Mechanism of signal-to-noise ratio gain in a monostable threshold stochastic resonator

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Abstract

In the last few years, several papers have been published that reported high signal-to-noise ratio (SNR) gains in systems showing stochastic resonance. In the present work, we consider a level-crossing detector driven by a periodic pulse train plus Gaussian band-limited white noise, and provide analytical formulae for the dependence of the SNR gain on the relevant parameters of the input (the amplitude and the cut-off frequency of noise, the duty cycle of the deterministic signal and the distance between the threshold and the amplitude of the signal). Our results are valid in the input parameter range wherein high gains are expected, that is, wherein the probabilities of missing and, especially, extra output peaks are very low. We also include numerical simulation results that support the theory, along with illustrations of cases which are outside the validity of our theory.

Hao Chen, Pramod K. Varshney, +1 author James H. Michels. Published 2007 in IEEE Transactions on Signal Processing. Mechanism of signal-to-noise ratio gain in a monostable threshold stochastic resonator Author(s): Tamas Fulei; Zoltan Gingl; Peter Makra. Show Abstract. In the last few years, several papers have been published that reported high signal-to-noise ratio (SNR) gains in systems showing stochastic resonance. In the present work, we consider a level-crossing detector driven by a periodic pulse train plus Gaussian band-limited white noise, and provide analytical formulae for the dependence of the SNR gain on the relevant parameters of the input (the amplitude and the cut-off frequency of noise, the d