Computerized control - Introduction

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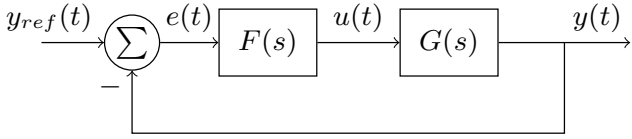
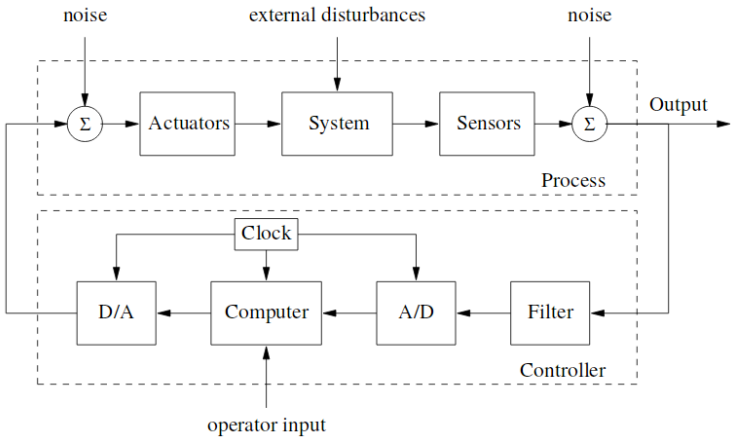
Feedback control

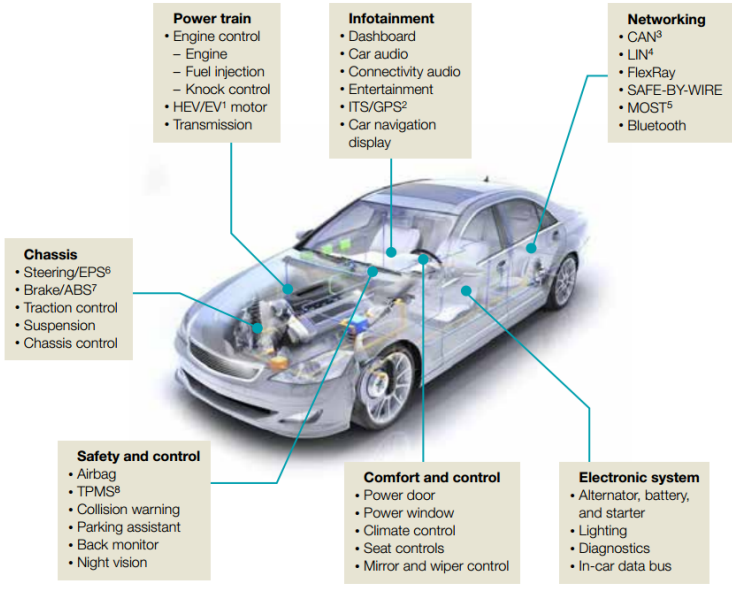


Feedback control



Why computerized control?

Computers everywhere



Discrete design can give better performance

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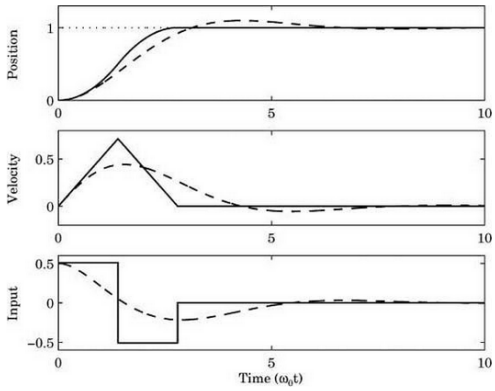


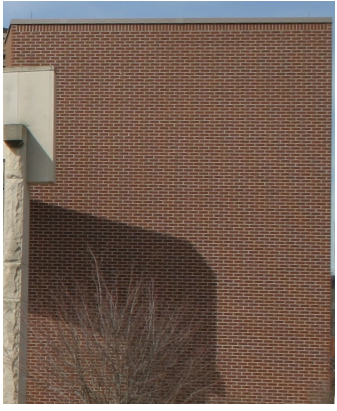
Figure 1.9 Simulation of the disk arm servo with deadbeat control (solid). The sampling period is $h = 1.4/\omega_0$. The analog controller from Example 1.2 is also shown (dashed).

