1-D memristor-based cellular automaton for pseudo-random number generation

Karamani, R. E., Ntinas, V., Vourkas, I., & Sirakoulis, G. C. (2017, September). 1-D memristor-based cellular automaton for pseudo-random number generation. In 2017 27th International Symposium on Power and Timing Modeling, Optimization and Simulation (PATMOS) (pp. 1-6). IEEE. <10.1109/PATMOS.2017.8106991> Accessed 28 May 2022.

Abstract

Cellular Automata (CAs) is a well-known parallel, bio-inspired, computational model. It is based on the capability of simpler, locally interacting units, i.e. the CAs cells, to evolve in time, giving rise to emergent computation, suitable to model physical system behavior, prediction of natural phenomena and multi-dimensional problem solutions. Moreover, at the same time CAs constitute a promising computing platform, beyond the von Neumann architecture. In this paper, a memristor device is considered to be the basic module of a CA cell circuit implementation, performing as a combined memory and processing element to implement CA-based circuits, able to model sufficiently systems and applications as mentioned above, targeting tentatively to a more energy efficient design compared to the conventional electronics. In particular and as a proof of concept, the results of elementary CAs modeling and simulation for the generation of pseudo-random numbers are presented using a 1-D memristor-based CAs array to illustrate the robustness and the efficacy of the proposed computing approach.

Keywords

Memristors, Integrated circuit modeling, Computational modeling, Computer architecture, Automata, Boundary conditions, Mathematical model.