

CH5120: Course Project 1

Submission deadline

- Submit the assignment on or before **October 10th 2022**
- Submission link for the course project will be opened in Moodle.
- Ensure the filename is in the format **<Rollno.pdf>**

Note

- It is an individual project.
- Make a detailed report (max 15 pages) describing the results and inferences.
- Use only the equations mentioned and not direct commands or package to implement Kalman filter.

Problem Statement

Part 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 link 1.

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 link 2. Use them as the true measurements.

You can also refer to lecture 25 from last year's videos uploaded for the equations involved in implementing the Kalman filter. Stick to the variable names mentioned in that to maintain uniformity. All 8 plots mentioned in the lecture have to be shown as the output.

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

Link 2: <https://docs.google.com/spreadsheets/d/10lm7KOxo6k3etXTsW5t2KYcC7d0sGUIZ/edit?usp=sharing&ouid=108491382124139074371&rtpof=true&sd=true>

Part 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 part 1.

You can refer to the presentation uploaded on google drive for the equations involved in implementing the Particle filter.

Part 3:

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