

FRACTALS, RENORMALIZATION GROUP AND CHAOS IN DISTRIBUTED SYSTEMS

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Usually one connects symmetry with regular processes, temporal order, any type of structures. But researches of systems where the phenomenon of dynamical chaos (complicated non-periodic motion) can be observed have shown that concepts of symmetry are of significant importance for such systems. It was found that usually strange attractors, describing dynamical chaos, are fractals, i.e. they have structure that reproduces itself on smaller scales.

These objects proves to be invariant under certain renormalization group. Apparently, for the first time this fact has been rigorously proved in the theory of one-dimensional mappings for the Feigenbaum attractor. Symmetry enables the investigation of internal structure of the set in phase space.

In this report the fractal dimensions (characteristics used for description of fractal attractors) and numerical algorithms for their evaluation are discussed. We consider a number of examples that demonstrates the applicability of these approaches for the study of wide class of chaotic regimes in distributed systems. Among them are turbulent regimes in hydrodynamic systems, diffusion induced and spatio-temporal chaos that are characteristic of several oscillating chemical reactions.