BASIC CONTROL SYSTEMS

COURSE INTRODUCTION

HANSHU YU

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CONTENTS

- Learning objectives
- Course material & structure
- Preliminary knowledge
- Potential job opportunities
- Introduction Assignment (Today!)

LEARNING OBJECTIVES - KNOWLEDGE

- **Modelling physical systems using the correct mathematical tool**

- **Have a basic understanding about simple control systems**

- **Know about how to design and tune a simple controller**

- **Understand classical analysis and design tools for stable control of simple systems.**

LEARNING OBJECTIVES - KNOWLEDGE

- **Have a basic understanding of the fundamentals of classical control theory.**

- **Apply the theory into engineering practice.**

Control theory?

A branch of applied mathematics.

LEARNING OBJECTIVES - SOFT SKILLS

Lab Skills

Report writing

Presenting

Collaboration

- We want you to learn from each other!
- Ask questions in your group, study together, help each other with assignments

COURSE MATERIAL

Notes, lecture slides, companion exercises, old exams:

https://hanshuyu.com/material/LN-CCS.html

Other recommended reading material:

Feedback Systems: An Introduction for Scientists and Engineers,
1st edition, Karl J. Åström and Richard M. Murray

Modern Control Engineering,
any edition, Katsuhiko Ogata

PRELIMINARY KNOWLEDGE

- **Some understanding & computational skills in:**
    - **Calculus**
    - **Complex analysis**
    - **Integral transforms**
    - **High school level physics and algebra**

- **Some experience in:**
    - **Working in a team**
    - **Writing reports**
    - **Making presentations**

COURSE STRUCTURE - DAILY ACTIVITIES

3   weeks

      10   lectures   (~1.5h * 10)

      2   presentations   (1+1)   17.5%*2

      3   experiments   (2+1)   15%

      1   written exam   50%

WARNING

Theoretical course

But **very practical if you understand the principles**

Higher workload

Involves a lot of self-study

Encourages a lot of group-study

Extremely useful

WARNING - STATISTICS

Historical passing rate 1st exam:

57% ~ 65%

Written exam raw score number >60%:

40% ~ 50%

WARNING -
BEHAVIOURS CORRELATED WITH (ALMOST) EXAM FAILURE

- **I can just skip the lecture and self-study at home with some book I found in the library/internet.**
  (63, 60, 71, 54, 53, 47, 20, 32, 78, 92)

- **I do not have to participate in the group work.**
  (66, 40, 41, 20, 48, 55, 41, 34, 54, 60, 60)

- **I am afraid to ask questions.**
  (50, 40, 68)

- **Cheating in the exam**
  (caught 2 last year)

HOW TO STUDY? (RECOMMENDATIONS)

Think, communicate, and interact with me in lectures.

Do the homework assignments in sync with the lecture.

Try solve a few extra problems provided.

Read the reading material if you have time.

Discuss and collaborate with your peers.

Do the experiments & simulations while you can.

HOW TO STUDY? (WARNING)

Treat online material like (video tutorials) with care.

They could be wrong.

COURSE STRUCTURE - DAILY ACTIVITIES

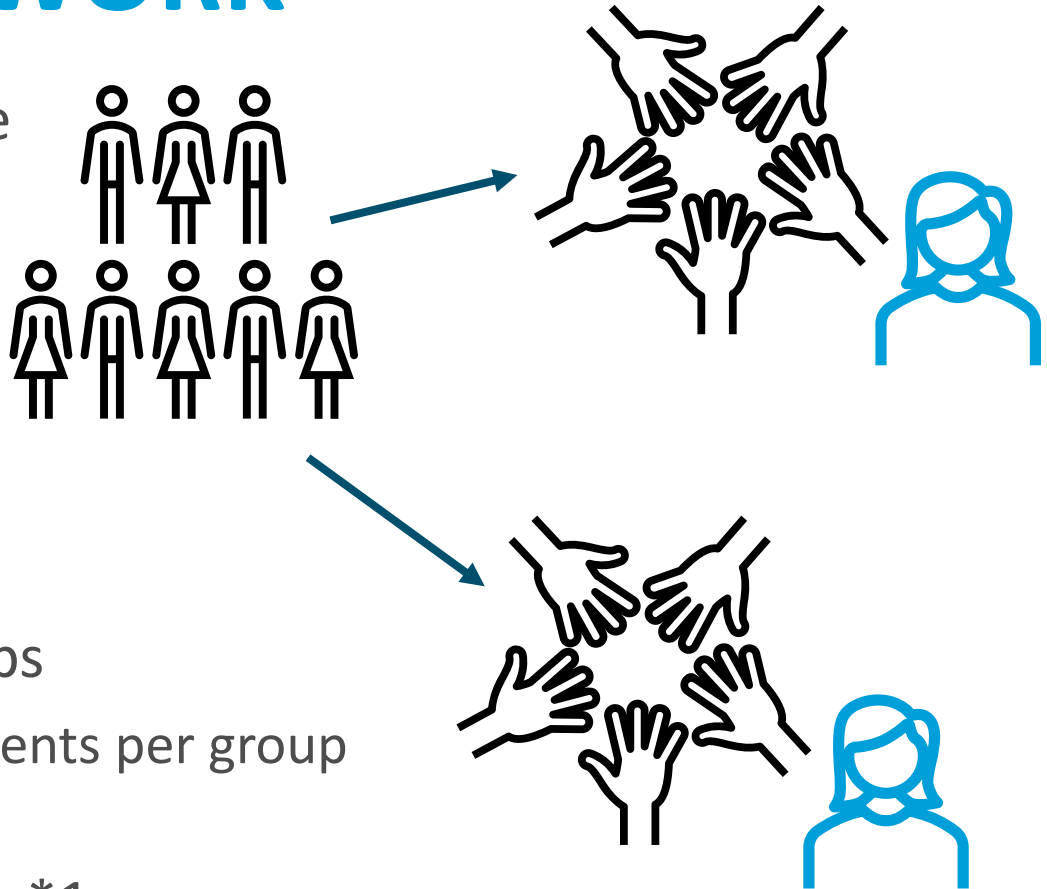| No teaching activities |
| Lecture |
| Guided Instructions |
| Lab Experiments |
| Presentation |
| Workshops |

