

Bibliography of
Functions of Matrices:
Theory and Computation
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References

- [1] N. I. Achieser. *Theory of Approximation*. Frederick Ungar Publishing Co., New York, 1956.
- [2] Eva Achilles and Richard Sinkhorn. Doubly stochastic matrices whose squares are idempotent. *Linear and Multilinear Algebra*, 38:343–349, 1995.
- [3] Martin Afanasjew, Michael Eiermann, Oliver G. Ernst, and Stefan Güttel. Implementation of a restarted Krylov subspace method for the evaluation of matrix functions. Manuscript, July 2007.
- [4] Martin Afanasjew, Michael Eiermann, Oliver G. Ernst, and Stefan Güttel. On the steepest descent method for matrix functions. Manuscript, 2007.
- [5] S. N. Afriat. Analytic functions of finite dimensional linear transformations. *Proc. Cambridge Philos. Soc.*, 55(1):51–61, 1959.
- [6] Donald J. Albers and G. L. Alexanderson, editors. *Mathematical People: Profiles and Interviews*. Birkhäuser, Boston, MA, USA, 1985.
- [7] J. Albrecht. Bemerkungen zu Iterationsverfahren zur Berechnung von $A^{1/2}$ und A^{-1} . *Z. Angew. Math. Mech.*, 57:T262–T263, 1977.
- [8] G. Alefeld and N. Schneider. On square roots of M -matrices. *Linear Algebra Appl.*, 42:119–132, 1982.

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- [9] Marc Alexa. Linear combination of transformations. *ACM Trans. Graphics*, 21(3):380–387, 2002.
- [10] E. J. Allen, J. Baglama, and S. K. Boyd. Numerical approximation of the product of the square root of a matrix with a vector. *Linear Algebra Appl.*, 310:167–181, 2000.
- [11] Simon L. Altmann. *Rotations, Quaternions, and Double Groups*. Oxford University Press, 1986.
- [12] E. Anderson, Z. Bai, C. H. Bischof, S. Blackford, J. W. Demmel, J. J. Dongarra, J. J. Du Croz, A. Greenbaum, S. J. Hammarling, A. McKenney, and D. C. Sorensen. *LAPACK Users' Guide*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, third edition, 1999.
- [13] T. Ando. Concavity of certain maps on positive definite matrices and applications to Hadamard products. *Linear Algebra Appl.*, 26:203–241, 1979.
- [14] T. Ando. *Operator-Theoretic Methods for Matrix Inequalities*. Hokusei Gakuen University, March 1998.
- [15] T. Ando, Chi-Kwong Li, and Roy Mathias. Geometric means. *Linear Algebra Appl.*, 385:305–334, 2004.
- [16] Huzihiro Araki and Shigeru Yamagami. An inequality for Hilbert–Schmidt norm. *Commun. Math. Phys.*, 81:89–96, 1981.
- [17] M. Arioli, B. Codenotti, and C. Fassino. The Padé method for computing the matrix exponential. *Linear Algebra Appl.*, 240:111–130, 1996.
- [18] W. E. Arnoldi. The principle of minimized iterations in the solution of the matrix eigenvalue problem. *Quart. Appl. Math.*, 9:17–29, 1951.
- [19] Vincent Arsigny, Oliver Commowick, Xavier Pennec, and Nicholas Ayache. A log–Euclidean framework for statistics on diffeomorphisms. In Rasmus Larsen, Mads Nielsen, and Jon Sporring, editors, *Medical Image Computing and Computer-Assisted Intervention—MICCAI 2006*, number 4190 in Lecture Notes in Computer Science, pages 924–931. Springer-Verlag, Berlin, 2006.
- [20] Vincent Arsigny, Pierre Fillard, Xavier Pennec, and Nicholas Ayache. Geometric means in a novel vector space structure on symmetric positive-definite matrices. *SIAM J. Matrix Anal. Appl.*, 29(1):328–347, 2007.
- [21] Ashkan Ashrafi and Peter M. Gibson. An involutory Pascal matrix. *Linear Algebra Appl.*, 387:277–286, 2004.
- [22] Kendall E. Atkinson and Weimin Han. *Theoretical Numerical Analysis: A Functional Analysis Framework*. Springer-Verlag, New York, second edition, 2005.

- [23] Jean-Pierre Aubin and Ivar Ekeland. *Applied Nonlinear Analysis*. Wiley, New York, 1984.
- [24] L. Autonne. Sur les groupes linéaires, Réels et orthogonaux. *Bulletin de la Société Mathématique de France*, 30:121–134, 1902.
- [25] Ivo Babuška, Milan Práger, and Emil Vitásek. *Numerical Processes in Differential Equations*. Wiley, London, 1966.
- [26] Zhaojun Bai, Wenbin Chen, Richard Scalettar, and Ichitaro Yamazaki. Lecture notes on advances of numerical methods for Hubbard quantum Monte Carlo simulation. Manuscript, 2007.
- [27] Zhaojun Bai and James W. Demmel. Design of a parallel nonsymmetric eigenroutine toolbox, Part I. In Richard F. Sincovec, David E. Keyes, Michael R. Leuze, Linda R. Petzold, and Daniel A. Reed, editors, *Proceedings of the Sixth SIAM Conference on Parallel Processing for Scientific Computing, Volume I*, pages 391–398. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1993. Also available as Research Report 92-09, Department of Mathematics, University of Kentucky, Lexington, KY, USA, December 1992, 30 pp.
- [28] Zhaojun Bai and James W. Demmel. On swapping diagonal blocks in real Schur form. *Linear Algebra Appl.*, 186:73–95, 1993.
- [29] Zhaojun Bai and James W. Demmel. Using the matrix sign function to compute invariant subspaces. *SIAM J. Matrix Anal. Appl.*, 19(1):205–225, 1998.
- [30] Zhaojun Bai, James W. Demmel, Jack J. Dongarra, Axel Ruhe, and Henk A. Van der Vorst, editors. *Templates for the Solution of Algebraic Eigenvalue Problems: A Practical Guide*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2000.
- [31] Zhaojun Bai, James W. Demmel, and Ming Gu. Inverse free parallel spectral divide and conquer algorithms for nonsymmetric eigenproblems. *Numer. Math.*, 76:279–308, 1997.
- [32] Zhaojun Bai, Mark Fahey, and Gene H. Golub. Some large-scale matrix computation problems. *J. Comput. Appl. Math.*, 74:71–89, 1996.
- [33] Zhaojun Bai, Mark Fahey, Gene H. Golub, M. Menon, and E. Richter. Computing partial eigenvalue sum in electronic structure calculations. Technical Report SCCM-98-03, SCCM, Stanford University, January 1998.
- [34] Zhaojun Bai and Gene H. Golub. Bounds for the trace of the inverse and the determinant of symmetric positive definite matrices. *Ann. Numer. Math.*, 4:29–38, 1997.

