Contribution ID: **73** Type: **Oral Presentation**

Modular Semiconductor-Based Marx Generator for Bipolar Ground-symmetric Pulse Generation

Tuesday 5 June 2018 10:15 (15 minutes)

For laboratory-scale experiments on the treatment of biological material by pulsed electric fields an eight-stage Marx-type pulse generator has been developed and set up. Its stages comprise IGBT switches in full-bridge configuration for generating bipolar pulses. The generator is grounded at its center allowing for a ground-symmetric operation of a flow chamber for material treatment. The generator has been designed for a pulse current of 600 A, and a maximum stage voltage of 1 kV enabling the use of inexpensive off-the-shelf components. It delivers rectangular pulses of adjustable polarity and length in a range between 1 µs and 10 µs at a pulse repetition rate up to 200 Hz. Each stage combines two modules each equipped with two IGBT switches in half-bridge configuration, the related control circuitry, one charging switch, and the stage capacitor. A circuit design focusing on low inductance enables a full-load current rise of a stage within approximately 100 ns. The contribution describes selected design aspects of the generator and presents measurement results obtained during commissioning.

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Session Classification: Oral 5 - Solid State Modulators and HV Design

Track Classification: Solid State Power Modulators, Components, Switches, and Systems