

Energy Conversion Unit with Optimized Waveform Generation

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The ever-increasing demand for electrical energy has put pressure on identifying and implementing ways to increase the efficiency of the devices dealing with energy conversion. The power supplies devices able to generate ac voltage from dc one is crucial in automotive and computing industries. Different technologies have been developed to implement power supplies with higher efficiency, such as multilevel and interleaved converters.

This paper proposes an energy conversion unit constituted by a single-phase DC-AC converter with five levels at the output converter side. The proposed converter has an optimized relationship between the numbers of levels per number of switches (nL/nS). The proposed five-level four-switch converter has $nL/nS=5/4$, which is by far the best relationship among the converters proposed in the technical literature. The most important characteristics of the proposed configuration are: (i) reduced number of semiconductor devices, while keeping the high number of levels at the output converter side, (ii) only one DC source without any need to balance capacitor voltages, and (iii) high efficiency. Details regarding the operation of the configuration and modulation strategy are presented, as well as the comparison between the proposed converter and the conventional ones. Simulated results are presented to validate the theoretical expectations.

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