

# Control

## Control systems and Computer Networks

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Lecture 8.2

# Digital Control

- ▶ The majority of embedded systems provide some form of control
- ▶ Monitor some property of a system
- ▶ Decide on what value it *should* be
- ▶ Drive the inputs to the system in such a way, so that the property reaches it's desired value.

## Some terms

**Plant** The system you want to control (older term)

**System** the thing controlled

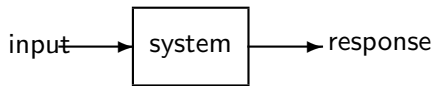
**Process variable** The property measured,

**Set-point** the desired value of the *process-variable*

**Control input** some property that the controller can affect, causing a change in the monitored *process variable*

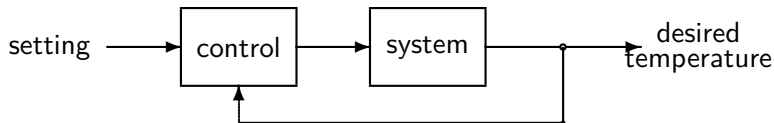
**Controller** The algorithm and hardware that decides what inputs to use to move the *process variable* to the *set point*

# Basic view of a system



- ▶ A system can be anything, from the heating of a house, speed of a car, . . .
- ▶ Some *inputs* can be changed
  - The heating can be turned on or off
  - The throttle can be opened or closed
- ▶ The system responds in some way that can be measured, temperature, speed, pressure, . . .

# Control loop



Adding a control loop

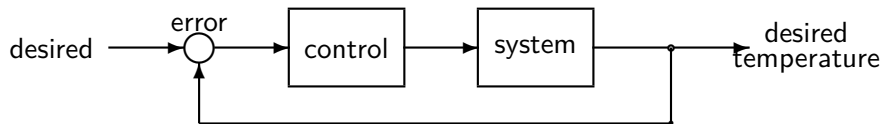
- ▶ Monitor the temperature
- ▶ compare with the desired temperature
- ▶ do something to the system to change the temperature as needed

**Feedback control**

## We're not going too deep

- ▶ You can do whole Master's degrees on Control Engineering
- ▶ Complex Mathematics
  - Fourier analysis
  - Laplace transforms
- ▶ You'll be please to know we're not going there here.
- ▶ But I want to give you an insight into the principles

# feedback controller



- ▶ Measure property
- ▶ Check desired value
- ▶ Calculate error between desired and current value
- ▶ Use error to decide on what to do, how to change inputs

# An Example

## Domestic heating

1. Set temperature on control
2. Measure room temperature
3. control:
  - if too hot turn heating Off
  - if too cold turn heating On
4. Repeat every second, minute or so.