ME 475/575
Control Systems Analysis

Professor Xiangrong Shen
SERC 3009: 348-6743
xshen@eng.ua.edu

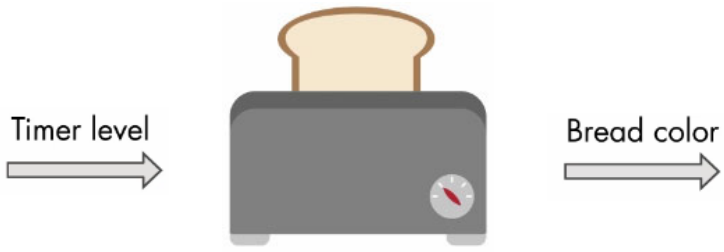
1. Introduction

Classical and modern feedback-control system design and analysis; and block diagrams, state variables, stability, root locus, and computerized analysis. Includes an introduction to modern control techniques.

Course Outline

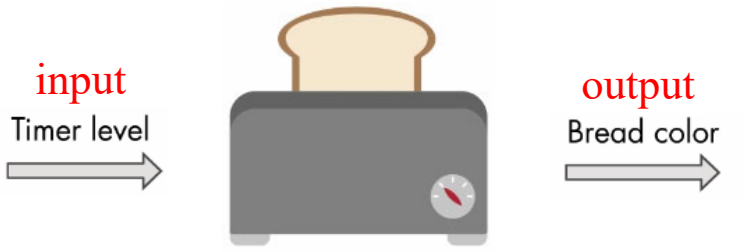
1. *Introduction*
2. *Review: Modeling in the Frequency Domain*
3. *Review: System Response in the Time Domain*
4. *Feedback and PID Controls*
5. *Root Locus Techniques*
6. *Control System Design via Root Locus*
7. *Control System Design via Frequency Response Techiques*
8. *State Space Representation of Systems*
9. *Control System Design via State Space Method*

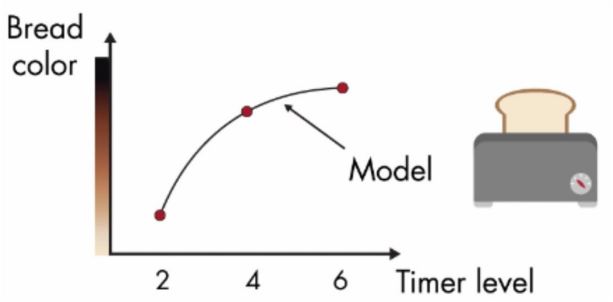
Control



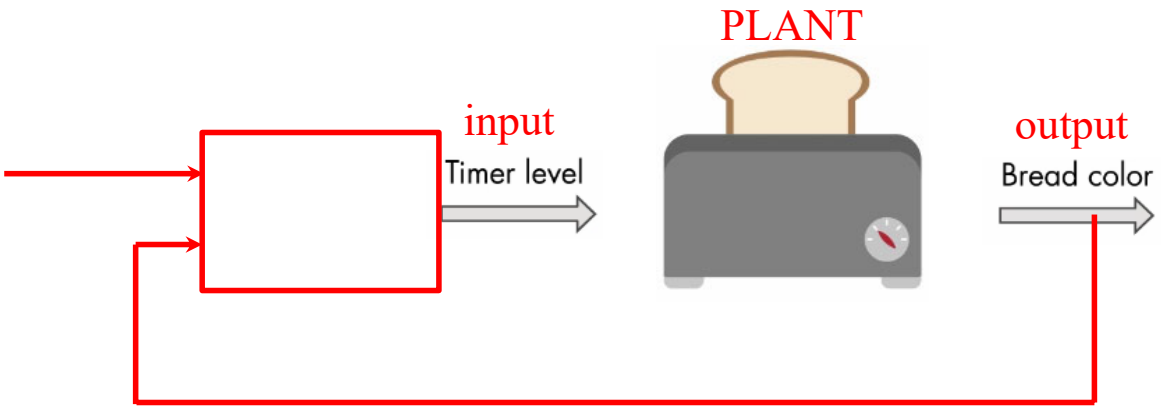
Find a proper input to obtain the desired output!

