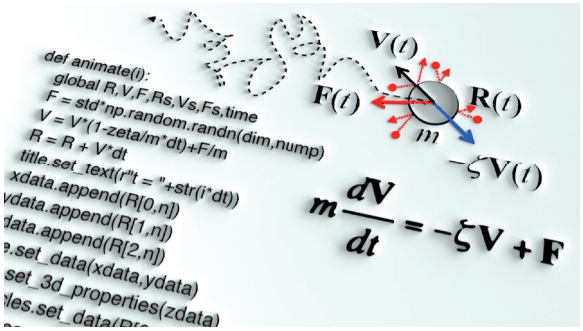
KyotoUx 009x

Free online courses from Kyoto University

“Stochastic Processes:
Data Analysis and Computer Simulation”

Learn how to simulate and analyze stochastic processes, in particular the dynamics of small particles diffusing in a fluid.



September 26, 2019 – August 4, 2020

Length: **Self-paced (6 weeks)**

Instructor: **Ryoichi Yamamoto, Ph.D.**

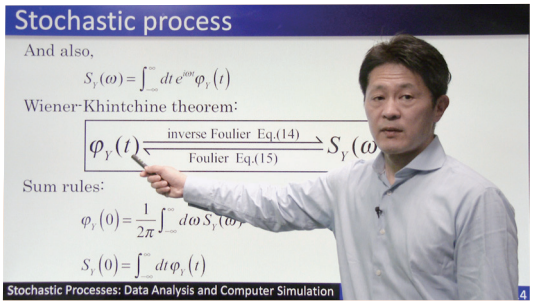
Professor of Chemical Engineering, Kyoto University

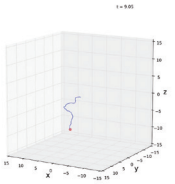
The motion of falling leaves or small particles diffusing in a fluid is highly stochastic in nature. Therefore, such motions must be modeled as stochastic processes, for which exact predictions are no longer possible. This is in stark contrast to the deterministic motion of planets and stars, which can be perfectly predicted using celestial mechanics.

This course is an introduction to stochastic processes through numerical simulations, with a focus on the proper data analysis needed to interpret the results. We will use the Jupyter (iPython) notebook as our programming environment. It is freely available for Windows, Mac, and Linux through the Anaconda Python Distribution.

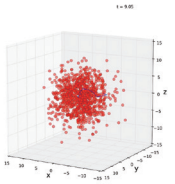
The students will first learn the basic theories of stochastic processes. Then, they will use these theories to develop their own python codes to perform numerical simulations of small particles diffusing in a fluid. Finally, they will analyze the simulation data according to the theories presented at the beginning of course.

At the end of the course, we will analyze the dynamical data of more complicated systems, such as financial markets or meteorological data, using the basic theory of stochastic processes.

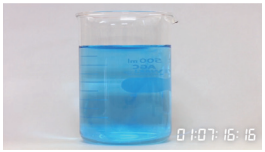


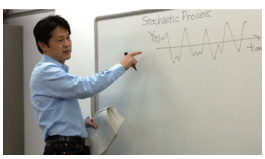


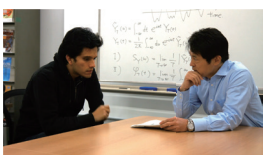
Simulated trajectory of a Brownian particle



Superposition of 1,000 trajectories with different sets of random forces







Week 1	Python programming for beginners
Week 2	Distribution function and random number
Week 3	Brownian motion 1: basic theories
Week 4	Brownian motion 2: computer simulation
Week 5	Brownian motion 3: data analyses
Week 6	Stochastic processes in the real world

https://www.edx.org/course/stochastic-processes-data-analysis-and-computer-simulation-2

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