lectures-ayv08.tex

Ergodic SDEs with numerical aspects

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Lectures will be on Mondays 1.9., 8.9. and 15.9. at 15 – 18 in U 322, Otakari 1 M, Department of Mathematics and Systems Analysis, TKK.

A Three day "crash course", September 2008[1]

Day-1. Stochastic Differential Equations (SDEs): weak and strong solutions according to Itô, Skorokhod, Krylov; techniques by Yamada–Watanabe and Zvonkin–Veretennikov, with recent new ideas. Krylov's inequalities for Itô processes. Skorokhod's Unique Probability Space Lemma. Dependence on initial data and parameters according to Blagoveshensky–Freidlin and Krylov. Flows according to Kunita.

Prerequisites: Please, revise Wiener process and Itô stochastic integration. It would be nice if everybody in the audience knew in advance Itô's Theorem. It would be also good to revise the notions of L_p spaces and Sobolev classes W_p (via approximation by smooth functions in L_p with derivatives in question).

[Recommended Literature: e.g., the books by Krylov, (Introduction...; Controlled diffusion processes), Skorokhod]

Day-2. Markov and strong Markov properties of SDEs, according to Feller, Girsanov, Krylov. Ergodic properties for SDEs with good recurrent properties. Lyapunov stability for SDEs and some generalizations. Notion of Mixing for Markov SDEs, mixing coefficients. Invariant measures. Harris-Khasminskii technique. Poisson equations via resolvents. Invariant measures, rate of convergence, Poisson equations with parameters.

Prerequisites: please, revise Markov and strong Markov properties.

[Recommended Literature: Stroock–Varadhan, Krylov, AYV course at TKK 2004.]

Day-3. Euler approximation schemes, weak and strong approximations according to Kloeden–Platen, Milstein–Tretyakov, Gyongy–Krylov. Mixing rates for approximations. Approximate Poisson equations. Some applications to stochastic algorithms according to Benveniste–Metivier–Priouret (BMP).

Prerequisites: nothing.

[Recommended Literature: AYV course at TKK 2004, the BMP book.]

[1] The programme is provisional. The use of the term "crash course" has been suggested by Prof Valkeila, probably to attract your attention; I personally am not intended to crash anything. I am not quite sure if I manage to include all topics that are planned into nine hours during three days which are scheduled. Prerequisites are very desirable in the sense that I will have no time for a careful revision during the course. Plenty of recommended literature is given just for orientation: the lecturer does not assume that the audience will read or re-read all of them, nor even do I promise that all books will be really used.