Math 60860: Stochastic Modeling
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Spring 2006: Stochastic Modeling: Math 60860

This course is a sequel to Math 60850 (Applied Probability). It gives an introduction to stochastic modeling and stochastic differential equations, with application to models from biology and finance.

1. Martingales, including stopping times and optimal stopping.
2. Various stochastic processes, including Gaussian processes, Brownian motion, queues, and applications.
3. Brownian motion and related Processes, e.g., the Ornstein-Uhlenbeck Process
4. Stochastic integration (including Ito's formula and derivation of the Black-Scholes differential equation).
5. Stochastic versus deterministic models
6. Diffusion processes and random walks
7. Poisson processes with applications
8. Elements of stochastic dynamical systems
9. Numerical methods for stochastic processes

Some good books on the material in this course are listed below.

References

[1] G. Grimmett and D. Strizaker, Probability and random processes, Oxford, 3rd edition, 2001.

[2] W. Feller, An Introduction to Probability Theory and Its Applications, Volume 1, Wiley.

[3] S. Karlin and H. M. Taylor, A first course in stochastic processes. Second edition. Academic Press, New York-London, 1975.

[4] S. Karlin and H. M. Taylor, A second course in stochastic processes. Academic Press, New York-London, 1981

[5] B. Oksendal, Stochastic Differential Equations : An Introduction with Applications, Sixth edition. Universitext. Springer-Verlag, Berlin, 2003.

[6] H. M. Taylor and S. Karlin, An introduction to stochastic modeling, 3rd ed., San Diego : Academic Press, 1998.

[7] L. Rogers and D. Williams, Diffusions, Markov processes, and Martigales, vol. 1, Wiley, 1987.

[8] L. Rogers and D. Williams,

[9] L. Rogers and D. Williams, Diffusions, Markov processes, and Martigales, vol. 2: Ito Calculus, Wiley, 2000.

[10] S. Ross, A first course on probability, 6th ed., Prentice Hall (2002).

[11] D. Williams, Probability and Martingales, Cambridge, 1991.