Math 127: Computational Methods - Fall 2019

Instructor

Name: Lei Li *E-mail:* leili2010@sjtu.edu.cn *Office:* Science Building No.5, Room 323
Personal Website: https://ins.sjtu.edu.cn/people/leili/

Textbooks and references

- R. Burden, D. Faires (9th edition or higher), Numerical Analysis.
- 李庆扬，王能超，易大义，《数值分析》

Note that I will mainly refer to the book by Burden and Faires, while I will also refer to the Chinese book. However, I will try to upload lecture notes. I will establish both a website and a canvas site for our course.

Grading Policy

Cheating is not allowed. You can discuss of course, but the works should be done by yourself. If identical assignments are found, both will get zero credits.

- *Homework (20%)* Homework will be assigned every two weeks. If coding is needed, you can use whatever language you prefer. MATLAB, however, is recommended. Please indicate your designed algorithm in the homework and show your results via figures or tables. The actual code should be submitted as appendices only.
- *Independence study (30%)* Due to the limit of time, the part of numerical integration and numerical differentiation will not be gone over in lectures. Instead, you will study this chapter/chapters by yourself. Then, write a report/summary, and use the techniques studied to numerically solve a problem. Details will be given later.
- *Final (50%)* There will be a final exam. One cheating sheet of size A4 is allowed.
- *Optional projects* We encourage exploration. If you are interested in some problems, you may do optional projects. The scores of this part can be used as an alternative to the final exam. (I will take the maximum between this and the final exam.)

Tentative Schedule:

- **1-6 lectures**: Interpolation and approximation (Lagrange polynomials, cubic splines, least square, rational function approximation), solution of nonlinear equations (Newton's method, Quasi-Netwon, steepest descent or gradient descent)
- **7-13 lectures**: Numerical linear algebra. Solving linear system using direct or iterative methods (Gauss elimination, matrix factorization, Gauss-Seidel, SOR, Conjugate Gradient), Approximating eigenvalues (Power Method, Householder, QR, Singular value decomposition)
- **remaining letures** A brief introduction to solving initial value problems of ODEs (forward Euler, Runga-Kutta, Linear multistep Method, concept of stability regions)