

Nonlinear System Design

2 units (selection)

Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Target For various nonlinear phenomena observed in physical, chemical, and biological systems, construction methodologies of numerical models describing their dynamical behavior are discussed. Analysis and design methods are also studied.

Outline Analysis and design of nonlinear dynamical systems are discussed: 1) description and characterization of dynamical systems, 2) qualitative theory of ordinary differential equations, 3) numerical method of analysis, 4) analysis of chaotic states and bifurcations 5) controlling chaos. Typical nonlinear phenomena are illustrated and analyzed by qualitative and numerical methods. Nonlinear system design problems are also discussed.

Style Lecture

Keyword *nonlinear dynamical system, bifurcation, system design*

Fundamental Lecture “Advanced Theory of Complex System Engineering” (1.0), “Topics of Analysis for Mathematical Science”(1.0), “Advanced Circuit Theory”(1.0)

Relational Lecture “Control System Design”(0.5), “Advanced Nonlinear Circuit Technology”(0.5)

Requirement None

Notice A lecture “Advanced Theory of Complex System Engineering,” available for the Master’s course is mutually cooperated with this lecture.

Goal acquisition of techniques for deriving model equations and proceeding bifurcation analyses.

Schedule

1. Introduction to dynamical systems
2. Fixed points, equilibria and their stability
3. Periodic solution and its stability
4. Analytic approaches for periodic solutions
5. Numerical approaches for periodic solutions
6. Local bifurcations
7. Calculation of bifurcation parameter values
8. Global bifurcations and its numerical analysis
9. Deriving model equations 1
10. Deriving model equations 2

11. Symmetry and its applications to calculations

12. Various bifurcation phenomena and chaos

13. Existence and numerical indices for chaos

14. practice 1

15. practice 2

16. answers and survey

Evaluation Criteria The total grade is evaluated by homework reports (70 %) and attendance of the class. (30 %)

Textbook not specified.

Contents <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216851>

Student Able to be taken by only specified class(es)

Contact

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Note

- ◇ This lecture is given in English.
- ◇ This lecture requires a 2-hour preparation study and a 2-hour review for comprehension.
- ◇ The achievement of every subject in the plan is evaluated by reports.