

The CHEN attractor

This short application note deals with the CHEN attractor which is described in detail in [AUGUSTOVÁ et al. 2013] and [JASIM et al. 2011]. It is defined by

$$\begin{aligned}\dot{x} &= a(y - x), \\ \dot{y} &= (c - a)x + cy - xz, \text{ and} \\ \dot{z} &= -bz + xy\end{aligned}$$

with parameters $a = 35$, $b = 3$, and $c = 28$. A quick numerical experiment shows that suitable (and simple) scaling factors are $\lambda_x = \lambda_y = \frac{1}{50}$ and $\lambda_z = \frac{1}{100}$, yielding

$$\begin{aligned}\dot{x} &= 0.35y - 0.35x, \\ \dot{y} &= -0.07x + 0.28y - xz, \text{ and} \\ \dot{z} &= -0.03z + 0.25xy.\end{aligned}$$

These equations can be directly implemented on THE ANALOG THING as shown in the schematic in figure 1.

The resulting x, z phase space plot is shown in figure 2. The picture was taken from the screen of a Hameg HM203-6 oscilloscope with the rare blue phosphor option using a Canon EOS 50D digital camera set to ISO 200 with an exposure time of six seconds.

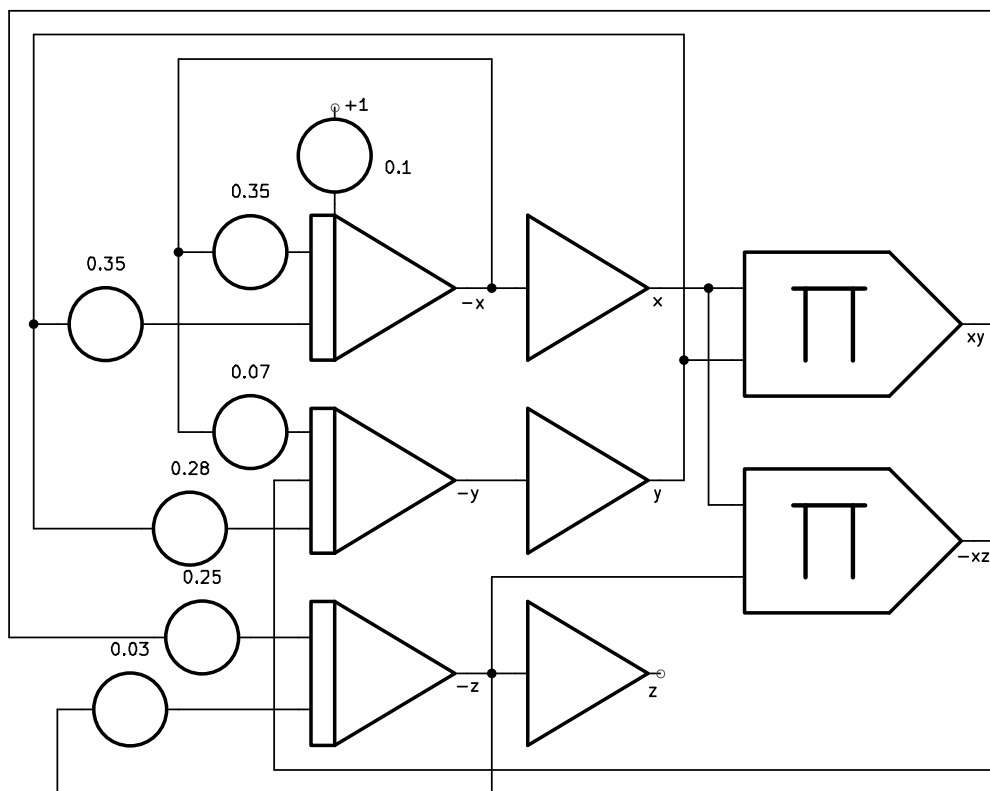


Figure 1: Analog computer setup for the CHEN attractor

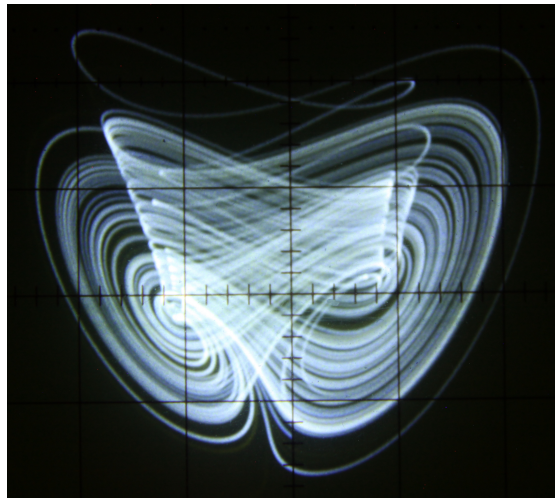


Figure 2: CHEN attractor

References

- [AUGUSTOVÁ et al. 2013] PETRA AUGUSTOVÁ, ZDENĚK, “Characteristics of the Chen Attractor”, in [ZELINKA et al. 2013, pp. 305–132]
- [JASIM et al. 2011] SAAD F. JASIM, KARAM A. ABED, “Using Δ -Discriminate Method to Determine the Stability and Bifurcation of Chen Chaotic System”, in *Raf. J. of Comp. & Math's*, Vol. 8, No. 2, 2011, pp. 111–122
- [ZELINKA et al. 2013] IVAN ZELINKA, GUANRONG CHEN, OTTO E. RÖSSLER, VACLAV SNASEL, AJITH ABRAHAM (eds.), *Nostadamus 2013: Prediction, Modeling and Analysis of Complex Systems*, Springer, 2013