- [35] Zhaojun Bai and Gene H. Golub. Some unusual eigenvalue problems. In J. Palma, J. Dongarra, and V. Hernández, editors, *Vector and Parallel Processing—VECPAR'98*, volume 1573 of *Lecture Notes in Computer Science*, pages 4–19. Springer-Verlag, Berlin, 1999.
- [36] David H. Bailey. Algorithm 719: Multiprecision translation and execution of FORTRAN programs. *ACM Trans. Math. Software*, 19(3):288–319, 1993.
- [37] David H. Bailey, Yozo Hida, Xiaoye S. Li, and Brandon Thompson. ARPREC: An arbitrary precision computation package. Technical Report LBNL-53651, Lawrence Berkeley National Laboratory, Berkeley, California, March 2002.
- [38] H. F. Baker. The reciprocation of one quadric into another. *Proc. Cambridge Philos. Soc.*, 23:22–27, 1925.
- [39] A. V. Balakrishnan. Fractional powers of closed operators and the semi-groups generated by them. *Pacific J. Math.*, 10(2):419–437, 1960.
- [40] R. P. Bambah and S. Chowla. On integer cube roots of the unit matrix. *Science and Culture*, 12:105, 1946.
- [41] Itzhack Y. Bar-Itzhack, J. Meyer, and P. A. Fuhrmann. Strapdown matrix orthogonalization: The dual iterative algorithm. *IEEE Trans. Aerospace and Electronic Systems*, AES-12(1):32–37, 1976.
- [42] A. Y. Barraud. Investigations autour de la fonction signe d'une matrice application a l'équation de Riccati. *R.A.I.R.O. Automatique/Systems Analysis and Control*, 13(4):335–368, 1979.
- [43] Anders Barrlund. Perturbation bounds on the polar decomposition. *BIT*, 30:101–113, 1990.
- [44] Friedrich L. Bauer. *Decrypted Secrets: Methods and Maxims of Cryptology*. Springer-Verlag, Berlin, third edition, 2002.
- [45] U. Baur and Peter Benner. Factorized solution of Lyapunov equations based on hierarchical matrix arithmetic. *Computing*, 78:211–234, 2006.
- [46] Connice A. Bavely and G. W. Stewart. An algorithm for computing reducing subspaces by block diagonalization. *SIAM J. Numer. Anal.*, 16(2):359–367, 1979.
- [47] C. A. Beattie and S. W. Smith. Optimal matrix approximants in structural identification. *J. Optimization Theory and Applications*, 74(1):23–56, 1992.
- [48] Alfredo Bellen and Marino Zennaro. *Numerical Methods for Delay Differential Equations*. Oxford University Press, 2003.

- [49] Richard Bellman. *Introduction to Matrix Analysis*. McGraw-Hill, New York, second edition, 1970. Reprinted by Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1997. ISBN 0-89871-399-4.
- [50] Adi Ben-Israel and Thomas N. E. Greville. *Generalized Inverses: Theory and Applications*. Springer-Verlag, New York, second edition, 2003.
- [51] Peter Benner and Ralph Byers. Disk functions and their relationship to the matrix sign function. In *Proceedings of the European Control Conference ECC97, Paper 936, BELWARE Information Technology, Waterloo, Belgium, 1997*. CD ROM.
- [52] Peter Benner, Ralph Byers, Volker Mehrmann, and Hongguo Xu. A unified deflating subspace approach for classes of polynomial and rational matrix equations. Preprint SFB393/00-05, Zentrum für Technomathematik, Universität Bremen, Bremen, Germany, January 2000.
- [53] Peter Benner and Enrique S. Quintana-Ortí. Solving stable generalized Lyapunov equations with the matrix sign function. *Numer. Algorithms*, 20(1):75–100, 1999.
- [54] Peter Benner, Enrique S. Quintana-Ortí, and Gregorio Quintana-Ortí. Solving stable Sylvester equations via rational iterative schemes. *J. Sci. Comput.*, 28:51–83, 2006.
- [55] Michele Benzi and Gene H. Golub. Bounds for the entries of matrix functions with applications to preconditioning. *BIT*, 39(3):417–438, 1999.
- [56] Michele Benzi and Nader Razouk. Decay bounds and $O(n)$ algorithms for approximating functions of sparse matrices. *Electron. Trans. Numer. Anal.*, 28:16–39, 2007.
- [57] Håvard Berland, Bård Skaflestad, and Will Wright. EXPINT—A MATLAB package for exponential integrators. *ACM Trans. Math. Software*, 33(1):Article 4, 2007.
- [58] Abraham Berman and Robert J. Plemmons. *Nonnegative Matrices in the Mathematical Sciences*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1994. Corrected republication, with supplement, of work first published in 1979 by Academic Press.
- [59] David S. Bernstein and Charles F. Van Loan. Rational matrix functions and rank-1 updates. *SIAM J. Matrix Anal. Appl.*, 22(1):145–154, 2000.
- [60] Rajendra Bhatia. Some inequalities for norm ideals. *Commun. Math. Phys.*, 111:33–39, 1987.
- [61] Rajendra Bhatia. Matrix factorizations and their perturbations. *Linear Algebra Appl.*, 197/198:245–276, 1994.

- [62] Rajendra Bhatia. *Matrix Analysis*. Springer-Verlag, New York, 1997.
- [63] Rajendra Bhatia. *Positive Definite Matrices*. Princeton University Press, Princeton, NJ, USA, 2007.
- [64] Rajendra Bhatia and Fuad Kittaneh. Approximation by positive operators. *Linear Algebra Appl.*, 161:1–9, 1992.
- [65] Rajendra Bhatia and Kalyan K. Mukherjea. On weighted Löwdin orthogonalization. *Int. J. Quantum Chemistry*, 29:1775–1778, 1986.
- [66] M. D. Bingham. A new method for obtaining the inverse matrix. *J. Amer. Statist. Assoc.*, 36(216):530–534, 1941.
- [67] Dario A. Bini, Nicholas J. Higham, and Beatrice Meini. Algorithms for the matrix p th root. *Numer. Algorithms*, 39(4):349–378, 2005.
- [68] Dario A. Bini, Guy Latouche, and Beatrice Meini. *Numerical Methods for Structured Markov Chains*. Oxford University Press, 2005.
- [69] R. E. D. Bishop. Arthur Roderick Collar. 22 February 1908–12 February 1986. *Biographical Memoirs of Fellows of the Royal Society*, 33:164–185, 1987.
- [70] Åke Björck and C. Bowie. An iterative algorithm for computing the best estimate of an orthogonal matrix. *SIAM J. Numer. Anal.*, 8(2):358–364, 1971.
- [71] Åke Björck and Sven Hammarling. A Schur method for the square root of a matrix. *Linear Algebra Appl.*, 52/53:127–140, 1983.
- [72] Sergio Blanes and Fernando Casas. On the convergence and optimization of the Baker–Campbell–Hausdorff formula. *Linear Algebra Appl.*, 378:135–158, 2004.
- [73] Artan Boriçi. QCDLAB project. <http://phys.fshn.edu.al/qcdlab.html>.
- [74] Steffen Börm, Lars Grasedyck, and Wolfgang Hackbusch. Hierarchical matrices. Lecture Note No. 21, Max-Planck-Institute for Mathematics in the Sciences, Leipzig, Germany, 2003. Revised June 2006.
- [75] Jonathan M. Borwein, David Bailey, and Roland Girgensohn. *Experimentation in Mathematics: Computational Paths to Discovery*. A K Peters, Natick, Massachusetts, 2004.
- [76] C. Bouby, D. Fortuné, W. Pietraszkiewicz, and C. Vallée. Direct determination of the rotation in the polar decomposition of the deformation gradient by maximizing a Rayleigh quotient. *Z. Angew. Math. Mech.*, 85(3):155–162, 2005.

