



Lecture 2

Topics covered

- **Classification of control systems**
- **Advantages of Control systems**
- **Open loop system**
- **Close loop system**

Classification of control systems

- I. Open loop and closed loop control system
- II. Linear and non-linear control system
- III. Static and dynamic system
- IV. Continuous and discrete data system
- V. SISO and MIMO systems

a) If the aim is to maintain a physical variable at some fixed value when there are disturbances, this is a *regulator*.

Example: speed-control system on the ac generators of power utility companies.

b) The second class is the *servomechanism*. This is a control system in which a physical variable is required to follow (track) some desired time function.

Example: an automatic aircraft landing system, or a robot arm designed to follow a required path in space.

Advantages of a Control System

• 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.

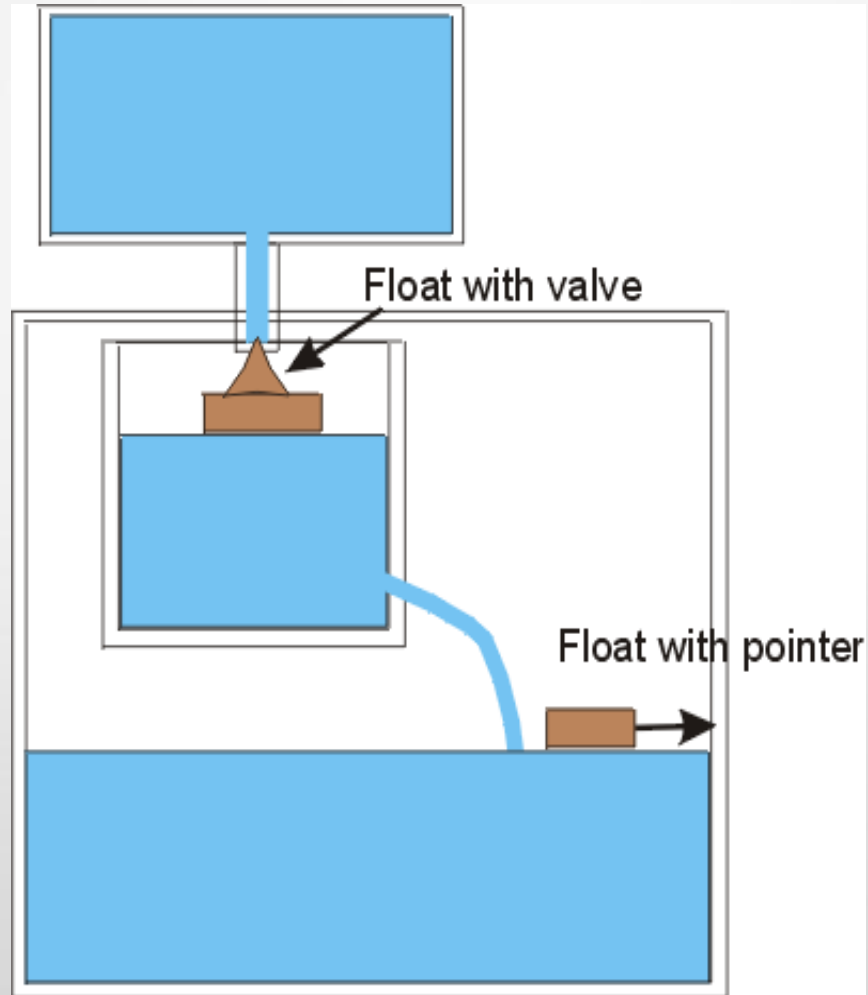
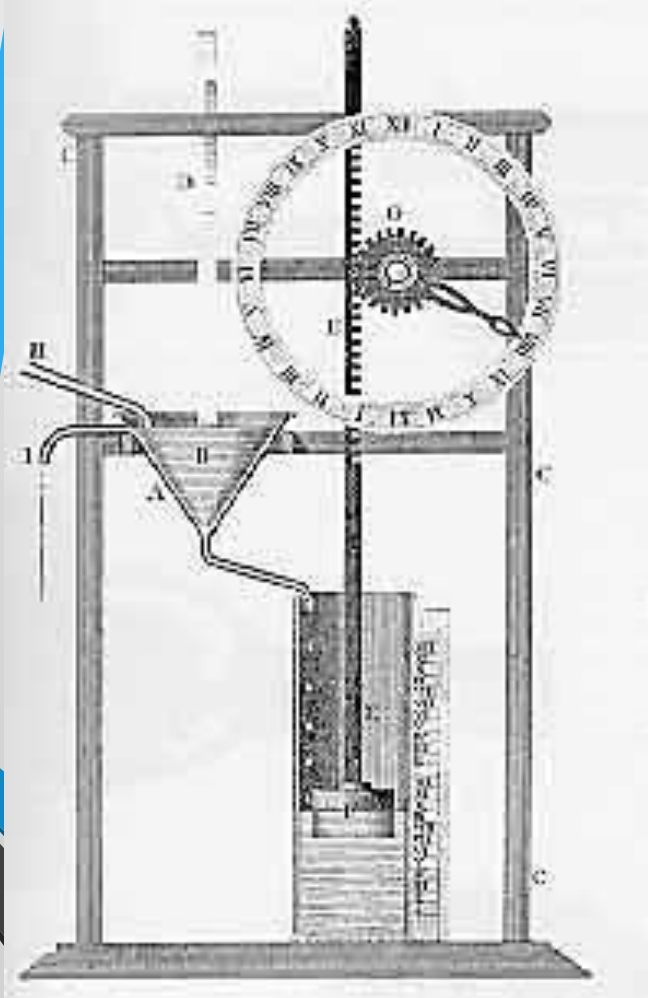
Advantages of a Control System

