

# Classification of control systems

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- Open loop and closed loop control system
- Linear and non-linear control system
- Static and dynamic system
- Continuous and discrete data system
- SISO and MIMO systems

# Advantages of a Control System

## 1. Convenience of input form

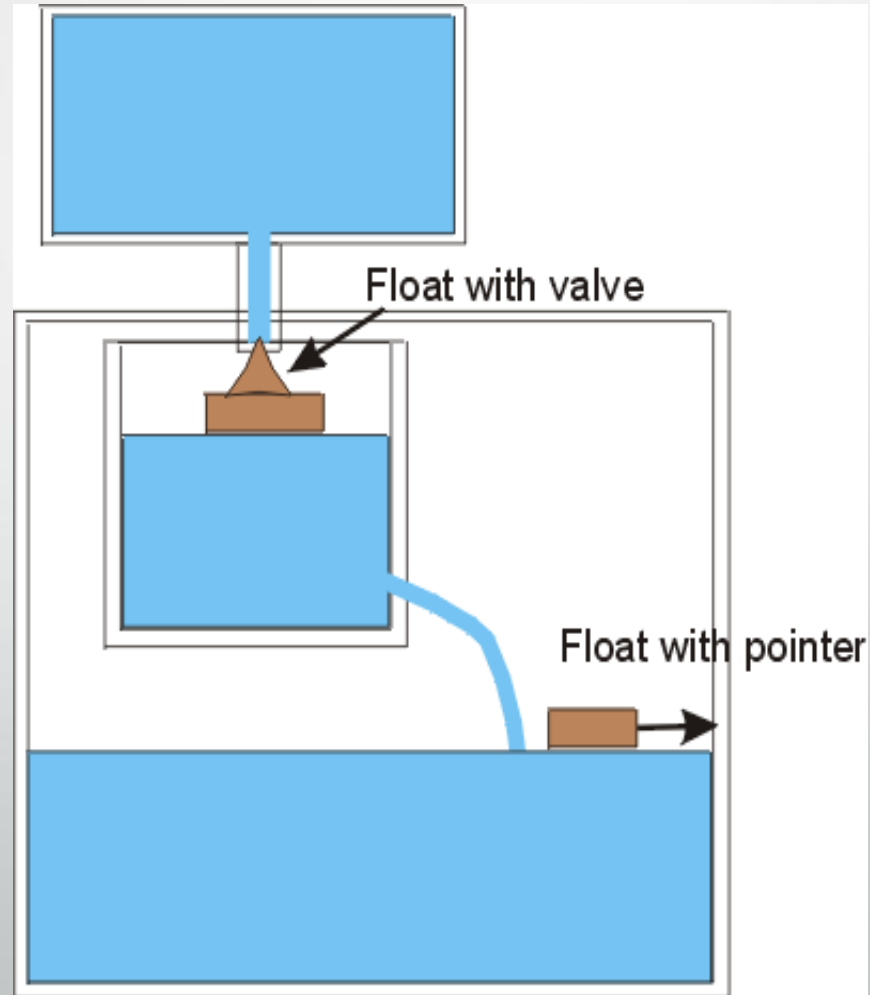
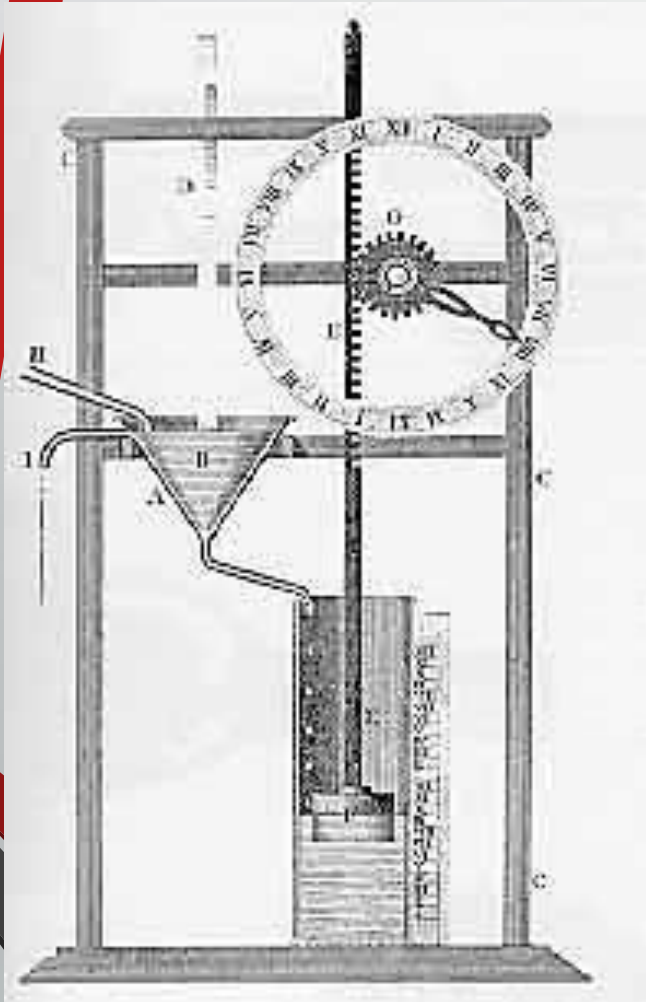
- In a temperature control system, the input is the position on a thermostat and the output is the heat. Thus a convenient position input yields a desired thermal output.