- [77] David W. Boyd. The power method for ℓ^p norms. *Linear Algebra Appl.*, 9:95–101, 1974.
- [78] Geoff Boyd, Charles A. Micchelli, Gilbert Strang, and Ding-Xuan Zhou. Binomial matrices. *Adv. in Comput. Math.*, 14:379–391, 2001.
- [79] Russell J. Bradford, Robert M. Corless, James H. Davenport, David J. Jeffrey, and Stephen M. Watt. Reasoning about the elementary functions of complex analysis. *Annals of Mathematics and Artificial Intelligence*, 36:303–318, 2002.
- [80] T. J. Bridges and P. J. Morris. Differential eigenvalue problems in which the parameter appears nonlinearly. *J. Comput. Phys.*, 55:437–460, 1984.
- [81] William Briggs. *Ants, Bikes, and Clocks: Problem Solving for Undergraduates*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2005.
- [82] A. Buchheim. On the theory of matrices. *Proc. London Math. Soc.*, 16:63–82, 1884.
- [83] A. Buchheim. An extension of a theorem of Professor Sylvester’s relating to matrices. *Phil. Mag.*, 22(135):173–174, August 1886. Fifth series.
- [84] G. J. Butler, Charles R. Johnson, and H. Wolkowicz. Nonnegative solutions of a quadratic matrix equation arising from comparison theorems in ordinary differential equations. *SIAM J. Alg. Discrete Methods*, 6(1):47–53, 1985.
- [85] Ralph Byers. A LINPACK-style condition estimator for the equation $AX - XB^T = C$. *IEEE Trans. Automat. Control*, AC-29(10):926–928, 1984.
- [86] Ralph Byers. Solving the algebraic Riccati equation with the matrix sign function. *Linear Algebra Appl.*, 85:267–279, 1987.
- [87] Ralph Byers, Chunyang He, and Volker Mehrmann. The matrix sign function method and the computation of invariant subspaces. *SIAM J. Matrix Anal. Appl.*, 18(3):615–632, 1997.
- [88] D. Calvetti, E. Gallopoulos, and L. Reichel. Incomplete partial fractions for parallel evaluation of rational matrix functions. *J. Comput. Appl. Math.*, 59:349–380, 1995.
- [89] Daniela Calvetti, Sun-Mi Kim, and Lothar Reichel. Quadrature rules based on the Arnoldi process. *SIAM J. Matrix Anal. Appl.*, 26(3):765–781, 2005.
- [90] S. L. Campbell and C. D. Meyer Jr. *Generalized Inverses of Linear Transformations*. Pitman, London, 1979. Reprinted by Dover, New York, 1991.

- [91] João R. Cardoso, Charles S. Kenney, and F. Silva Leite. Computing the square root and logarithm of a real P -orthogonal matrix. *Appl. Numer. Math.*, 46:173–196, 2003.
- [92] João R. Cardoso and F. Silva Leite. The Moser–Veselov equation. *Linear Algebra Appl.*, 360:237–248, 2003.
- [93] João R. Cardoso and F. Silva Leite. Padé and Gregory error estimates for the logarithm of block triangular matrices. *Appl. Numer. Math.*, 56:253–267, 2006.
- [94] Gianfranco Cariolaro, Tomaso Erseghe, and Peter Kraniavskas. The fractional discrete cosine transform. *IEEE Trans. Signal Processing*, 50(4):902–911, 2002.
- [95] Lennart Carleson and Theodore W. Gamelin. *Complex Dynamics*. Springer-Verlag, New York, 1993.
- [96] A. J. Carpenter, A. Ruttan, and R. S. Varga. Extended numerical computations on the “1/9” conjecture in rational approximation theory. In P. R. Graves-Morris, E. B. Saff, and R. S. Varga, editors, *Rational Approximation and Interpolation*, volume 1105 of *Lecture Notes in Mathematics*, pages 383–411. Springer-Verlag, Berlin, 1984.
- [97] Arthur Cayley. A memoir on the theory of matrices. *Philos. Trans. Roy. Soc. London*, 148:17–37, 1858.
- [98] Arthur Cayley. On the extraction of the square root of a matrix of the third order. *Proc. Roy. Soc. Edinburgh*, 7:675–682, 1872.
- [99] Arthur Cayley. The Newton–Fourier imaginary problem. *Amer. J. Math.*, 2(1):97, 1879.
- [100] Elena Celledoni and Arieh Iserles. Approximating the exponential from a Lie algebra to a Lie group. *Math. Comp.*, 69(232):1457–1480, 2000.
- [101] F. Chaitin-Chatelin and S. Gratton. On the condition numbers associated with the polar factorization of a matrix. *Numer. Linear Algebra Appl.*, 7:337–354, 2000.
- [102] Raymond H. Chan, Chen Greif, and Dianne P. O’Leary, editors. *Milestones in Matrix Computation: The Selected Works of Gene H. Golub, with Commentaries*. Oxford University Press, 2007.
- [103] Shivkumar Chandrasekaran and Ilse C. F. Ipsen. Backward errors for eigenvalue and singular value decompositions. *Numer. Math.*, 68:215–223, 1994.
- [104] Chi-Tsong Chen. *Linear System Theory and Design*. Oxford University Press, third edition, 1999.

- [105] Sheung Hun Cheng, Nicholas J. Higham, Charles S. Kenney, and Alan J. Laub. Return to the middle ages: A half-angle iteration for the logarithm of a unitary matrix. In *Proceedings of the Fourteenth International Symposium of Mathematical Theory of Networks and Systems, Perpignan, France*, 2000. CD ROM.
- [106] Sheung Hun Cheng, Nicholas J. Higham, Charles S. Kenney, and Alan J. Laub. Approximating the logarithm of a matrix to specified accuracy. *SIAM J. Matrix Anal. Appl.*, 22(4):1112–1125, 2001.
- [107] M. Cipolla. Sulle matrice espressione analitiche di un'altra. *Rendiconti Circolo Matematico de Palermo*, 56:144–154, 1932.
- [108] W. J. Cody, G. Meinardus, and R. S. Varga. Chebyshev rational approximations to e^{-x} in $[0, +\infty)$ and applications to heat-conduction problems. *J. Approximation Theory*, 2:50–65, 1969.
- [109] John P. Coleman. Rational approximations for the cosine function; P-acceptability and order. *Numer. Algorithms*, 3:143–158, 1992.
- [110] A. R. Collar. The first fifty years of aeroelasticity. *Aerospace (Royal Aeronautical Society Journal)*, 5:12–20, February 1978.
- [111] Samuel D. Conte and Carl de Boor. *Elementary Numerical Analysis: An Algorithmic Approach*. McGraw-Hill, Tokyo, third edition, 1980.
- [112] Robert M. Corless, Hui Ding, Nicholas J. Higham, and David J. Jeffrey. The solution of $S \exp(S) = A$ is not always the Lambert W function of A . In *ISSAC '07: Proceedings of the 2007 International Symposium on Symbolic and Algebraic Computation*, pages 116–121, New York, 2007. ACM Press.
- [113] Robert M. Corless, Gaston H. Gonnet, D. E. G. Hare, David J. Jeffrey, and Donald E. Knuth. On the Lambert W function. *Adv. in Comput. Math.*, 5(4):329–359, 1996.
- [114] Robert M. Corless and David J. Jeffrey. The unwinding number. *ACM SIGSAM Bulletin*, 30(2):28–35, June 1996.
- [115] Marius Cornea-Hasegan and Bob Norin. IA-64 floating-point operations and the IEEE standard for binary floating-point arithmetic. *Intel Technology Journal*, 3, 1999. <http://developer.intel.com/technology/itj/>.
- [116] S. M. Cox and P. C. Matthews. Exponential time differencing for stiff systems. *J. Comput. Phys.*, 176:430–455, 2002.
- [117] Trevor F. Cox and Michael A. A. Cox. *Multidimensional Scaling*. Chapman and Hall, London, 1994.
- [118] Tony Crilly. Cayley's anticipation of a generalised Cayley–Hamilton theorem. *Historia Mathematica*, 5:211–219, 1978.