→ Always bring your laptop and notebook/pens to class, changes can still be made last minute!

→ No gaming in the classroom at anytime! If you would like to game, do that in the dormitory or internet café.

COURSE STRUCTURE - GROUP WORK

Group structure

→ Project groups

  7 ~ 8 students per group

→ Group leader *1

  Responsible for **homework hand-in** and **communications** with the teaching staff

HANDING-IN YOUR HOMEWORK

File name format:

GroupX_assignment1.pdf
GroupX_assignment2.pdf
GroupX_report.pdf

You upload your pdf to the server using a local area network within a **fixed time-window**!

Wifi name: Course_admin

Wifi password: 37582968

Each group will receive a server ipv4 address to hand-in your pdf, this will be announced by the teaching assistant.

GRADING AND EXAMINATION

Presentation:

- **17.5%** Presentation for assignment 1   (group score)
- **17.5%** Presentation for assignment 2   (group score)

Report:

- **15%** Experiment report   (group score)

Peer Assessment factor: **f**   (individual)

In-course raw score:

- sum of raw presentation and experiment scores.
- The raw scores should be the same for every student in the same group.

In-course final score for each student:

- **50%**   raw score * **f** (max 50)

3 weeks in-course contents

Final Exam (3 hours):

- **50%**   Exam is organised by SMU after our 3-week course

GRADING AND EXAMINATION

3 weeks in-course contents

Presentation:

- **17.5%** Presentation for assignment 1 (group score) - **75**
- **17.5%** Presentation for assignment 2 (group score) - **80**

Report:

- **15%** Experiment report   (group score) - **70**

Peer Assessment factor: **f**   (individual) - **1.1**

In-course raw score: *75*0.175+80*0.175+70*0.15 = 37.625*

- sum of raw presentation and experiment scores.
- The raw scores should be the same for every student in the same group.

In-course final score for each student: *37.625*1.1=~~41.3875~~*

- **50%**   raw score * **f** (max 50)   **41.4**

Final Exam (3 hours):   *75*0.5 = 37.5*

- **50%**   Exam is organised by SMU after our 3-week course

GRADING AND EXAMINATION

Presentation:

3 weeks in-course contents

- **17.5%** Presentation for assignment 1 (group score) - **75**
- **17.5%** Presentation for assignment 2 (group score) - **80**

Report:

- (group score) - **70**

Peer Ass (individual) - **1.1**

In-course *0*0.15 = 37.625*

TOTAL

~~78.9~~   **79**

≡ **3.0**

- nt scores.
- every student in the same group.

In-course final score for each student: *37.625*1.1=~~41.3875~~*

- **50%**   raw score * **f** (max 50)   **41.4**

Final Exam (3 hours):   *75*0.5 = **37.5***

- **50%** Exam is organised by SMU after our 3-week course

JOB OPPORTUNITIES(INDUSTRY)

Industries these people in:

They know & use control theory:

- Aerospace Engineer
- Mechanical Engineer
- Systems Engineer
- Biotechnical Engineer
- Robotics Engineer
- Power Electronics Engineer
- Integrated Circuit Designer
- ……

- Robots & Vehicles
- Manufacturing factories
- Microelectronics & semiconductors
- Energy
- Chemical plants
- Smart infrastructure
- Bio-medical instruments
- Modern technology farming
- Consultancy
- Finance & banking
- High Frequency Trading
- IT & network
- Aerospace   …………

INTRODUCTION ASSIGNMENT

Take a group photo
Put it in a presentation (ppt)
Include everyone's English & Chinese name
+ a special skill (Good at drawing, can do a backflip, great at KTV??)
Make clear who is the group leader

Tell us a little about yourselves in a presentation this afternoon!

~8 minutes

Group leader

English name
Special skill

QUESTIONS ?

If you have questions, ask them through during the lectures or work sessions.

GOOD LUCK AND HAVE FUN WITH THE BCS COURSE!