lab 10

- What is a real time system ?
- What are the basic blocks of a Computer-Controlled system ?
- How are analog Controllers transformed into digital Controllers ?

lab 11

- what are the magnetic levitation system applications ?
- what is an operating point ? How can you get an operating point for a system ?

lab 12

- what is open-loop stability ?
- define :-
  gain crossover frequency , phase crossover frequency , gain margin phase margin , bandwidth , settling time , rise time , steady-state error
- what is Bode stability criterion ?

lab 13

- what is Controller emulation method ?
- define :
  Euler Transformation , Tustin transformation
- How does root locus change by adding a pole or a zero to the transfer function ?

lab 14

- what are the effects of P-I-D components of the PID controller ?
- what are dominant poles ?

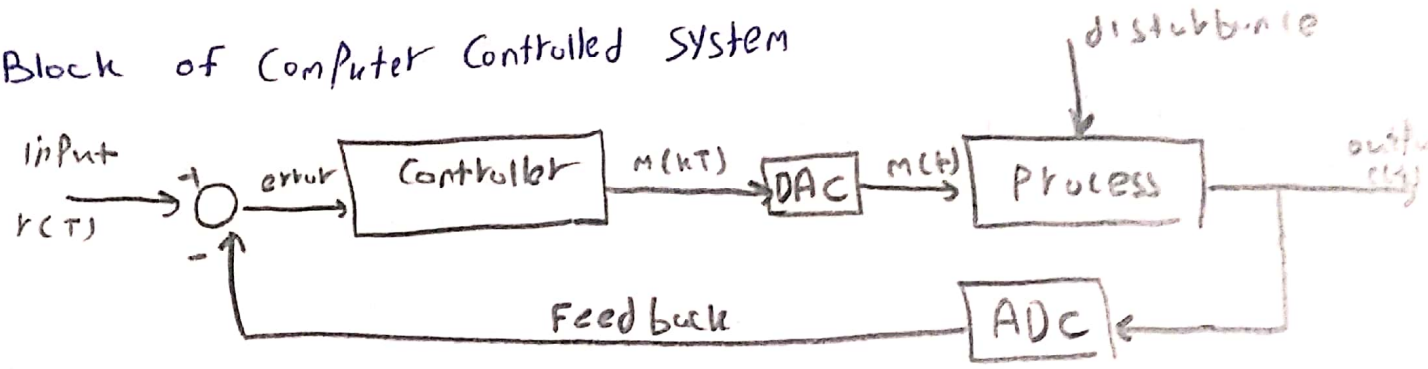
lab 15

- what is Controller emulation ?
- How to verify performance of controllers ?

[1] Real time system

- Software system where the correct Functioning of the system depend on the results produced by the system and the time at which thes results are produced
- it is the system which control and monitor environment
- associted with → sensors
  → actuators

[2] Block of Computer Controlled System



[3] How analog controllers to digital Controllers.

- Adding interfaces (ADC) (DAC)
- Converting the dynamic operating (Z-transform)
- Bilineur $s \leftarrow \frac{z-1}{z+1} \frac{2}{T}$
- Euler $s \leftarrow \frac{z-1}{T}$

[4] What magnatic levitation system and applications.

maglev → electromechanical device that suspend Ferromagnetic materials using electromagnetism.

app → magnetic bearings
high-persision positioning platform
aerospace Shuttle
fast maglev train

[5] operating Point ? How can get it ?

- is the steady-state DC voltage at a specified terminal of an active device

- specific Point within the operation characteristics of device

how to get it

Simulink → Analysis → Control design → Linear analysis → operating Point → Trim model

Start trimming

[6] Open-loop Stability ?

All the Poles of the open-loop tf in the left hand side of S-Plan

[7] define

gain crossover Frequency W_{gc}

Freq where the amplitude of oL TF is 1

Phase crossover Freq W_{pc}

Freq where the Phase shift of oL TF is -180

gain margin: Value before system become just stable. occurs at Phase cross over Freq

Phase margin: is the Phase that can be varied before system become just stable, occurs at gain cross over freq.

bandwidth:

Frequency range where the magnitude of CL gain greater than -3 dB

Settling time

the time required for the response curve to reach and stay within a range of certain percentage of the final value (5% or 2%)

rise time

time take for signal to change from low value to high

steady state error SSE

- the difference between I/O of a system in the limit as time goes to ∞
- depends on the type of input

[8] Bode Stability Criterion

1- definition

→ the phase cross over freq W_{pc} : ____

the gain " " W_{gc} : ____

2- Stability criterion

if at the phase crossover frequency, the crossponding log module is less than 0 dB, then Feedback syst is stable

3- Stability criterion

a- gain margin $GM = \frac{1}{X}$ $X = |G(iw_{pc})|$

b- Phase margin $PM = 180 + \theta$ $\theta = \arg(G(iw_{gc}))$

[9] Controller emulation method

10 Euler transformation
Binomial

Tustin transformation.
bilinear
used in digital signal Processing and discrete-time control theory to transform Continous time system representation to discrete-time.

11 RL Change by add P/Z to tf.

Zero
RL Pulled to left.
Stability ↑
Settling time ↓

Pole
RL pulled to right.
Stability ↓
Settling time ↑

12 the affect of P.I.D of PID Controller:

13 dominut Poles (near Poles)

required in Stability analysis, because it is that location which gives an idea where your locus is progressing towards right or towards left

14 How to verify performance of Controllers.