- [119] Tony Crilly. *Arthur Cayley: Mathematician Laureate of the Victorian Age*. Johns Hopkins University Press, Baltimore, MD, USA, 2006.
- [120] G. W. Cross and P. Lancaster. Square roots of complex matrices. *Linear and Multilinear Algebra*, 1:289–293, 1974.
- [121] Michel Crouzeix. Bounds for analytical functions of matrices. *Integral Equations and Operator Theory*, 48:461–477, 2004.
- [122] L. Csanky. Fast parallel matrix inversion algorithms. *SIAM J. Comput.*, 5(4):618–623, 1976.
- [123] Charles G. Cullen. *Matrices and Linear Transformations*. Addison-Wesley, Reading, MA, USA, second edition, 1972. Reprinted by Dover, New York, 1990.
- [124] Walter J. Culver. On the existence and uniqueness of the real logarithm of a matrix. *Proc. Amer. Math. Soc.*, 17:1146–1151, 1966.
- [125] James R. Cuthbert. On uniqueness of the logarithm for Markov semi-groups. *J. London Math. Soc.*, 4:623–630, 1972.
- [126] Germund Dahlquist. *Stability and Error Bounds in the Numerical Integration of Ordinary Differential Equations*. PhD thesis, Royal Inst. of Technology, Stockholm, Sweden, 1958. Reprinted in *Trans. Royal Inst. of Technology*, No. 130, Stockholm, Sweden, 1959.
- [127] Ju. L. Daleckiĭ. Differentiation of non-Hermitian matrix functions depending on a parameter. *Amer. Math. Soc. Transl., Series 2*, 47:73–87, 1965.
- [128] Ju. L. Daleckiĭ and S. G. Kreĭn. Integration and differentiation of functions of Hermitian operators and applications to the theory of perturbations. *Amer. Math. Soc. Transl., Series 2*, 47:1–30, 1965.
- [129] E. B. Davies. Approximate diagonalization. *SIAM J. Matrix Anal. Appl.*, 29(4):1051–1064, 2007.
- [130] E. Brian Davies. *Science in the Looking Glass: What Do Scientists Really Know?* Oxford University Press, 2003.
- [131] E. Brian Davies. *Linear Operators and their Spectra*. Cambridge University Press, Cambridge, UK, 2007.
- [132] Philip I. Davies. Structured conditioning of matrix functions. *Electron. J. Linear Algebra*, 11:132–161, 2004.
- [133] Philip I. Davies and Nicholas J. Higham. A Schur–Parlett algorithm for computing matrix functions. *SIAM J. Matrix Anal. Appl.*, 25(2):464–485, 2003.

- [134] Philip I. Davies and Nicholas J. Higham. Computing $f(A)b$ for matrix functions f . In Artan Boriçi, Andreas Frommer, Báalint Joó, Anthony Kennedy, and Brian Pendleton, editors, *QCD and Numerical Analysis III*, volume 47 of *Lecture Notes in Computational Science and Engineering*, pages 15–24. Springer-Verlag, Berlin, 2005.
- [135] Philip I. Davies, Nicholas J. Higham, and Françoise Tisseur. Analysis of the Cholesky method with iterative refinement for solving the symmetric definite generalized eigenproblem. *SIAM J. Matrix Anal. Appl.*, 23(2):472–493, 2001.
- [136] Philip I. Davies and Matthew I. Smith. Updating the singular value decomposition. *J. Comput. Appl. Math.*, 170:145–167, 2004.
- [137] Chandler Davis. Explicit functional calculus. *Linear Algebra Appl.*, 6:193–199, 1973.
- [138] George J. Davis. Numerical solution of a quadratic matrix equation. *SIAM J. Sci. Statist. Comput.*, 2(2):164–175, 1981.
- [139] Philip J. Davis and Aviezri S. Fraenkel. Remembering Philip Rabinowitz. *Notices Amer. Math. Soc.*, 54(11):1502–1506, 2007.
- [140] Philip J. Davis and Philip Rabinowitz. *Methods of Numerical Integration*. Academic Press, London, second edition, 1984.
- [141] Carl de Boor. Divided differences. *Surveys in Approximation Theory*, 1:46–69, 2005.
- [142] Lokenath Debnath and Piotr Mikusiński. *Introduction to Hilbert Spaces with Applications*. Academic Press, San Diego, CA, USA, second edition, 1999.
- [143] James W. Demmel. *Applied Numerical Linear Algebra*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1997.
- [144] Eugene D. Denman and Alex N. Beavers Jr. The matrix sign function and computations in systems. *Appl. Math. Comput.*, 2:63–94, 1976.
- [145] Henk A. Van der Vorst. An iterative solution method for solving $f(A)x = b$, using Krylov subspace information obtained for the symmetric positive definite matrix A . *J. Comput. Appl. Math.*, 18:249–263, 1987.
- [146] Henk A. Van der Vorst. Solution of $f(A)x = b$ with projection methods for the matrix A . In Andreas Frommer, Thomas Lippert, Björn Medeke, and Klaus Schilling, editors, *Numerical Challenges in Lattice Quantum Chromodynamics*, volume 15 of *Lecture Notes in Computational Science and Engineering*, pages 18–28. Springer-Verlag, Berlin, 2000.
- [147] Henk A. Van der Vorst. *Iterative Krylov Methods for Large Linear Systems*. Cambridge University Press, 2003.

- [148] Jean Descloux. Bounds for the spectral norm of functions of matrices. *Numer. Math.*, 15:185–190, 1963.
- [149] Robert L. Devaney. *An Introduction to Chaotic Dynamical Systems*. Addison-Wesley, Reading, MA, USA, second edition, 1989.
- [150] Inderjit S. Dhillon and Joel A. Tropp. Matrix nearness problems with Bregman divergences. *SIAM J. Matrix Anal. Appl.*, 29(4):1120–1146, 2007.
- [151] Bradley W. Dickinson and Kenneth Steiglitz. Eigenvectors and functions of the discrete Fourier transform. *IEEE Trans. Acoust., Speech, Signal Processing*, ASSP-30(1):25–31, 1982.
- [152] Luca Dieci. Considerations on computing real logarithms of matrices, Hamiltonian logarithms, and skew-symmetric logarithms. *Linear Algebra Appl.*, 244:35–54, 1996.
- [153] Luca Dieci. Real Hamiltonian logarithm of a symplectic matrix. *Linear Algebra Appl.*, 281:227–246, 1998.
- [154] Luca Dieci, Benedetta Morini, and Alessandra Papini. Computational techniques for real logarithms of matrices. *SIAM J. Matrix Anal. Appl.*, 17(3):570–593, 1996.
- [155] Luca Dieci, Benedetta Morini, Alessandra Papini, and Aldo Pasquali. On real logarithms of nearby matrices and structured matrix interpolation. *Appl. Numer. Math.*, 29:145–165, 1999.
- [156] Luca Dieci and Alessandra Papini. Conditioning and Padé approximation of the logarithm of a matrix. *SIAM J. Matrix Anal. Appl.*, 21(3):913–930, 2000.
- [157] Luca Dieci and Alessandra Papini. Padé approximation for the exponential of a block triangular matrix. *Linear Algebra Appl.*, 308:183–202, 2000.
- [158] Luca Dieci and Alessandra Papini. Conditioning of the exponential of a block triangular matrix. *Numer. Algorithms*, 28:137–150, 2001.
- [159] J. Dieudonné. *Foundations of Modern Analysis*. Academic Press, New York, 1960.
- [160] John D. Dixon. Estimating extremal eigenvalues and condition numbers of matrices. *SIAM J. Numer. Anal.*, 20(4):812–814, 1983.
- [161] Elizabeth D. Dolan and Jorge J. Moré. Benchmarking optimization software with performance profiles. *Math. Programming*, 91:201–213, 2002.

