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ABSTRACT

Due to the more vigorous regulations on carbon gas emissions and fuel economy, Fuel cell electric vehicles (FCEV) are becoming more popular in the automobile industry. This article presents a 1.26-kW proton exchange membrane fuel cell (PEMFC), supplying electric vehicle powertrain through a Ultra voltage-gain dc–dc boost converter. High switching-frequency and high voltage-gain dc–dc converters are essential for the propulsion of FCEV. In order to attain high voltage-gain, a Ultra voltage-gain boost converter is also designed for FCEV system. The main principle of this converter is to operate in a continuous conduction mode under steady-state analysis and it makes use of switched Inductors for obtaining high voltage gain. This converter includes two diodes, three inductors, two capacitors and three switches. Even with the small values of duty ratios, higher voltage gain can be obtained with the help of proposed converter. The traditional boost converter has the minimum boosting capability, while the proposed converter has the higher voltage gain among the different topologies. The proposed converter provides high voltage-gain while at the same time, imposing small voltage stresses on the switches. Such features make the proposed converter to suitable well for electric vehicle applications. A stack of PEMFC produces an unregulated low DC output voltage. A Ultra gain Boost converter regulates the PEMFC output voltage. Boost converter is extensively used as a front-end power conditioner for the fuel cell. The output voltage of the proposed converter is given to the electric motor through an inverter for propulsion of the vehicle. The electric motor plays an important role in FCEVs. An adequate motor considerably reduces the cost and size of the fuel cell. Adversely, DC motors have high maintenance cost and low efficiency due to the brushes and rotating devices. At present, permanent magnet BLDC motor is mostly using in FCEV applications due to simple control, high reliability and high ruggedness. The Proposed configuration is simulated using MATLAB software and verified theoretically.

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ABBREVATIONS

PEMFC	Proton Exchange Membrane Fuel Cell
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
IC	Integrated Circuit
CCM	Continuous Conduction Mode
DCM	Discontinuous Conduction Mode
DC	Direct Current
BLDC	Brushless Direct Current
VSI	Voltage source inverter