Automatic Control Systems

Question

- A system may have different state equations but one transfer function for a certain input-output pair, will different state equations lead to different transfer function for the same input-output pair?

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设置

Different state equations lead to different transfer function for the same input-output pair

A True

B False

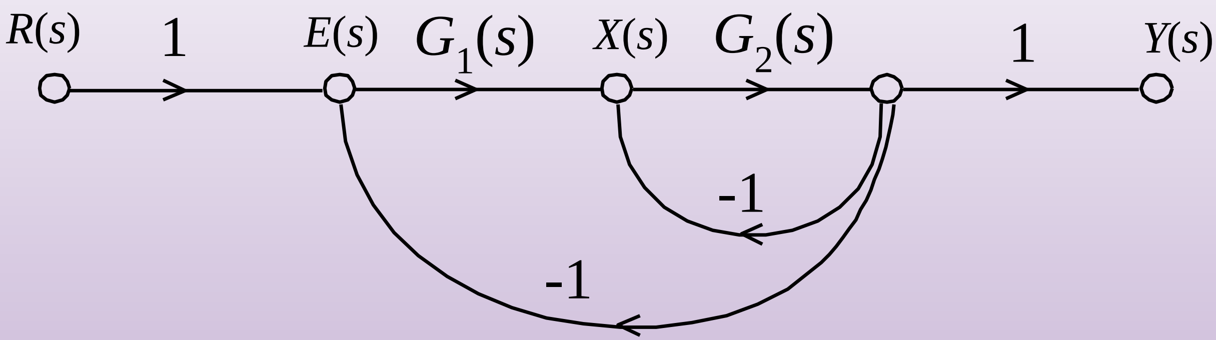
提交

Discussions

- Can signal-flow graphs be applied to nonlinear systems?
- Can the gain formula be directly applied between any two nodes of a SFG?
- For an electric circuit with R, L and C, is the number of its state variables equal to the number of L and C?

Discussions

- For a multi-input multi-output LTI system, if the inputs and outputs have been determined, are the denominators of all the elements in the system transfer function matrix the same?



Discussions

- For a non-proper system, such as a pure derivative block, will it change to a proper one if we reverse its input and output?

DISCUSSION

Is a time delay block a linear block?

$$y(t) = f[u(t)] = u(t-\tau)$$

DISCUSSION

Basic idea:

According to the definition, if and only if a system satisfies the following two requirements, it is a linear system:

- **Principle of superposition**

$$f[u_1(t)+u_2(t)] = f[u_1(t)] + f[u_2(t)]$$

- **Property of homogeneity**

$$f[\beta u_1(t)] = \beta f[u_1(t)]$$

DISCUSSION

Proof: Property of homogeneity

$u_4(t)$ **is denoted as :**

$$u_4(t) = \beta u_1(t)$$

The output of the time delay block with respect to $u_4(t)$ **is**

$$f[u_4(t)] = u_4(t-\tau) = \beta u_1(t-\tau)$$

$$f[\beta u_1(t)] \qquad = \qquad \beta f[u_1(t)]$$

Thus, the property of homogeneity holds

Now, we have proved that a time delay block is a linear block.

DISCUSSION

Further information:

In time domain, the time delay block is not a linear function with respect to time t, but it is a linear block with respect to the input .

$$u\ (t)$$

In s domain, the Laplace transform of the time delay block $e^{-\tau s}$ **is not a linear function with respect to the parameter s, but it is still a linear block with respect to the input.**

Review questions

The Routh-Hurwitz criterion can be applied to the following system

$$s^4 + 7s^3 + 4s^2 + 17s + 11e^{-2s} = 0$$

- A True
- B False

Review questions

When a row of Routh’ s tabulation contains all zeros before the tabulation ends, this means that the equation has roots on the imaginary axis of the s-plane.

- A True
- B False

Review questions

If a unity-feedback control system is of type two, it is certain that the steady-state error of the system to a step input or a ramp input will be zero.

- A True
- B False

Discussion

If a system has a steady-state error equal to infinite, does that mean the system is unstable?

- A Yes
- B No

Discussion

For an unstable system, must it have an infinite steady-state error?

- A Yes
- B No

Discussion

If a system does not have a constant steady-state error, does that mean the system unstable?

- A Yes
- B No

Discussion

- When Nyquist path comes across pure imaginary poles or zeros of $1+G_0(s)$, can we just let the path go around those poles and zeros from the left side of the imaginary axis?

Review questions

- If a PD controller is so designed that the characteristic-equation roots have better damping than the original system, the maximum overshoot of the system is always reduced

(T) (F)

Review questions

- A system compensated with a PD controller is usually more robust than a system compensated with a PI controller.

(T) (F)

Review questions

- The maximum phase that is available from single-stage phase-lead control is 90 degree.

(T) (F)

Review questions

- The design objective of the phase-lead controller is to place the maximum phase lead at the new gain-crossover frequency.

(T) (F)

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Can state feedback change the controllability of a system?

A Yes

B No

提交

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设置

Can state feedback change the observability of a system?

A Yes

B No

提交

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Will state feedback change the order of a system?

A Yes

B No

提交

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设置

Will state feedback change the type of a control system?

A Yes

B No

提交

单选题 1分

设置

Can we just use difference to approximate derivative, then get the discrete state equation?

A Yes

B No

提交

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Is there any difference between the following two characteristic equations?

Continuous system $s^2 + 1.2s + 0.96 = 0$

Digital system $z^2 + 1.2z + 0.96 = 0$

A Yes

B No

提交

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Can we use Routh-Hurwitz criterion to evaluate the stability of a discrete-data system?

- A Yes, we can!
- B No, we can not

提交

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Are the eight rules for constructing the root loci of continuous systems still applicable?

A Yes

B No

提交