Control Engineering II

Topic 2:
Obtaining the Transfer Function of a System

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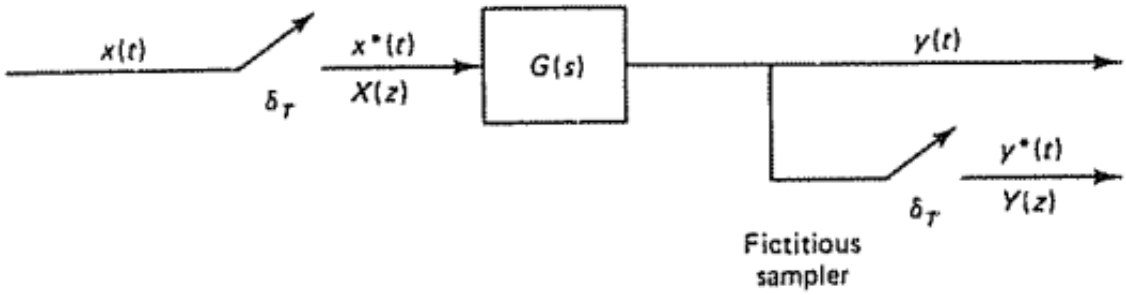
Problems

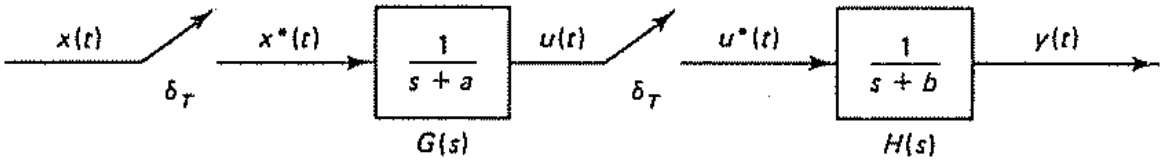
Problem 1
Obtain the equivalent z transfer function of the system shown in the figure, where:

$$G(s) = \frac{1 - e^{-Ts}}{s} \frac{1}{s(s+1)}$$

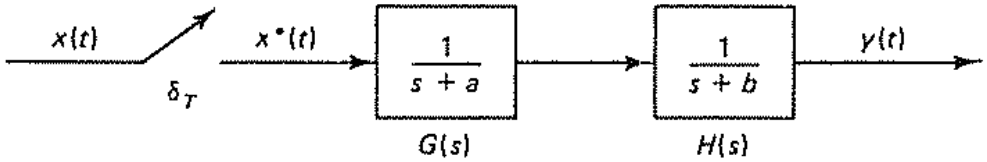


Problem 2
Obtain the equivalent transfer function of the following systems:

Case a: The transfer functions are separated by a sampler. We assume that the two samplers are synchronized and have the same sampling period.

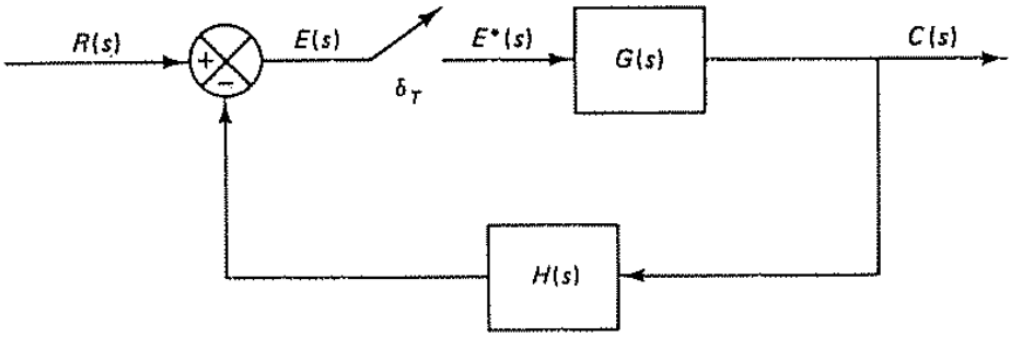


Case b: There is only one sampler at the beginning.

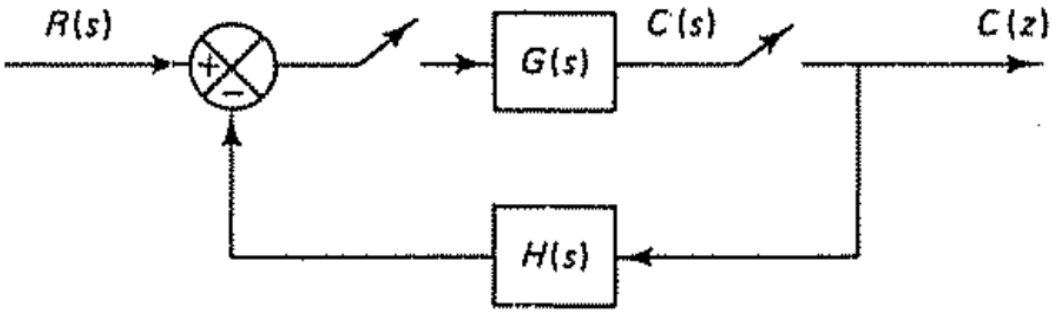


Problems

Problem 3
Obtain the equivalent transfer function of the following system:



Problem 4
Obtain the equivalent transfer function of the following system:



Problem 5
Obtain the position error for a system with unit feedback whose equivalent transfer function of the system (with hold and sampler) is:

$$G_{BSM}(z) = \frac{K(z+a)}{(z-1)^2(z-b)}$$

The transfer function of the controller is:

$$G_C(z) = \frac{K_C(z-b)}{(z-c)}$$

The value of the constants: $0 < a, b, c < 1$

Problem 6
Obtain the position error for a system with unit feedback whose equivalent transfer function of the system (with hold and sampler) is:

$$G_{BSM}(z) = \frac{K(z+a)}{(z-b)}$$

The transfer function of the controller is:

$$G_C(z) = \frac{K_C(z-b)}{(z+a)}$$

The value of the constants: $0 < a, b < 1$

Problem 7
Study the behavior of the following functions when sampled with a sampling period $T_S = 1s$:

$$u_1(t) = \cos(2\pi t/8)$$
$$u_2(t) = \cos(2\pi 7t/8)$$

Calculate the sampling frequency for both signals according to the sampling theorem ($w_s > 2w_m$).