Types of Attractor

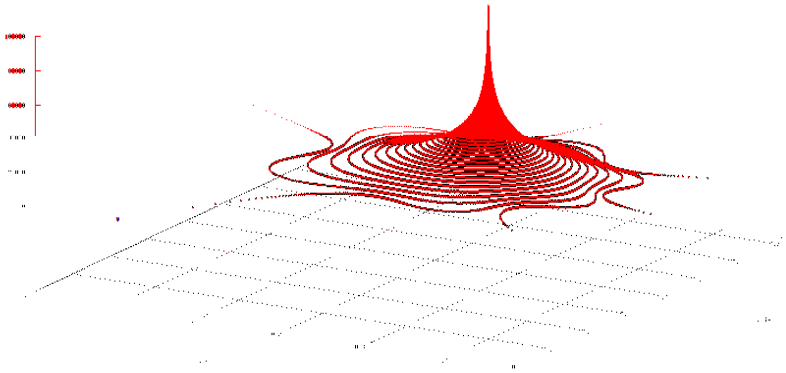
There are four main types of attractors : point attractor , limit cycle attractor , torus attractor and strange attractor . Also there exist many kinds of attractor which relative at least with one of these types .

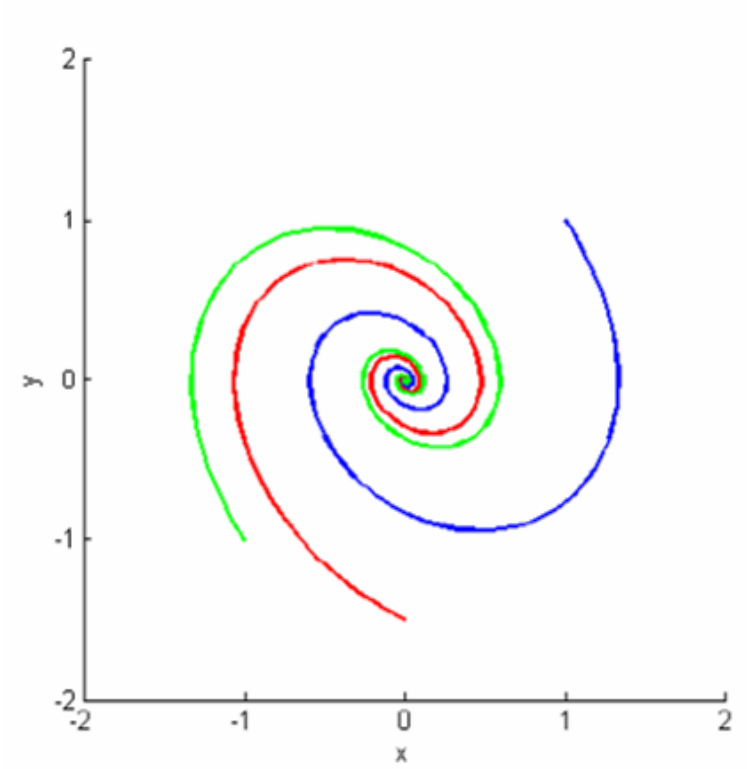
Our purpose in this section is to see these types with their different shapes and we will remind some names of some kinds of attractors .

Now we will start with first type of attractor which is point attractor

Definition

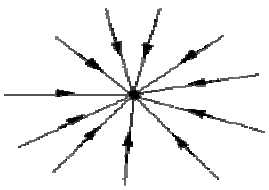
we say that x_0 is ***sink*** or an ***attracting fixed point*** for f if there is a neighborhood U of x_0 in R having the property that , $y_0 \in U$, then $f^n(y_0) \in U$ for all n and , moreover , $f^n(y_0) \to x_0$ as $n \to \infty$, see Figure





The point attractor is the simplest way to bring order out of chaos. A point attractor is a fixed point that a system evolves towards, such as a falling book, a damped pendulum, or the halting state of a computer.

