

86-888 complex systems



The course is intended for second and third degree students for Exact Sciences and for advanced first degree students.

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In recent years there is a growing interest in complex systems, which appear in the nature as well as created by human. For example: The galaxies, the DNA molecule, the internet, climate and economical systems earthquakes and epidemic spread are complex systems. This interest is mainly due to the new mathematical and physical tools developed that led to a better understanding of these complex systems and phenomena.

Course Contents

Fractals - Fractal geometry, scaling laws, fractal dimension, self similarity, chaos and fractals, fractals in nature.

Percolation - phase transitions, critical exponents, universality, critical dimension.

Networks – classical networks, free-scale networks, network's robustness, WWW, population and networks immunization.

Models and Methods – self organized criticality (landslide and earthquakes), random walk (Levy walk, Brownian motion, diffusion), long term correlations (DNA, heartbeat rate, fluctuations of weather), synchronization (neuron and Parkinson, heart and respiration).



