SYLLABUS - EE 511 (SPRING 2019)
SIMULATION METHODS FOR STOCHASTIC SYSTEMS

Course Information:

Location: GFS 101 (1800h/1900h)
Instructor: Dr. Osonde Osoba
Office Hours: F 1700h in EEB 420
Email: osonde.osoba@usc.edu (put "EE511" in the subject)

TAs/Graders: TBD

Grading: 5 Projects, 20% each

Course Description:
Randomness and uncertainty are an integral part of nature e.g. random variations in weather, human traffic, epidemic spread, stock prices, etc. Stochastic models are important tools for characterizing such random phenomena. The goal of this course is to develop a facility with working with a couple of models for stochastic simulation and analysis. The course starts with an introduction into tools for generating and validating models of randomness. We take a look at maximum likelihood methods for characterizing and clustering random data. Then we end by learning to put randomness to work on optimization and estimation applications like machine learning modeling using Monte Carlo and Markov chain Monte Carlo (MCMC) methods.

Requirements:
A graduate-level maturity in mathematics. Students should either have taken EE503. Students should have some programming experience, preferably in MATLAB, Python, or R. You may want to consider starting a GitHub repository for your code solutions. Your performance on the projects determines your grade.

Text & References:
The primary references for the class will be selected papers and notes uploaded on the blackboard page. I also recommend the following texts (not required) for reference.
- Ross, S. M. *Simulation*. Academic Press, 2013.
- Glasserman, P. *Monte Carlo Methods in Financial Engineering*. Springer, 2013.

Course Topics

1) Review of Probability & Randomness
2) Random Number Generation & Resampling methods
3) Hypothesis Tests & Statistical Tests for validating probabilistic models
4) Monte Carlo Simulation & Variance Reduction techniques
5) Markov Chains & Advanced Markov Models
6) Clustering, Dimension Reduction, & Expectation-Maximization
7) Markov Chain Monte Carlo (MCMC) Simulation
8) MCMC in Machine Learning