Professor Kulik (Kiev) will offer a student seminar on

Stochastic approximation and Monte Carlo methods for diffusions and Lévy driven processes

in the Wintersemester 2016/17. The seminar will take place in three blocks (possibly on weekends). A first meeting for potentially interested students will be on

Tuesday, October 25th, 10.00 (sharp!), Room MA748.

Participants should have a good knowledge of the basics of probability theory (like Wahrscheinlichkeitstheorie 2). It is advisable for participants to attend also the course on Lévy processes and Lévy driven SDEs by Professor Kulik.

Potentially interested students: please send an e-mail to me (ms@math.tu-berlin.de) with the subject "Seminar" containing your name, university (if different from TU Berlin), subject of study (eg "Master Wirtschaftsmathematik"), and a list of courses you completed in Probability Theory so far. Please send this e-mail before October 16th.

For those who need a certificate ("Seminarschein"), the requirements are the following:
- seminar talk (of sufficient quality)
- written version of the talk ("Ausarbeitung") to be submitted at a specified time after the talk (of sufficient quality)
- attendance at all talks.

Here is a preliminary list of topics:

Block I: Generation of random variables and output analysis

1. Generation, A: general methods. Inversion, A-R (Acceptance-Rejection), and FFT (Fast Fourier transform)[1,3]
2. Generation, B: ad hoc methods. Box-Muller and Marsaglia algorithms for the normal distribution; Chambers, Mallow and Stuck algorithm for stable ditributions [3]
3. Asymptotic output analysis: Normal confidence intervals, Variance-Reduction methods [1,3]
4. Non-asymptotic output analysis, A: Gaussian concentration inequalities via the log-Sobolev inequality [1]
5. Non-asymptotic output analysis, B: sub-Gaussian random variables and Gaussian concentration inequalities [2]
6. Non-asymptotic output analysis, C: pre-Gaussian random variables and exponential concentration inequalities [2]

Block II: Brownian Motion and SDEs

7. Simulation methods for the Brownian Motion: linear interpolation and wavelet decomposition [1,3]
8. SDEs and the Feynman-Kac formula. Generalities on the Monte-Carlo methods for PDEs: the statistical error and the discretisation error; strong and weak convergence orders [1]
9. The Euler method: description, the algorithm, weak and strong convergence orders [1,3]
10. The statistical error analysis: Gaussian concentration inequalities [1,2]
11. The Milstein scheme and other higher-order schemes [1,3]
12. The Euler method for ergodic diffusions [3]
13. The discrete parametrix method (optional)

Block III: Lévy processes and Lévy driven SDEs

14. Simulation methods for Lévy processes: discrete skeleton method, compound Poisson processes. The DamienLaudSmith algorithm, the Asmussen-Rosinski procedure [3]

15. Subordinators and subordination. Series representations and related simulation algorithm [3]

16. The Euler method for Lévy driven SDEs: description, the algorithm, strong convergence order [3]

17. The statistical error analysis: exponential moment bounds and exponential concentration inequalities. Orlicz spaces, -sub-Gaussian random variables, and -exponential concentration inequalities [2]

Bibliography

1. E.Gobet, Methodes de Monte-Carlo et processus stochastiques: du lineare au non-lineare, Editions de l'Ecole Polytechnique, 2013.

2. V.V.Buldygin, Yu.V.Kozachenko, Metric characterization of Random Variables and Processes, American Mathematical Society, Providence, RI, 2000.

3. S.Asmussen, P.W.Glynn, Stochastic Simulation Algorithms and Analysis, New York: Springer, 2007.