- [162] Jack J. Dongarra, Iain S. Duff, Danny C. Sorensen, and Henk A. Van der Vorst. *Numerical Linear Algebra for High-Performance Computers*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1998.
- [163] M. P. Drazin, J. W. Dungey, and K. W. Gruenberg. Some theorems on commutative matrices. *J. London Math. Soc.*, 26(2):221–228, 1951.
- [164] P. G. Drazin. *Nonlinear Systems*. Cambridge University Press, Cambridge, UK, 1992.
- [165] P. Van Den Driessche and H. K. Wimmer. Explicit polar decomposition of companion matrices. *Electron. J. Linear Algebra*, 1:64–69, 1996.
- [166] V. Druskin, A. Greenbaum, and L. Knizhnerman. Using nonorthogonal Lanczos vectors in the computation of matrix functions. *SIAM J. Sci. Comput.*, 19(1):38–54, 1998.
- [167] Vladimir L. Druskin and Leonid A. Knizhnerman. Two polynomial methods of calculating functions of symmetric matrices. *U.S.S.R. Comput. Maths. Math. Phys.*, 29(6):112–121, 1989.
- [168] Ian L. Dryden and Kanti V. Mardia. *Statistical Shape Analysis*. Wiley, New York, 1998.
- [169] Augustin A. Dubrulle. An optimum iteration for the matrix polar decomposition. *Electron. Trans. Numer. Anal.*, 8:21–25, 1999.
- [170] B. J. Duke. Certification of Algorithm 298 [F1]: Determination of the square root of a positive definite matrix. *Comm. ACM*, 12(6):325–326, 1969.
- [171] Nelson Dunford and Jacob T. Schwartz. *Linear Operators. Part III: Spectral Operators*. Wiley, New York, 1971.
- [172] Nelson Dunford and Jacob T. Schwartz. *Linear Operators. Part I: General Theory*. Wiley, New York, 1988. Wiley Classics Library edition.
- [173] Alan Edelman and Gilbert Strang. Pascal matrices. *Amer. Math. Monthly*, 111(3):189–197, 2004.
- [174] Michael Eiermann and Oliver G. Ernst. A restarted Krylov subspace method for the evaluation of matrix functions. *SIAM J. Numer. Anal.*, 44(6):2481–2504, 2006.
- [175] Timo Eirola. A refined polar decomposition: $A = UPD$. *SIAM J. Matrix Anal. Appl.*, 22(3):824–836, 2000.
- [176] Ludwig Elsner. Iterative Verfahren zur Lösung der Matrizengleichung $X^2 - A = 0$. *Buletinul Institutului Politehnic din Iasi*, xvi(xx):15–24, 1970.

- [177] Ivan Erdelyi. On partial isometries in finite-dimensional Euclidean spaces. *SIAM J. Appl. Math.*, 14(3):453–467, 1966.
- [178] J.-Cl. Evard and F. Jafari. A complex Rolle’s theorem. *Amer. Math. Monthly*, 99(9):858–861, November 1992.
- [179] Jean-Claude Evard and Frank Uhlig. On the matrix equation $f(X) = A$. *Linear Algebra Appl.*, 162–164:447–519, 1992.
- [180] D. K. Faddeev and V. N. Faddeeva. *Numerische Methoden der Linearen Algebra*. Veb Deutscher Verlag der Wissenschaften, Berlin, 1964.
- [181] Ky Fan and A. J. Hoffman. Some metric inequalities in the space of matrices. *Proc. Amer. Math. Soc.*, 6:111–116, 1955.
- [182] Heike Faßbender, D. Steven Mackey, Niloufer Mackey, and Hongguo Xu. Hamiltonian square roots of skew-Hamiltonian matrices. *Linear Algebra Appl.*, 287:125–159, 1999.
- [183] T. I. Fenner and G. Loizou. Optimally scalable matrices. *Philos. Trans. Roy. Soc. London Ser. A*, 287(1345):307–349, 1977.
- [184] W. L. Ferrar. *Finite Matrices*. Oxford University Press, 1951.
- [185] Miroslav Fiedler and Hans Schneider. Analytic functions of M -matrices and generalizations. *Linear and Multilinear Algebra*, 13:185–201, 1983.
- [186] P. Filipponi. An algorithm for computing functions of triangular matrices. *Computing*, 26:67–71, 1981.
- [187] Steven R. Finch. *Mathematical Constants*. Cambridge University Press, Cambridge, UK, 2003.
- [188] Harley Flanders. Elementary divisors of AB and BA . *Proc. Amer. Math. Soc.*, 2(6):871–874, 1951.
- [189] J. Fortiana and C. M. Cuadras. A family of matrices, the discretized Brownian bridge, and distance-based regression. *Linear Algebra Appl.*, 264:173–188, 1997.
- [190] David Fowler and Eleanor Robson. Square root approximations in old Babylonian mathematics: YBC 7289 in context. *Historia Mathematica*, 25:366–378, 1998.
- [191] Chris Fraley. Test problems for unconstrained optimization and nonlinear least squares. <http://www.netlib.org/uncon>.
- [192] Gene F. Franklin, J. David Powell, and Michael L. Workman. *Digital Control of Dynamic Systems*. Addison-Wesley, Reading, MA, USA, third edition, 1998.

- [193] R. A. Frazer, W. J. Duncan, and A. R. Collar. *Elementary Matrices and Some Applications to Dynamics and Differential Equations*. Cambridge University Press, 1938. 1963 printing.
- [194] Paul Friedland. Algorithm 312: Absolute value and square root of a complex number. *Comm. ACM*, 10(10):665, 1967.
- [195] G. Frobenius. Über die cogredienten Transformationen der bilinearen Formen. *Sitzungsber K. Preuss. Akad. Wiss. Berlin*, 16:7–16, 1896.
- [196] Andreas Frommer, Thomas Lippert, Björn Medeke, and Klaus Schilling, editors. *Numerical Challenges in Lattice Quantum Chromodynamics*, volume 15 of *Lecture Notes in Computational Science and Engineering*. Springer-Verlag, Berlin, 2000.
- [197] Andreas Frommer and Valeria Simoncini. Stopping criteria for rational matrix functions of Hermitian and symmetric matrices. Manuscript, 2007.
- [198] Andreas Frommer and Valeria Simoncini. Matrix functions. In W. Schilders and H. A. Van der Vorst, editors, *Model Order Reduction: Theory, Research Aspects and Applications*. Springer-Verlag, Berlin, 2008. To appear.
- [199] Jean Gallier and Dianna Xu. Computing exponentials of skew-symmetric matrices and logarithms of orthogonal matrices. *International Journal of Robotics and Automation*, 17(4):1–11, 2002.
- [200] E. Gallopoulos and Y. Saad. Efficient solution of parabolic equations by Krylov approximation methods. *SIAM J. Sci. Statist. Comput.*, 13(5):1236–1264, 1992.
- [201] Walter Gander. On Halley’s iteration method. *Amer. Math. Monthly*, 92(2):131–134, 1985.
- [202] Walter Gander. Algorithms for the polar decomposition. *SIAM J. Sci. Statist. Comput.*, 11(6):1102–1115, 1990.
- [203] F. R. Gantmacher. *The Theory of Matrices*, volume one. Chelsea, New York, 1959.
- [204] Judith D. Gardiner. A stabilized matrix sign function algorithm for solving algebraic Riccati equations. *SIAM J. Sci. Comput.*, 18(5):1393–1411, 1997.
- [205] Judith D. Gardiner and Alan J. Laub. A generalization of the matrix-sign-function solution for algebraic Riccati equations. *Internat. J. Control*, 44(3):823–832, 1986.
- [206] Walter Gautschi. Algorithm 726: ORTHPOL—A package of routines for generating orthogonal polynomials and Gauss-type quadrature rules. *ACM Trans. Math. Software*, 20(1):21–62, 1994.

