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A New soft Switch Circuit to improve the efficiency of a solid-state Marx generator

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Nowadays, it is important to improve the power efficiency with the growing variety of environmental, biological, medical, and especially for homogeneous dielectric barrier discharges (DBD) industry application using a repetitive high-voltage solid-state Marx generator. However, most solid-state pulse generators are action at hard switching on or off, such as a huge current for the DBD load, which will increase power loss, enlarge thermal stress and have to enlarge the heat sinks or decrease their repetitive rate.
In order to improve the power efficiency of the repetitive high-voltage solid-state Marx generator applied in DBD, a series resonant soft switch technology is proposed in this paper. It is series in an inductor matched to DBD capacitor, where series resonant for soft switching will be happened. The influence of the Q-factor and the value of the series inductor will also be analyzed. Studies have shown that the new circuit will provide us a quasi-zero current switching on and off. If we select a high Q of the inductor will improve the radiant power and system efficiency of KrCl* lamp, a typical DBD load.
A laboratory prototype pulse generator is implemented operated with the voltage range 0-10 kV, the repetition rate from 0.1 Hz to 10 kHz, pulse width from 1 μs to 5 μs and the rise time less than 100 ns. The efficiency of the Marx generator improves over 30% and the radiant power improves over 25%.

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