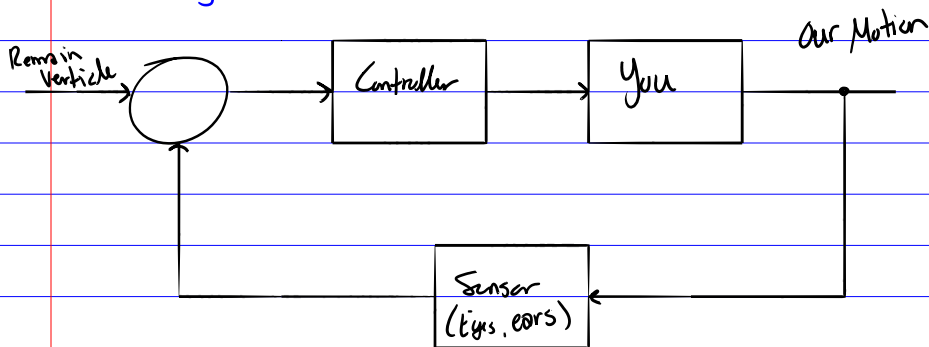# Two Primary Forms of Control Systems

Open Loop & Closed Loop

↓

No automatic correction
for changes in the environment
or the system itself

Automatic correction
for changes in the environment
or the system itself

🔖 Closed Loop Block Diagram
Standing on 1 foot

Remain
Verticle → ◯ → | Controller | → | You | → Our Motion

| Sensor |
| (Eyes, ears) |

Controller also called compensator or equalizer

🔖 Block diagram of Control Systems

| Control
Systems |

| Open
Loop | | Closed Loop |

| On/off
(bang-bang) | | Continuous
Correction |
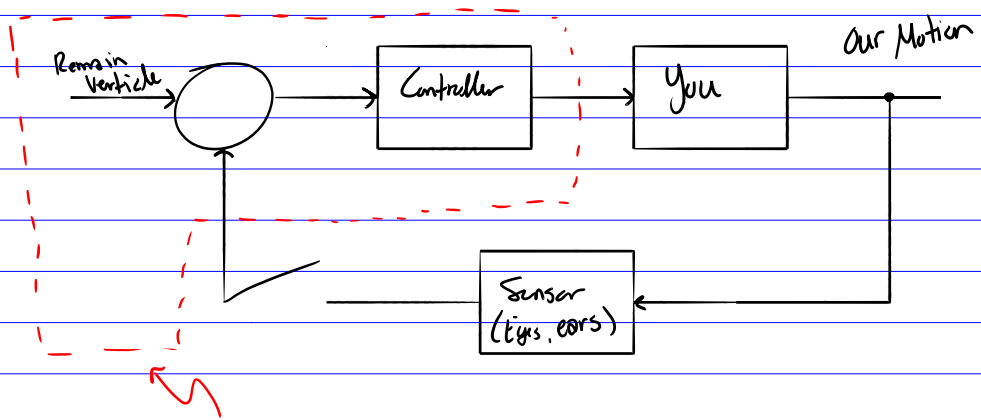
| Analog | | Discrete
(Computer) |
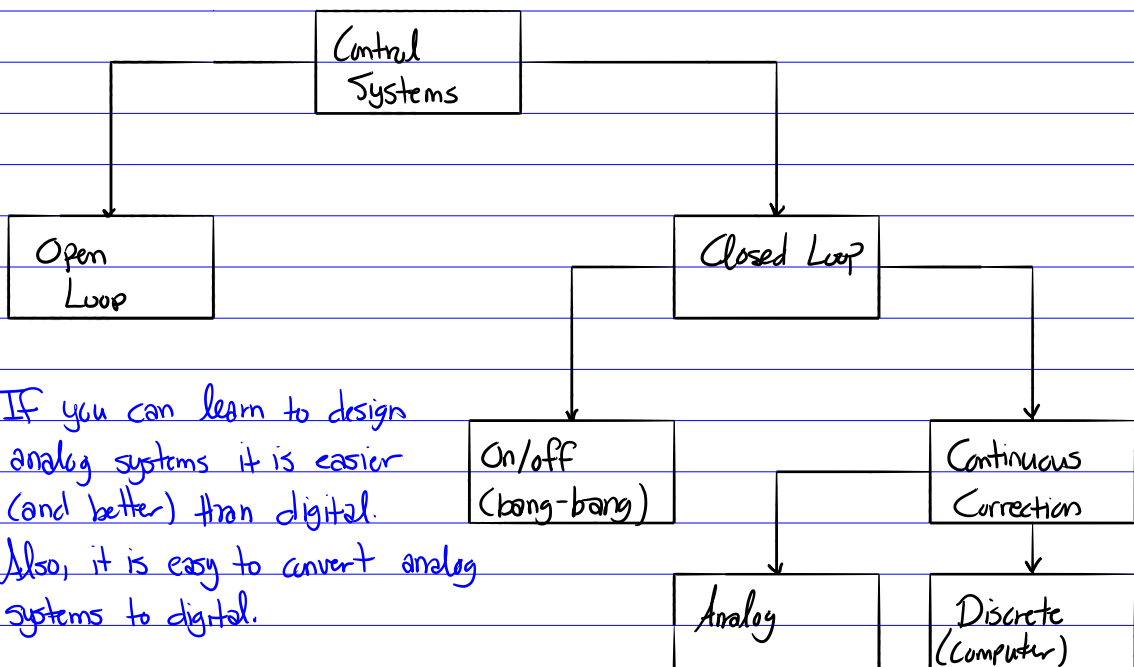
If you can learn to design
analog systems it is easier
(and better) than digital.
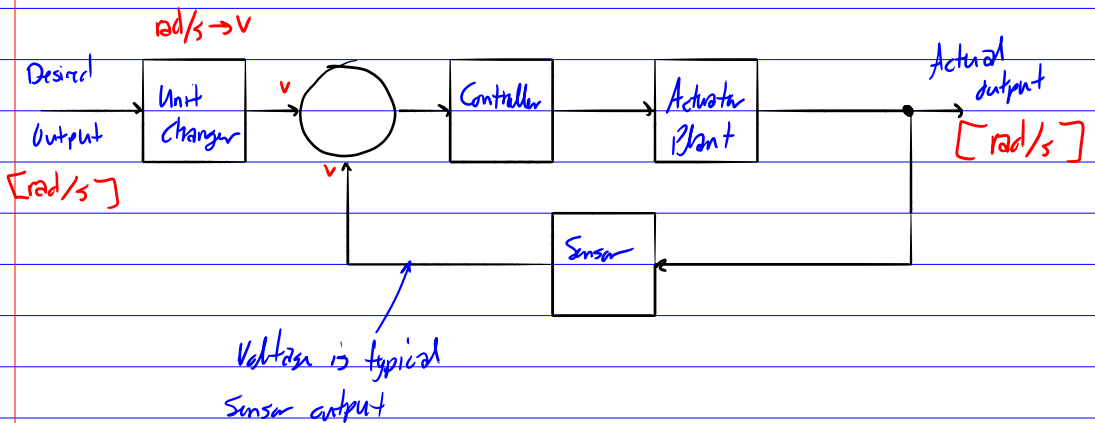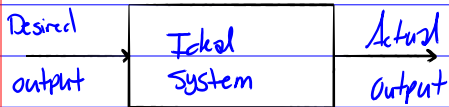Also, it is easy to convert analog
systems to digital.

