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Transformerless Multiport DC-DCC Wireless Converter for Plug in Electric Vehicle Charging

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ABSTRACT: Hybrid renewable electric energy generation system become essential to the most of electric networks and the stand-alone systems like the electric vehicle. The renewable sources usually required storage system due to change in the power outputs during the day. Due to increase in demand of using batteries, the charging process of battery system needed to be well managed through an adaptive controlled energy managing system.

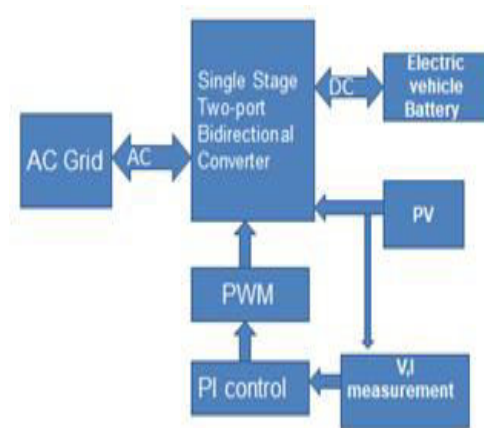
In this project a standalone system using photovoltaic, fuel cell and storage batteries are contributed in supplying the desired load and the charging balance of batteries is achieved by using AI techniques to enhance battery charging controller performance. The main goal of this paper is to design and implement an integrated smart artificial controller, this controller is responsible for controlling both the battery charge voltage using the boost converter and the other controller is to control the charging current of the battery through Four port converter using PLL techniques. This study is implemented using MATLAB /Simulink and the results are presented to show the applicability and efficiency of the proposed technique.

I. INTRODUCTION

An energy storage system plays an important role in electric vehicles (EV). Batteries, such as lead-acid or lithium batteries, are the most popular units because of their appropriate energy density and cost. Since the voltages of these kinds of battery cells are relatively low, a large number of

battery cells need to be connected in series to meet the voltage requirement of the motor drive. Because of the manufacturing variability, cell architecture and degradation with use, the characters such as volume and resistance will be different between these cascaded battery cells.

II. EXISTING PROBLEM



- The existing problem with transformless, multiport DC-DC wireless converters for plug-in EV's charging is the difficulty in achieving high voltage gain and bidirectional power flow, along with challenges in managing multiple input sources and ensuring efficient power transfer.
- Traditional transformless converters often struggle to achieve the high voltage gains required for efficient EV charging potentially limiting their applicability to lower voltage systems.
- While some converters can handle bidirectional power flow, achieving this capability in a transformless, multiport design can be complex and may require more sophisticated control strategies.
- Managing multiple input sources like different charging stations and ensuring efficient power transfer to the E battery requires careful design and control.

III. LITERATURE SURVEY

Vehicle-To-Grid Technology in a Micro-grid Using DC Fast wireless charging Architecture

- Femina Mohammed Shakeel; Om P. Malik @ 2019 Electric Vehicle (EV) batteries can be utilized as potential energy storage devices in micro-grids. They can help in micro-grid energy management by storing energy when there is surplus (Grid-To-Vehicle, G2V) and supplying energy back to the grid (Vehicle-To-Grid, V2G) when there is demand for it. Proper infrastructure and control systems have to be developed in order to realize this concept. Architecture for implementing a V2G-G2V system in a micro-grid using level-3 Fast wireless charging of EVs is presented in this paper. A micro-grid test system is modeled which has a dc Fast wireless charging station for interfacing the EVs. Simulation studies are carried out to demonstrate V2G-G2V power transfer. Test results show active power regulation in the micro-grid by EV batteries through G2V-V2G modes of operation. The charging station design ensures minimal harmonic distortion of grid injected current and the controller gives good dynamic performance in terms of dc bus voltage stability.

