CONTROL SYSTEM LAB

Major equipments

1. AC Position Control Setup with motor
2. PID Controller
3. DC Position Servo Mechanism Trainer

A Brief write-up

In Control System Lab four numbers of codes EC-583, EE-593, EI-593(EE) and EE-691 are performed. In these code the following Experiments has been conducted.

i) Familiarization with MATLAB control system toolbox, MATLAB simulink toolbox and PSPICE

ii) Determination of step response for first order and second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot. Settling time etc. from the response

iii) Simulation of Step response & impulse response for type-0, type-1 & type-2 system with unity feedback using MATLAB & PSPICE

iv) Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system toolbox for 2nd order system & determination of different control system specification from the plot

v) Determination of PI, PD and PID controller action of first order simulated process

vi) Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin with additional lead compensator in forward path transfer function using MATLAB and PSPICE

vii) Tuning of P, PI and PID controller for first order plantwith dead time using Z-N method. Process parameters (time constant and delay/lag) will be provided. The gain of the controller to be computed by using Z-N

method. Steady state and transient performance of the closed loop plant to be noted with and without steady disturbances. The theoretical phase margin and gain margin to be calculated manually for each gain setting

viii) Design of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function. Analyze step response of the system by simulation.

ix) Obtain transfer function of a given system from state variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation

x) State variable analysis using simulation tools. To obtain step response and initial condition response for a single input, two output system in SV form by simulation.

xi) Performance analysis of a discrete time system using simulation tools. Study of closed response of a continuous system with a digital controller and sample and hold circuit by simulation.

xii) Study of the effects of nonlinearity in a feedback controlled system using time response. Determination of step response with a limiter nonlinearity introduced into the forward path of 2nd order unity feedback control systems. The open loop plant will have one pole at the origin and the other pole will be in LHP or RHP. To verify that (i) with open loop stable pole, the response is slowed down for larger amplitude input (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude by simulation.

xiii) Study of effect of nonlinearity in a feedback controlled system using phase plane plots. Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities.

xiv) Study of position control system using Servo motor

xv) Design and hardware implementation of a temperature controller using Microprocessor / Microcontroller

xvi) Determine the effect of PID actions on first order simulated process and obtaining the system transfer function from bode plot.