ME535
"Computational Techniques in Mechanical Engineering"

Course Info - Winter 2023

Instructional personnel: Prof. Duane Storti

TAs – Chris Uchytil, Shunsuke Winston

Planned Content

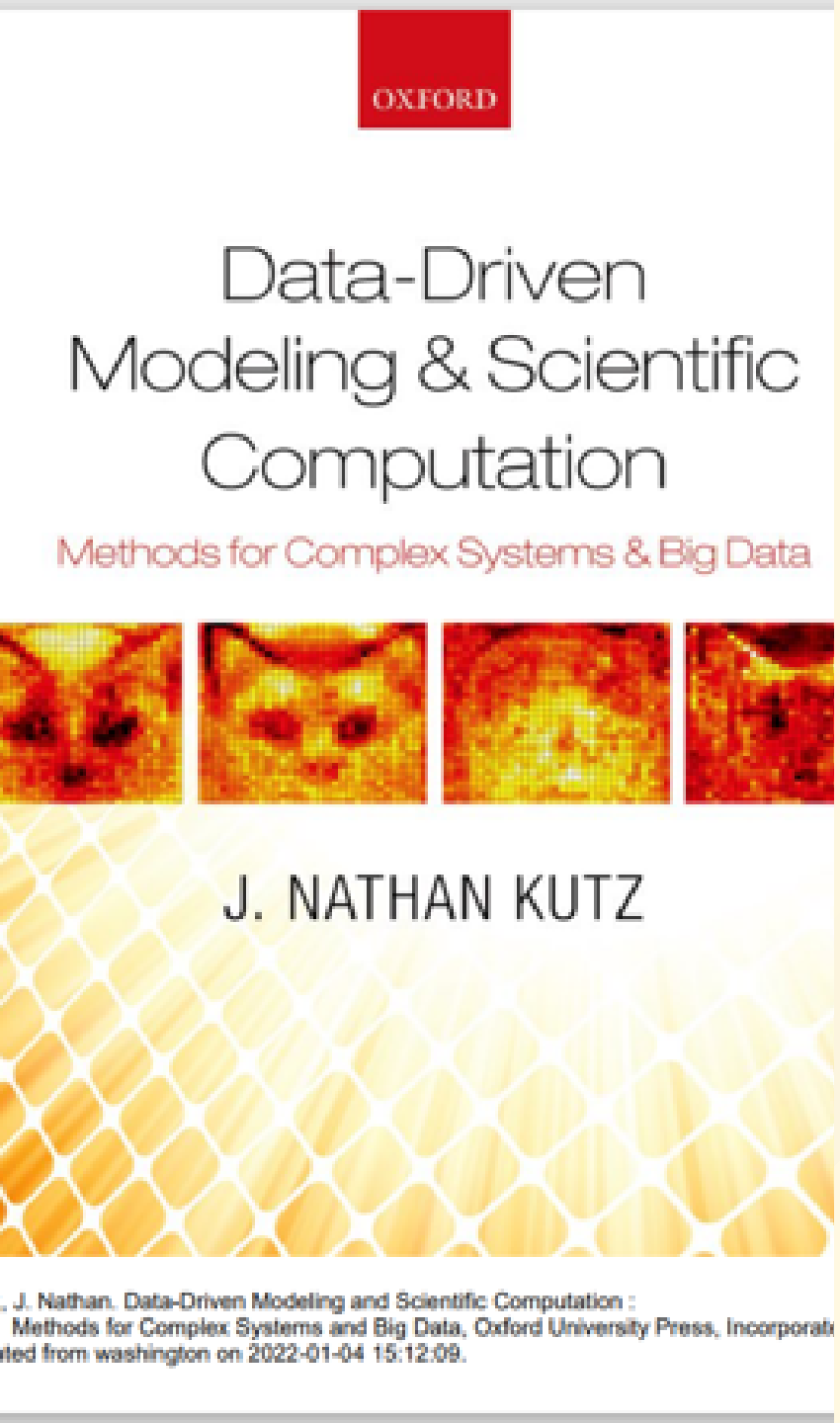
Basic intro to numerical techniques used by mechanical engineers

- Floating point arithmetic and sources of error
- Linear systems and matrix decompositions
- Interpolation and curve fitting
- Numerical differentiation and integration
- Numerical solution of ordinary differential equations
- Numerical solution of partial differential equations

