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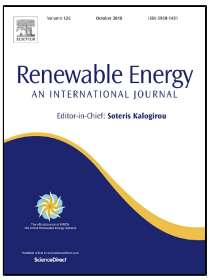

Combining a proton exchange membrane fuel cell (PEMFC) stack with a Li-ion battery to supply the power needs of a hybrid electric vehicle

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Combining a proton exchange membrane fuel cell (PEMFC) stack with a Li-ion battery to supply the power needs of a hybrid electric vehicle

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Abstract

A fuel cell hybrid electric vehicle (FCHEV) is more advantageous compared to a gasoline-powered internal combustion engine based vehicle or a traditional hybrid electric vehicle (HEV) because of using only one electric motor instead of an internal combustion engine or an electric motor in combination with an internal combustion engine. This study proposes a novel fuel cell (FC)/Lithium (Li)-ion battery hybrid power source to be utilized in FCHEVs. The power source includes a 90 kW PEMFC stack used as the main power source, and a 19.2 kWh Li-ion battery used as the auxiliary energy storage device. A prototype of the FC/Li-ion battery hybrid power source has been constructed, and experimental verifications are presented that explicitly substantiate having a power efficiency of 96.1% around the rated power, highly accurate DC-link voltage regulation and producing an appropriate three-phase stator current for the traction motor by using PWM technique are the main contributions of this work. Providing a maximum speed of 155 km/h and a total cruising range of 530 km are the other advantages. The FC/Li-ion battery hybrid power source is also compared to the state of the art of all kinds of power sources used in FCHEVs and reported in the literature that clearly demonstrates its better performance such as higher power efficiency and speed.

Keywords

Hybrid power generation system; Lithium-ion battery; hybrid electric vehicle.