- [207] Walter Gautschi. *Numerical Analysis: An Introduction*. Birkhäuser, Boston, MA, USA, 1997.
- [208] Walter Gautschi. *Orthogonal Polynomials: Computation and Approximation*. Oxford University Press, 2004.
- [209] Ivan P. Gavrilyuk, Wolfgang Hackbusch, and Boris N. Khoromskij. \mathcal{H} -matrix approximation for the operator exponential with applications. *Numer. Math.*, 92:83–111, July 2002.
- [210] A. O. Gel'fond. *Calculus of Finite Differences*. Hindustan Publishing Corporation, Delhi, 1971. Authorized English translation of the third Russian edition.
- [211] James E. Gentle. *Random Number Generation and Monte Carlo Methods*. Springer-Verlag, New York, second edition, 2003.
- [212] Alan George and Kh. Ikramov. Is the polar decomposition finitely computable? *SIAM J. Matrix Anal. Appl.*, 17(2):348–354, 1996.
- [213] Alan George and Kh. Ikramov. Addendum: Is the polar decomposition finitely computable? *SIAM J. Matrix Anal. Appl.*, 18(1):264, 1997.
- [214] Michael Gil. Estimate for the norm of matrix-valued functions. *Linear and Multilinear Algebra*, 35:65–73, 1993.
- [215] Philip E. Gill, Walter Murray, and Margaret H. Wright. *Practical Optimization*. Academic Press, London, 1981.
- [216] G. Giorgi. Nuove osservazioni sulle funzioni delle matrici. *Atti Accad. Lincei Rend.*, 6(8):3–8, 1928.
- [217] Glucat: Generic library of universal Clifford algebra templates. <http://glucat.sourceforge.net/>.
- [218] GNU MP: Multiple precision arithmetic library. <http://www.swox.com/gmp/>.
- [219] S. K. Godunov. *Ordinary Differential Equations with Constant Coefficient*, volume 169 of *Translations of Mathematical Monographs*. American Mathematical Society, Providence, RI, USA, 1997.
- [220] I. Gohberg, Peter Lancaster, and Leiba Rodman. *Matrix Polynomials*. Academic Press, New York, 1982.
- [221] Jerome A. Goldstein and Mel Levy. Linear algebra and quantum chemistry. *Amer. Math. Monthly*, 98(8):710–718, 1991.
- [222] Herman H. Goldstine. *A History of Numerical Analysis from the 16th through the 19th Century*. Springer-Verlag, New York, 1977.

- [223] Gene H. Golub and Charles F. Van Loan. *Matrix Computations*. Johns Hopkins University Press, Baltimore, MD, USA, third edition, 1996.
- [224] Gene H. Golub and Gerard Meurant. Matrices, moments and quadrature. In D. F. Griffiths and G. A. Watson, editors, *Numerical Analysis 1993, Proceedings of the 15th Dundee Conference*, volume 303 of *Pitman Research Notes in Mathematics*, pages 105–156. Addison Wesley Longman, Harlow, Essex, UK, 1994. Reprinted in [102].
- [225] Nicholas I. M. Gould, Dominique Orban, and Philippe L. Toint. CUTer and SifDec: A constrained and unconstrained testing environment, revisited. *ACM Trans. Math. Software*, 29(4):373–394, 2003.
- [226] John C. Gower and Garnt B. Dijkstra. *Procrustes Problems*. Oxford University Press, 2004.
- [227] W. B. Gragg. The Padé table and its relation to certain algorithms of numerical analysis. *SIAM Rev.*, 14(1):1–62, 1972.
- [228] L. Grasedyck, W. Hackbusch, and B. N. Khoromskij. Solution of large scale algebraic matrix Riccati equations by use of hierarchical matrices. *Computing*, 70:121–165, 2003.
- [229] Bert F. Green. The orthogonal approximation of an oblique structure in factor analysis. *Psychometrika*, 17(4):429–440, 1952.
- [230] Anne Greenbaum. Some theoretical results derived from polynomial numerical hulls of Jordan blocks. *Electron. Trans. Numer. Anal.*, 18:81–90, 2004.
- [231] R. Grone, C. R. Johnson, E. M. Sá, and H. Wolkowicz. Normal matrices. *Linear Algebra Appl.*, 87:213–225, 1987.
- [232] Ming Gu. Finding well-conditioned similarities to block-diagonalize non-symmetric matrices is NP-hard. *Journal of Complexity*, 11(3):377–391, September 1995.
- [233] Chun-Hua Guo and Nicholas J. Higham. A Schur–Newton method for the matrix p th root and its inverse. *SIAM J. Matrix Anal. Appl.*, 28(3):788–804, 2006.
- [234] Chun-Hua Guo and Peter Lancaster. Analysis and modification of Newton’s method for algebraic Riccati equations. *Math. Comp.*, 67(223):1089–1105, 1998.
- [235] Hongbin Guo and Rosemary A. Renaut. Estimation of $u^T f(A)v$ for large-scale unsymmetric matrices. *Numer. Linear Algebra Appl.*, 11:75–89, 2004.
- [236] Markus Haase. *The Functional Calculus for Sectorial Operators*. Number 169 in *Operator Theory: Advances and Applications*. Birkhäuser, Basel, Switzerland, 2006.

