

FPGA based Programmable Pulse Generator for Solid-State Marx Generators

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FPGA BASED PROGRAMMABLE PULSE GENERATOR FOR SOLID-STATE MARX GENERATORS



KEYNOTE SPEAKER

VAN OORSCHOT Jeoreen, AZIZI Madhi, HUISKAMP Tom

Electrical Energy Systems, Eindhoven University of Technology, Eindhoven, Netherlands

ABSTRACT



In this contribution, we present an FPGA control system to generate the control signals needed for our Flexible Solid-State Marx generator (see [1]). The control system generates (at least) 20 individual control signals with 2.5ns precision and up to seconds in length. It is implemented on a Pynq-Z2, a cheap FPGA development board with embedded ARM SoC. The system is live-reprogrammable, so the Marx output pulse shape can be changed multiple times per second. Furthermore, bursts of pulses can be made by repeating a pulse shape. An interface in Python takes care of translating Marx pulse shape to control signals, including calculating deadtime. This interface can be combined with any measurement system to create a feedback loop. For instance, an oscilloscope can measure the Marx output pulse and tune the control signals to improve the measured waveform. Alternatively, the system can be connected to a plasma diagnostics system and change the pulse shape based on the plasma behavior. Finally, we present some preliminary results on future improvements, including a delay system using programmable delay lines in the FPGA to reduce the time precision from 2.5 ns to about 20ps.

[1] J.J. v. Oorschot, M. Azizi, A.J.M. Pemen and T. Huiskamp “Fast & Flexible Impedance-Matched Solid-State Marx Generator for PAW Generation”, EAPPC 2020, Aug. 29 – Sep. 02 2021, Biarritz, France.