

CMSE 801, Spring 2019

Introduction to Computational Modeling

Course instructor: Jianrong Wang, wangj164@msu.edu

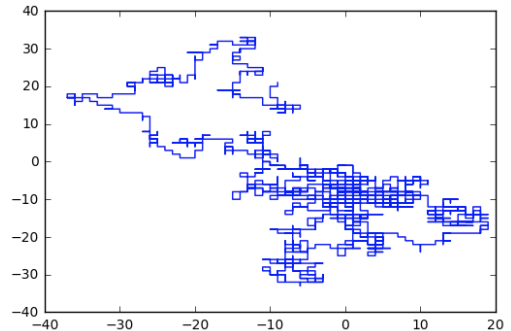
Date/time: Tuesday/Thursday, 8:30-9:50 AM.

Location: C104 Wonders Hall.

Prerequisites: One semester of introductory calculus.

Notes: This course counts toward the CMSE graduate certificate in Computational Modeling.

Course description: Computational models are very useful tools to understand the world around us. Over the course of this semester, we will explore the tools required to design, build and utilize computational models that are applied to many problems from a wide range of scientific disciplines. The main goal is to learn the skills necessary to apply computational techniques to a dataset of interest. Creating models to describe and understand systems (in the physical, life, or social sciences, or in engineering) is the driving principle of this course.



Expected learning outcomes:

- Gain insight into physical, biological and social systems through the use of computational algorithms and tools;
- Algorithmic thinking and write programs to solve common problems across a variety of disciplines;
- Identify important features of a system that can be parameterized and modeled;
- Manipulate, analyze, and visualize datasets and use these datasets to evaluate models;
- Achieve an understanding of basic numerical methods and use them to solve problems;
- Present results from a scientific computing problem, both orally and in writing.

Outline of major topics (subject to changes):

Part 1: Fundamentals of computational modeling

- Creating models
- Basics of programming in Python
- Data visualization
- Dataset manipulation
- Basic numerical techniques (Monte Carlo, Agent-based modeling, numerical integration)
- Statistics and linear regression
- Optimization

Part 2: Real-world applications

- Biomolecular modeling
- Network models for Amazon
- Heat transport
- Anomalous diffusion

