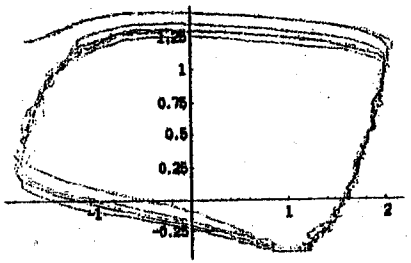
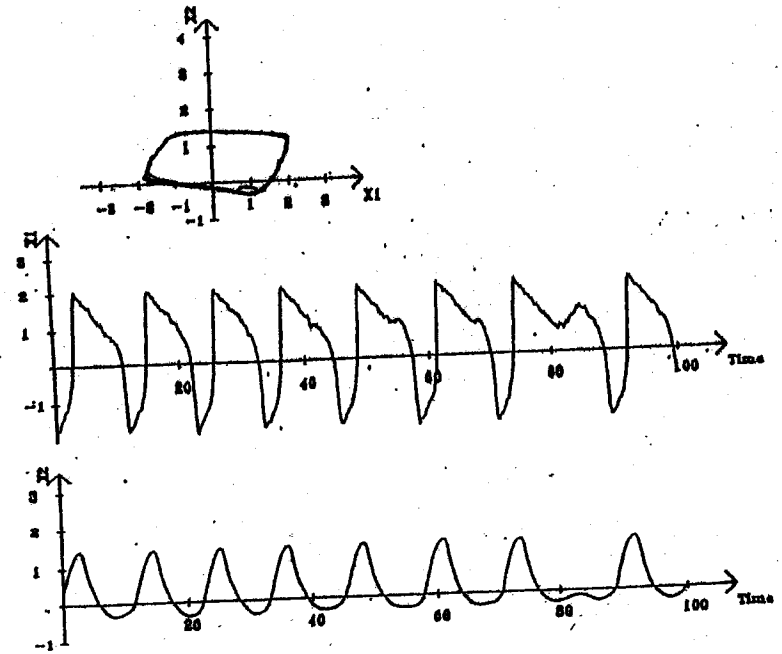
NOISY BONHOEFFER-VAN DER POL OSCILLATOR

- **BONHOEFFER-VAN DER POL MODEL**
  - 2-dimensional simplification of 4-dimensional Hodgkin-Huxley system of ordinary differential equations for modeling firing of a single neuron
  - effects of membrane imperfections and firing of nearby neurons can be simulated by the addition of low intensity noise in the voltage dynamics



KLOEDEN- PLATEN - SCHURZ, p. 220



Bonhoeffer-Van der Pol oscillator, weak noise $\sigma = 0.1$

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X^1 = *membrane voltage* X^2 = *membrane permeability*

$$dX_t^1 = c(X_t^1 + X_t^2 - \tfrac{1}{3}(X_t^1)^3 + z)dt + \sigma dB_t$$

$$dX_t^2 = -\tfrac{1}{c}(X_t^1 + bX_t^2 - a)dt$$

- **Parameters:** $a = 0.7,\ b = 0.8,\ c = 3.0,\ z = -0.34$
- **Limit cycle with** $\sigma = 0$

Effect of increase in noise