Dynamical Systems
Homework Nine
Due February 6, 2013

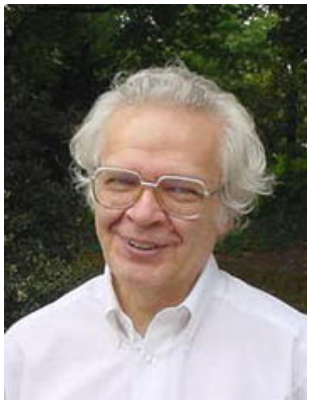

Figure 1: Otto Rössler. Figure source: `http://lifeboat.com/ex/bios.otto.e.rossler`.

1. Determine the bifurcation diagram for

$$\frac{dx}{dt} = rx + x^3 - x^5 \; . \tag{1}$$

   This bifurcation diagram is a good bit more complex (and more interesting) than the ones we have encountered so far. You will need to try out a number of different r values to get the full diagram. Optional: If you feel like practicing some calculus, determine the r and x values for all bifucations.

2. Here is another system of differential equations:

$$\frac{dx}{dt} = -y - z \tag{2}$$

$$\frac{dy}{dt} = x + ay \tag{3}$$

$$\frac{dy}{dt} = b + z(x - c) \; . \tag{4}$$

   Modify the Lorenz program from last class so that it calculates and plots solutions to these ODEs. Use the following values for the parameters: $a = 0.1$, $b = 0.1$, and $c = 14$. The resulting plots should be exciting.