## 2. Compensation for disturbances

- In an antenna system that points in a commanded direction, wind can force the antenna to deviate from commanded direction. The system should detect the disturbance and act accordingly.

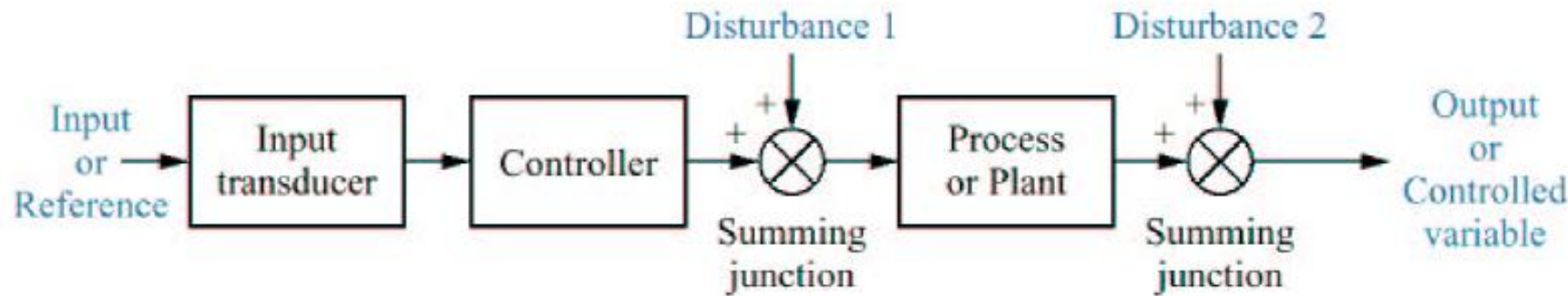
# Classical Control Systems

- Liquid Level Control



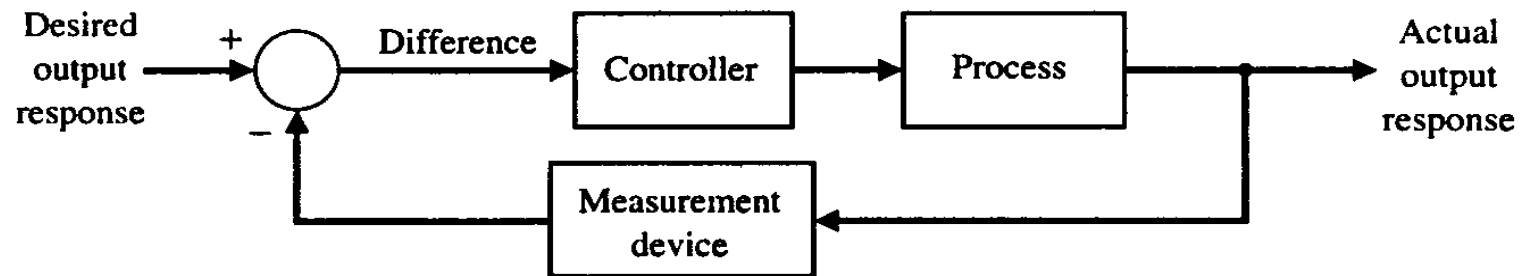
# Open-Loop Systems

- An open-loop system cannot compensate for any disturbances that add to the controller's driving signal or to the process output.

