

MIE1613H: Stochastic Simulation (Winter 2023)

- **Instructor:** Prof. Vahid Sarhangian, Office: BA8108, Email: sarhangian@mie.utoronto.ca
- **Office hours:** TBD in class
- **Teaching assistant:** Jangwon Park, Email: jangwon.park@mail.utoronto.ca
- **Lectures:** Thursday, 9AM-12, Room: WB 219

Course description and prerequisites

This course is a graduate level introduction to modelling and analysis of stochastic dynamical systems using computer simulation. The course provides a rigorous yet accessible treatment of the probability foundations of simulation, and covers programming simulation models in a lower-level language. Throughout the course, concepts and methods are illustrated using various examples from different application areas. In particular, applications to service and financial engineering are emphasized.

Students are expected to have a strong background in undergraduate-level probability and statistics, and be familiar with a general purpose programming language. Familiarity with stochastic processes would be helpful but not required. Students are required to use Python for the homework and project.

Textbook and other resources

- Textbook (required):
 - Nelson, Barry, and Pei Linda. *Foundations and methods of stochastic simulation: A first course*. Second edition. Springer Science & Business Media, 2021. (Available online at <https://link.springer.com/book/10.1007/978-3-030-86194-0>)
- Additional references:
 - Glasserman, Paul. *Monte Carlo methods in financial engineering*. Springer Science & Business Media, 2003. (Available online at <http://library.utoronto.ca>)
 - Asmussen, Søren, and Peter W. Glynn. *Stochastic simulation: algorithms and analysis*. Springer Science & Business Media, 2007. (Available online at <https://link.springer.com>)

Evaluation

- 40% Homework (see the table for tentative assignment dates - all homework will be due in 2 weeks from the assignment date)
- 30% Project (Assigned by Feb 16th; Proposal due on March 09, final report deadline to be announced)
- 30% Final exam (date and time to be announced)

Tentative course schedule

Date	Topic	Homework / Project
Jan 12	Intro. to stochastic simulation	
Jan 19	Probability and statistics review	Homework 1 assigned
Jan 26	Simulation examples (1)	
Feb 02	Simulation examples (2)	
Feb 09	Simulation as a stochastic process A framework for simulation modelling and analysis	Homework 2 assigned
Feb 16	Simulation input - input modelling and estimation	
Feb 23	Reading week (no class)	
March 02	Simulation input - random variate generation	
March 09	Simulation output	Project proposals due Homework 3 assigned
March 16	Design and analysis of simulation experiments	
March 23	Simulation optimization - ranking and selection	
March 30	Simulation optimization - gradient estimation	Homework 4 assigned
April 6	Variance reduction Simulation for research	