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Design of Bipolar Pulse Generator Topology Base on Marx Generator Supplied by Double Power

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Pulsed power technology has been used for the ablation tumor. Considerable research shows that a high-strength unipolar pulse electric field can induce irreversible electroporation (IRE) on the cell membrane, which can effectively kill cells. But some scholars and doctors have found that muscle contractions occur during treatment, which are associated with the delivery of electric pulses. Confirmed by further studies that bipolar pulses have been proven more advanced in the treatment of tumor because of the elimination of muscle contractions and the effect for ablating non-uniform tissue. So the bipolar pulse generator is needed for the research on the tumor ablation with bipolar pulses. In this paper, a new type of modular bipolar pulsed-power generator base on Marx generator with double power is proposed. The concept of this generator is charging two series of capacitors in parallel by two power sources respectively, and then connecting the capacitors in series through solid-state switches with different control strategy. Utilizing a number of fast solid-state switches, the capacitors can be connected in series with different polarities, so that a positive or negative polarity pulse will be delivered to the load. A laboratory prototype has been implemented in laboratory. The development of this pulse generator can provide the hardware foundation for the research on biological effect without muscle contraction when the tumors are applied with bipolar pulse electric field.

Author: Mr DONG, shoulong (Chongqing University)

Co-authors: Prof. YAO, Chenguo (Chongqing University); Dr LI, Chengxiang (Chongqing University); Mrs LIU, Hongmei (Chongqing University); Dr MI, Yan (Chongqing University); Mr LV, Yanpeng (Chongqing University); Mr ZHAO, yajun (Chongqing University)

Presenters: Prof. YAO, Chenguo (Chongqing University); Mr DONG, shoulong (Chongqing University)

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