Cost of Feedback
- Cost of sensor
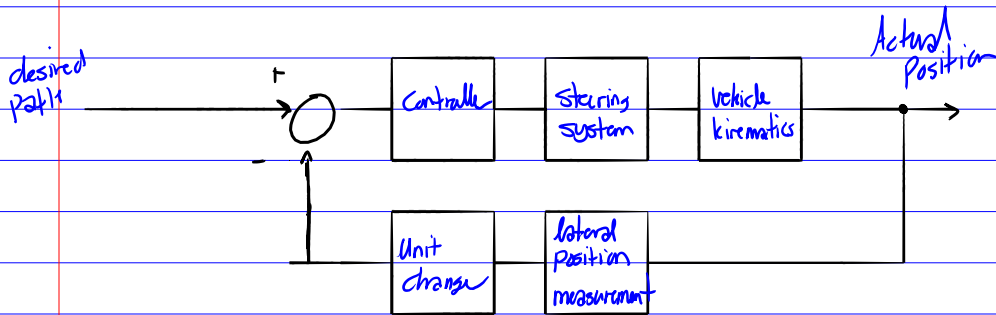- Drive system unstable

🔖 Digital Closed Loop

Remain Verticle → ⊕ → Controller → You → Our Motion

Sensor (Eyes, ears)

Replace w/ PC

🔖 Ideal Systems

Desired output → | Ideal System | → Actual Output

rad/s → V

Desired Output → | Unit Changer | → V → ⊕ → Controller → | Actuator Plant | → Actual output

[rad/s]

[rad/s]

V

Sensor

Voltage is typical Sensor output

==Actuator Example → Motor==
==Plant Example → Roll axis of Plane==

Example Problem

Car — desired — type — error

desired path → ⊕ → | Controller | → | Steering System | → | Vehicle kinematics | → Actual Position

| Unit change | → | lateral position measurement |
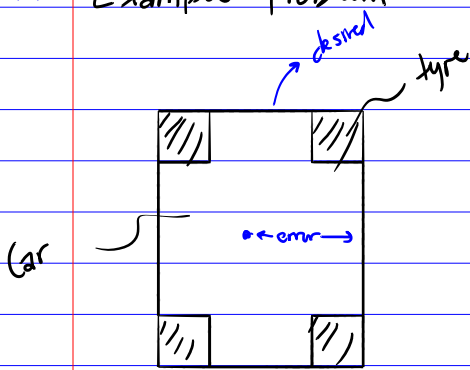
- As the engineer, the level of tolerance (when to activate) is determined by the engineer. A thermostat has a large tolerance to prevent heater turning on and off. An autopilot system has a much less tolerant system.