KTH ROYAL INSTITUTE
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Hybrid and Embedded Systems EL2450 - Exercise 5

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Content

- Delays
- Jitter
- Packet loss
- Quantization

What is it? Why does it happen? Why do we care?

Exercise 5.2

Problem

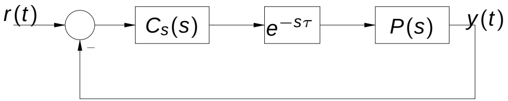
(a) Given the system in the figure, find the controller $C_s(s)$ (Smith predictor) such that the closed loop transfer function from r to y becomes

$$H_{c\ell} = \frac{C(s)P(s)}{1 + C(s)P(s)} e^{-s\tau}$$

(b) Let

$$P(s) = \frac{1}{s+1}, \quad H_{c\ell}(s) = \frac{8}{s^2 + 4s + 8} e^{-s\tau}$$

find the expression for the Smith predictor $C_s(s)$.



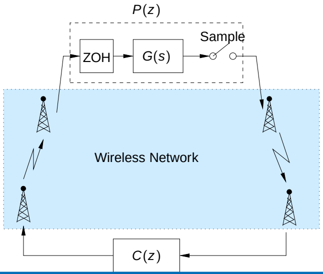
Exercise 5.3

Problem

A process with transfer function P is controlled by the PI-controller C

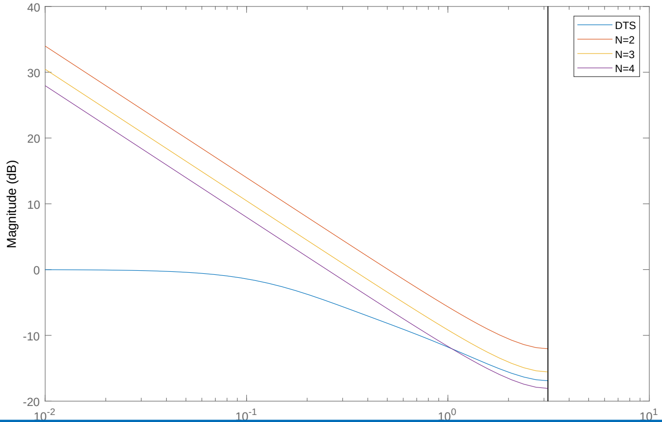
$$P(z) = \frac{z}{z - 0.5}, \quad C(z) = K_p + K_i \frac{z}{z - 1}$$

where $K_p = 0.2$ and $K_i = 0.1$. The control works over a wireless network, as shown below. Due to retransmission of dropped packets, the network induces time-varying delays. How large can the maximum delay be, so that the closed loop system is stable?



Exercise 5.3

Matlab Plot



Exercise 5.1

Problem

Consider the discrete-time controller characterized by the pulse-transfer function

$$H(z) = \frac{1}{(z-1)(z-1/2)(z^2+1/2z+1/4)}.$$

Implement the controller in parallel form.