The Arneodo attractor

A particularly beautiful chaotic system is due to [Arneodo et al. 1981]. It has the general form

$$\begin{aligned}\dot{x} &= y,\\ \dot{y} &= z, \text{ and}\\ \dot{z} &= -y - \beta z + f_\mu(x).\end{aligned}$$

The particular system implemented in the following is

$$\begin{aligned}\dot{x} &= y,\\ \dot{y} &= z, \text{ and}\\ \dot{z} &= ax - by - z - cx^3\end{aligned}$$

with $a = 5.5$, $b = 3.5$, and $c = 1$. Suitable initial conditions are $x(0) = y(0) = 1$ and $z(0) = 0$. As a quick numerical experiment shows, suitable scaling factors are $\lambda_x = \frac{1}{5}$, $\lambda_y = \frac{1}{10}$, and $\lambda_z = \frac{1}{15}$ yielding

$$\begin{aligned}\dot{x} &= 2y,\\ \dot{y} &= 1.5z, \text{ and}\\ \dot{z} &= a^*x - b^*y - z - c^*x^3\end{aligned} \tag{1}$$

with $a^* = 1.833$, $b^* = 2.333$, and $c^* = 8.333$.[1] The initial conditions for this scaled problem are $x(0) = 0.2$, $y(0) = 0.1$, and $z(0) = 0$.

The implementation of the system is straightforward and shown in figure 1. A typical x/z phase-space-plot is shown in figure 2.

[1] It should be noted that the analog implementation works better with a factor of 0.2 instead of 0.15 in equation (1).

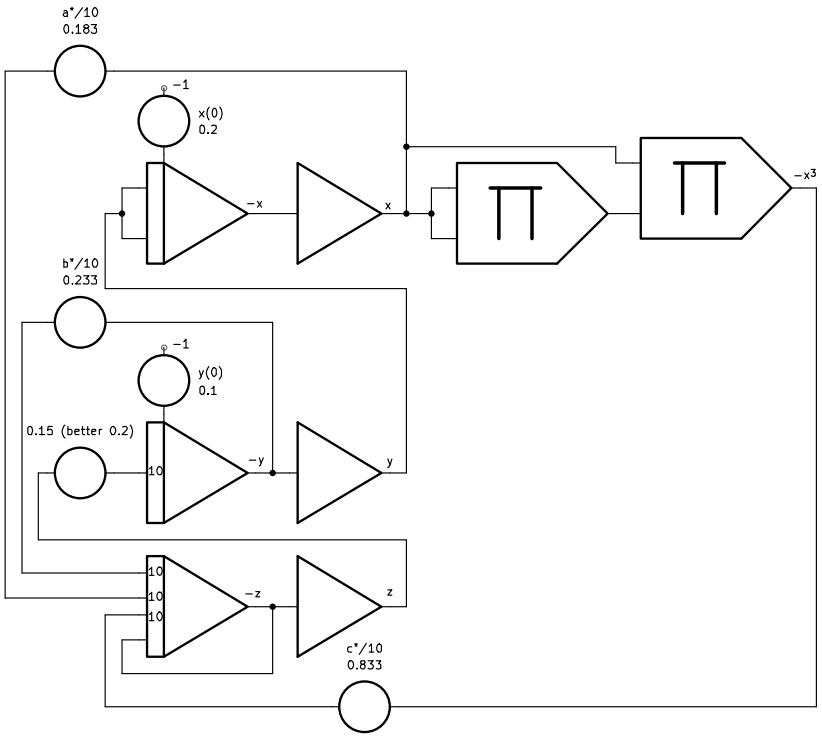

Figure 1: Implementation of the ARNEODO system

References

[ARNEODO et al. 1981] A. ARNEODO, P. COULLET, textscC. Tresser, "Possible New Strange Attractors With Spiral Strucuture", in *Communications in Mathematical Physics*, 79, 1981, pp. 573–579

