

27-level converter for electric vehicles using only one power supply

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Abstract

The main advantage of asymmetrical multilevel inverters is the optimization of levels with a minimum number of power supplies. However, this optimized multilevel system still needs a large number of isolated and floating DC supplies, which makes these converters complicated to implement in electric vehicles (EVs), because the system will require many independent battery packs. In this paper, a very simple scheme, based on a small and cheap high frequency link (HFL), allows the utilization of only one power supply for the complete multilevel inverter drive, with an inherent regulation of the voltages supplied among the H-bridges. It also allows voltage control with full number of levels if the DC power supply is of variable voltage characteristic. This work is focused on a 27-level asymmetric inverter but the strategy, using only one power supply, can be applied to converters with any number of levels. In particular, an asymmetrical 27-level converter needs nine isolated power supplies and the proposed system reduces these nine sources to only one: the battery car. The topology also permits full regenerative braking working as a three-level converter. The proposed system is intended for application in electric vehicles from power ratings up to 150 kW. Simulations and experimental results show the feasibility to implement this "one-source" multilevel system.

Keywords

Bridge circuits, Converters, Power supplies, Inverters, Topology, Voltage control, Windings.