



## DEPARTMENT OF MATHEMATICAL SCIENCES

### **NFMV021 Piecewise deterministic Markov processes and continuous-time Monte Carlo, 7.5 credits**

Styckvis deterministiska Markovprocesser och Monte Carlo-metoden i kontinuerlig tid, 7,5 högskolepoäng

*Third-cycle level / Forskarnivå*

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### **Confirmation**

This syllabus was confirmed by the Department of Mathematical Sciences on 2021-11-12, and is valid from Autumn semester 2021.

#### ***Responsible Department***

Department of Mathematical Sciences, Faculty of Science

### **Entry requirements**

Analysis, probability theory, familiarity with basic stochastic processes, deriving basic Markov-Chain Monte Carlo methods and being able to implement them.

### **Learning outcomes**

At the end of the course students will be able to:

Use piecewise deterministic Markov processes as modelling tools.

Use and design Monte-Carlo methods based on piecewise-deterministic Markov processes (event-chain Monte-Carlo).

### **Course content**

Structure and contents:

- Introduction and examples.
- Continuous time Markov processes.
- Construction of piecewise deterministic Markov processes and examples.
- Stationarity of piecewise deterministic Markov processes.
- Event-chain Monte Carlo.

## Literature:

- Liggett, T.M. (2010). *Continuous time Markov processes*. Vol. 113. Graduate Studies in Mathematics. American Mathematical Society, Providence, RI, 2010.
- Davis, M.H.A. (1993). *Markov models and optimization*. Vol. 49. Monographs on Statistics and Applied Probability. Chapman & Hall, London.
- Fearnhead, P., Bierkens, J., Pollock, M., and Roberts, G.O. (2018). Piecewise deterministic Markov processes for continuous-time Monte Carlo. *Statistical Science*, 33(3), 386-412.
- Vanetti, P., Bouchard-Côté, A., Deligiannidis, G., and Doucet, A. (2017). Piecewise-deterministic Markov chain Monte Carlo. *Preprint*. ArXiv:1707.05296.

## Types of instruction

The course will consist of two meetings per week of two hours each and reading assignments for self study. The first meeting in a week will have the character of a lecture, the second meeting in a week has an open character with problem discussion and student presentations.

### *Language of instruction*

The course is given in English.

## Grades

The grade Pass (G) or Fail (U) is given in this course.

## Types of assessment

Homework, topic presentations and oral examination.

## Course evaluation

The course will be evaluated with two student representatives.