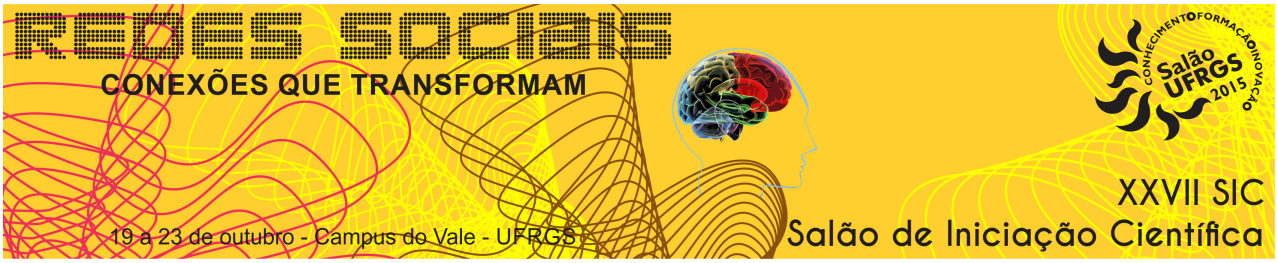

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Título	Izhikevich`s Simple Model on FPGA
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Title: “Izhikevich’s Simple Model on FPGA."

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The human brain has about 10^{11} neurons, and each one can have more than 10^4 synaptic connections with others neurons [1].

As the most inspiring and powerful computing machine we know at present, it is normal to try breaking the code. We believe its computer capacity comes from a three level complexity: (a) the number of adaptable cells, the neurons; (b) the capability of configurable connections, the synapses; and (c) the waveform that is at the same time robust against noise and capable to encode information, the spike or action potential.

In terms of the waveform, the literature presents various spike models, each one with a respective biological plausibility and computational complexity. The Izhikevich’s Simple Model (ISM) [2] offers one of the best compromises between waveform quality and computational cost at the moment. It is composed of a system of two ordinary differential equations of the first order that can be easily digitalized. In terms of capability of configuration connections and number of cells, it is important to find a hardware that can at the same time be powerful, flexible, and inexpensive. FPGAs (Field- Programmable Gate Array) seem to fill all these requirements as reprogrammable digital circuits.

The hardware on the literature differs from how serial or parallel the computations are and, consequently, how many clock periods are needed to compute. Our approach is a highly combinational so far it maintains a good speed when compared to the literature and, at the same time, has a low latency.

Future works consists of implement: (a) a networks with biological meaning, (b) reuse of logic with pipeline, (c) use of precomputed values in auxiliary shared memory, and (d) explore the parallelism technique for multiple virtual neurons in a single FPGA.

REFERENCES

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