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Bi-Directional Electric Vehicle (EVs) Charger

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***Abstract*: The goal of this project is to create an on-board bidirectional battery charger for Electric Vehicles (EVs) that can be used for Grid-to-Vehicle (G2V), Vehicle-to-Grid (V2G), and Vehicle-to-Home (V2H) technologies. The batteries are charged from the power grid with sinusoidal current and unitary power factor in the G2V operation mode. Computer simulations were used to validate the results, which were then confirmed by experimental data Instruction. The energy stored in the batteries may be utilized to power home loads during power outages or to power loads in areas where there is no access to the power grid in the V2H operation mode. The hardware structure of the bidirectional battery charger is given throughout the study, as well as the control algorithms. Some size concerns for the AC side passive filter are taken into account.**

***Keywords*: Utilized, vehicle to grid, simulation**

1. Introduction

Electric vehicles (EVs) are a novel concept in the global transportation business. As a result, there has been a considerable rise in interest in EV technology in recent years, culminating in numerous scholarly papers on the issue. EVs are anticipated to account for 24 percent of the light vehicle fleet in the United States by 2030, or 64 percent of the total fleet. Proliferation of EVs a considerable amount of energy will be stored in their batteries, arising the opportunity of the energy flow in opposite sense (Vehicle-to-Grid, V2G). In the future smart grids, the interactivity with the EVs will be one of the key technologies, contributing to the power grid autonomous operation. Nowadays, several projects related with smart grids are under development around the world. Regarding this new approach, especially in homes equipped with charging points for EVs, besides the G2V and V2G operation modes the EVs can also operates as voltage source capable to feed the home loads. This technology, begins to be denominated in the literature as Vehicle-to-Home (V2H). As example of this new approach, Nissan presented the "LEAF-to-Home"

2. Main Component

1) Powergui

The Powergui block opens a graphical user interface (GUI) that displays steady-state values of measured current and Voltages as well as all state variables (inductor currents and capacitor voltages). The Powergui block allows you to modify the initial states in order to start the simulation from any initial conditions. The Powergui block allows you to choose one of these methods to solve your circuit:

- Continuous, which uses a variable-step solver from Simulink.
- Discretization of the electrical system for a solution at fixed time steps.
- Continuous or discrete phasor solution have a sub subsection, then copy and paste the sub subsection Three Phase Sources:
- Implement three-phase source with internal R-L impedance
- Library Simscape / Electrical / Specialized Power Systems / Sources

3. Methodology

The battery charger in question is made up of two power converters connected by a DC connection. The first is to connect to the power grid, and the second is to connect to the traction batteries. A full-bridge AC-DC bidirectional converter is used to connect to the power grid. Using two bidirectional converters, the required hardware this converter can operate as active rectifier with sinusoidal current and unitary power factor during the G2V operation mode. During the V2G and V2H operation modes this power converter operates as inverter. In the V2G mode the converter operates as controlled current source to inject the required power in the power grid. In the V2H mode, the converter operates as a controlled voltage source with true sine-wave output to feed the home loads. In order to interface the batteries is used a reversible DC-DC converter. In the G2V operation mode this converter operates as buck converter to control the current and voltage during the current and voltage batteries charging stages, respectively. During V2G and V2H the converter operates as boost converter to elevate the batteries voltage to an adequate DC link voltage aiming to guarantee the proper operation of the full-bridge AC-DC bidirectional converter. The complete electric diagram of the bidirectional battery charger is presented in Fig. Although

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using two bidirectional converters, the required hardware is equivalent to a controlled three leg IGBT bridge.

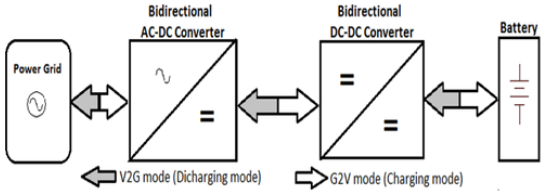

Fig. 1. Methodology of block diagram

4. Conclusion

In this project, according to the working of this model we observed that:

- Constantly supplying (Ib) 24.72A, (Vb) 247.2V and (Soc) 59.99 in G2V operation.
- In the scope, for V2G operation, inverter voltage and Grid voltage should be in phase.
- Constantly supplying (Soc) 59.9 in V2G operation but minor variations in Ib and Vb.
- We also observed that Grid voltage and inverter voltages are in phase.
- You can repeatedly run the simulation for more time to observe the result in both cases.

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