

# **A Digital Memristor Emulator for FPGA-Based Artificial Neural Networks**

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## **Abstract**

FPGAs are reconfigurable electronic platforms, well-suited to implement complex artificial neural networks (ANNs). To this end, the compact hardware (HW) implementation of artificial synapses is an important step to obtain human brain-like functionalities at circuit-level. In this context, the memristor has been proposed as the electronic analogue of biological synapses, but the price of commercially available samples still remains high, hence motivating the development of HW emulators. In this work we present the first digital memristor emulator based upon a voltage-controlled threshold-type bipolar memristor model. We validate its functionality in low-cost yet powerful FPGA families. We test its suitability for complex memristive circuits and prove its synaptic properties in a small associative memory via a perceptron ANN.

## **Keywords**

Memristors, Neurons, Field programmable gate arrays, Threshold voltage, Artificial neural networks, Mathematical model, Associative memory.