Stationary Stochastic Processes

Credits: 9 ECTS

Course organizer and lecturer
Department of Mathematics and Mathematical Statistics
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Course period: April 2021 – June 2021

Prerequisites
Doctoral courses in Advanced Probability Theory and Advanced Statistical Inference. Knowledge in stochastic processes at second circle level and signal processing helps.

Objective
The objective is to present how stationary process models are constructed and how their mathematical, probabilistic, and statistical properties can be analysed.

There will be one three-hour lecture per week, and one three-hour homework presentation and discussion per week.

Content
This course covers the following topics in stationary stochastic processes:
1. How to define a stochastic process; sample space, ensemble, distribution
2. Sample function properties, continuity, derivatives and integrals
3. Covariance functions and their Fourier transform, spectral representation of the covariance function
4. Spectral representation of a stationary process
5. Linear filter operations, correlation- and spectral relations, white noise
6. Hilbert transform, envelope, Karhunen-Loève expansion
7. Multivariate processes and cross-correlation properties
8. Spectral properties of random fields

Examination
The examination consists of an oral exam and a written exam at the end of the course.

Literature
The main course literature is Georg Lindgren's book 1). The other books are complementary reading:
1) Lindgren, G. *Stationary Stochastic Processes – Theory and Applications*. CRC Press, 2013.
2) Cramér, H. and Leadbetter, M.R. *Stationary and Related Stochastic Processes – Sample function properties and their applications.* Wiley, 1967.
3) Lindgren, G., Rootzén, H. and Sandsten, M. *Stationary Stochastic Processes for Scientists and Engineers*, CRC Press, 2014.