

The Lorenz Attractor

The Lorenz attractor is a strange attractor that arises in a system of equations describing the 2-dimensional flow of fluid of uniform depth, with an imposed vertical temperature difference. In the early 1960s, Lorenz discovered the chaotic behavior of a simplified 3-dimensional system of this problem, now known as the Lorenz equations:

$$\frac{d}{dt}X = \sigma(Y - X) \quad (1)$$

$$\frac{d}{dt}Y = -XZ + rX - Y \quad (2)$$

$$\frac{d}{dt}Z = XY - bZ \quad (3)$$

The following figure shows the numerical solution of equations (1) to (3) calculated with $\sigma = 3$, $r = 26.5$ and $b = 1$. The complex 3-dimensional structure of this attractor is hard to see in a 2-dimensional plot. Therefore click on the image to start/stop a slow rotation.

Reference

- Lorenz, E. N. "Deterministic Nonperiodic Flow." *J. Atmos. Sci.* 20, 130-141, 1963.