

Yet another LORENZ system

Recently, I stumbled over PETER MCNAIR's great blog *Analog Ontology*,¹ where he describes – among many other highly interesting things – his implementation of another chaotic system devised by EDWARD N. LORENZ. In 1984 LORENZ published a paper titled *Irregularity: a fundamental property of the atmosphere*² where he describes the following system of three coupled differential equations:

$$\begin{aligned}\dot{x} &= -y^2 - z^2 - ax + af \\ \dot{y} &= xy - bxz - y + g \\ \dot{z} &= bxy + xz - z\end{aligned}$$

The parameters of this system are $a = \frac{1}{4}$, $b = 4$, $f = 8$, $g = 1$.

Scaling this system is pretty straightforward as a quick numerical experiment shows: $|x|$ and $|y|$, $|z|$ are bounded by 2 and 3, respectively. The resulting analog computer program is shown in figure 1. Tweaking the parameters is quite interesting, a typical set of solutions is shown in figure 2.

References

[LORENZ 1984] EDWARD N. LORENZ, *Irregularity: a fundamental property of the atmosphere*, Tellus (1984), 36A, pp. 98–110

¹<http://analog-ontology.blogspot.com/>

²See [LORENZ 1984].

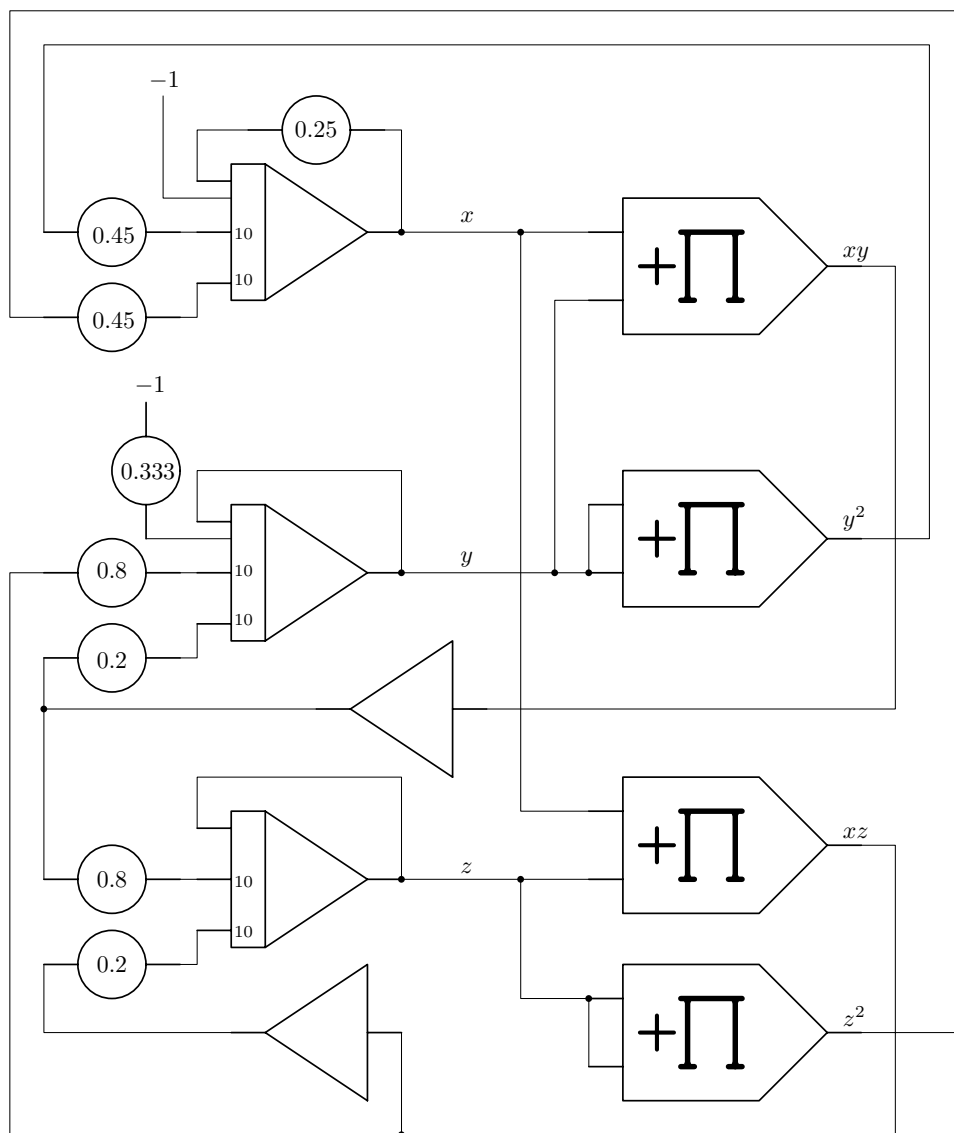


Figure 1: Program for the chaotic LORENZ-84 system

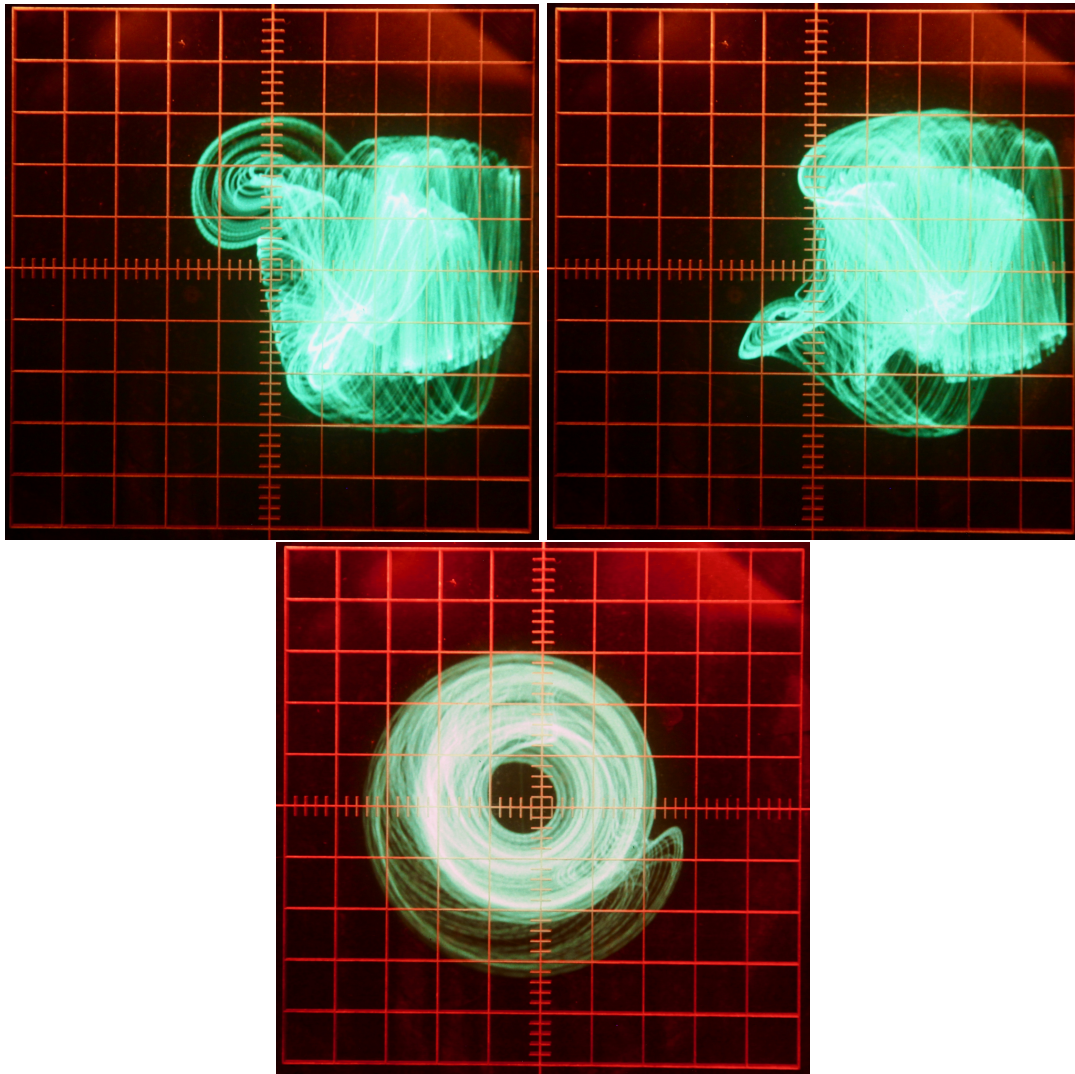


Figure 2: Typical behavior of the LORENZ-84 system, the three screen shots show x vs. y , x vs. z , and y vs. z