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One-bit stochastic resonance storage device

S. A. Ibáñez, P. I. Fierens, G. A. Patterson, R. P. J. Perazzo, D. F. Grosz

(Submitted on 4 Nov 2009)

The increasing capacity of modern computers, driven by Moore's Law, is accompanied by smaller noise margins and higher error rates. In this paper we propose a memory device, consisting of a ring of two identical overdamped bistable forward-coupled oscillators, which may serve as a building block in a larger scale solution to this problem. We show that such a system is capable of storing one bit and its performance improves with the addition of noise. The proposed device can be regarded as asynchronous, in the sense that stored information can be retrieved at any time and, after a certain synchronization time, the probability of erroneous retrieval does not depend on the interrogated oscillator. We characterize memory persistence time and show it to be maximized for the same noise range that both minimizes the probability of error and ensures synchronization. We also present experimental results for a hard-wired version of the proposed memory, consisting of a loop of two Schmitt triggers. We show that this device is capable of storing one bit and does so more efficiently in the presence of noise.

Comments:	12 pages, 7 figures
Subjects:	**Adaptation and Self-Organizing Systems (nlin.AO)**; Other Condensed Matter (cond-mat.other); Other Computer Science (cs.OH)
Cite as:	**arXiv:0911.0878v1 [nlin.AO]**

Submission history

From: Pablo Fierens [view email]
[v1] Wed, 4 Nov 2009 16:59:11 GMT (1372kb,D)

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