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.

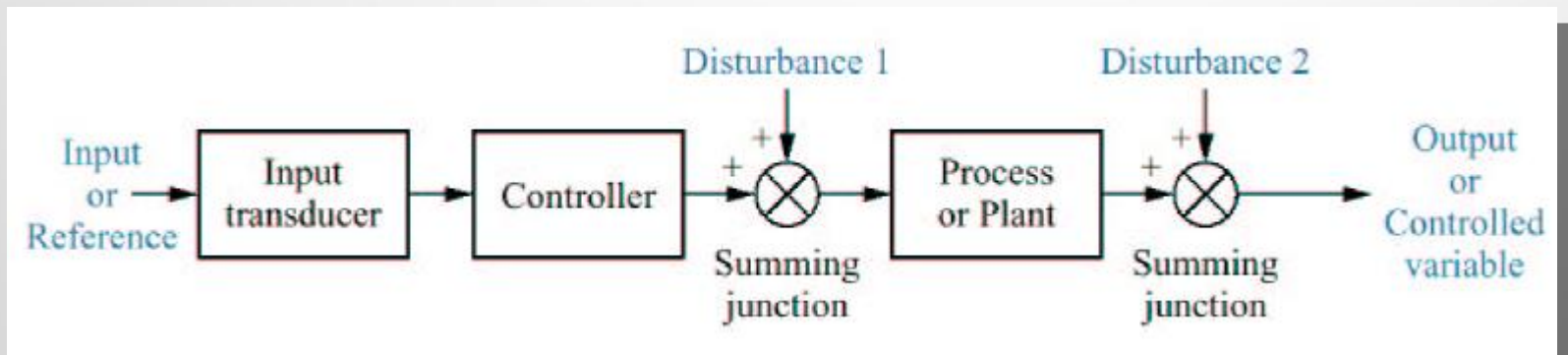
Classical Control Systems

- Liquid Level Control



Open-Loop Systems

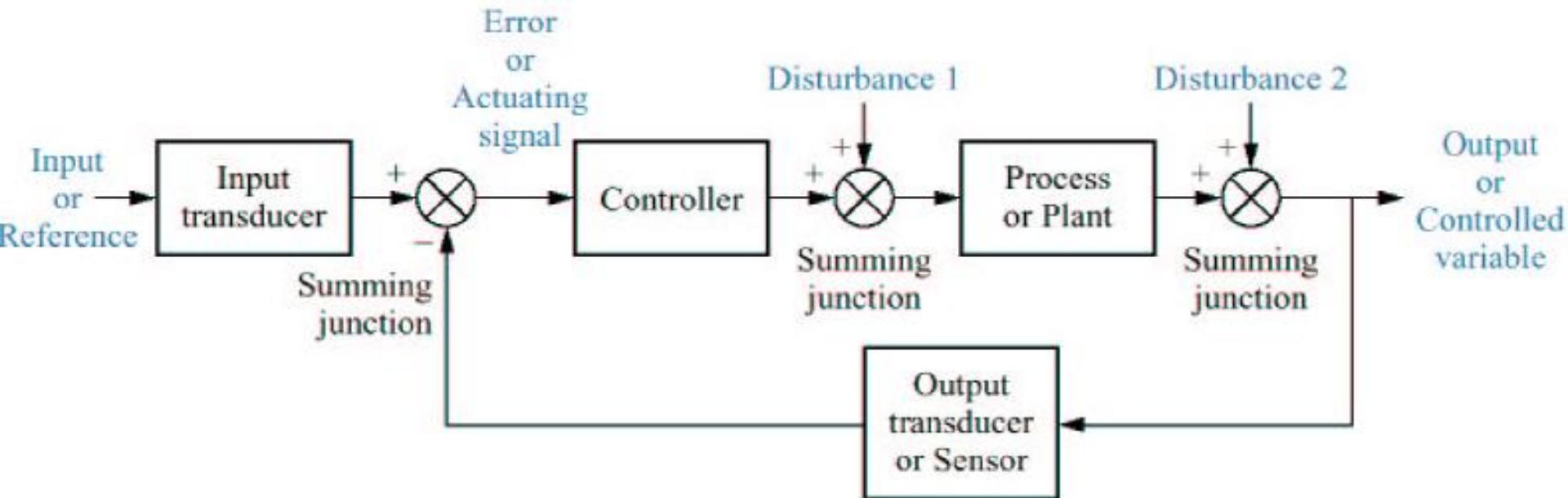
