

Zero-Current Switching (ZCS) for a High Step Ratio Modular Multilevel dc-dc Converter with wide voltage range operation

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Abstract

The rise of new dc technologies is pushing the development of highly efficient dc-dc converters, especially at high voltage and high step ratio. Modular multilevel converters (MMCs) are an attractive alternative because they can manage medium and high dc voltages with standard semiconductor devices with high efficiency if they employ soft-switching techniques. However, the latest soft-switching techniques have been proposed for fixed voltage range, limiting their operation. This paper proposes a soft-switching modulation for the high step ratio Modular Multilevel dc-dc Converter in extended voltage range. The proposal achieves zero-current switching and regulates the voltage balance among the floating cell capacitors, while using a simple control scheme to regulate the output voltage. The theoretical analysis has been verified with full-scale simulations, demonstrating excellent dynamic response and reduced rms current.

Keywords

Voltage control, Inductors, Capacitors, Zero current switching, Switches, Low voltage, Two dimensional displays.