Non - Contact Automatic Charging System Development for Electric Scooters

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ABSTRACT

Due to significant changing in climate and national environmental measures, the efficiency improvement and CO2 reduction become a very important task for the motorcycles industry. Taiwan ’ s motorcycles industry spares no effort to the development of electric motorcycles. The basic characteristics requirement of modern battery for electric motorcycles includes high energy density, fast charge and discharge, high power output, and long cycle life. However, existing two kind of charging systems of electric motorcycles are not so conveniently. First, for the traditional removable battery box design, one should take 5~10 kg battery box and find a charging device to replenish battery capacity. Secondly, plug-in charging design is better than the removable battery box design because we don ’ t need take the heavy battery box. When the electric motorcycle stops, one should find an AC power source and pull the motorcycle plug into the socket. According to this inconvenient fact, it should be pointed out that the two traditional battery charging design must be modify. This thesis has focused on a new design system of fully automatic charging system for electric motorcycles. A novel distributed charging design with SOC balance property is introduced for series connected battery strings. It reaches these functions of improving the storing efficiency and reducing energy losses. Moreover, it can also equilibrium charge at the same time to lengthen the battery life. The fully automatic charging system is divided into three parts: 1. Regenerative braking system: Design a special charging circuit for regenerative braking control of electric motorcycles. The SOC balance function is also established in this charging circuit. 2. Parking stand charging system: When the electric motorcycle stops with the parking stand setting up, a non-directly-contact charging module is designed for the battery charging. By using this charging module, the charging procedure will be automatically running with SOC balance function. 3. Plug-in charging system: Use the same basic circuit structure of the parking stand charging system, plug-in charging system is also designed while stopping the motorcycle. The charge system can replenish battery capacity rapidly. Some basic analysis for a charging system of electric motorcycle is presented. The circuit design of regenerative braking system, parking stand charging system and plug-in charging system will be discussed in detail. Experimental results demonstrated to achieve the objective of the full charging functions.

Keywords : electric motorcycles、LiFePO4 battery、automatic charging system、non-contact charging、charge equalization

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