Module Description

Stochastic Modelling

General Information

Number of ECTS Credits

3

Abbreviation

FTP_StochMod

Version

2.12.2016

Responsible of module

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Language

	Lausanne	Bern	Zürich
Instruction	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E
Documentation	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E
Examination	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E

Module category

☑ Fundamental theoretical principles

☐ Technical/scientific specialization module

☐ Context module

Lessons

☑ 2 lecture periods and 1 tutorial period per week

Brief course description of module objectives and content

The ubiquitous presence of uncertainty and noise in the engineering sciences makes it mandatory to understand and quantify random phenomena. To achieve this goal the course will provide a solid introduction to the theory of probability and stochastic processes. Special attention is given to applications (Kalman-Filter) and the student will model and analyze stochastic situations as encountered in practice. The applications include examples from various fields such as information technologies and communications, vision, signal processing, production, traffic flows, queuing theory.

Aims, content, methods

Learning objectives and acquired competencies

The student is familiar with the main working tools and concepts of stochastic modelling. He/She is able to explain properties and limitations of stochastic processes as a modelling tool for noisy systems. He/She will be able to model and analyze simple random phenomena through adaptation of proposed stochastic models.

Contents of module with emphasis on teaching content

- Probability review: random variables, theorem of large numbers, central limit theorem.
- General introduction to discrete and continuous stochastic processes. Applications: communications and Kalman-Filter.
- Discrete and continuous Markov Chains and hidden Markov models. Applications: stochastic manufacturing systems, queuing systems, pattern recognition.
- Bernoulli, Poisson, Gaussian Processes.

Teaching and learning methods

Ex cathedra teaching

Presentation of simulation results and case studies

Prerequisites, previous knowledge, entrance competencies

1. Basis calculus (integration, differentiation, ordinary differential equations)
2. Basic probability theory
3. Linear algebra (matrix algebra, Eigenvalues)

Literature

The script is, in principle, sufficient. Further readings are:

1. Sheldon M. Ross, *Probability Models*, Elsevier.
2. John A. Gubner, *Probability and Random processes for electrical and computer Engineers*, Cambridge University Press
3. Mario Lefebvre, *Applied Stochastic Processes*, Springer.
4. Bassel Solaiman, *Processus stochastiques pour l'ingénieur*, PPUR.

Assessment

Certification requirements for final examinations (conditions for attestation)

Nothing

Written module examination

Duration of exam :	120 minutes
Permissible aids:	Script, books and calculator (open book, without E-communication tools).