools can be employed in both directions for V2G and G2V furthermore, her benefits of using the interleaving technique both in V2G and G2V modes of procedures. Ripper tools reconfiguration concept is helpful in minimizing the dimensions and parts within the power train of the electric vehicle. The device-ripper tools combined simulation results demonstrated the integrated ripper tools can be used as the ability transfer with flexibility without considerably extra power elements.

References

[1] O. Ellabban, O. Hegazy, J. Van Mierlo, and P. Lataire, “Dual loop digital control design and implementation of a dsp based high power boost converter in fuel cell electric vehicle,” in Proc. IEEE Int. Conf. Optim. .Electr. Electro. Equipment, May 2010, pp. 610–617.
[2] S. Haghbin, S. Lundmark, M. Alak¨ula, and O. Carlson, “An isolated high-power integrated charger in electrified vehicle applications,” IEEE Trans.Veh. Technol., vol. 60, no. 9, pp. 4115–4126, Nov. 2011
[3] M. N. Arafat, S. Palle, Y. Sozer, and I. Husain, “Transition control strategy between standalone and grid-connected operations of voltage-source inverters, ”IEEE Trans. Ind. Appl., vol. 48, no. 5, pp. 1516–1525, Sep./Oct.2012.
[4] O. Hegazy, J. Van Mierlo, and P. Lataire, “Analysis, modelling, and implementation of a multidevice interleaved DC/DC converter for fuel cell hybrid electric vehicles,” J. Power Electron., vol. 27, pp. 4445–4458, Jul 2011
[5] M. Milanovic, A. Roskaric, and M. Auda, “Battery charger based on double-buck and boost converter,” in Proc. IEEE Int. Symp. Ind. Electron., Jul. 1999, vol. 2, pp. 747–752.
[6] O. Hegazy, J. Van Mierlo, and P. Lataire, “Control and analysis of an integrated bidirectional DC/AC and DC/DC converters for plug-in hybrid electric vehicle applications,” J. Power Electron., vol. 11, no. 4, pp. 408–417, Jul. 2011.
[7] G. Pellegrino, E. Armando, and P. Guglielmi, “An integral battery charger with Power Factor Correction for electric scooter,” in Proc. IEEE Electric Mach. Drives Conf., May 2009, pp. 661–668

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