Malliavin calculus, fall 2016

News

Description

In Stochastic analysis a central role is played by the stochastic integral with respect to Brownian motion, introduced by Ito (1944). The classical Theory of Frechet derivatives on a Banach space does not fit with Ito integration. In 1976 Paul Malliavin invented a new way to differentiate functionals of Brownian motion. The adjoint operator of the Malliavin derivative is the Skorokhod integral, which extends the Ito integral to non-anticipative integrands. Malliavin calculus has concrete applications, for example in mathematical finance: the Ito-Clark-Ocone formula gives explicitly the martingale representation of a square integrable Brownian functional. This is used to compute the hedging of path-dependent options. The Malliavin calculus is developed similarly also on the Poisson space.

Prerequisites

Probability theory or Measure and Integration. The background in functional and stochastic analysis will be presented in the lectures

Contents


Applications: computation and smoothness of densities of random variables and solutions of stochastics differential equations. Option pricing and computation of sensitivities.

Bibliography


Some other books on Malliavin Calculus

• Privault N. Stochastic Analysis in Discrete and Continuous Settings, with Normal Martingales, Springer 2009.

Freely available lecture notes:

• Friz, Peter: *An introduction to Malliavin Calculus*.
• Öksendal, Bernt: *An introduction to Malliavin Calculus with applications in economics* 1997.
• Fred Espen Benth: *An Addendum to “An Introduction to Malliavin Calculus with Applications in Economics” exercises with solutions and miscellaneous notes.*
• Sottinen Tommi: *Malliavin-laskenta*.
• Imkeller Peter: *Malliavin’s calculus and applications in stochastic control and finance, Warsaw 2008*.

**Teaching schedule**

Weeks 36-42 and 44-50, lectures on Tuesday 12-14 in room C122 and Thursday 12-14 in room C123, with exercise class on wednesdays 10-12 in C122. The first lecture is on tuesday 6.9 and the first tutorials are on wednesday 14.9.

**Exams:**

The exam is passed by solving the problems assigned weekly and writing a final home exam.

**Course material**

slides: ABC of malliavin calculus .Lecture notes: Notes on Gaussian measures in infinite dimension

**Registration**

Did you forget to register? [What to do?](#)
Exercises

Assignments
- Exercise sets 1-2 (14 and 21.9.2016) \textit{latex}
- Exercise set 3 (28.9.2016) \textit{latex}
- Exercise set 4 (5 and 12.10.2016) \textit{latex}
- Exercise set 5 (19 and 26.10.2016) \textit{latex}
- Exercise set 6 (16.11.2016) \textit{latex}
- Exercise set 7 (30.11 and 7.12) \textit{latex}

Exercise classes

<table>
<thead>
<tr>
<th>Group</th>
<th>Day</th>
<th>Time</th>
<th>Room</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wednesday</td>
<td>10-12</td>
<td>C122</td>
<td>Dario Gasbarra</td>
</tr>
</tbody>
</table>

Course feedback

Course feedback can be given at any point during the course. Click \textit{here}. 