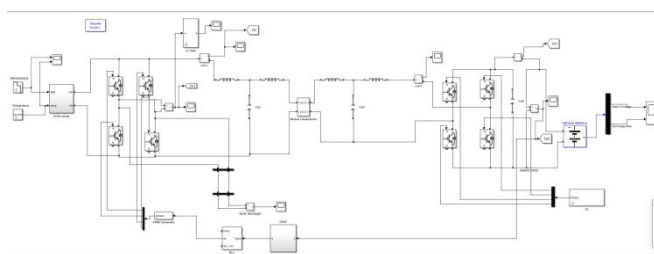
Grid Connected Power Generation Control Method for Z-Source Integrated Bidirectional Charging System

- Xu Jia; Guoming Chuai; @ 2018 When electric vehicles stop to charge the batteries, the motor drive in vehicles do not work. The motor drives can be reconstructed into the charging system of the vehicle in an appropriate way. With a few devices added, it can possess the capacity of Fast wireless charging and the function of V2G(Vehicles to grid). In this paper, a Z-source integrated bidirectional charging system with LCL filter is proposed. An active damping method based on the integrated charging system is used to reduce the harmonic current at the resonant frequency of the output current. The mathematical model of proposed system is established, and the control methods of the DC side and the AC side are put forward. Finally, the Z-source experimental platform under the operation of grid connected is set up. The experiment was carried out to verify the feasibility of system.

Intelligent Charging Infrastructure Design for Connected and Autonomous Electric Vehicles in Smart Cities.

- Palwasha W. Shaikh; Hussein T. Mouftah @ 2021 For an environmentally sustainable future, electric vehicle (EV) adoption rates have been growing exponentially around the world. There is a pressing need for constructing smart charging infrastructures that can successfully integrate the large influx of connected and autonomous EVs (CAEVs) into the smart grids. To fulfill the aspirations for massive deployments of autonomous mobility on demand (AMoD) services, the proposed fast and secure framework will also need to address the long charging times and long waiting times of static charging, and will need to consider dynamic wireless charging as a viable solution for the CAEVs on the move. In this paper, a three-layer hierarchical charging infrastructure design that has interoperability with existing static wired charging systems and future wireless static and dynamic charging systems for Intelligent Transportation System (ITS) is presented.

Simulation:

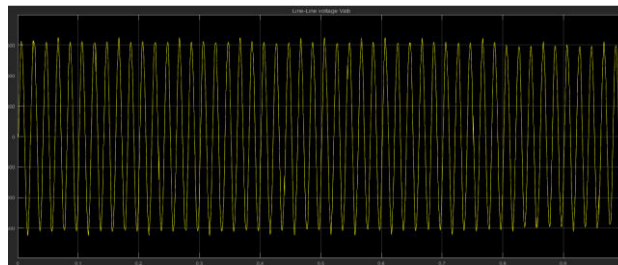


Components Details:

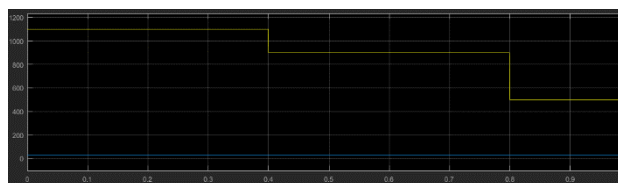
S.No	Components	Parameters	Values
1	Series RLC Branch	Inductance	3.36e-6
2	Battery	Nominal Voltage(V)	48
		Rated Capacity(Ah)	100
		Initial State-of-Charge(%)	100
		Battery Response Time(S)	30
3	PLL Controller	Minimum Frequency(Hz)	45
		Initial Input	[0 50]
		Regulator Gains	[180 3200 1]
4	RLC Branch	Capacitance	4.7e-6
5	PWM Generator	Carrier Frequency(Hz)	40000
		Sample Time	5e-5

6	IGBT	Internal Resistance(Ohms)	1e-3
		Snubber Resistance(Ohms)	1e-5
		Snubber Capacitance(F)	inf

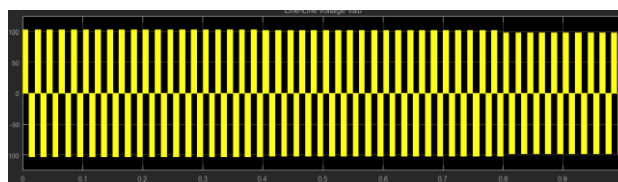
Voltage measurement output 1



Solar panel



Voltage measurement output 2



Output of grid voltage



IV. CONCLUSION

In this project Four port converter of electric vehicles have been discussed along with their advantages and disadvantages based on fast battery charging convenience and suitability of driving. Literature review of the state of the art of on-board battery chargers with hybrid sources of PV and other reveals that the current charger topology is a wireless power conversion. This project focuses on three problem statements. Firstly, a single phase, single stage, isolated, Fast wireless charging Four port converter based on Dual Active Bridge (DAB) topology is proposed and analyzed.

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