

# Simulation of a cubic-like Chua's oscillator with variable characteristic

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Chua's oscillator is one of the simplest electronic circuits that is capable of producing chaos. It can exhibit a vast array of behaviors including an assortment of attractors, bifurcations and routes to chaos. The standard Chua's circuit uses a piecewise linear characteristic associated with a nonlinear resistor that can be implemented using two operational amplifiers [1].

An alternative version of Chua's oscillator is obtained using a cubic-like nonlinearity [2], which is implemented with two CMOSFET transistors. We propose a modification of this implementation that allows to change the shape of the characteristic in an easy way. A mathematical model of the circuit is derived based on the equations of MOSFET transistors [3] and a Chua's circuit is simulated using this model. Chua's circuit presents several strange attractors that are obtained in the simulation for different values of the bifurcation parameter. We have studied the dependence of these phenomena on the shape of the characteristic of Chua's circuit.

A physical realization of the circuit has been constructed using the Texas Instruments CD4007 integrated circuit and the experimental results have been compared with the simulation.

## References

- [1] Kennedy, M.P. Robust op amp realization of Chua's circuit, *Frequenz*, Vol. 46, No. 3-4, (1992) 66-80.
- [2] O'Donoghue, K., Kennedy, M.P., Forbes, P., Min Qu, Jones, S. A fast and simple implementation of Chua's oscillator with cubic-like nonlinearity. *International Journal of Bifurcation and Chaos*, Vol. 15, No. 9 (2005) 2959-2971.
- [3] Sedra, Adel S. *Circuitos microelectrónicos* México D.F. : McGraw-Hill/Interamericana , 2006