

What does it mean by Polarity and Levitation?

Polarity: A state or a condition of an atom or a molecule having positive and also negative charge charges, especially in case of magnetic or an electrical poles.

Levitation: The state of rising and floating in the air in apparent defiance of gravity.

What is Controller emulation and how to verify performance of controllers?

emulation: is to use a discrete equivalent of a continuous controller in the design of digital controller
- we verify the controller with rising time, settling time, no delay, no overshoot.

Define and write all the requirements to calculate and compute all using ~~equation~~ equations?

Gain crossover frequency: The frequency where the magnitude of the open loop transfer function is 1

Phase ~~margin~~ crossover frequency: The frequency where the phase shift of the open loop transfer function is -180°

Gain margin: The gain which can be varied before the system becomes just stable, occurs at phase crossover

Phase margin: The phase that can be varied before the system become just stable, occurs at gain crossover frequency.

$$* [GM, PM, W_{gm}, W_{pm}] = \text{margin}(SYS)$$

Band width: frequency range where the magnitude of closed-loop gain doesn't drop below -3dB.

$$* \text{bandwidth} = \text{bandwidth}(SYS)$$

Settling time: The time required for the response curve to reach and stay within a range about the final value.

Rise time: The time needed by the system to reach 90% from its final value.

$$* \text{stepinfo}(SYS)$$

Steady-state error: the difference between the input (reference) and the output.

$$* [Y, t] = \text{step}(SYS)$$

$$sserror = \text{abs}(1 - Y(\text{end}))$$

Indicate why each of the following are needed in relation to control system?

modeling: The control engineer designs new systems, operates existing ones following these rules

- ① mathematical model
- ② Analyze the mathematical model
- ③ design system/controller
- ④ Implement system/controller
- ⑤ test

Operating Point:

a specific point within the system's operating characteristics that can be engaged due to properties of system & environment.

- to linearize system around certain point.

Simulink

- make the engineer easily design any system
- Allows things for SISO & MIMO
- Allows finding operating points & computing exact linearization.

Step response

- is the time behaviour of the outputs of a system when input changes from 0 \rightarrow 1 at short time.
- Step response tells a lot about a system stability.

What is the difference between kinetic & Potential.

Kinetic energy

- Energy due to motion
- Can be transferred between objects

It is measured from the place itself

$$K.E = \frac{1}{2}mv^2$$

Potential energy

Energy due to position

- Cannot be transferred between objects

- It is measured from the bottom.

$$P.E = mgh$$

1. Relative Error

