ED2230 Chaos and Self-organization 6.0 credits

Kaos och själv-organisation

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for ED2230 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

Self-organization is a new way of addressing nature, economy, biology and many other aspects of man and environment. Described phenomena are typically far from static equilibrium, strongly influenced by the external environment and organize themselves through chaotic fluctuations.

Aim

Understanding for mechanisms that lead from chaotic behaviour to perfect order and harmony. Meaning of catastrophes like avalanches, earth quakes, stock market crashes and so on.

After completion of the course the student shall be able to

1. explain the ubiquitous power laws emerging in different fields

2. apply power laws to Gutenberg – Richter statistics of earthquakes, starquakes and solar flares

3. describe the sand-pile paradigm and quantify the algorithm

4. show the robustness and sensitivity to initial and boundary conditions

5. explain the origin of the self-organization using the game of life as the example

6. use the self-organization paradigm in addressing density and temperature profiles in tokamaks

7. create a Java-implementation of one of the selforganizing systems

8. use the program to qualitatively hint at some of the attributes of the system

9. write a report where to describe the model and implementations

Course contents

Chaos and self-organization. The Gutenberg-Richter law. Fractal geometry. Mandelbrot diagrams. The 1/f distribution. The sandpile model. Applications in plasma physics.

Course literature

Mandelbrot B., The Fractal Geometry of Nature, New York, Freeman, 1983.

Prigogine I., From Being to Becoming, San Francisco, Freeman, 1980.

Tendler M., Kontroll över Kaos i Starkt Magnetiserat Plasma, Fysik-Aktuellt, nr 2, s. 25- 28, 1997.

Examination

- ÖVN1 - Assignments, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Hand in exercises and group-work.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.