Feedforward (open-loop) Control



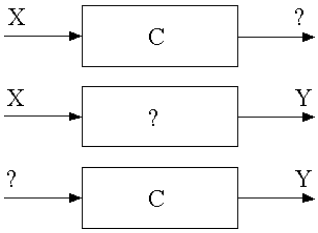


Feedback (closed-loop) Control

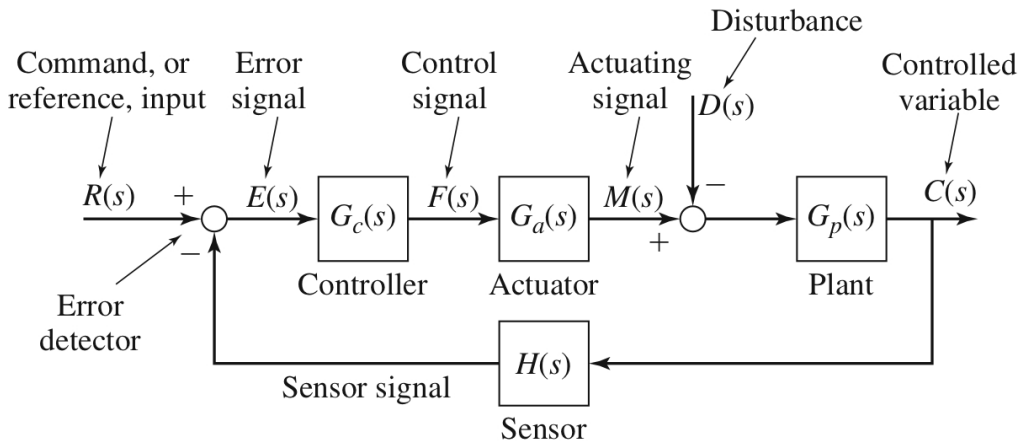


Terminology

1. ***Control*** *- the process of causing a system variable to conform to some desired value called a reference value*
2. ***Feedback control*** *- process of measuring the controlled variable and using that information to influence the controlled variable by feedback*
3. *Areas of focus*
   1) _____: to find the system output when the system and the input to the system are known.
   2) _____: to find the system itself when the input and output of the system are known.
   3) _____: to find the shape input to the system when a desired system output is known.



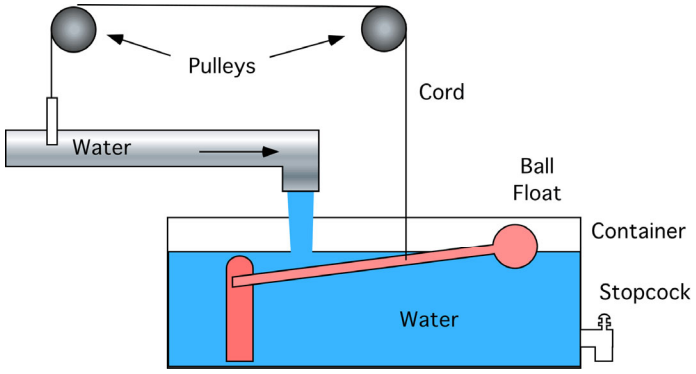
Components in Control System



1. _____**:** system whose output variable is to be controlled.
2. _____**:** a logic element that compares the reference signal with the measurement of the output and decides what should be done.
3. _____**:** produces physical measures (force, torque, pressure, or heat) to influence the plant.
4. _____**:** measures controlled output (sensor output)

Example: Mechanical Controller

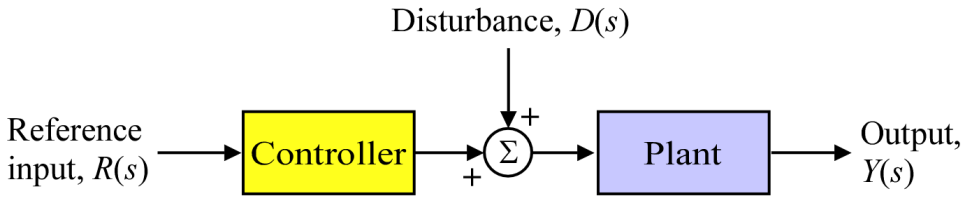
- *A control system can be realized purely mechanically.*



1. *Plant - Container*
2. *Sensor - Ball Float Mechanism*
3. *Actuator - Stopper*

Types of Control

1. ***Open loop:*** _____



2. ***Closed loop:*** _____