

Abstract

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A Full-Bridge Submodule-Based Modular Unipolar/Bipolar High-Voltage Pulse Generator With Sequential Charging of Capacitors

Repetitive high pulsed electric field (PEF) is an effective method to kill microorganisms and bacteria in water treatment applications. The PEF can be generated by applying high-power electromagnetic pulse across the sample to be treated. There are two main types of high-voltage pulse generators, namely, unipolar and bipolar. In this paper, a fullbridge submodule-based modular high-voltage pulse generator, having the ability to generate unipolar and bipolar high-voltage pulses with different shapes from a relatively low-voltage input dc supply, is proposed. In the proposed configuration, relatively low-voltage insulated gate bipolar transistors (IGBTs) are required to generate the high-voltage bipolar pulses. A thyristor rated at the level of the pulsed output voltage is required in the proposed configuration to bypass the load during the charging process of capacitors. In the proposed approach, a thyristor is used instead of the self-commutated high-voltage switch (e.g., series-connected IGBTs), as thyristors are available with high-voltage ratings and possess inherent reverse voltage blocking capability. A detailed illustration of the proposed configuration and its operational concept are introduced in this paper. Simulation and experimental results are presented to validate the proposed approach.