Aalto University
School of Electrical
Engineering

Exercise Round 10

The deadline of this exercise round is **Thursday March 27, 2025**. The solutions will be discussed during the exercise session in the T2 lecture hall of Computer Science building starting at 14:15.

The problems should be *solved before the exercise session*. During the session those who have completed the exercises will be asked to present their solutions on the board/screen.

Exercise 1. (Extended RTS Smoother)

Derive and implement the extended RTS smoother to the model in in Round 4, Exercise 1, and compare the errors of the filters and smoothers.

Exercise 2. (Backward Simulation Particle Smoother)

(a) Implement a backward simulation particle smoother for the non-linear model in Round 4, Exercise 1.

(b) Evaluate the performance of the smoother in terms of the estimated mean and covariance, as well as execution time as a function of the number of particles. *Hint: If you experience numerical problems (why?), try to increase the process noise covariance Q slightly.*

Exercise 3. (Reweighing Particle Smoother)

(a) Implement a reweighing particle smoother for the non-linear model in Round 4, Exercise 1.

(b) Evaluate the performance of the smoother in terms of the estimated mean and covariance, as a well as execution time as a function of the number of particles. *Hint: The computational complexity of the smoother grows quadratically with the number of particles. Start by choosing low numbers of particles.*