- [237] William W. Hager. Condition estimates. *SIAM J. Sci. Statist. Comput.*, 5(2):311–316, 1984.
- [238] E. Hairer and G. Wanner. *Analysis by Its History*. Springer-Verlag, New York, 1996.
- [239] Ernst Hairer, Christian Lubich, and Gerhard Wanner. *Geometric Numerical Integration: Structure-Preserving Algorithms for Ordinary Differential Equations*. Springer-Verlag, Berlin, 2002.
- [240] Nicholas Hale, Nicholas J. Higham, and Lloyd N. Trefethen. Computing A^α , $\log(A)$ and related matrix functions by contour integrals. MIMS EPrint 2007.103, Manchester Institute for Mathematical Sciences, The University of Manchester, UK, August 2007. To appear in *SIAM J. Numer. Anal.*
- [241] Brian C. Hall. *Lie Groups, Lie Algebras, and Representations*. Springer-Verlag, New York, 2003.
- [242] Paul R. Halmos. Positive approximants of operators. *Indiana Univ. Math. J.*, 21(10):951–960, 1972.
- [243] Paul R. Halmos. *Finite-Dimensional Vector Spaces*. Springer-Verlag, New York, 1974. Reprint of the Second edition published by Van Nostrand, Princeton, NJ, 1958.
- [244] Paul R. Halmos. *A Hilbert Space Problem Book*. Springer-Verlag, Berlin, second edition, 1982.
- [245] H. L. Hamburger and M. E. Grimshaw. *Linear Transformations in n -Dimensional Vector Space: An Introduction to the Theory of Hilbert Space*. Cambridge University Press, 1951.
- [246] Richard J. Hanson and Michael J. Norris. Analysis of measurements based on the singular value decomposition. *SIAM J. Sci. Statist. Comput.*, 2(3):363–373, 1981.
- [247] Gareth Hargreaves. *Topics in Matrix Computations: Stability and Efficiency of Algorithms*. PhD thesis, University of Manchester, Manchester, England, 2005.
- [248] Gareth I. Hargreaves and Nicholas J. Higham. Efficient algorithms for the matrix cosine and sine. *Numer. Algorithms*, 40(4):383–400, 2005.
- [249] Lawrence A. Harris. Computation of functions of certain operator matrices. *Linear Algebra Appl.*, 194:31–34, 1993.
- [250] W. F. Harris. The average eye. *Ophthalm. Physiol. Opt.*, 24:580–585, 2005.

- [251] W. F. Harris and J. R. Cardoso. The exponential-mean-log-transference as a possible representation of the optical character of an average eye. *Ophthalm. Physiol. Opt.*, 26(4):380–383, 2006.
- [252] Timothy F. Havel, Igor Najfeld, and Ju-xing Yang. Matrix decompositions of two-dimensional nuclear magnetic resonance spectra. *Proc. Nat. Acad. Sci. USA*, 91:7962–7966, 1994.
- [253] Thomas Hawkins. The theory of matrices in the 19th century. In *Proceedings of the International Congress of Mathematicians, Vancouver*, volume 2, pages 561–570, 1974.
- [254] Thomas Hawkins. Another look at Cayley and the theory of matrices. *Arch. Internat. Histoire Sci.*, 27(100):82–112, 1977.
- [255] Thomas Hawkins. Weierstrass and the theory of matrices. *Archive for History of Exact Sciences*, 12(2):119–163, 1977.
- [256] Jane M. Heffernan and Robert M. Corless. Solving some delay differential equations with computer algebra. *Mathematical Scientist*, 31(1):21–34, June 2006.
- [257] Peter Henrici. Bounds for iterates, inverses, spectral variation and fields of values of non-normal matrices. *Numer. Math.*, 4:24–40, 1962.
- [258] Kurt Hensel. Über Potenzreihen von Matrizen. *J. Reine Angew. Math.*, 155(2):107–110, 1926.
- [259] Konrad J. Heuvers and Daniel Moak. Matrix solutions of the functional equation of the gamma function. *Aequationes Mathematicae*, 33:1–17, 1987.
- [260] *The Hewlett-Packard HP-35 Scientific Pocket Calculator*. Hewlett-Packard, Cupertino, CA, USA, 1973. Advertising brochure. 5952-6000 Rev. 7/73.
- [261] *HP 48 Programmer's Reference Manual*. Hewlett-Packard, Corvallis Division, Corvallis, OR, USA, July 1990. Mfg. No. 00048-90053.
- [262] Desmond J. Higham. Time-stepping and preserving orthonormality. *BIT*, 37(1):24–36, March 1997.
- [263] Desmond J. Higham and Nicholas J. Higham. *MATLAB Guide*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, second edition, 2005.
- [264] Nicholas J. Higham. The Matrix Computation Toolbox. <http://www.man.ac.uk/~higham/mctoolbox>.
- [265] Nicholas J. Higham. *Nearness Problems in Numerical Linear Algebra*. PhD thesis, University of Manchester, Manchester, England, July 1985.

- [266] Nicholas J. Higham. Computing the polar decomposition—with applications. *SIAM J. Sci. Statist. Comput.*, 7(4):1160–1174, October 1986.
- [267] Nicholas J. Higham. Newton’s method for the matrix square root. *Math. Comp.*, 46(174):537–549, April 1986.
- [268] Nicholas J. Higham. Computing real square roots of a real matrix. *Linear Algebra Appl.*, 88/89:405–430, 1987.
- [269] Nicholas J. Higham. Computing a nearest symmetric positive semidefinite matrix. *Linear Algebra Appl.*, 103:103–118, 1988.
- [270] Nicholas J. Higham. FORTRAN codes for estimating the one-norm of a real or complex matrix, with applications to condition estimation (Algorithm 674). *ACM Trans. Math. Software*, 14(4):381–396, December 1988.
- [271] Nicholas J. Higham. Experience with a matrix norm estimator. *SIAM J. Sci. Statist. Comput.*, 11(4):804–809, July 1990.
- [272] Nicholas J. Higham. Stability of a method for multiplying complex matrices with three real matrix multiplications. *SIAM J. Matrix Anal. Appl.*, 13(3):681–687, July 1992.
- [273] Nicholas J. Higham. The matrix sign decomposition and its relation to the polar decomposition. *Linear Algebra Appl.*, 212/213:3–20, 1994.
- [274] Nicholas J. Higham. Stable iterations for the matrix square root. *Numer. Algorithms*, 15(2):227–242, 1997.
- [275] Nicholas J. Higham. Evaluating Padé approximants of the matrix logarithm. *SIAM J. Matrix Anal. Appl.*, 22(4):1126–1135, 2001.
- [276] Nicholas J. Higham. *Accuracy and Stability of Numerical Algorithms*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, second edition, 2002.
- [277] Nicholas J. Higham. J -orthogonal matrices: Properties and generation. *SIAM Rev.*, 45(3):504–519, September 2003.
- [278] Nicholas J. Higham. The scaling and squaring method for the matrix exponential revisited. *SIAM J. Matrix Anal. Appl.*, 26(4):1179–1193, 2005.
- [279] Nicholas J. Higham. *Functions of Matrices: Theory and Computation*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2008.
- [280] Nicholas J. Higham and Sheung Hun Cheng. Modifying the inertia of matrices arising in optimization. *Linear Algebra Appl.*, 275–276:261–279, 1998.

- [281] Nicholas J. Higham and Hyun-Min Kim. Numerical analysis of a quadratic matrix equation. *IMA J. Numer. Anal.*, 20(4):499–519, 2000.
- [282] Nicholas J. Higham and Hyun-Min Kim. Solving a quadratic matrix equation by Newton’s method with exact line searches. *SIAM J. Matrix Anal. Appl.*, 23(2):303–316, 2001.
- [283] Nicholas J. Higham, D. Steven Mackey, Niloufer Mackey, and Françoise Tisseur. Computing the polar decomposition and the matrix sign decomposition in matrix groups. *SIAM J. Matrix Anal. Appl.*, 25(4):1178–1192, 2004.
- [284] Nicholas J. Higham, D. Steven Mackey, Niloufer Mackey, and Françoise Tisseur. Functions preserving matrix groups and iterations for the matrix square root. *SIAM J. Matrix Anal. Appl.*, 26(3):849–877, 2005.
- [285] Nicholas J. Higham and Pythagoras Papadimitriou. A new parallel algorithm for computing the singular value decomposition. In John G. Lewis, editor, *Proceedings of the Fifth SIAM Conference on Applied Linear Algebra*, pages 80–84. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1994.
- [286] Nicholas J. Higham and Pythagoras Papadimitriou. A parallel algorithm for computing the polar decomposition. *Parallel Comput.*, 20(8):1161–1173, August 1994.
- [287] Nicholas J. Higham and Robert S. Schreiber. Fast polar decomposition of an arbitrary matrix. *SIAM J. Sci. Statist. Comput.*, 11(4):648–655, July 1990.
- [288] Nicholas J. Higham and Matthew I. Smith. Computing the matrix cosine. *Numer. Algorithms*, 34:13–26, 2003.
- [289] Nicholas J. Higham and Françoise Tisseur. A block algorithm for matrix 1-norm estimation, with an application to 1-norm pseudospectra. *SIAM J. Matrix Anal. Appl.*, 21(4):1185–1201, 2000.
- [290] Lester S. Hill. Cryptography in an algebraic alphabet. *Amer. Math. Monthly*, 36:306–312, 1929.
- [291] Einar Hille. On roots and logarithms of elements of a complex Banach algebra. *Math. Annalen*, 136(1):46–57, 1958.
- [292] Marlis Hochbruck and Christian Lubich. On Krylov subspace approximations to the matrix exponential operator. *SIAM J. Numer. Anal.*, 34(5):1911–1925, October 1997.
- [293] Marlis Hochbruck, Christian Lubich, and Hubert Selhofer. Exponential integrators for large systems of differential equations. *SIAM J. Sci. Comput.*, 19(5):1552–1574, September 1998.

