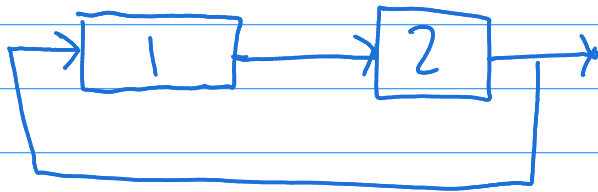


## 1.1 What is Feedback?

Dynamic System  $\rightarrow$  Change with time

Feedback  $\rightarrow$  Two or more systems connected so that each system influences the other.



Closed Loop

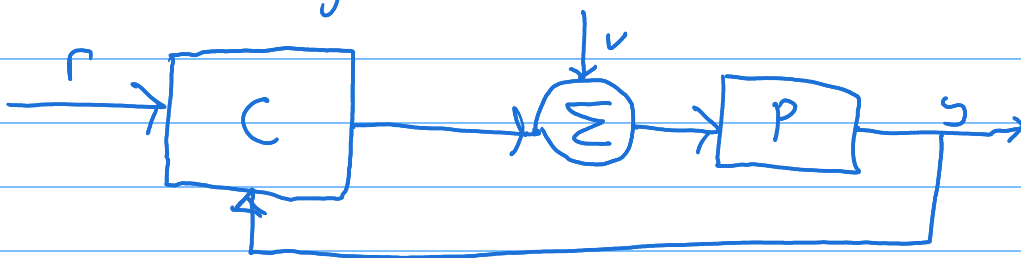


Open Loop-

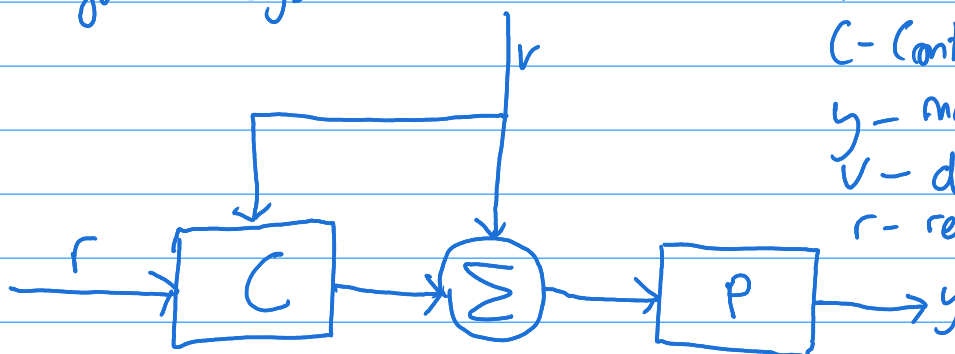
Negative feedback = decrease effects of disturbances

Positive feedback = disturbance is further increased by feedback.

Feedback System:



Feedforward System:



P - Process

C - Controller

y - measured output

v - disturbance

r - reference signal

## 1.2 What is Feedforward?

Feed back = reactive

Feedforward = able to measure disturbance and take corrective action.

<u>Feedback</u>	<u>Feed forward</u>
<ul style="list-style-type: none"><li>- Closed loop</li><li>- Acts on deviations</li><li>- Robust to model uncertainty</li><li>- Risk for instability</li></ul>	<ul style="list-style-type: none"><li>- Open loop</li><li>- Acts on plans</li><li>- Sensitive to model uncertainty</li><li>- No risk of instability</li></ul>

## 1.3 What is Control

Feedback loop: Sensing, Computation, Actuation

Objectives:

- Stable (bounded inputs give bounded output)
- Achieve desired behaviours

## 1.4 Uses of feedback and control

- Unstable system can be stabilized

Uses:

- Power generation and transmission
- Telecommunications
- Aerospace and transportation

- Materials and processing
- Instrumentation.
- Robotics
- Networks and Computing Systems
- Economics
- Feedback in nature

## 1.5 Feedback Properties

Base Corrective Action on difference between desired and actual performance.

- Robustness to Uncertainty
- Design dynamics
  - ↳ Stabilise unstable systems
  - ↳ Speed up sluggish systems
  - ↳ Hold drifting operating point constant.
- Create modularity
  - ↳ Replace individual components without having to modify the entire system.

## Questions:

1. Toilet Stop Cock:

Sensing mechanism: float

Control mechanism: valve

Control Law: Stop the water supply when the tank is full

↳ Without control the tank would overflow

1.2 .

