Class Syllabus

Instructor: Anthony Patrick

Contact: apatrick@gmu.edu

This course introduces students to scientific computing for modeling and simulation building on CDS 130. The target audience consists of anyone interested in honing their computational skills for the application of computational and/or data science. Students will further

- Learn programming concepts including iteration, arrays, matrices, and data structures;
- Implement models and develop simulations using Python;
- Develop and implement algorithms that solve problems encountered frequently in scientific computing and data science involving image processing, pattern recognition, numerical integration and text processing;

Objectives

By the end of this course, students will be able to:

1. Understand and define important terms used in modeling and simulation
2. Work comfortably at the command line of their computer
3. Use computers to investigate simple scientific problems using both data and simulation.
4. Solve simple scientific equations.
5. Describe how data are acquired, processed, analyzed, and visualized in a variety of scientific domains
6. Understand how modeling and simulation is used across the general sciences.

Prerequisites

CDS 130

Textbooks

Two electronic textbooks will be made available to the students; one through the instructor and the other by download http://greenteapress.com/ModSimPy/ModSimPy.pdf.

Other options are: Steven I. Gordon & Brian Guilfoos. *Introduction to Modeling and Simulation with MATLAB and Python*. CRC Press, Angela B. Shiflet & George Shiflet. *Introduction to Computational Science: Modeling and Simulation for the Sciences*. Princeton University Press, 2006. Bernard P. Zeigler, Herbert Praehofer, & Tag Gon Kim, *Theory of Modeling and Simulation* Academic Press, 2000. Jan Willem Polderman & Jan C. Willems, *Introduction to the Mathematical Theory of Systems and Control*

Software

I will be using the latest available release of each of these libraries with the exception of Python. We will use Python 3.x, though, if desired, you may be able to complete the coursework using Python 2.7. Anaconda will include most if not all libraries used in this class.

- git
- Python
- Jupyter
- Numpy
- Scipy
- matplotlib
- pandas
- scikit-learn
- nltk

An account on github may be needed

Course Grade

- 10% Participation
- 20% Homework
- 35% Mid-Term
- 35% Final + Project