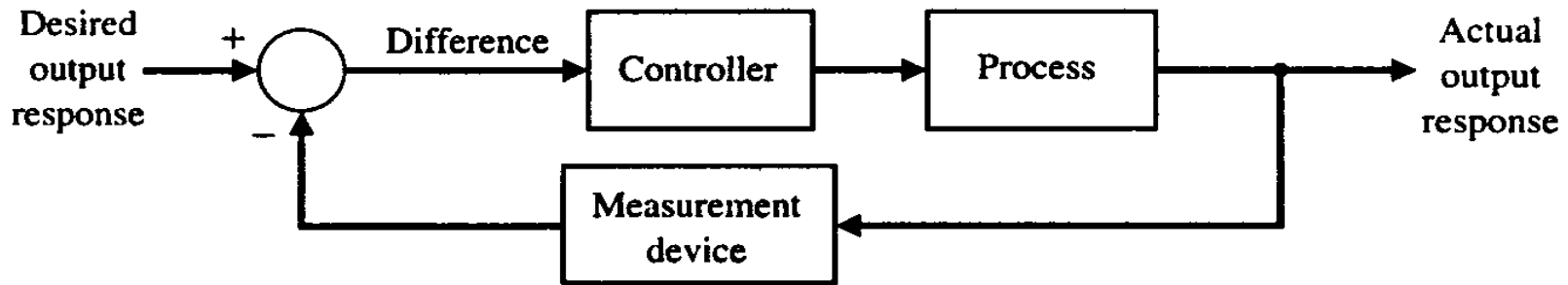
- An open-loop system cannot compensate for any disturbances that add to the controller's driving signal or to the process output.



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.