Time Series Analysis 2025

Introductory meeting and start of course
The introductory meeting takes place on Monday, November 3rd, 2025, at 15.15, in MA:2.

Course overview
Course credits: 7.5 hp.

The course is a project course, containing lectures, computer exercises and an independent project with both oral and written presentation.

Course content
Time series analysis deals with the modeling of stochastic systems, such as the air temperature, the price and demand of electricity, radar signals, EKG or option pricing on the stock market. The model structure is chosen partly from knowledge of the physical system, and partly by examining observed data measurements. Central problems are, for instance, the predictability of the model, how to estimate the model parameters in a robust way, estimation of the spectral content of the model, or other non-parametric descriptions of the system, as well as validation of the chosen model, i.e., how one should ensure that the model well describes the observed measurements.

Course material
The course is based on the textbook *An Introduction to Time Series Modeling* (4th ed., Studentlitteratur, 2021), by Andreas Jakobsson. The book is available at, for instance, KFS Studentbokhandel and online. Additional material, including Matlab code, data, slides, and the project are available on the Canvas page.

Link to Youtube lectures: *https://www.youtube.com/channel/UCEG5e04-Bupgp-Ag41-zxuQ*
Link to Python code: *https://github.com/andreasjak/TimeSeriesAnalysis*

Students are expected to watch videos 1-5 before the first lecture.

Examination
The course examination consist of mandatory computer exercises as well as a project. As a part of the examination, a detailed project report should be handed in and the results disseminated in an oral presentation.

Project examination will take place on **19/12**, at 13.15, in MH:G or on **16/1**, at 14.15, in MH:R (choose either of the times). Note that the project should be submitted **no later than two days prior** to the presentation. Please see the course webpage for further details.

Lecturer
Andreas Jakobsson 046 / 222 4520 aj@maths.lth.se MH:217

Course schedule

Lecture	Content	Videos	Code	Reading
Lect 1	Introduction. Multivariate random variables.	1-6		Ch. 1, 2
Lect 2	Multivariate random variables. Stochastic processes. *Complete the first mini-project.* *Suggested problems: 2.1, 2.2, 2.3, 3.1, 3.4*	7-15	1	Ch. 2, 3.1-3.3
Lect 3	Stochastic processes.	16-17	2-5	Ch. 3
Lect 4	Stochastic processes. Identification. *Complete the second mini-project.* *Suggested problems: 3.5-3.10, 3.12-3.15*	18-19	6	Ch. 3, 4.1-4.2
Lect 5	Identification.	20	7	Ch. 4
Lect 6	Estimation. *Complete the third mini-project.* *Suggested problems: 4.1-4.4*	21-22	8	Ch. 4, 5.1-5.2
Lect 7	Model order selection.	23-24	9-12	Ch. 5
Lect 8	Residual analysis. *Complete the first computer exercise.* *Suggested problems: 5.1-5.5, 5.8, 5.10-5.11*	25	13-14	Ch. 5
Lect 9	Prediction.	26-27	15-17	Ch. 6
Lect 10	Multivariate time series. *Complete the second computer exercise.* *Suggested problems: 6.1-6.8*	28-32	18-19	Ch. 7
Lect 11	Recursive estimation. State-space models.		20-23	Ch. 8
Lect 12	The Kalman filter. Project discussion. *Complete the third computer exercise.* *Suggested problems: 7.1-7.4, 8.1-8.8*		24-28	

Comments

- The above noted code refers to the lecture codes, with '1' implying the file *code1.m*, etc.
- The list of videos are the online lectures. These are deliberately set at a *higher* pace for the first lectures than we will keep, to get us started.
- The reading material refers to the corresponding book chapters and reflect the pace we will keep in the lectures.
- The above listed problems should be viewed as suggestions for students wishing to further their knowledge of the material. It is *not* mandatory to complete these.
- Please see *examCode.m* for an example of the format for submitting your predictor.
- It is recommended that you wait to work on the project until you have (at least) completed the first computer exercise.

Webpage The detailed schedule, material, and news related to the course can be found at the course's Canvas page.