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(57) Abstract :
The transition towards sustainable transportation infrastructure has spurred the development of innovative solutions to integrate renewable energy sources with electric vehicle (EV) charging operations. In this idea, we propose a novel three-phase hybrid converter system designed specifically for PV electric vehicle charging stations. This system aims to optimize the utilization of solar energy for EV charging while ensuring grid stability, reliability, and cost-effectiveness. Key features of the proposed system include advanced power electronics, sophisticated control algorithms, and intelligent energy management strategies. The system enables bidirectional power flow between the PV array, the electric grid, and the EV battery, allowing for efficient energy conversion and grid interaction. Through dynamic load balancing, maximum power point tracking (MPPT), and grid interaction control, the system optimizes energy utilization, minimizes environmental impact, and reduces overall operational costs. Furthermore, the system offers scalability, adaptability, and interoperability, facilitating easy integration into existing charging infrastructure and future expansion to meet growing demand. The proposed three-phase hybrid converter system represents a significant advancement in sustainable transportation infrastructure, paving the way for a cleaner, greener, and more resilient future of electric transportation.The present invention relates to a single-stage Zeta-SEPIC-based multifunctional integrated converter designed for plug-in electric vehicles (PEVs), aiming to streamline and enhance the efficiency of power conversion processes within these vehicles. This innovative converter combines the functionalities of Zeta and SEPIC converters into a singular, compact module, capable of efficiently managing the charging and discharging of PEV batteries from and to an external AC power source. Additionally, it facilitates the integration of renewable energy sources into the vehicle's charging system and supports vehicle-to-grid (V2G) capabilities, thereby contributing to the sustainability and flexibility of the electric grid. The converter is characterized by its high energy conversion efficiency, robustness, and adaptability to various PEV models and battery technologies. This invention addresses the need for more efficient, reliable, and versatile power electronics systems in electric vehicles, offering a significant advancement in the field of electric mobility and sustainable transportation.

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