

Bi-directional DC-DC Converter to Charge/Discharge a Supercapacitor Module in a Hybrid Renewable Energy System.

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ABSTRACT

This paper presents an interconnected integrated bidirectional dc-dc flyback converter and its application to charge (and discharge) a supercapacitor module (SC) from a +24V dc-bus energized by renewable energy sources such as: photovoltaic (PV) panels and a wind turbine. The SC module is interconnected to the rest of the hybrid system by a dc-dc integrated bi-directional flyback converter (IBFBC). The dc-bus voltage in the hybrid system is supplied from two renewable energy sources: a +60V, 2.4kW photovoltaic array, a low voltage/low power wind turbine at +48V, 250kW, and a battery bank (+24V). In this paper, the development of a dc-dc flyback converter for charge and discharge at 165F +48V, 2.48Wh/kg supercapacitor module is presented. A design example will illustrate the feasibility of the proposed bidirectional flyback converter to charge the SC module from the +24V dc-bus voltage to store energy, as well as to supply the energy demand of required loads connected to the dc-bus voltage. Extensive analysis, simulation and experimental results are presented to validate the theory. A design example will be presented to demonstrate the performance of charge/discharge functions of the proposed IBFBC.

Keywords: Bidirectional; Flyback; Hybrid System; Supercapacitor.

