



11th Eco-Energy and Materials Science and Engineering (11th EMSES)

An Off-line Battery Charger Based on Buck-Boost Power Factor Correction Converter for Plug-in Electric Vehicles

Supasit Ketsingsoi and Yuttana Kumsuwan*

*Department of Electrical Engineering, Faculty of Engineering, Chiang Mai University
239, Huay Keaw Road, Chiang Mai, 50200 THAILAND*

Abstract

This paper presents an off-line battery charger based on the buck-boost power factor correction (PFC) converter for plug-in electric vehicles (EV). The integrated battery charger is obtained from the traditional three-phase voltage source inverter (VSI) for EV, which operates as buck-boost converter with power factor correction ability. The PFC controller regulates the battery voltage and controls the supply current of the converter to achieve unity power factor which is very simple and gives good performance. The proposed buck-boost PFC converter is operating in buck mode and boost mode, which is alternatively carried out according to the relationship between the rectified input voltage and battery voltage. The practicality and performance of the battery charger of the proposed converter topology has been verified via simulation.

© 2014 Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

Peer-review under responsibility of COE of Sustainable Energy System, Rajamangala University of Technology Thanyaburi (RMUTT)

Keywords: Battery chargers, buck-boost converter, power factor correction, electric vehicle, ac motor drives ;

1. Introduction

The development of electric vehicles (EV) has proliferated rapidly in recent years. The battery has become the most significant power source for the EV propulsion systems, electric motors, power converters, and controllers. Its cost, energy and power density, memory effect, and charging time are still practical applications. In addition, the charging time and battery life time depend highly on the characteristics of the battery charger [1]-[3].

* Corresponding author. Tel.: +66-5394-4135-40; fax: +66-5394-4195, +66-5322-1485.

E-mail address: yt@eng.cmu.ac.th.

The battery charger system has an important role in the battery and EV technology. In general, the plug-in EV battery charger system can be classified as on-board and off-board charging systems with unidirectional /bidirectional converter [4], [5]. There are advantages and disadvantages with both charging systems. In on-board charging systems, the batteries can be recharged anywhere from household utility outlets. However, it is limited in power output because of the size and weight limitations defined by EV design. The off-board charging system can be designed for high charging power levels and is less constrained by the size and weight. However, this system is limited in power output only by the ability of the batteries to accept the charge. Moreover, the springiness to charge at different locations is restrained.

The integrated EV battery chargers into the electrical drive system have been reported in the literature. Reference [6] presented the integrated battery chargers using the inductor of induction motor during charging time to constitute a dc/dc boost PFC converter with the three-phase VSI. The battery voltage of this system should be more than maximum line-to-line peak voltage to guarantee unity power factor operation. In [7], a single-phase integrated charger for an electrical scooter with an interior permanent magnet motor traction drive was presented. The battery system operated as a dc/dc boost PFC converter where the motor works as a coupled inductor, which used the three-phase VSI as a switch in the charging mode.

In this paper, an off-line battery charger based on the buck-boost PFC converter is proposed for plug-in EV. The proposed converter modified the structure of the three-phase VSI and motor drive into a battery charger system. The PFC controller technique for the integrated battery charger is used to the line frequency current shaping control scheme. Finally, simulation results are shown to verify the performance of the proposed battery charger for EV.

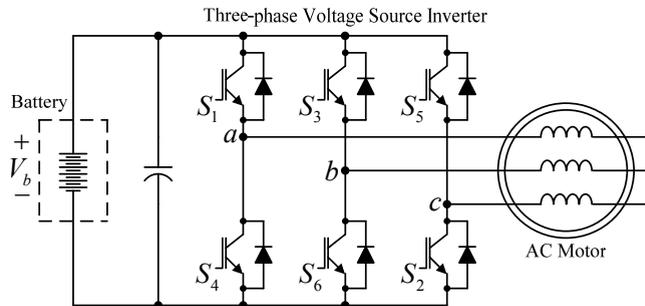


Fig. 1. Traditional three-phase voltage source inverter for electric vehicles.

2. The proposed circuit configuration

A basic configuration for the traditional three-phase VSI powered by a battery for EV is shown in Fig. 1. It consists of a three-phase ac motor, a three-phase VSI and a battery pack. In addition, some methods are an inverter accompany with a bidirectional dc/dc converter [8].

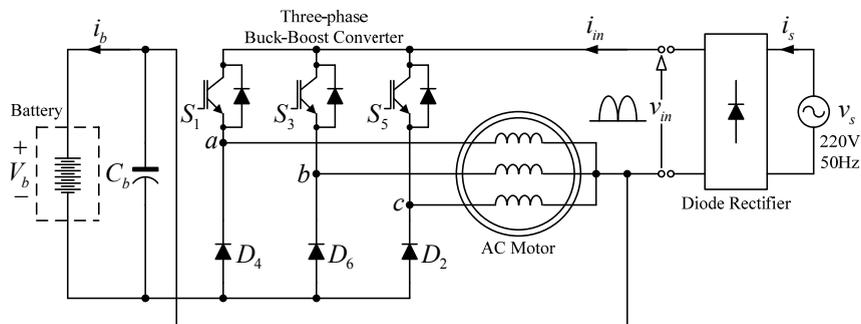


Fig. 2. The proposed buck-boost PFC converter.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات