## Advanced Control Systems (3 Credits)

### 现代控制系统

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<th>Instructor</th>
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<td>Ying TAN (<a href="mailto:yingt@unimelb.edu.au">yingt@unimelb.edu.au</a>) Melbourne School of Engineering, University of Melbourne</td>
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### Synopsis

This subject provides an introduction to modern control theory with a particular focus on state-space techniques and optimal control. Students will study topics including:

- System modelling, state-space models, Lyapunov stability theory, and linearization;
- Controllability and observability of linear-time-invariant system, state feedback and pole placement, output feedback and observer design;
- Linear quadratic regulators, moving-horizon predictive control with constraints, and dynamic programming.

This material is complemented by the use of software tools (e.g. MATAHB/ Simulink) for computation and simulation.

### Offering

2015 Julmester

### Audience

Year 3 & 4 Undergraduate and Graduate Students

### Classroom

Room xxx, Teaching Bldg. No. XX, Peking University

### Schedule

Class: 2-5 PM, M-F, July 6–24, 2015; Final Exam: 2-5 PM, July 25, 2015

### Objective

On completing this subject the student should be able to:

- Apply fundamental state-space techniques in the analysis and design of linear feedback control systems, as they arise in a variety of contexts;
- Formulate control engineering problems in terms of optimising an objective function subject to constraints;
- Use software tools to simulate and design the linear control systems.

### Topics

**Part 1: State-space modelling**

- linear time-invariant systems
- nonlinear time-varying systems
- linearization

**Part 2: Properties of linear time-invariant systems: controllability and observability**

**Part 3: Controller design and implementation**

- Design full state feedback controller using pole-placement

**Part 4: Internal model principle to track a reference or reject a disturbance**

**Part 5: Optimal control**

- Optimization problem
- Motivation of optimal control
- Two methods to solve optimal control problem
- LQR problem and its solution

**Part 6: Model Predictive Control**

### References

2. Feedback Control of Dynamic Systems. G. Franklin et al. 5th ed. Addison-Wesley
5. Feedback Systems: An Introduction for Scientists & Engineers

### Grading

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