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.