think hybrid

Analog Computer Applications

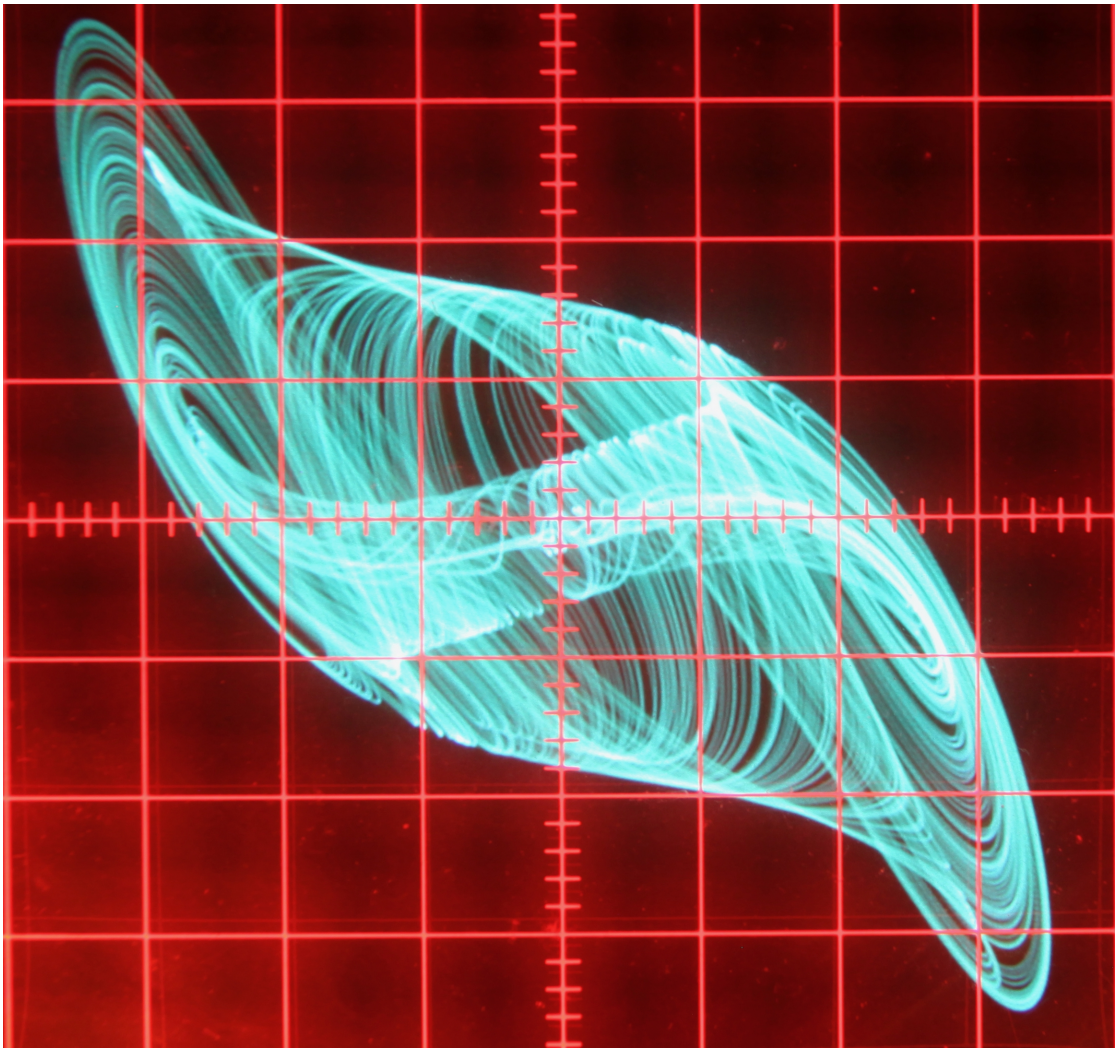

Figure 2: Typical x/z phase-space-plot of the ARNEODO system

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