EPFL

MATH-342	**Time series**
	Thibaud Emeric

Cursus	Sem.	Type
Financial engineering	MA2, MA4	Opt.
Mathematics	BA6	Opt.
Mineur STAS Russie	E	Opt.

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

Summary

A first course in statistical time series analysis and applications, including practical work.

Content

- Motivation; basic ideas; stochastic processes; stationarity; trend and seasonality.
- Autocorrelation and related functions.
- Stationary linear processes: theory and applications.
- Spectral representation of a stationary process: theory and applications.
- ARIMA, SARIMA models and their use in modelling.
- State-space models: key ideas and applications.
- Prediction of stationary processes.
- Financial time series: stylised facts, volatility, unit roots and non-stationarity, ARCH, GARCH, stochastic volatility and related models.
- Multivariate time series.
- Long memory processes.
- 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
- Analyze empirical data using time series models

Teaching methods

Ex cathedra lectures, exercises and computer practicals in the R language in the classroom and at home.
Mini-project based on data chosen by the student.

Assessment methods

Mini-project, final exam.

Supervision

Assistants   Yes

Resources

Bibliography

Polycopié is available with slides, problems, bibliography, etc.

Ressources en bibliothèque

- Time Series Analysis and its Applications, with R Examples / Shumway
- (electronic version)
- Introduction to time series and forecasting / Brockwell
- (electronic version)
- Dynamic linear models with R / Petris
- (electronic version)
- Analysis of financial time series / Tsay
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Notes/Handbook

- Brockwell, P. J. and Davis, R. A. (1996) Introduction to Time Series and Forecasting.
- Springer. Diggle, P. J. (1990) Time Series : A Biostatistical Introduction. Oxford University Press
- Tsay, R. S. (2005) Analysis of Financial Time Series. Second edition. Wiley.
- Shumway, R. H. and Stoffer, D. S. (2011) Time Series Analysis and its Applications, with R Examples. Third edition. Springer-Verlag.