

STATISTICS, PROBABILITY AND CHAOS

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The study of chaotic behaviour has received substantial attention in many disciplines such as biology, medicine, economics, chemistry, engineering, physics, just to name a few. Although it is often based on deterministic models, chaos is associated with complex, random behaviour and forms of unpredictability.

Actually, stochastic methods are well established with nonlinear systems theory. System bifurcations like period-doubling or intermittency, for example, can be observed through estimation of power spectra. Moreover, the concepts for nonlinear measures like correlation dimension or Kolmogorov-entropy are based on probabilistic descriptions. The definition of dimension originally is derived from the probability to find system states within volume elements of an infinitesimal diameter. This definition relies on the fact, that in case of chaotic system, the states in phase space converge to a fractal attractor set. In this sense, probabilistic descriptions are already incorporated in nonlinear system theory.

The understanding of some of these concepts is not a trivial task for a beginner student. We present multimedia tools, which can reduce this complexity. The student will experiment with the ideas presented to create fractal landscapes, chaotic systems and to compute fractal dimension.