EED604E OPTIMIZATION

Recursive Parameter Estimation

HOMEWORK #1

[Deadline: 20.11.2024 @23.00]

In the system model below, $\{e(t)\}$ is an independent normal random variable with N(0, 0.5) distribution. The system equation is given by:

$$y(t) + ay(t-1) = bu(t-1) + e(t) + ce(t-1), \qquad t = 1, 2, \ldots$$

Do the following:

a) Perform parameter estimation using the following methods: Standard RLS (Recursive Least Squares), RLS with forgetting factor, Extended Least Squares, Least Means Square (LMS), Projection Algorithm (PA), and Stochastic Algorithm (SA). Compare the simulation results and examine the effect of the forgetting factor.

b) Estimate the parameters of the system using RLS with closed-loop feedback for: $u(t) = -0.2y(t)$ and $u(t) = -0.32y(t-1)$. Analyze the results.

Note:

- In the simulations, the system parameter values will be taken as $a = 1,\ b = 0.5$, and $c = -0.5$. Also, specify the values of $P(0)$ and $\hat{\theta}(0)$ that you use in the simulations.

- Reports will be submitted via the UBIS system including the simulation files. The specified system and related simulations can be found in the book of Astrom, Example 2.13 - 2.16, and you can compare your results with the book simulation.