Aalto University
School of Electrical
Engineering

# Exercise Round 9

The deadline of this exercise round is **Wednesday March 25, 2020**. Due to the COVID-19 disease, we move the exercise session to online (Slack workspace http://elec-e8105-2020.slack.com/) according to policies by Aalto University and Finnish government.

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

## Exercise 1. (Statistically Linearized Smoother)

Write down the derivation of the (additive form) statistically linearized RTS smoother. You can follow the same steps as in the derivation of extended RTS smoother.

## 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 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 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.*