Planned format

- Lectures
  - In-person and live-streamed via Zoom
  - Recorded for asynchronous availability
- Homeworks and quizzes distributed and collected via Canvas

Aim to support in-person, remote synchronous, and remote asynchronous participation in the class.
Note: Circumstances can change, so plan on being flexible.
We may do some fully remote lectures to make sure we are prepared to mode shift if necessary…



Textbook

Data-Driven Modeling & Scientific Computation by J. Nathan Kutz

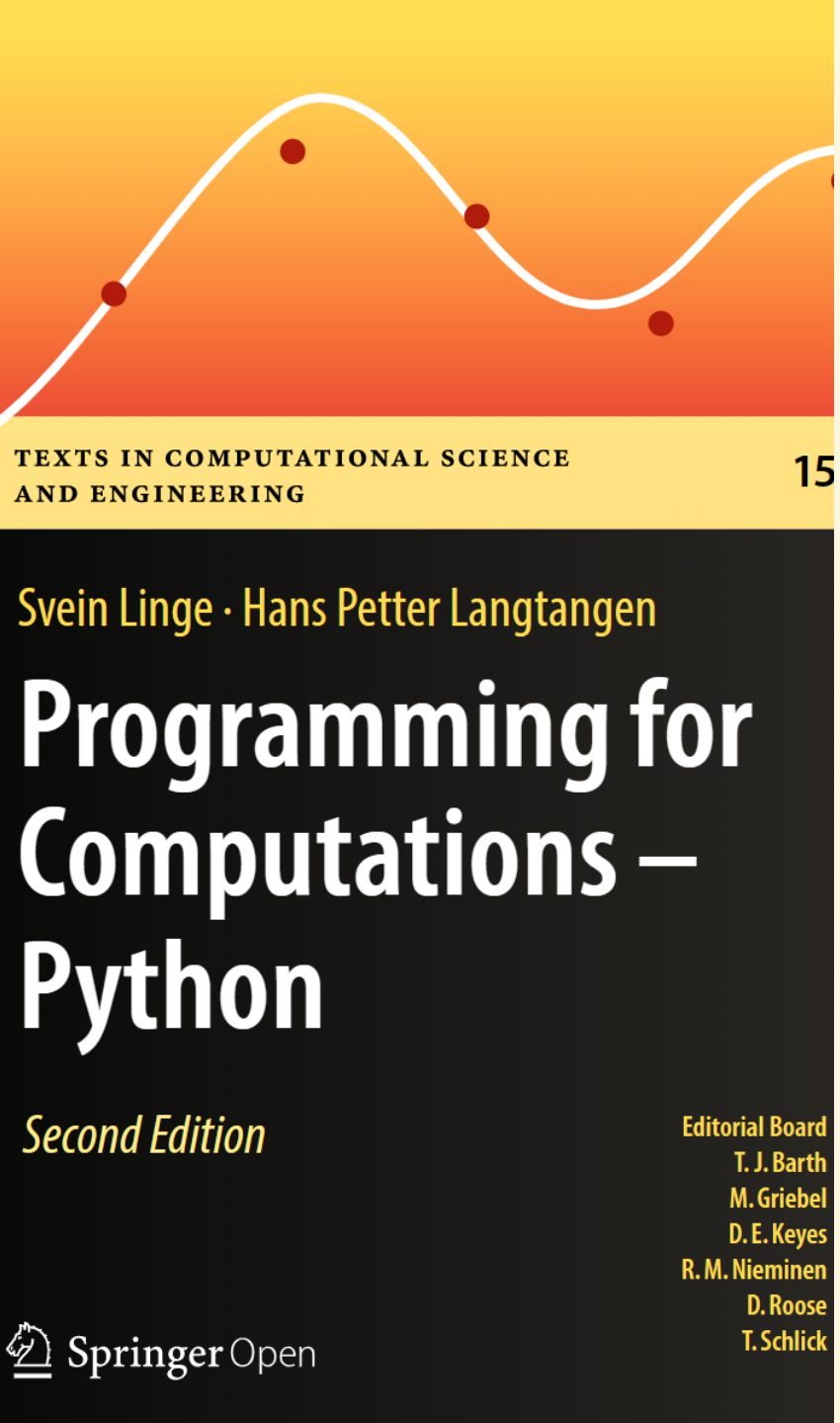
Aim to cover much of parts 1 and 2.

Recommended book for ME564-5.

