

# 1 Stochastic Resonance Equation

In our generic model we investigate the time evolution of a stochastic variable  $x$ . In our work we want to simulate a particle, that is performing a random walk in a fluid, namely the well known brownian motion. Here we investigate only the drift in  $x$  *direction*. Additionally the particle is moving in a potential  $V(x)$  and we can switch on a driving force. It has two minima, where the particle can be located. These two states are separated trough a potential wall  $\delta V$ . The time evolution is described as follows:

$$\dot{x}_t = -V_x(x) + A\cos(\omega t + \phi) + \sigma x(t) \quad (1)$$

The subscript variable means a derivative  $\dot{x}_t = dx/dt$ . As usual:  $t$  time variable,  $A$  amplitude and  $\omega$  frequency of the oscillator and  $x(t)$  as noise, it is the temporal derivative of a Wiener Process.

$$\xi(t) = \frac{dW}{dt} \quad (2)$$

The potential function  $V(x)$  of the stochastic variable  $x$ :

$$V(x) = -\frac{1}{2}x^2 + \frac{1}{4}x^4$$

We use an oscillator to get a triggered resonance. In our model we work with an additional Gaussian white noise and with the auto-correlation we get

$$\langle \xi(t)\xi(0) \rangle = 2D\delta(t) \quad (3)$$

with  $\sigma$  the noise factor, hence the variance of noise is  $\sqrt{2D} = \sigma$ . In our investigation we set the initial phase to

$$\varphi = 0 .$$

We add all relations together and get for our simulation the main equation:

$$\dot{x}_t = x^3 - x + A\cos(\omega t) + \sqrt{2D}x(t) \quad (4)$$

The two minima of the potential function are  $x_{\pm} = \pm 1$  and hence we have  $\delta V = 1/4$ .

## 1.1 something else

$$L_i V \quad (5)$$