

Electric Vehicle Charging Systems and Energy Storage

電動汽車充電儲能系統

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Abstract

Charging system is one of the most important devices for electric vehicle (EV). Today, we have developed a number of advanced power electronics technologies that provide good and safe power conditioning for the charging method. However, charging network is not only related to the parts and components development, it also affects the city development. The infrastructure of the charging network is the main successful factor of the electric vehicle. The charging method has been classified as normal or slow charging, fast charging and quick charging that differentiate the power output of the charger and the battery energy components installed in the vehicles. The charging power also affects the grid. The power management of the network has to look after the power and time handling. The standards of various charger, voltage and connector are also areas of concern.

Another successful factor is the energy storage of the vehicle. Besides the conventional Li-ion battery, we are looking into other high performance storage device such as CNT, super-capacitor and other integrated versions. The development of battery management system (BMS) or energy management system (EMS) is the necessary factor for all the energy storage devices installed in an EV. The packages of the energy storage devices development including the packaging method vehicle body design, thermal management, fault analysis and the interfacing with charger and charging network are also important R&D topics.

The energy storage is not limited to battery. Other devices such as compressed gas, fuel cell and other zero or low emission fuel are also being noticed. The power electronics and machines control have taken an important part in all the above technology developments. This presentation will describe the history and the future development and provide an overview of the possible development of the field.

摘要

充電及其計費系統對電動車來講是一個非常重要的設備。到現在為止，我們已經開發出一系列先進的電力電子技術，為電動車充電提供良好和安全的充電方案。然而，充電網絡不僅關係到零部件的發展，也影響城市的發展。充電網絡等基礎設施建設是電動車推廣成功的主要因素。而充電方式被歸類為正常或慢速充電，快速充電、高快速充電並取決於充電器的輸出功率和安裝在車輛上電池能源組件，同時充電功率也影響到電網。電源管理網絡需要考慮充電功率和時間，各種充電器標準、充電電壓標準以及充電連接器的標準也是現階段電動汽車發展中關注較多的方面。

另一個成功的因素是能量儲存。除了傳統的鋰離子電池，我們正在研究其他高性能存儲設備，如碳納米管、超級電容器或其他集成系統。電池管理系統(BMS)和能量管理系統(EMS)的開發是電動汽車能量存儲裝置的必要因素。該儲能裝配的研發，包括車身設計、熱管理、故障分析、介面與充電器和充電網絡都是重要的研發課題。

儲能不僅限於電池，其他設備，如壓縮天然氣、燃料電池等零或低排放燃料也正被人注意。電力電子和電機控制在所有上述技術的發展佔據一個重要組成部分。本演講將介紹電動車充電及儲能的歷史和未來的發展，並給出電動車未來可能的研究方向。

Biography

Prof Cheng is a Professor of Hong Kong Polytechnic University. He has published over 250 published papers and seven books. His research interests include power electronics, motor drives, electromagnetic interference and electric vehicle. He received the IEE Premium Award in 1995, the Outstanding Consultancy Award in 2000, Faculty Merit Award for Best Teaching in 2003, Industrial and Engineering Services Grant Achievement Award in 2006, Brussels Innova Energy Gold Medal With Mention in 2007, Consumer Product Design Award in 2008, and Electric Vehicle Team Faculty Merit Award and Industrial and Engineering Services Grant Achievement Award of the University in 2009.