

SYLLABUS

Nonlinear Physics with Maple 7.5 credits F7001T

Ickelinjär fysik med Maple

Course syllabus admitted: Autumn 2009 Sp 1 - Autumn 2009 Sp 2

DECISION

The syllabus was established by the Department of Applied Physics and Mechanical Engineering 2007-02-28, and remains valid from autumn 2007.

Nonlinear Physics with Maple 7.5 credits F7001T

Ickelinjär fysik med Maple

Second cycle, F7001T

Education level
Second cycle

Grade scale
G U 3 4 5

Subject
Fysik

Subject group (SCB)
Physics

Entry requirements

Selection

The selection is based on 30-285 credits

Examiner

Johan Hansson

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 similtation, e) Inverse scattering method, f) Solitons

Realization

Lectures, computer labs.

Examination

Hand-in assignments/final exam.

Voluntary practical experiments on nonlinear systems, giving bonus points in final grade.

Overlap

The course F7001T is equal to F7030T

Literature. Valid from Autumn 2007 Sp 1

Nonlinear Physics With Maple for Scientists and Engineers, latest edition

R.H. Enns, G.C. McGuire. (Contains CD-ROM).

Course offered by

Department of Engineering Sciences and Mathematics

Items/credits

Number	Type	Credits	Grade
0001	Homework assignment/Written exam	7.5	G U 3 4 5

Last revised

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