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Dual Loop Control of Fuel Cell Source using Non-isolated IBC-IDDB Converter for Hybrid Vehicle Applications

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Abstract

Fuel cells are a promising new alternative energy resource in distributed generation and electric vehicle applications. However, usually a fuel cell has slow response due to the dynamic of its auxiliaries. To optimize the fuel cell system performances, an appropriate controller that can regulate the power flow and automatically adjust the converter output voltage is needed. In this paper, Authors suggest and introduce such converter. Our approach consists in designing and managing the control of a non-isolated DC/DC converter with high voltage ratio coupled to a fuel cell stack in transport application. The proposed converter consists of two cascade stages non-isolated DC/DC converters. The first stage is an interleaved boost converter and the second is a floating-interleaving boost. The choice of each converter is based on the efficiency of the converter with high voltage ratio and small input current undulations. The control of both converters is ensured by hybrid dual loop control that contains a voltage loop with a linear PI controller and a fast current loop with a non-linear sliding controller. The simulation of the proposed control under load step variation is performed under Matlab-Simulink environment and gives interesting results. This paper presents and comments the introduced device and discusses the obtained results.

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