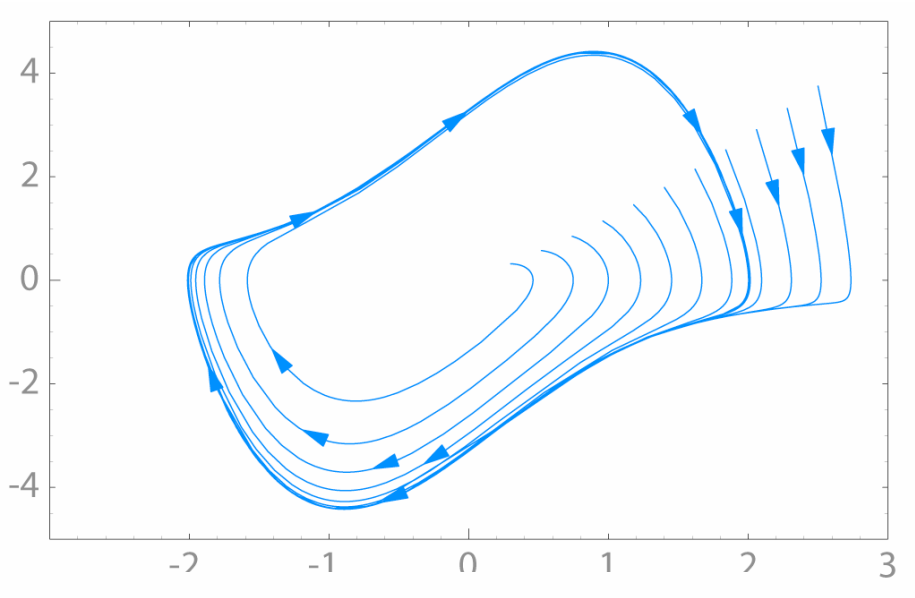
In the figure, the arrows represent trajectories starting from different points but all converging in the same equilibrium state

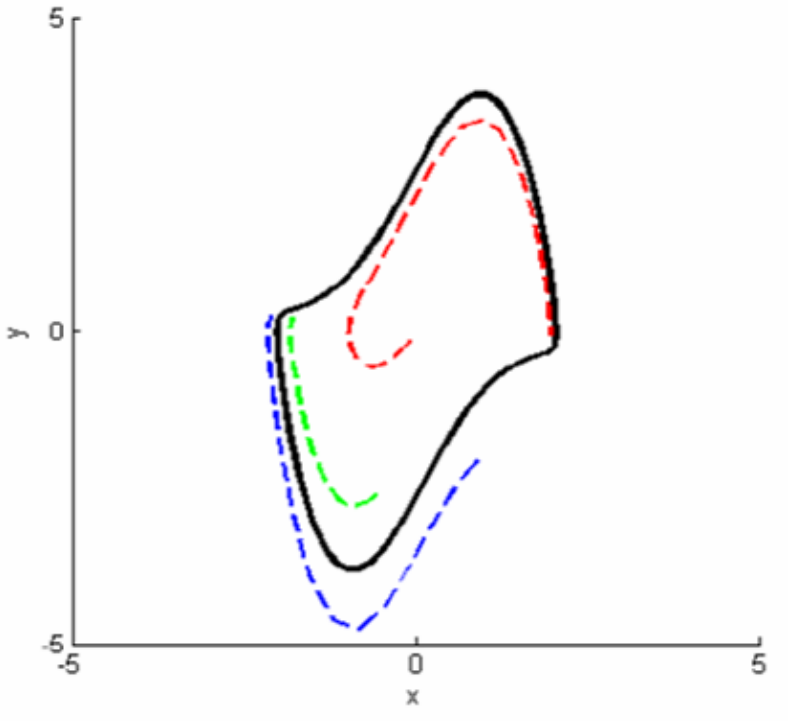


Definition

A *limit cycle* is an isolated closed orbit.

This means that its neighboring trajectories are not closed – they spiral either towards or away from the limit cycle, see Figure .

