Mini Project - 01

Due: Monday, July 10th

Instructions

- Make any additional assumptions if needed and justify your assumption.

- It is an individual project; please submit your own work.

- Attach the codes and results for the respective questions if MATLAB or any software is used.

- Make a detailed report describing the results and inferences.

- Use only the equations mentioned and not direct commands or packages to implement the Kalman filter

Problem - 1: Kalman Filter

Implement the Kalman Filter to estimate the level of water in the 4 tanks present in the Quadruple tank experiment, as discussed in class. The experiment is explained in detail in the reference paper (Quadruple tank process) as in the link given below.

Link: https://drive.google.com/file/d/1XQ-O1Rov4L_b6n1J6dJQ7_3cUy-l-ik4/view?usp=sharing

Please use the same parameter values as described in the paper. For the initial conditions, use the minimum-phase characteristic values. The transfer functions given in the paper can be ignored for this assignment. Q and R values have to be tuned to attain convergence of the filter and get better accuracy with the estimates. Tolerance, defined as the L2 norm between prior and posterior state vectors, has to be less than or equal to 5×10^{-3}. Measurements are sampled at a time interval of 0.1s. Measurement values obtained by solving the model equations have also been uploaded in the link given below. Use them as the true measurements.

Link:

https://docs.google.com/spreadsheets/d/10lm7KOxo6k3etXTsW5t2KYcC7d0sGUlZ/edit?usp=sharing&ouid=108491382124139074371&rtpof=true&sd=true

Problem - 2: Particle filter

Implement the Particle Filter to estimate the level of water in the 4 tanks present in the Quadruple tank experiment, as discussed in class. Follow the same procedures as mentioned in Problem 1.

Problem - 3: Comparison

Compare the results obtained from Part 1 and 2 with the actual measured values and document your inferences.