线性离散系统分析

离散系统稳态误差

Outline

Topic

离散系统稳态误差

- 连续系统稳定误差:
  - Laplacian 变换的终值定理
  - 静态误差系数
  - 动态误差系数
- 离散系统稳态误差
  - Z 变换终值定理

$$\lim_{t\to\infty} e^*(t) = \lim_{z\to 1}(z-1)E(z) = \lim_{z\to 1}(z-1)\Phi_e(z)R(z)$$

离散系统稳态误差

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  - Laplacian 变换的终值定理
  - 静态误差系数
  - 动态误差系数
- 离散系统稳态误差
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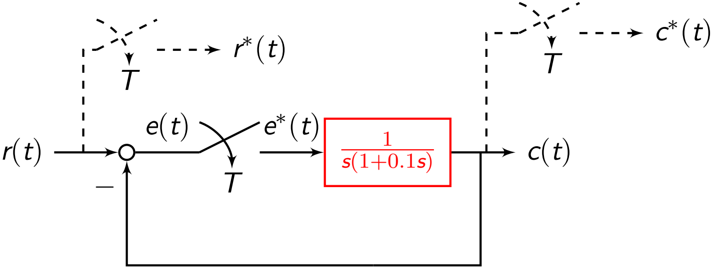
\begin{aligned}
\lim_{t\to\infty} e^*(t) &= \lim_{z\to 1}(z-1)E(z) \\
&= \lim_{z\to 1}(z-1)\Phi_e(z)R(z)
\end{aligned}
$$

离散系统稳态误差示例:



其中

$T=0.1, r_1(t)=1(t), r_2(t)=t$ 求离散系统相应的稳态误差

解:

$$
\begin{aligned}
G(z) &= \frac{z(1-0.368)}{(z-1)(z-0.368)} \\
\Phi_e(z) &= \frac{1}{1+G(z)} = \frac{(z-1)(z-0.368)}{z^2-0.736z+0.368}
\end{aligned}
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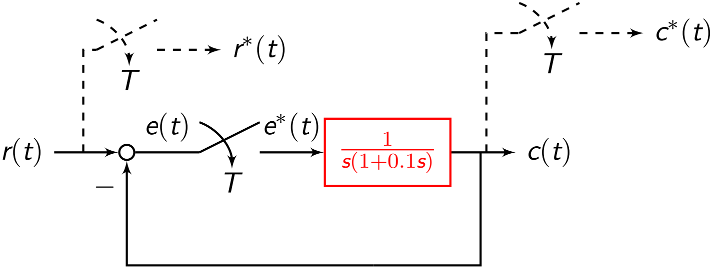

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离散系统稳态误差示例 (续)

$r_1(t) = 1(t)$ 时

$$\begin{aligned} R_1(z) &= \frac{1}{1-z^{-1}} \\ \lim_{z\to 1}(1-z^{-1})\Phi_e(z)R(z) &= 0 \end{aligned}$$

$r_2(t) = t(t)$ 时

$$\begin{aligned} R_2(z) &= \frac{Tz^{-1}}{(1-z^{-1})^2} \\ \lim_{z\to 1}(1-z^{-1})\Phi_e(z)R(z) &= \lim_{z\to 1}\frac{T(z-0.368)}{z^2-0.736z+0.368} \\ &= T \end{aligned}$$

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Topic

1 离散系统稳态误差

2 离散系统型别与静态误差系数

离散系统型别

- 连续系统型别:

$$G_o(s) = \frac{M(s)}{s^\nu N(s)}$$

若 $\nu = 0, 1, 2$ 则分别称为 0 型,I 型,II 型系统.

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静态误差系数:0 型系统:

连续系统

$$\begin{aligned} K_p &= \lim_{s\to 0} G_o(s) \\ r(t) &= 1 \\ e_{ss} &= \frac{1}{1+K_p} \end{aligned}$$

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K_p &= \lim_{s\to 0} sG_o(s) \\
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e_{ss} &= \frac{1}{K_v}
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离散系统

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静态误差系数:II 型系统:

连续系统

$$
\begin{aligned}
K_p &= \lim_{s\to 0} s^2 G_o(s) \\
r(t) &= \frac{t^2}{2} \\
e_{ss} &= \frac{1}{K_a}
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