MATH-342

Time series

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Cursus	Sem.	Type
Data Science	MA2, MA4	Opt.
Financial engineering minor	E	Opt.
Financial engineering	MA2, MA4	Opt.
Mathematics	BA6	Opt.
Statistics	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

A first course in statistical time series analysis and applications.

Content

- Motivation; basic ideas; stochastic processes; stationarity; trend and seasonality.
- Autocorrelation and related functions.
- Stationary linear processes: theory and applications.
- ARIMA, SARIMA models and their use in modelling.
- Prediction of stationary processes.
- Spectral representation of a stationary process: theory and applications.
- Financial time series: ARCH, GARCH models.
- State-space models:Kalman filter.
- VAR and other simple multivariate time series models
- Other topics as time permits.

Learning Prerequisites

Required courses

Probability and Statistics

Recommended courses

Probability and Statistics for mathematicians. A course in linear models would be valuable but is not an essential prerequisite.

Important concepts to start the course

The material from first courses in probability and statistics.

Learning Outcomes

By the end of the course, the student must be able to:

- Recognize when a time series model is appropriate to model dependence
- Manipulate basic mathematical objects associated to time series
- Estimate parameters of basic time series models from data

- Critique the fit of a time series model and propose alternatives
- Formulate time series models appropriate for empirical data
- Distinguish a range of time series models and understand their properties

Teaching methods

Ex cathedra lectures and exercises in the classroom and at home.

Assessment methods

final exam & mid term assessed coursework - counts for 15%
Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Assistants	Yes
Forum	No

Resources

Bibliography

Lecturenotes available at https://moodle.epfl.ch/course/view.php?id=15393

Ressources en bibliothèque

- Spectral Analysis for Physical Applications / Percival
- Analysis of Financial Time Series / Tsay
- Introduction to Time Series and Forecasting / Brockwell & Davis
- (electronic version) Introduction to Time Series and Forecasting
- Time Series Analysis and its Applications, with R Examples / Shumway & Stoffer
- (electronic version) Time Series Analysis and its Applications, with R Examples
- (electronic version) Analysis of Financial Time Series

Notes/Handbook

- Brockwell, P. J. and Davis, R. A. (2016) Introduction to Time Series and Forecasting. Third edition. Springer.
- Shumway, R. H. and Stoffer, D. S. (2011) Time Series Analysis and its Applications, with R Examples. Third edition. Springer.
- Tsay, R. S. (2010) Analysis of Financial Time Series. Third edition. Wiley.

- Percival, D.P. and Walden A. T. (1994) Spectral Analysis for Physical Applications. CUP.

Moodle Link

- https://go.epfl.ch/MATH-342