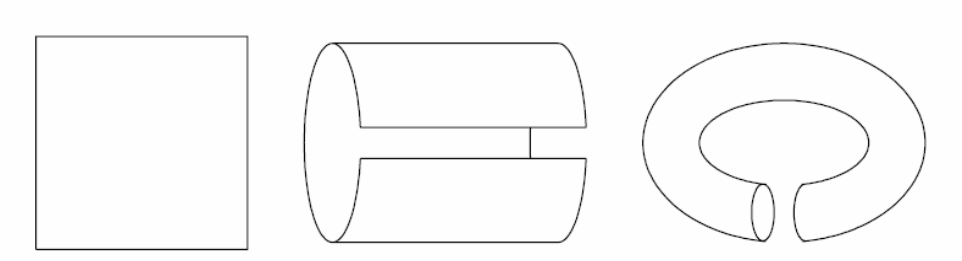


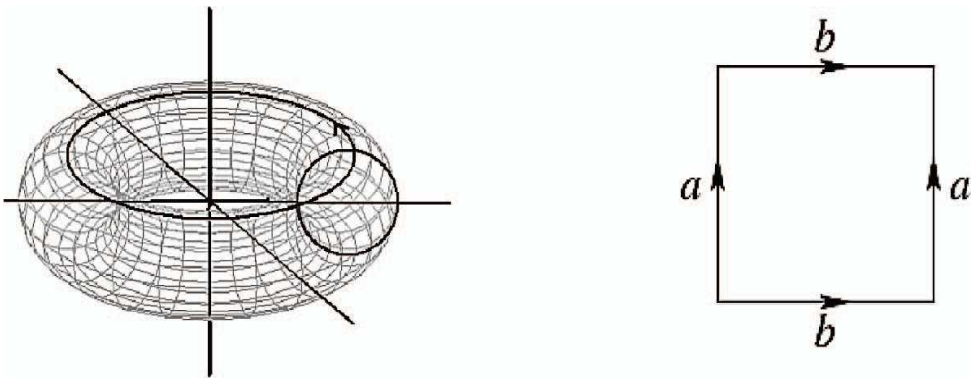


The third type of attractor is torus attractor .

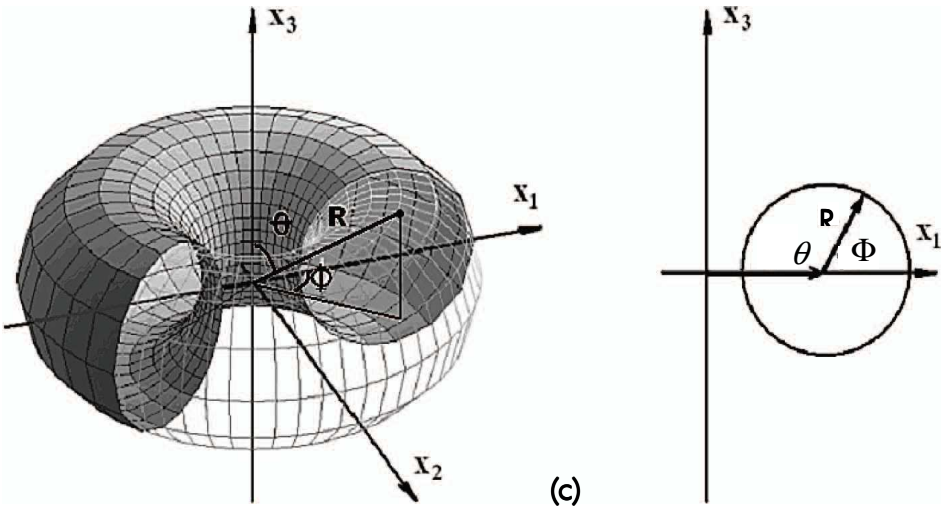
Definition

torus attractor is a system which change in detailed characteristic over time but does not change its form. Such a system has trajectory which will produce a path looking like the doughnut shape of a torus , see Figures .





(a) (b)



(c)