Advanced Control Theory

2 units (selection)

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Target〉 The purpose of this lecture is to explain the design theory of control systems based on the state space method. Furthermore, norms for signals and systems, systems analysis based on Linear Matrix Inequalities (LMIs) and robust control are outlined.

Outline〉 The state space method describes the dynamics of systems with the state equation, and it has a merit that it can deal with multi-input multi-output systems as well as single-input single-output systems. In this lecture, among the design methods belonging to the state space method, the linear-quadratic regulator is demonstrated. In addition, norms for signals and systems and calculation of norms for systems are presented. Furthermore, systems analysis for dynamical systems based on Linear Matrix Inequalities (LMIs) and the concept of robust control are outlined. (lecture style)

Style〉 Lecture

Keyword〉 ***optimal regulator, robust control, norms for signals and systems, linear matrix inequalities***

Fundamental Lecture〉 "**Basic Theory of Systems**"(1.0)

Relational Lecture〉 "**Control Theory (II)**"(0.5), "**Control System Design**"(0.5)

Requirement〉 Basic knowledge about the linear algebra and differential equations is required to attend this lecture.

Notice〉 Take notes carefully. Preparation and review are essential.

Goal〉

1. To understand the notion of the system structure in the state space method (Lectures 2-5)
2. To master the design method of the linear-quadratic regulator (Lectures 1,6,7)
3. To understand the notion of norms for signals and systems (Lectures 9-12)
4. To master the analysis method of dynamical systems via Linear Matrix Inequalities (LMIs) (Lectures 13-15)

Schedule〉

1. What is the linear-quadratic regulator?
2. Eigenvalues, eigenvectors and diagonalization of matrix
3. Quadratic form and positive definiteness of matrix
4. Controllability
5. State variable transformation and equivalence of systems
6. Linear-quadratic regulator
7. Solving Riccati equation
8. Examination for the first half (for goals 1 and 2)
9. Norms and normed space
10. Norms for signals and systems
11. Calculation of norms for sysems
12. Norms for systems and design specifications
13. Linear Matrix Inequalities (LMIs)
14. Systems analysis via Linear Matrix Inequalities (LMIs)
15. Robust control
16. Examination for the second half (for goals 3 and 4)

Evaluation Criteria〉 Mainly by the examination.

Textbook〉 Not used.

Contents〉 http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216724

Contact〉

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