EED604E OPTIMIZATION

Model Reference Adaptive Systems (MARS)

HOMEWORK #2

[Deadline: 27.11.2024 @23.00]

A system is given with the transfer function:

$$G(s) = \frac{b}{s(s+5)}$$

where b is an unknown positive parameter. The system is controlled by a proportional controller with the control law:

$$u(t) = K\big(u_c(t) - y(t)\big)$$

The closed-loop control system is required to behave like a reference model with the transfer function:

$$G_m(s) = \frac{9}{s^2 + 5s + 9}$$

The goal is to design a model reference adaptive control system that minimizes the following performance criteria.

a) Design the system according to the MIT rule that minimizes the square of the error (error squared performance criterion).

b) Design the system according to the MIT rule that minimizes the absolute error (absolute error performance criterion) and provide the block diagrams for both cases.

c) Investigate how the stability of the system changes as a function of the input signal amplitude by applying input signals of different amplitudes.

d) Update your design based on the square of the error performance criterion, so that the system behavior becomes independent of the input signal (normalize the adaptive rule). Investigate the system behavior for input signals of different amplitudes.