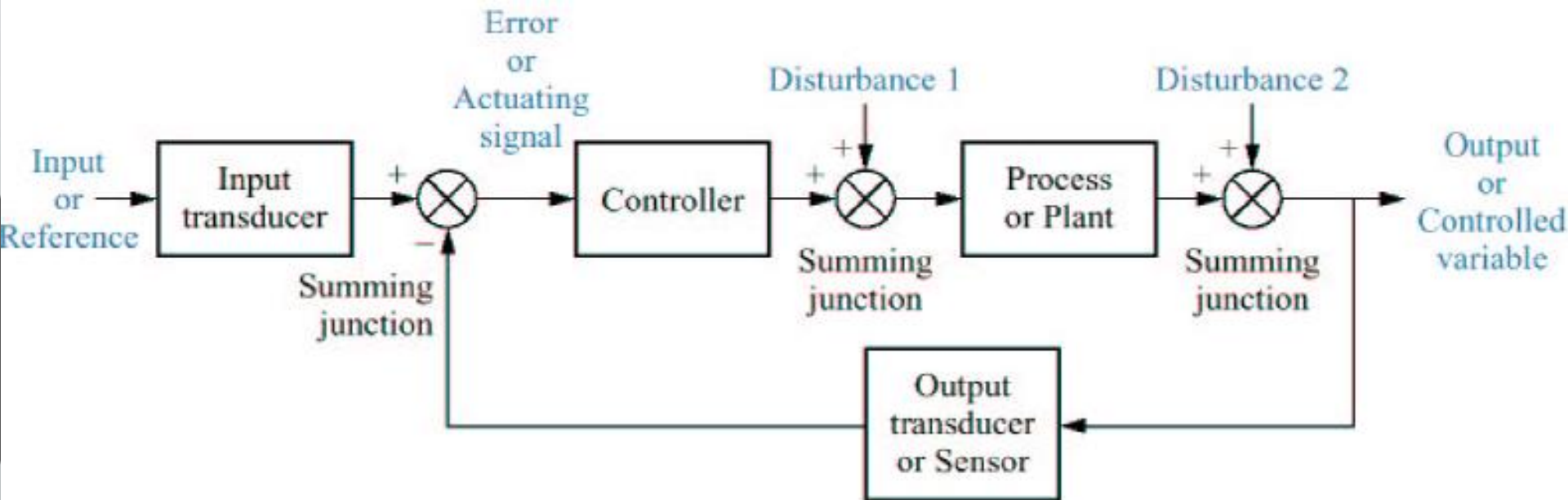


# Closed-Loop (Feedback Control)

- A closed-loop system can compensate for disturbances by measuring the output, comparing it to the desired output, and driving the difference toward zero.



# Closed-Loop (Feedback Control)



# Feedback

Feedback is a key tool that can be used to modify the behavior of a system.

- This behavior altering effect of feedback is a key mechanism that control engineers exploit deliberately to achieve the objective of acting on a system to ensure that the desired performance specifications are achieved.



# Closed-Loop (Feedback Control)

- **Greater accuracy than open-loop systems**
- **Transient and steady-state responses can be controlled more easily**
- **More complex and expensive than open-loop systems**
  - **Requires monitoring the plant output**

# Why Control Systems for CSE and ECE?

- *Engineering involves the study of design and analysis of engineering systems.*
- *Engineering systems are physical systems which could be modeled mathematically (mathematical models).*
- *Many engineering or physical systems are control systems. Examples are: central heating system, auto pilot, robots, automobiles, etc.*
- *Software engineers and Electronics engineers often participate in the development of softwares and hardwares for control systems, e.g. software for the control of the space shuttle.*