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A Novel Active Soft-Switching Converter with loss-less Snubber for MTEM Electromagnetic Transmitter

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Multi-channel transient electromagnetic (MTEM) is an artificial source electromagnetic detection method, the transmitter injects the high-power pseudo-random binary sequence (PRBS) signals with different coding frequencies into the earth to obtain the geological structure and the mineral resources. A novel active soft-switching converter with loss-less snubber for MTEM transmitter is presented in this paper. In contrast to the conventional DC/DC converter, the main switches, auxiliary switches and rectifier diodes of the proposed converter can achieve soft-switching from nearly zero to full load. According to the change of the load power, the proposed converter can operate in the passive soft-switching or the active soft-switching. Under the action of the cut-off diodes and auxiliary windings coupled to the main transformer, the auxiliary switches achieve soft-switching without increasing the electric stress of the devices. In addition, the conduction loss and switching loss are greatly reduced than the ordinary auxiliary circuits. The loss-less snubber in the output rectifier is composed of a controlled switch, a capacitor and two diodes, which ensures the soft-switching for the rectifier diodes. So the voltage ringing across the output rectifier is clamped. The transmission efficiency and power density of the proposed converter are significantly improved than the conventional converter. Firstly, the topology of the proposed converter and the timing diagram of control signals are described. Secondly, the working principle of the converter is analyzed in detail. And then, the relationship between the operating modes and the load power is given. Finally, the Saber simulation and experimental results verify the feasibility and validity of the converter, and a 60kW prototype is implemented.

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