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.