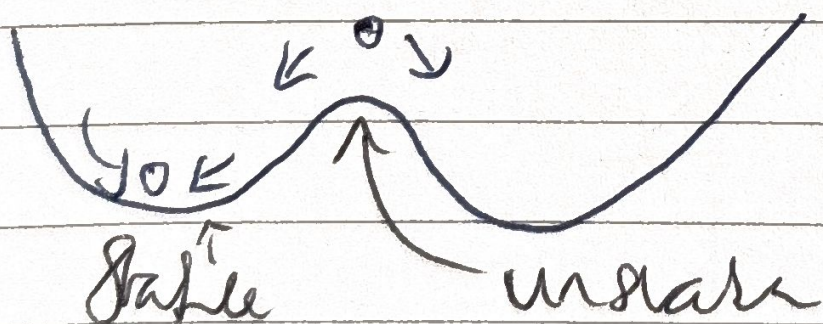# Week 3.² - Negative feedback

Main points:
- the basic principle of negative feedback
- Neg feedback tends to lead to Stability
  ↳ Pos = instability
- Stability w/out controls
- Delays in feedback loops

today
- Stable & unstable equilibria:
- Most intro to neg feedback controls

Stable equilibria   vs   Unstable

Stable   unstable

- Stable = drawn to a point
- unstable = can be balanced by force will change point. Hard to keep @ point

- Standing up straight is an example of an unstable equib
- An upright object w/ no stabili will naturally fall
- We use negative feedback to adjust & control our upright beans

Negative feedback Control

• Controlled system often referred to as the Plant
• Output of sys = controlled variable
• refence signal = Desired Plant output
• Neg feedback control = Error based Cont
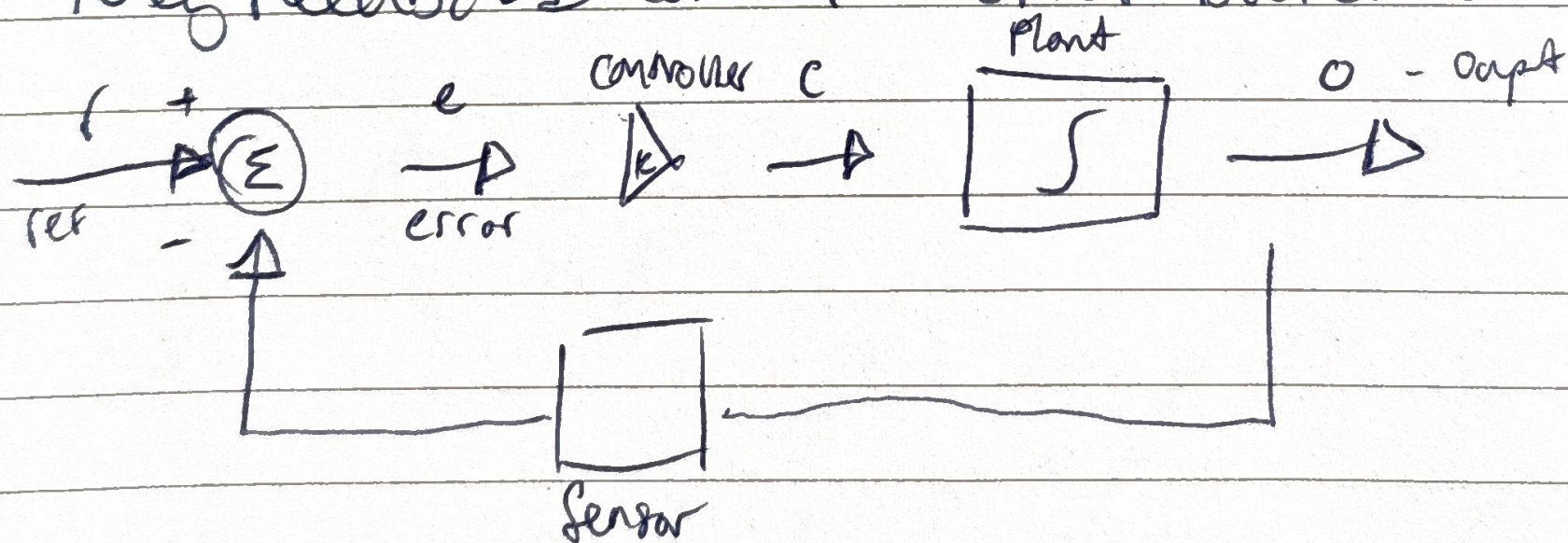
• Actual output of Plant is fed back to the controller so the controller acts on the error
• error = Dest between Desired & actual

Sensors often have delays or imperfect

e.g of feedback systems
- Drones x fluid dynamics
- & steering vechicly
- unicigeu

① On paper example:

$$ r \rightarrow o \rightarrow e \rightarrow c \rightarrow o $$

$r = 10 \qquad k = 0.1 \qquad t = 0 \qquad o = 0$

each step the following calc takes place:

$e = r - o$

$c = ke$

$o_{t+1} = o_t + c_t$

t	o	e	c	over time the
0	0	10	1	output = the
1	1	9	0.9	input = 10
2	1.9	8.1	0.81	
3	2.71	7.29	0.729	
n	≈10	0	0	