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NEW EMBEDDED NANOSECOND PULSE GENERATOR BASED ON SPARK GAP AND IGBT

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A new architecture of high voltage pulse generator has been proposed. It is based on combining two types of switches'technologies, namely IGBT used as opening switch and spark gap used as closing one, and two types of energy storage, Inductive and capacitive, in order to get a compromise with a better performances dedicated especially for embedded applications.
This new architecture has several advantages such as a simple architecture and driving system, high and stable repetition rate which can reach some kilo-Hertz, a very sort rising time of few nanoseconds, a very high gain and efficiency. The generator doesn't need a high voltage supply (i.e. Marx generator) just a tens of volts input suffices to produce a high voltage pulse of some kilo-volts that's why this architecture is adequate for embedded applications.
A Matlab simulation has been implemented to check the functioning principal. A prototype generator has been built and tested in the high voltage laboratory, which belongs to the Faculty of Electrical Engineering Warsaw University of Technology. The obtained results confirm the theory behind it.
Basically, the generator consists of an inductor, an IGBT, a diode, a capacitor, a spark gap and a load. In the first phase, the power flows from the input supply (batteries) to the inductor throw the closed IGBT, and then we open the IGBT, the current changes the path and flows throw the capacitor and makes it charging. When the voltage across the capacitor surpasses the breakdown value of the spark gap, a very short pulse occurs across the load. After the discharge of the capacitor and the end of the spark, the system enters in a waiting phase until the next closing of the IGBT.

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