

# Schedule: Numerical Programming 1

Caroline Lasser

Winter term 2022/23

(updated October 17, 2022)

## Tentative schedule

1. Floating point numbers (Oct 24)
2. Conditioning (Oct 26)
3. Stability (Oct 31)
4. Polynomial interpolation (Nov 2)
5. Trigonometric interpolation (Nov 7)
6. Splines (Nov 9)
7. Interpolation accuracy (Nov 14)
8. Sum rules (Nov 16)
9. Gaussian quadrature (Nov 21)
10. Monte Carlo quadrature (Nov 23)
11. Some linear algebra (Nov 28)
12. Conditioning of matrices (Nov 30)
13. LU decomposition (Dec 5)
14. QR decomposition (Dec 7\*)
15. Singular value decomposition (Dec 12)
16. Least squares problems (Dec 14)
17. Linear iterations (Dec 19)
18. Christmas lecture: Molecules and light (Dec 21)
19. Nonlinear iterations (Jan 9)
20. Newton iteration (Jan 11)
21. Power iteration (Jan 16\*)
22. QR iteration (Jan 18)
23. Euler methods (Jan 23)
24. Runge–Kutta methods (Jan 25)
25. Linear multistep methods (Jan 30)

Exam preparation: Feb 1, Feb 6, Feb 8.

Exam: Feb 15

# Suggested Reading

- [C] R. Caflisch, Monte Carlo and quasi-Monte Carlo methods, *Acta Numerica* 7, 11–49, 1998
- [Cheb] G. Wright, M. Javed, H. Montanelli, N. Trefethen, Extension of Chebfun to periodic functions, *SIAM J. Sci. Comput.* 37(5), 554–573, 2015
- [DR] P. Davis, P. Rabinowitz, *Methods of numerical integration* (2nd ed.), Dover Publications, 2007
- [D] J. Demmel, *Applied Numerical Linear Algebra*, SIAM 1997
- [GW] G. Golub, J. Welsch, Calculation of Gauss quadrature rules, *Math. Comp.* 23(106), 221–230, 1969
- [H] N. Higham, *Accuracy and Stability of Numerical Algorithms*, SIAM, 1996
- [I] A. Iserles, *A First Course in the Numerical Analysis of Differential Equations* (2nd ed.), Cambridge University Press, 2009.
- [KU] A. Krommer, C. Ueberhuber, *Computational integration*, SIAM, 1998
- [O] M. Overton, *Numerical Computing with IEEE Floating Point Arithmetic*, SIAM, 2001
- [S1] G. Stewart, *Afternotes on numerical analysis*, SIAM, 1996
- [S2] G. Stewart, *Afternotes goes to graduate school*, SIAM, 1998
- [T] L. N. Trefethen, *Approximation theory and approximation practice*, SIAM, 2013
- [TB] L. N. Trefethen, D. Bau, *Numerical Linear Algebra*, SIAM, 1997