

## Exercise Round 7.

- The deadline for exercise round 7 is **March 31, 2012**.

The answers should be sent as email to the teacher (simo.sarkka@aalto.fi) in PDF form. When sending the email, please add "S-114.4610" or "1144610" to subject. The answers can also be returned on paper to the teacher.

### Exercise 1. (Smoother for Gaussian Random Walk)

**A)** Implement the Gaussian random walk model smoother (without EKF/UKF toolbox) and compare its performance to the corresponding Kalman filter. Plot the evolution of the smoothing distribution.

**B)** Form grid-based approximation to the Gaussian random walk model smoother in the same way as was done for the filtering equations in Exercise 2 of Round 3. Verify that the result is practically the same as of the RTS smoother above.

**C)** Write down the smoother equations, when the stationary filter is used as the filter. Note that the smoother becomes a stationary backward filter. Compare the performance of this stationary smoother to non-stationary smoother.

### Exercise 2. (Smoother for Stochastic Resonator)

Implement RTS smoother to the resonator model in Exercise 3 of Round 3. Compare its RMSE performance to the filtering and base line solutions and plot the results. Also return the Matlab codes that you implemented.

### Exercise 3. (Statistically Linearized Smoother)

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

**B)** Derive and implement statistically linearized RTS smoother and extended RTS smoother to the model in Exercise 1 of Round 4 and compare the errors of filters and smoothers. Also return the Matlab codes.

**C)** In Exercise 2 of Round 4 you derived an alternative (derivative) form of SLF. Write down the corresponding alternative form of SLRTS. Check that the resulting smoother in B) is the same with both the formulations.