Control Systems

CONTROL SYSTEM ENGINEERING

TEXT BOOK:

1.Control Systems :Anuj Jain & Naveen mehra vayu education

2.Control Systems - Principles & Design : Madan Gopal Tata

Mc Graw Hill.

3.Control System Engineering : I.J.Nagrath & M.Gopal; New Age

4. Control System Engineering by B.S.Manke

REFERENCE BOOKS :

1. Automatic Control Systems : B.C.Kuo, PHI.
2. Modern Control Engg : K.Ogata; PHI.

Syllabus

Section-A

- **INTRODUCTORY CONCEPTS** :System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, controller servomechanism, regulating system, linear time-invariant (LTI) system, time-varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations),stability, external disturbance (noise), overall gain etc. Introductory remarks about non-linear control systems.

Section-B

- **MATHEMATICAL MODELLING :**Con**c**ept of transfer function, relationship between transfer function and impulse response, order of a system, blockdiagram algebra, signal flow graphs : Mason‟s gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design.

Contued…..

Section-C

- **TIME DOMAIN ANALYSIS :**Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation, w and wn, time domain specifications of a general and an under-damped 2nd order system, steady state error and error constants, dominant closed loop poles, concept of stability, pole zero configuration and stability, necessary and sufficient conditions for stability Hurwitz stability criterion Routh stability criterion and relative stability. Root locus concept, development of root loci for various systems, stability considerations..

Section-D

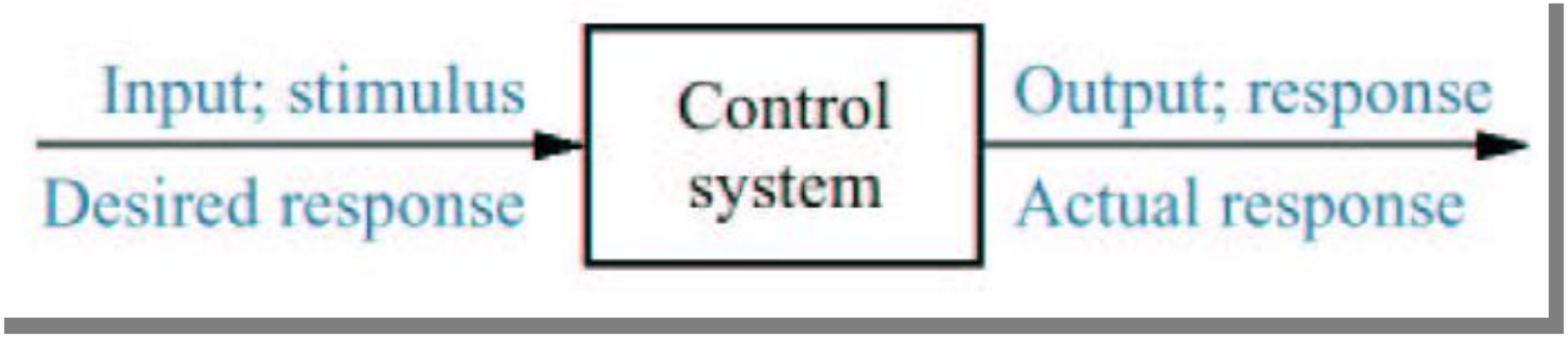
- **FREQUENCY DOMAIN ANALYSIS , COMPENSATION & CONTROL COMPONENT** :Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications. Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of feedback control, proportional, integral and derivative controllers, illustrative examples. Synchros, AC and DC techo-generators, servomotors, stepper motors, & their applications, magnetic amplifier.

Scope of the Subject

- Mathematical modeling of dynamic systems (transfer function, state space representation)
- Stability concepts
- Transient response for first and second order systems
- Root locus analysis
- Frequency response techniques: Nyquist criterion, Bode plots.

What is a Control System?

A Control System consists of subsystems and processes (or plants) assembled to control the outputs of a process.



Typical Examples

- Central Temperature Control
- Fluid Level maintenance systems
- Battery Voltage Control
- Human has numerous control systems built in it.

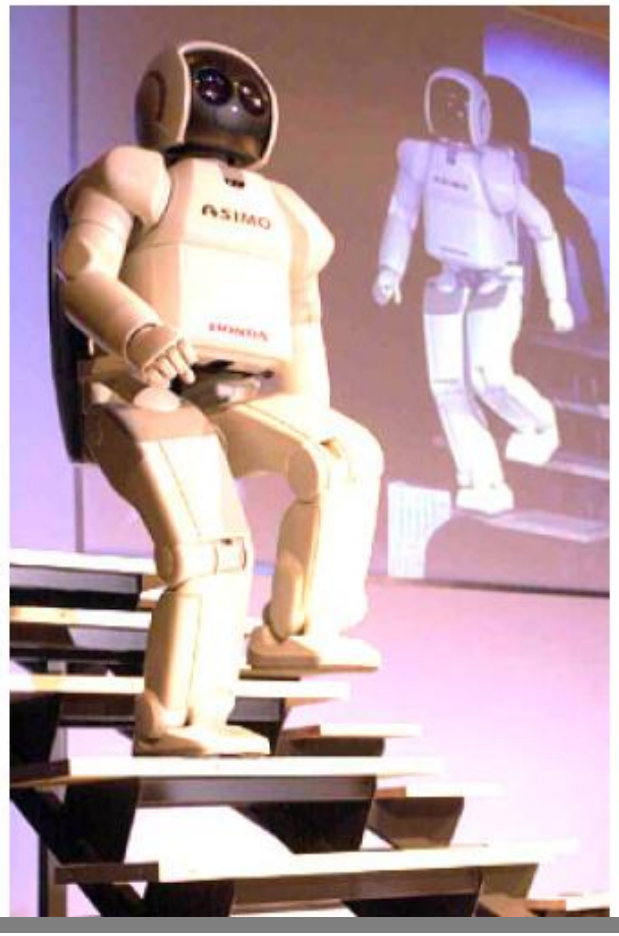
Control System - another view

- A Control System is an arrangement of physical components connected/related in such a manner as to command, direct or regulate itself or another system.

Main Components

- Output:-the actual response obtained from the system
- Input :- the stimulus or excitation applied to a control system from an external source
- Control:- it means direct or command a system so that desired output is attained
- Plant:-the portion of the system which is to be controlled or regulated is called as plant or process

Human like Control



Autonomous planning and Exploration

On other planets

Underwater

In dangerous mines

Industry

Assemble cars

……Everywhere