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Realizing the transformation of logic gates in a genetic toggle system under Lévy noise.  

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Summary: This paper aims to investigate the different logic gates and its transformation in a genetic toggle system under square wave signal and Lévy noise. The logical information transmission of the repressive protein concentrations of the genetic toggle system are studied. The logic gates NOR/OR for the repressive protein concentration are explored by the logic relationships. Also, the transformation from the logic gates NOR/OR to logic gates NAND/AND is explored through the adjustment of system parameters and Lévy noise parameters. What’s more, the logic latch gates NSGN/SNG are also explored for the information storage. According to the obtained logic gates NOR/OR and NAND/AND and the logic latch gates NSGN/SNG of the repressive protein concentration, the two-dimensional logical success probability of the logical information transmission concerning the pairwise parameters of stability index, skewness parameter and noise intensity of Lévy noise are analyzed respectively. The effects of those Lévy noise parameters on the logical information transmission for the obtained logic gates are analyzed. In addition, the logical stochastic resonance is studied in the genetic toggle system. It is found that Lévy noise with the certain intensity can greatly induce logical stochastic resonance, and optimally promote the logical information transmission for the realized logic gates of NOR/OR and NAND/AND and the logic latch gates NSGN/SNG.

MSC:  

92D10 Genetics and epigenetics  
60H10 Stochastic ordinary differential equations (aspects of stochastic analysis)

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References:


[23] Hillenbrand, P.; Fritz, G.; Gerland, U., Biological signal processing with a genetic toggle switch, Plos One, 8, 10 (2013)


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