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A Control System for an Isolated LLC Resonant DC-DC Converter

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In this paper, a control system for an isolated LLC resonant DC-DC converter is proposed to regulate the high voltage output level. The converter uses a single stage and it is based on a full bridge structure using IGBTs as switching devices. The output stage of the DC-DC converter is assembled using series-connected lower voltage modules. The proposed topology is based on the current-fed push-pull DC-DC converter operating and controlled with PWM modulation, active clamping and zero voltage switching. The control technique PWM-Phase-Shift together with a proportional and integral controller is used to in the converter. A high voltage transformer is used to step up AC voltage and its intrinsic capacitance and leakage inductance are utilized to obtain soft-switching zero voltage and zero current switching providing loss reduction, improving efficiency and increasing the power density. The theoretical equations of the circuit operations are studied in detail and an expression for average current at the load is presented. The theoretical converter efficiency operating at the nominal output power is almost 94%. The controller proposed is being experimentally used to control the output voltage of a 1.8 kW prototype, fed into 400V, which biases a pulsed TWT with voltages of 400V in the focusing electrode, 8 kV in the one stage depressed collector and 26 kV in the cathode.

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