Introduction to Control

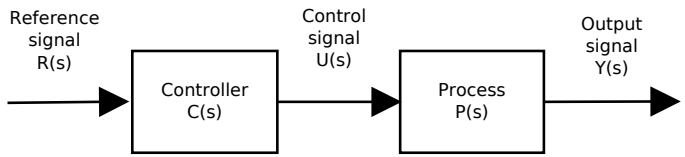
July 20, 2015

Outline

An introduction to control

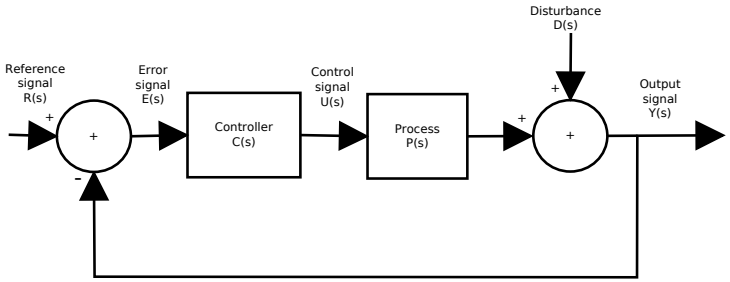
What is control?

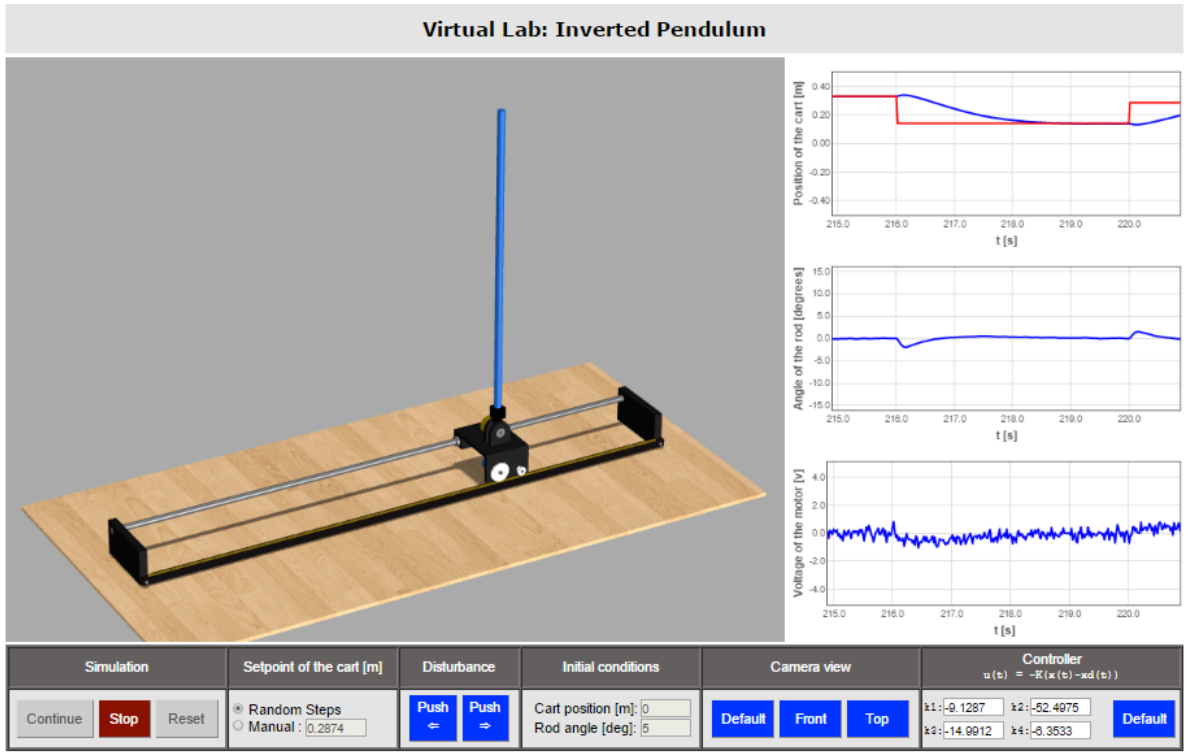
- The goal is to find an input (control signal U(s)) such that the process produces the desired output
- Open loop control system: the actual output signal has no effect on the control action



A general set-up of a closed loop system

- We will focus on closed loop control systems





KU Leuven/ESAT
Oscar Mauricio Agudelo
Bart De Moor

Figure: Inverted Pendulum

Concrete Control

- On-off controller
  - Thermostate at home
- **PID controllers, Lead and lag compensators (this course)**
  - Cruise-control in your car
- More advanced controllers
  - STATE-space feedback controllers
  - Model Predictive Controller (MPC)
  - Fuzzy Control
  - Neuro-fuzzy Control
  - ...

Outline

What is good control?

- Before we will start to design control systems we will first focus on the question. What is good control?
- It depends on the application
  - Stability
  - Disturbance rejection
  - Reference tracking (speed)
  - Sensitivity to errors on model
  - Etc...

Examples: stability

Figure: Space shuttles are like inverted pendulums. How do you make sure they don't flip over.

Examples: Disturbance rejection

- Your body will try to keep the temperature in your body as constant as possible. No matter what the outside temperature is. Two people will have almost the same body temperature.

Figure: Flickr.com, tent86, Marathon Des Sables 046

Figure: Jack Zalium, Enduring, https://creativecommons.org/licenses/by-nd/2.0/

Examples: Reference tracking

Figure: Audi has a system for automatic driving in traffic jams. The audi will follow the car in front of him at an appropriate distance. youtube

Exercise: name the correct property