You or a friend may already have a copy.

Available as paperback or e-book at reasonable price.

Check UW Libraries for online access.



Supplemental Reading

Supplemental book for more detailed discussion of coding basics:

Programming for Computations – Python A Gentle Introduction to Numerical Simulations with Python 3.6 2^{nd} Edition by Linge and Langtangen

Open access e-book available via UW libraries.

Note: ∃ companion version using MATLAB

Language

Text uses MATLAB, but the course will use python (one of the most popular and useful languages in the era of big data). Plan on acquiring experience with python as a side benefit of this class.

Expected background

Engineering: This is an introductory level graduate course, so some engineering background/sophistication is expected.

Coding: You do **NOT** need to enter the course as an experienced programmer, but you **DO** need to learn to:

- Write code
- Implement algorithms
- Utilize library functions
- Interpret numerical results

Software & Platforms

1. Canvas for distribution/submission of materials and course-related communication.
2. Anaconda Individual Edition for python, Jupyter notebooks, etc. https://www.anaconda.com/products/individual
3. Visual Studio code (plug-ins for editing/ executing/debugging python, Jupyter, Markdown, Git, consultation) https://code.visualstudio.com/Download
4. Optional: Google Colaboratory for web-based hosting of Jupyter notebooks https://colab.research.google.com/

Expectations

- Graduate standing in mech. engineering or related field.
- Math background: equivalent of ME564 & concurrent ME565.
- Some previous introduction to computing.
- Commitment to actually writing code.
- Students are expected to write code to implement/experiment with relevant numerical methods.

Class materials and discussion

- Class materials will be distributed and collected via Canvas.
- You will need to **visit the class Canvas page regularly** to keep up to date on announcements, discussion, assignments, exams, etc.
- **Use Ed Discussion** (via Canvas) for enhanced communications…
- It is your responsibility as a student to know about what happens in the course even when you miss class meetings:
  - Check Canvas/Ed Discussion regularly
  - Make friends with classmates so you can share notes/updates
  - Discuss class materials (but turn in your own work)

Approximate logistics

Homeworks: 70% (assigned and submitted via Canvas)
Quizzes: 30% (online via Canvas)

Aim to support in-person, hybrid, remote synchronous, and remote asynchronous participation, but adjustments may become necessary:

- Fully remote due to issues of weather, health, etc.
- Remote synchronous may be limited by recording technology.

Plan on being flexible and adjusting as needed…

Relevant policies: Religious Accommodations

"Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)."

Relevant policies: Academic Integrity

As a UW engineering student, you are expected to follow these conduct codes:

- Code of Ethics for Engineers http://www.nspe.org/Ethics/CodeofEthics/index.html
- University of Washington Student Conduct Code http://apps.leg.wa.gov/WAC/default.aspx?cite=478-120
- The College of Engineering's policies and procedures: https://www.engr.washington.edu/current/academics/principles#statement

College of Engineering statement of principles of academic honesty, integrity, and responsibility

The UW College of Engineering prepares students to enter the engineering profession and to hold themselves to the highest standards of integrity and honesty – including a commitment to the health, safety, and well-being of the communities they serve. Therefore, we are committed to promoting integrity in our teaching, learning, and research endeavors.

College of Engineering statement of principles of academic honesty, integrity, and responsibility (cont'd)

As a member of the UW College of Engineering and in preparation for entering the engineering profession students are expected to:

- Adhere to the University of Washington Student Code of Conduct and related policies: http://www.washington.edu/cssc/expectations/
- Hold yourself to highest standards of ethics, integrity, and accountability in line with becoming a professional engineer.

To promote academic integrity:

- Submit only your own work -- neither give nor receive unauthorized aid on exams or assignments.
- Always credit/cite the intellectual work of others.
- Only use or submit accurate and verifiable data, records, etc.
- Uphold the standards of conduct established by an instructor or outlined in a course materials.
- Observe standards of safety to protect yourself and others.
  - Be vaxxed/boosted, wear mask, wash hands, stay home when feeling ill, etc.

Immediate issues

- Questions?
- To Do List
  - Obtain text by Kutz (check UW libraries for availability)
  - Visit Canvas site (check out Ed Discussion). Make this a habit…
  - Download & install Anaconda Individual Edition
  - Skim text Ch. 1
- Work through Ch1_python document in detail
- Seek out supplemental material as needed: video intros to python, Jupyter notebook, VSCode, …