Aerospace Control1

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1. Course Description

In this course, students understand the basic concept of feedback control, and learn how to describe the controlled system (differential equations and transfer functions) and how to analyze the response (stationary characteristics, etc.). In addition, students will learn the features and design methods of PID (proportional + integral + differential) control, which is the basic control technology. In addition, programming training using control system analysis and design software is also conducted.
In this course, you will acquire basic knowledge about DP1.

2. Course Objectives

・Able to model the controlled system by the transfer function
・Able to analyze controlled system by time response
・Understand feedback control design techniques
・Learn the basic usage of MATLAB and Simulink

3. Grading Policy

In the class, the students are required to give exercises after the explanation, and the students must submit their answers. If you have any questions or requests for the class, please submit them with your answers. Exercises are also provided with explanations and feedback in the latter half of the lesson, collected, and the response and understanding of the students are grasped to advance the lesson.
The evaluation focuses on the final exam (80%), and also takes into account the answers to the questions given during class (10%) and the contents of reports on practical training (10%). The final exam can be done if you have done the questions during class.

4. Textbook and Reference

Textbook
佐藤 和也, 平元 和彦, 平田 研二　はじめての制御工学
　講談社
ISBN 978-4-06-155791-8
Reference
宇津木 諭　絵ときでわかる機械制御　オーム社
ISBN4-274-20287-9
木村 英紀　制御工学の考え方　講談社ブルーバックス
ISBN 978-4062573962
川田 昌克　MATLAB/Simulinkによるわかりやすい制御工学　森北出版
ISBN 978-4627917217

5. Requirements(Assignments)

An understanding of the basics of differentiation, integration and complex numbers is necessary to understand the content of the lesson. If you do not understand them well, study in these fields.
Preparation: Please read through the textbooks in the range that you will study in the next class, and find out any questions or questions that you do not understand in reference books or websites in advance and summarize them in a notebook (about 1.5 hours)
Review: Work on homework exercises. Review the class and create a report of the exercises to deepen your understanding (about 1.5 hours)

6. Note

Lectures are practiced using MATLAB as appropriate, even if not explicitly written.
Lecture content may change depending on progress.

7. Schedule

[1]　　　　Introduction, overview of automatic control
[2]　　　　Relation between motion and differential equation, differential equation and control engineering
[3]　　　　Mathematical model of the system
[4]　　　　Laplace transform, transfer function, block diagram
[5]　　　　Laplace transform, inverse Laplace transform, impulse response, step response of basic functions
[6]　　　　How to use MATLAB (practice)
[7]　　　　How to use MATLAB Simulink (practice)
[8]　　　　Time response analysis of transfer function (transient and steady-state characteristics), first-order system
[9]　　　　Second-order system, relationship between response and pole
[10]　　　System stability, stability conditions, steady-state characteristics, feedback / feedforward control
[11]　　　Design of feedback / feedforward control system
[12]　　　PID control (including MATLAB training)
[13]　　　PID parameters and poles
[14]　　　PID control training using an aircraft model (MATLAB training)
[15]　　　Test, Summary