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DESIGN AND SIMULATION OF NEW ZCS DC–DC CLOSED LOOP FULL-BRIDGE BOOST CONVERTER

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ABSTRACT

There are a number of applications where an output dc voltage that is considerably larger than the input dc voltage is needed. Such applications include fuel cell and photovoltaic (pv) applications, where the voltage obtained from the fuel or pv cell is low, and hybrid vehicles where the voltage required to run the motor is much higher than that provided by the battery. Pulse width modulation (PWM) full bridge dc–dc boost converters are typically used in applications where the output voltage is considerably higher than the input voltage, these converters can be implemented with either zero-voltage switching (ZVS) or zero-current switching (ZCS) depending on the application. ZCS converters are rarely used in applications where the input voltage is very low (i.e, 12 V–48 V) such as in fuel cell converters, because the converters in these applications are implemented with MOSFETs and not IGBTs. If a review of the power electronics literature is made, it can be seen that ZCS techniques are associated with IGBT and ZVS techniques are associated with MOSFETs, and that it has, thus been assumed that ZCS techniques are, therefore, unsuitable for converters with very low input voltages. This paper begins with a review of the operation of ZCS converters in general; the disadvantages of previous ZCS converters are stated. A new ZCS-PWM dc–dc boost full-bridge converter is then introduced. The operation of the new converter is explained and analyzed, and a procedure for the design of its key components is given. Simulation results obtained from simulation are compared with analytical results. Finally, two types of disturbances at the input side are created and closed loop control is provided to maintain constant output voltage with variation in the input voltage.

KEYWORDS: Active Clamp, Dc–Dc Power Conversion, LC Resonance, Low-Power Converters