Some of this needs to be updated for 2016.

Outline of course on Stochastic Numerical Analysis for SDEs and SPDEs

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Prerequisites: basic knowledge of probability. This will be reviewed in Lecture 1, and anyone who is not familiar with it will need to refresh their knowledge by reading a basic textbook.

- Lecture 0

  (This is material I'll assume as a starting pont; I'm happy to have a revision session to cover things in it.)

  Basics of Monte Carlo simulation: Central Limit Theorem, confidence interval, mean square error decomposition for a biased estimator

- Lecture 1

  Brownian motion / Wiener process: definition and basic properties

  SDEs: Ito and Stratonovich forms, as limits of discrete approximations, informal derivation of Ito calculus

  Ref: Des Higham's SIAM Review paper

- Lecture 2

  Numerical methods for SDEs: Euler, Milstein, predictor-corrector and implicit Euler

  Definitions of weak and strong convergence

  Numerical determination of order of convergence

  Ref: Bally & Talay papers on weak convergence, part I and part II

- Lecture 3

  Multi-dimensional SDEs and Lévy areas

  Clark-Cameron result on the strong order of convergence for multi-dimensional SDEs

  Ref: Clark & Cameron paper

- Lecture 4

  Markov, Hölder, Jensen and Doob's martingale inequalities

  Ref: Wikipedia entries for Markov, Hölder, Jensen and Doob inequalities

- Lecture 5

  Gronwall and Burkholder-Davis-Gundy inequalities

  Ref: Wikipedia entries for Gronwall and Burkholder-Davis-Gundy inequalities

  See also this Wikipedia list of inequalities in probability and statistics

- Lecture 6

  Analysis of strong convergence of Euler-Maruyama discretisation

  Ref: Kloeden & Platen book

- Lecture 7

  Multilevel Monte Carlo

  Ref: my original paper

- Lecture 8

  Multilevel Monte Carlo using Milstein discretisation

  Algorithms based on Brownian Bridge interpolation, and results for extrema of Brownian paths

  Ref: my Milstein paper

- Lecture 9

  Multilevel Monte Carlo using Milstein discretisation

  Numerical analysis

  Ref: my new paper with Debrabant and Roessler

- Lecture 10

  Mean-square strong stability: definition and analysis

  Ref: Des Higham's paper

- Lecture 11

  Parabolic SPDE driven by Brownian motion

  Numerical analysis of accuracy and stability

  Ref: my paper with Christoph Reisinger