

On the 0/1 test for chaos for continuous ODEs: resonance, oversampling and frequency properties.

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The 0/1 test for chaos developed several years ago (see: G. A. Gottwald and I. Melbourne, A new test for chaos in deterministic systems, Proc. R. Soc. London, vol. 460, pp. 603-611, 2003; also G.A. Gottwald and I. Melbourne, On the implementation of the 0/1 test for chaos, SIAM J. Appl. Dynamical Syst., vol. 8, pp. 129-145, 2009) is an alternative way to the Lyapunov exponents approach to test both discrete and continuous systems for the presence of chaos. The 0/1 test is based on the statistical methods of regression and correlation. It is known that in the continuous case the phenomena of resonance and oversampling may impact the results of the test and lead to incorrect findings.

In this paper we discuss in detail the resonance and oversampling features of the 0/1 test for chaos for continuous systems of ODEs and propose methods to avoid those undesired features. Our method is based on certain frequency properties of the 0/1 test for chaos. The results of our approach are compared with those obtained by using the first minimum approach of the mutual information approach. Several numerical results for typical chaotic systems (including memristive circuits) are included.