References for

"Advances in Numerical Analysis and Mathematical Modelling: exponential integrators for systems of Ordinary Differential Equations"

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This is a (non-exhaustive) list of references for the PhD course "Advances in Numerical Analysis and Mathematical Modelling: exponential integrators for systems of Ordinary Differential Equations" (A.Y. 2024-2025).

- Numerical methods for ODEs, A-stability, and stiffness: [10, 11]
- Exponential integrators: [15, 14, 13, 16]
- IMEX methods: [3, 4]
- Funcions of matrices (generic): [12]
- Matrix exponential and φ -functions: [1, 17, 21]
- Action of the matrix exponential and linear combinations of φ -functions: [2, 7, 18, 9, 19, 20]
- Kronecker-structured problems: [6, 5, 8]

References

- [1] A. H. Al-Mohy and N. J. Higham. A New Scaling and Squaring Algorithm for the Matrix Exponential. SIAM J. Matrix Anal. Appl., 31(3):970–989, 2010.
- [2] A. H. Al-Mohy and N. J. Higham. Computing the Action of the Matrix Exponential, with an Application to Exponential Integrators. *SIAM J. Sci. Comput.*, 33(2):488–511, 2011.
- [3] U. M. Ascher, S. J. Ruuth, and R. J. Spiteri. Implicit—explicit Runge—Kutta methods for time-dependent partial differential equations. *Appl. Numer. Math.*, 25:151–167, 1997.
- [4] U. M. Ascher, S. J. Ruuth, and B. T. R. Wetton. Implicit-Explicit Methods for Time-Dependent Partial Differential Equations. SIAM J. Numer. Anal., 32(2):797–823, 1995.

- [5] M. Caliari and F. Cassini. A second order directional split exponential integrator for systems of advection-diffusion-reaction equations. J. Comput. Phys., 498:112640, 2024.
- [6] M. Caliari, F. Cassini, and F. Zivcovich. A μ -mode BLAS approach for multidimensional tensor-structured problems. *Numer. Algorithms*, 92(4):2483–2508, 2023.
- [7] M. Caliari, P. Kandolf, A. Ostermann, and S. Rainer. The Leja Method Revisited: Backward Error Analysis for the Matrix Exponential. *SIAM J. Sci. Comput.*, 38(3):A1639–A1661, 2016.
- [8] M. C. D'Autilia, I. Sgura, and V. Simoncini. Matrix-oriented discretization methods for reaction—diffusion PDEs: Comparisons and applications. *Comput. Math. Appl.*, 79(7):2067–2085, 2020.
- [9] S. Gaudreault, G. Rainwater, and M. Tokman. KIOPS: A fast adaptive Krylov subspace solver for exponential integrators. *J. Comput. Phys.*, 372:236–255, 2018.
- [10] E. Hairer, S.P. Nørsett, and G. Wanner. Solving Ordinary Differential Equations I: Nonstiff Problems, volume 8 of Springer Series in Computational Mathematics. Springer, 2nd revised edition, 2008.
- [11] E. Hairer and G. Wanner. Solving Ordinary Differential Equations II: Stiff and Differential Algeriae Problems, volume 14 of Springer Series in Computational Mathematics. Springer Berlin, second edition, 1996.
- [12] N. J. Higham. Functions of Matrices. SIAM, Philadelphia, 2008.
- [13] M. Hochbruck and A. Ostermann. Explicit Exponential Runge–Kutta Methods for Semilinear Parabolic Problems. SIAM J. Numer. Anal., 43(3):1069–1090, 2005.
- [14] M. Hochbruck and A. Ostermann. Exponential Runge–Kutta methods for parabolic problems. *Appl. Numer. Math.*, 53(2–4):323–339, 2005.
- [15] M. Hochbruck and A. Ostermann. Exponential integrators. *Acta Numer.*, 19:209–286, 2010.
- [16] M. Hochbruck, A. Ostermann, and J. Schweitzer. Exponential Rosenbrock-type Methods. SIAM J. Numer. Anal., 47(1):786–803, 2009.
- [17] D. Li, S. Yang, and J. Lan. Efficient and accurate computation for the φ -functions arising from exponential integrators. Calcolo, 59(11):1-24, 2022.
- [18] J. Niesen and W. M. Wright. Algorithm 919: A Krylov Subspace Algorithm for Evaluating the ϕ -functions Appearing in Exponential Integrators. *ACM Trans. Math. Softw.*, 38(3):1–19, 2012.
- [19] Y. Saad. Analysis of some Krylov subspace approximations to the matrix exponential operator. SIAM J. Numer. Anal., 29(1):209–228, 1992.

- [20] T. Schmelzer and L. N. Trefethen. Evaluating matrix functions for exponential integrators via Carathéodory–Fejér approximation and contour integrals. *Electron. Trans. Numer. Anal.*, 29:1–18, 2007.
- [21] B. Skaflestad and W. M. Wright. The scaling and modified squaring method for matrix functions related to the exponential. *Appl. Numer. Math.*, 59(3–4):783–799, 2009.