

A chaotic Sprott system

A dark and rainy Sunday – what could be better than staying at home where it is warm and cosy and playing with an analog computer like THE ANALOG THING. This application shows the implementation of a simple chaotic Sprott system¹:

$$\begin{aligned}\dot{x} &= yz \\ \dot{y} &= x - y \\ \dot{z} &= 1 - xy\end{aligned}$$

This system is easy to scale, as all variables are well within the interval $[-10, 10]$ yielding the scaled system

$$\begin{aligned}\dot{x} &= 10yz \\ \dot{y} &= x - y \\ \dot{z} &= \frac{1}{10} - 10xy,\end{aligned}$$

which can be implemented directly as shown in figure 1.

¹See [GUILLÉN-FERNÁNDEZ et al. 2019], case B in table 1.

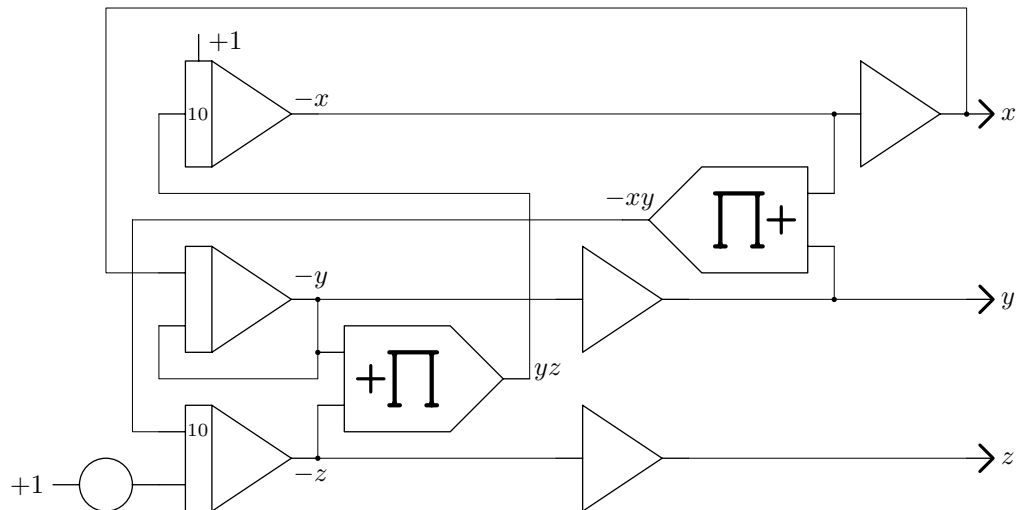


Figure 1: Analog computer setup for the chaotic SPROTT system

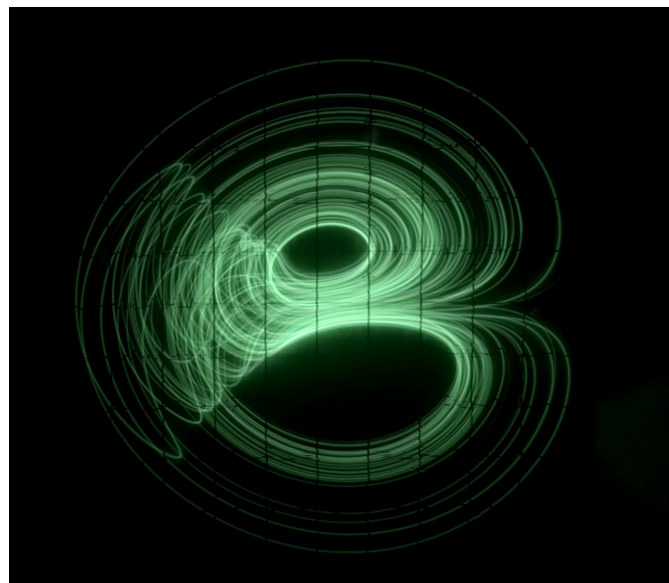


Figure 2: xz phase space plot of the chaotic SPROTT system

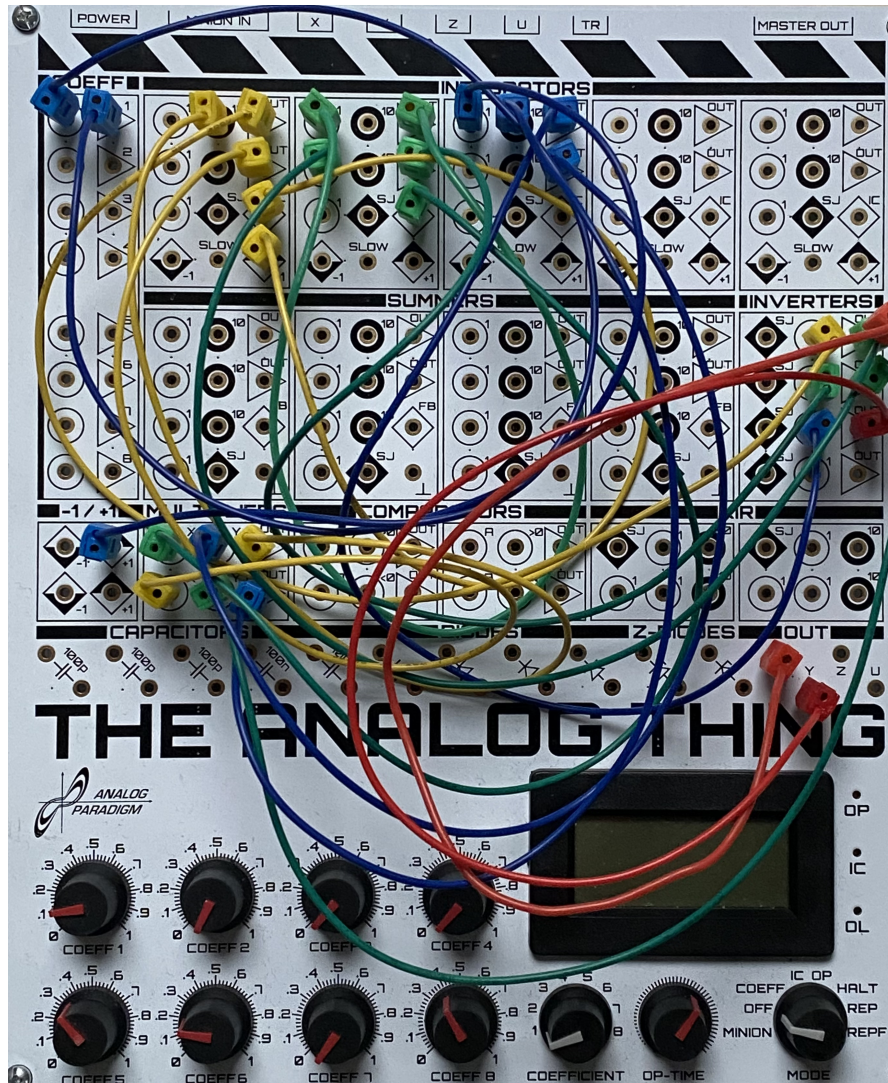


Figure 3: Setup of THE ANALOG THING for the chaotic SPROTT system

References

- [GUILLÉN-FERNÁNDEZ et al. 2019] OMAR GUILLÉN-FERNÁNDEZ, ASHLEY MELÉNDEZ-CANO, ESTEBAN TLELO-CUAUTLE, JOSE CRUZ NÚÑEZ-PÉREZ, JOSE DE JESUS RANGEL-MAGDALENO, "On the synchronization techniques of chaotic oscillators and their FPGA-based implementation for secure image transmission", in *PLOS ONE*, February 6, 2019, <https://doi.org/10.1371/journal.pone.0209618>