SYLLABUS

Chaos and Nonlinear Physics 7.5 credits F7030T

Kaos och Ickelinjär Fysik

Course syllabus admitted: Autumn 2023 Sp 1 - Present

DECISION DATE
2021-02-17

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LULEÅ TEKNISKA UNIVERSITET

Chaos and Nonlinear Physics 7.5 credits F7030T

Kaos och Ickelinjär Fysik

Second cycle, F7030T

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Fysik	Physics

Entry requirements

Physics 30hp and Linear Algebra.

Selection

The selection is based on 30-285 credits

Course Aim

It is well known that all physical systems (except in quantum mechanics) are nonlinear. Former limitations to linear systems was of practical nature, as they generally were the only ones which could be exactly solved. By working with user-friendly computer software like Maple the knowledge gained can be applied to problems that would be impossible to study by "paper and pen alone".
To teach basic methods of nonlinear physics, which the student can use in his/her continued education, reserch of future work.

Contents

1. The world - a nonlinear system!
2. Introduction to Maple
3. Modelling Nature
4. Nonlinear systems I: Examples from a) Mechanics, b) Population dynamics, c) Electrical circuits, d) Chemical osillations, e) Heartbeats
5. Nonlinear systems II: a) Structure formation, b) Solitons, c) Chaos
6. Topological analysis: a) Singular points, b) Phase-plane analysis, c) Bifurcations
7. Limit-cycles: a) Stability, b) Mathematical theorems
8. Forced oscillations: a) Examples, b) Chaotic oscillations, c)"Strange attractors" d) Chaos in Hamiltonian system
9. Nonlinear mapping: a) Logistic mapping, b) Fix-points and stability, c) Period doubling towards chaos, d) The Lyapunov exponent, e) 2-and 3-dimensional mappings, f) Chaos control
10. Nonlinear partial differential equations: a) Examples, b) Nonlinear superposition, c)Solitary waves d) Numerical simultation, e) Inverse scattering method, f) Solitons

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
Lectures.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
Hand-in assignments.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Overlap

The course F7030T is equal to F7001T

Course offered by

Department of Engineering Sciences and Mathematics

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Assignments	G U 3 4 5	7.5	Mandatory	A13	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Head Faculty Programme Director Niklas Lehto 2021-02-17

Syllabus established

by Department of Applied Physics and Mechanical Engineering 2010-02-23