

Stochastic Processes and their Applications

Coordinates

Online, Tue & Thu, 11-12.30 (tentative)

Course Content

- Introduction: Random variables and their properties; Central Limit theorem; Wiener-Khinchin theorem
- Markov processes: Chapman-Kolmogorov equation; Master equation; Stationary state, detailed balance
- Birth-death processes: natural boundaries, reflecting and absorbing boundaries. Random walk, Moran process, Yule process
- Fokker-Planck equation: Forward FPE, Brownian motion, Ornstein-Uhlenbeck process, applications to evolutionary models
- Langevin equation: relation to FPE, Ito vs. Stratonovich
- First-passage problems: Branching process, birth-death process; Backward FPE and fixation time; Feller diffusion; Quasistationary distribution (Kramers' escape problem, logistic birth-death process)

Evaluation

Assignments & Take-home exam

References

1. van Kampen *Stochastic Processes in Physics and Chemistry*
2. Risken *The Fokker -Planck Equation: Methods of Solution and Applications*
3. Gardiner *Stochastic Methods: A Handbook for the Natural and Social Sciences*
4. Ewens *Mathematical Population Genetics*