Critical noise amplitude in Chua’s circuit model

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The canonical Chua’s circuit model is described by three coupled first-order autonomous differential equations and presents a rich variety of dynamics as a function of the parameters, i.e., the voltages across the two capacitors, and the current across the inductor. Usually, the nonlinear model for Chua’s diode uses a piece-wise linear curve for its current-voltage characteristic. Recently, it was reported some experimental results in the inductorless version of the Chua circuit, showing deformations in its parameter space. Besides, it is well known that noise and temperature may cause fluctuations in the values of the electronic components, for example, in the resistors and in the operational amplifiers. Some works report that these fluctuations change the parameter spaces of dynamical systems.

In this work, we study the effect of noise in the inductorless Chua’s circuit model by solving numerically the equations of the circuit using a fourth-order stochastic Runge-Kutta integrator. As a model, we use a gaussian noise which is added to one of the equations. The main goal is to find the critical noise intensity which transforms the regular periodic motion in a chaotic one. Results are presented in the parameter space. With this model we expect to describe instabilities found in the corresponding experimental results.