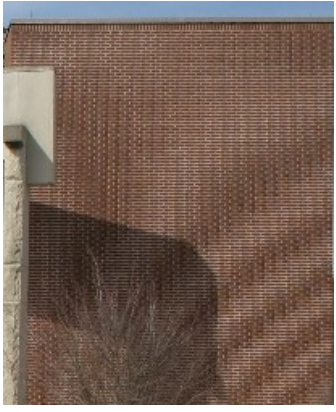
Why computerized control?

- Almost all control systems are implemented on computers/microcontrollers
- Controllers designed in continuous-time must be discretized to be implemented on a computer - What does this mean for the performance?
- Design that takes into account the discrete nature of the computer can give better performance

Challenges with computerized control

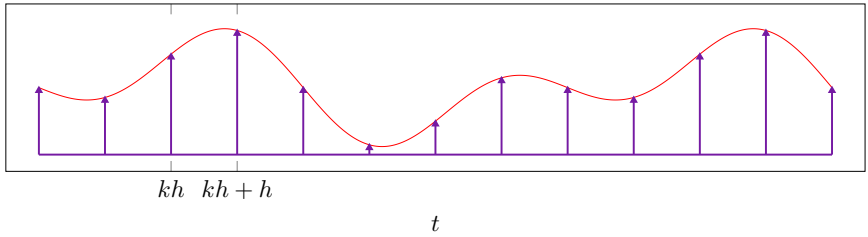
Aliasing





Challenges with computerized control

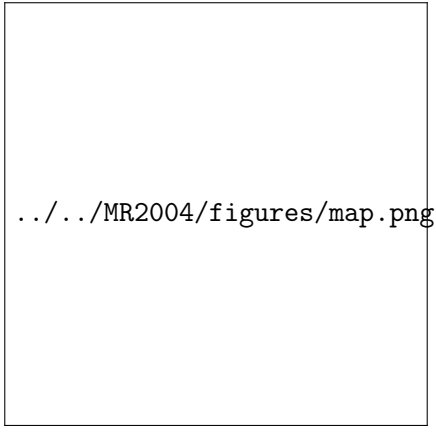
Sampling causes delay



Goal of the course

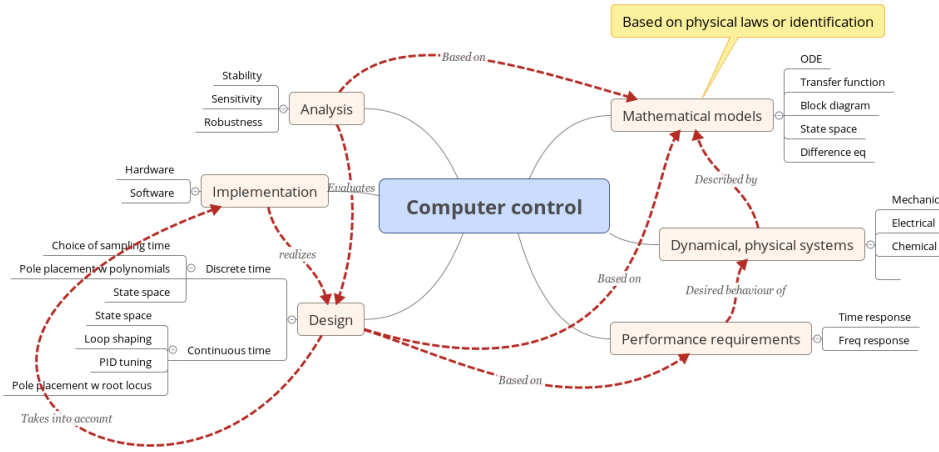
To be able to analyze, design and implement an appropriate discrete-time controller to meet given performance criteria.

