Syllabus 2019 System Information Sciences

system Control Science

■ Basic information

<table>
<thead>
<tr>
<th>held this year:</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>instructor(s)</td>
<td>Prof. Kazuya Yoshida (Graduate School of Engineering) Assoc. Prof. Yasuhisa Hirata</td>
</tr>
<tr>
<td>room</td>
<td>Mech-2</td>
</tr>
<tr>
<td>schedule</td>
<td>The first half year (Wednesday) 8:50-12:00 (The Quarter System)</td>
</tr>
<tr>
<td>begins on</td>
<td>06/09</td>
</tr>
</tbody>
</table>

■ Objectives and outline

Lectures are given in English.

1. Objective
Systems with novel mechanisms are developed in many advanced applications including medical support, welfare, space exploration, and disaster rescue activities. The objective of this lecture is to learn methodologies for designing highly complicated mechanical systems through modern linear and nonlinear control systems.

2. Abstract
First, modern linear control system design methods are reviewed. Numerical examples are given and students are required to solve examples using MATLAB. Next introduction of nonlinear dynamical systems is given and methods for analysis of nonlinear systems, including phase analysis and Lyapnov methods, are presented. Finally nonlinear feedback control designs are described.

3. Goals
Understanding the following topics are shown as goals of this lecture:
- Linear system design and how to use software tools
- Stability of nonlinear dynamical equations
- Phase analysis and Lyapnov methods
- Feedback linearization
- Robust nonlinear control system design

■ Class plan

1. Linear system design
   State space, Linear quadratic optimal control, Kalman filter
2. Stability of nonlinear dynamical equations
   Phase analysis, Equilibrium points, Lyapnov methods, Linearization
3. Feedback linearization
   Input–State linearization, Feedback linearization of SISO systems and MIMO systems
4. Robust nonlinear control system design
   Passivity, Robot systems, Adaptive systems

■ Evaluation

Final exam. Reports and attendance may be considered.