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# A Network Implementation of the Chua Oscillator. Characterization of Chua Phase Coherence

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Basic non linear models as Lorenz, Rossler or Chua are of great importance to understand the behaviour of the chaotic dynamical systems. Therefore it is interesting to have a relatively simple, versatile and robust implementation of the chaotic flow. In the first part of this work we propose and implement a Network Simulation Method (NSM) to solve numerically the three first order Chua differential equations (ODE Rs) of motion. NSM has been successfully applied in many areas of physics and engineering including sharp nonlinear problems [1] . The Network consists of three jointed electric circuits which realize the three ODE Rs. An auxiliary circuit, with a controlled voltage source, is necessary to realize the piecewise nonlinearity. We have compared these results with Qclassical R numerical methods and have found that the simulations and the computer times are very acceptable.

In the second part we are interested in the phase coherence property to understand the chaotic motion, because coherent phase oscillations bear some regular dynamics whereas incoherent oscillations are more irregular and fluctuating. Phase coherence implies the presence of a predominant frequency, as in Chua oscillations, and this fact is crucial in applications of phase synchronization and related issues [2]. We analyze the phase coherence of Chua chaotic flow, using the return times (the times between two consecutive maxima) of the first return maps. We show that Chua system is phase coherent in both topologies, the Single Scroll and the Double Scroll one; nevertheless, the degree of coherence varies, being more coherent the Single Scroll one. This indicates that phase coherence does not depend directly on the topologic properties of the chaotic attractors and that the chaotic flow preserves the large scale order with a background of small fluctuations inherent to the chaos behaviour.

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