Who am I?

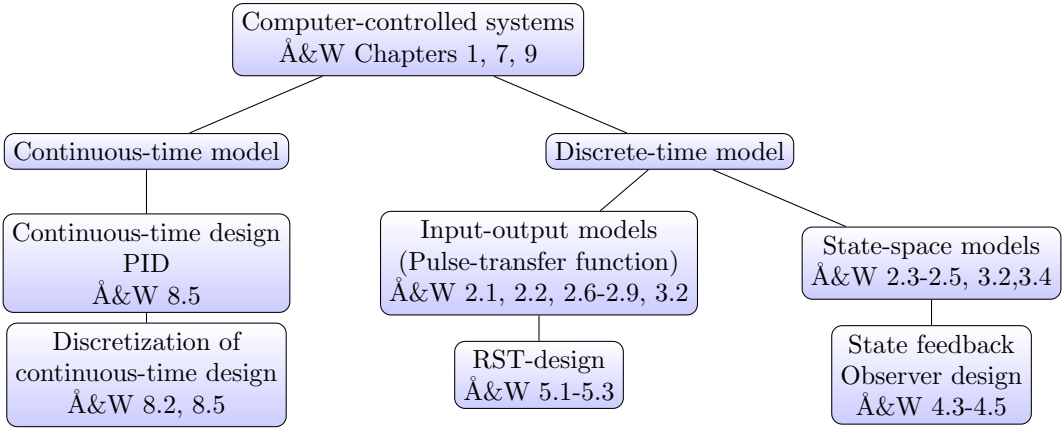


Who are you?

Control concepts



Course overview



Discrete time vs continuous time

Continuous time	Discrete time
$y(t)$	$y(kh)$
$\mathrm{p}\, y \triangleq \frac{d}{dt} y$	$\mathrm{q}\, y \triangleq y(kh+h)$
$(\mathrm{p}+a)y = bu \;\Leftrightarrow\; \frac{d}{dt}y + ay = bu$	$(\mathrm{q}+\alpha)y = \beta u \;\Leftrightarrow\; y(k+1) + \alpha y(k) = \beta u(k)$
$Y(s) \triangleq \mathcal{L}\{y(t)\}$	$Y(z) \triangleq \mathcal{Z}\{y(kh)\}$
$Y(s) = G(s)U(s) = \frac{b}{s+a}U(s)$	$Y(z) = H(z)U(z) = \frac{\beta}{z+\alpha}U(z)$
Pole of the system: $s + a = 0 \;\Rightarrow\; s = -a$	Pole of the system: $z + \alpha = 0 \;\; z = -\alpha$

How we will work

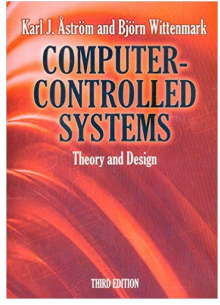
Prepare, prepare, prepare for classes:

1. Read text material and watch video
2. Solve quizz (test) on Blackboard (up to 100p, accounts for 1% of final grade)

In class:

1. Review of material
2. Work with concepts
3. Problem solving
4. Summarize

Course book



Buy ebook at Google Books (525 MXN)

Homework

- About every second week
- Solved individually, handed in on Blackboard
- Each homework accounts for 4% of final grade (except first hw which is 2%)

Project

- Implement controller on arduino, accounts for 10% of final grade
- Groups of 4 (self-elected)
- Partial reports (20p)
- Final report (30p)
- Demonstrate working open-loop setup (10p)
- Demonstrate controller design and working closed-loop system (20p)
- Individual journal (10p)

Examination

- Quizzes 10%
- Homework 18%
- Project 10%
- 2 partial exams (1.5hrs) 36%
- Final exam (3hrs) 26%

Coming up

- Homework 1: Repetition of stuff from control engineering. On Bb.
- See preparation instructions for next week on Bb