

宇宙機制御工学

～制御系のCADツール～

CAD tool for control system

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Tatsuaki Hashimoto

Schedule of the class

	Friday 13:00 ~ 14:40	
14-Oct	Spacecraft control overview	
21-Oct	Coordinates, orbital dynamics, and attitude dynamics	
28-Oct	Attitude sensors and attitude determination algorithm	
4-Nov	Navigation sensor hardware and image processing	
11-Nov	Attitude and orbit control actuators	
18-Nov	Attitude determination and control for spin-stabilized spacecraft	
25-Nov	No class (Komaba Festival)	
2-Dec	Attitude determination and control for three-axis-stabilized spacecraft	
9-Dec	CAD tool for spacecraft control	
16-Dec	Attitude and orbit control system for scientific satellites	
6-Jan	No class	
12-Jan	Project management for scientific satellites	
13-Jan	No class (Entrance Examination)	
20-Jan	Lessons learned from real operation	
27-Jan	Backup	

Control CAD

- Calculation tools for matrixes and vectors are useful for various area such as control and estimation. “MATLAB” is a famous commercial. There are some free tools which are almost compatible with MATLAB. They are “Octave” or “Scilab”, for example.
 - <http://www.mathworks.com/>
 - <http://www.scilab.org/>
 - <http://www.gnu.org/software/octave/>
- They have some special sub routines called “tool boxes”. Using tool boxes, we can not only calculate complex matrix operations but also solve equations, design controllers, or display some figures.
- In case of MATLAB or some software, they have some graphical input interface such as “Simulink”. We can simulate some control systems only putting and connecting some system blocks on a PC screen.

Let's try Matlab or Octave

1. Matrix Calculation

- Sum, multiply, inverse matrix, Eigenvalue, rank, etc.
- Coordinate conversion, attitude estimation, Controllability, Observability

2. Numerical simulation

- Simulation software can be written as a programming language
- Three dimensional calculation becomes easy using matrix expression.
- Some control Toolboxes are available.

3. Design controller

- Design tools and evaluation tools are provide as Toolboxes
- Bode plot, Root locus, H_∞ design, μ Synthesis, Neural net, Fuzzy
- Some Toolboxes for implementation are provided so that

Reference site for Octave tutorial

Japanese [/http://www.ecs.shimane-u.ac.jp/~kyoshida](http://www.ecs.shimane-u.ac.jp/~kyoshida)

English http://en.wikipedia.org/wiki/GNU_Octave

Textbook for Octave

- 吉田和信 : Octaveによる動的シミュレーション入門、2002
[http://www.ecs.shimane-u.ac.jp/~kyoshida/octave\(2002\).pdf](http://www.ecs.shimane-u.ac.jp/~kyoshida/octave(2002).pdf)