- [294] John H. Hodges. The matrix equation $X^2 - I = 0$ over a finite field. *Amer. Math. Monthly*, 65(7):518–520, 1958.
- [295] Roger A. Horn. The Hadamard product. In Charles R. Johnson, editor, *Matrix Theory and Applications*, volume 40 of *Proceedings of Symposia in Applied Mathematics*, pages 87–169. American Mathematical Society, Providence, RI, USA, 1990.
- [296] Roger A. Horn and Charles R. Johnson. *Matrix Analysis*. Cambridge University Press, 1985.
- [297] Roger A. Horn and Charles R. Johnson. *Topics in Matrix Analysis*. Cambridge University Press, 1991.
- [298] Roger A. Horn and Dennis I. Merino. Contragredient equivalence: A canonical form and some applications. *Linear Algebra Appl.*, 214:43–92, 1995.
- [299] Roger A. Horn and Gregory G. Piepmeyer. Two applications of the theory of primary matrix functions. *Linear Algebra Appl.*, 361:99–106, 2003.
- [300] W. D. Hoskins and D. J. Walton. A faster, more stable method for computing the p th roots of positive definite matrices. *Linear Algebra Appl.*, 26:139–163, 1979.
- [301] A. S. Householder and John A. Carpenter. The singular values of involutory and of idempotent matrices. *Numer. Math.*, 5:234–237, 1963.
- [302] Alston S. Householder. *The Numerical Treatment of a Single Nonlinear Equation*. McGraw-Hill, New York, 1970.
- [303] James Lucien Howland. The sign matrix and the separation of matrix eigenvalues. *Linear Algebra Appl.*, 49:221–232, 1983.
- [304] John H. Hubbard and Beverly H. West. *Differential Equations: A Dynamical Systems Approach. Higher Dimensional Systems*. Springer-Verlag, New York, 1995.
- [305] Thomas J. R. Hughes, Itzhak Levit, and James Winget. Element-by-element implicit algorithms for heat conduction. *J. Eng. Mech.*, 109(2):576–585, 1983.
- [306] Bruno Iannazzo. A note on computing the matrix square root. *Calcolo*, 40:273–283, 2003.
- [307] Bruno Iannazzo. On the Newton method for the matrix P th root. *SIAM J. Matrix Anal. Appl.*, 28(2):503–523, 2006.
- [308] Bruno Iannazzo. *Numerical Solution of Certain Nonlinear Matrix Equations*. PhD thesis, Università degli studi di Pisa, Pisa, Italy, 2007.

- [309] Khakim D. Ikramov. Hamiltonian square roots of skew-Hamiltonian matrices revisited. *Linear Algebra Appl.*, 325(1-3):101–107, 2001.
- [310] F. Incertis. A skew-symmetric formulation of the algebraic Riccati equation problem. *IEEE Trans. Automat. Control*, AC-29(5):467–470, 1984.
- [311] Ilse C. F. Ipsen and Dean J. Lee. Determinant approximations. Manuscript, 2003.
- [312] Eugene Isaacson and Herbert Bishop Keller. *Analysis of Numerical Methods*. Wiley, New York, 1966. Reprinted by Dover, New York, 1994.
- [313] Arieh Iserles. How large is the exponential of a banded matrix? *J. New Zealand Maths Soc.*, 29:177–192, 2000.
- [314] Arieh Iserles, Hans Z. Munthe-Kaas, Syvert P. Nørsett, and Antonella Zanna. Lie-group methods. *Acta Numerica*, 9:215–365, 2000.
- [315] Arieh Iserles and Antonella Zanna. Efficient computation of the matrix exponential by generalized polar decompositions. *SIAM J. Numer. Anal.*, 42(5):2218–2256, 2005.
- [316] Robert B. Israel, Jeffrey S. Rosenthal, and Jason Z. Wei. Finding generators for Markov chains via empirical transition matrices, with applications to credit ratings. *Mathematical Finance*, 11(2):245–265, 2001.
- [317] Anzelm Iwanik and Ray Shiflett. The root problem for stochastic and doubly stochastic operators. *J. Math. Anal. and Appl.*, 113(1):93–112, 1986.
- [318] Drahoslava Janovská and Gerhard Opfer. Computing quaternionic roots by Newton’s method. *Electron. Trans. Numer. Anal.*, 26:82–102, 2007.
- [319] Branislav Jansik, Stinne Høst, Poul Jørgensen, Jeppe Olsen, and Trygve Helgaker. Linear-scaling symmetric square-root decomposition of the overlap matrix. *J. Chem. Phys.*, 126:12404, 2007.
- [320] A. J. E. M. Janssen and Thomas Strohmer. Characterization and computation of canonical tight windows for Gabor frames. *The Journal of Fourier Analysis and Applications*, 8(1):1–28, 2002.
- [321] Elias Jarlebring and Tobias Damm. The Lambert W function and the spectrum of some multidimensional time-delay systems. *Automatica*, 43(12):2124–2128, 2007.
- [322] Charles R. Johnson and Eric Schreiner. The relationship between AB and BA . *Amer. Math. Monthly*, 103(7):578–582, 1996.
- [323] George A. Baker Jr. *Essentials of Padé Approximants*. Academic Press, New York, 1975.

- [324] George A. Baker Jr. and Peter Graves-Morris. *Padé Approximants*, volume 59 of *Encyclopedia of Mathematics and Its Applications*. Cambridge University Press, second edition, 1996.
- [325] John E. Dennis Jr., J. F. Traub, and R. P. Weber. The algebraic theory of matrix polynomials. *SIAM J. Numer. Anal.*, 13(6):831–845, 1976.
- [326] William F. Donoghue Jr. *Monotone Matrix Functions and Analytic Continuation*. Springer-Verlag, Berlin, 1974.
- [327] Bo Kågström. Bounds and perturbation bounds for the matrix exponential. *BIT*, 17:39–57, 1977.
- [328] Bo Kågström. Numerical computation of matrix functions. Report UMINF-58.77, Department of Information Processing, University of Umeå, Sweden, July 1977.
- [329] Bo Kågström and Peter Poromaa. Distributed and shared memory block algorithms for the triangular Sylvester equation with sep^{-1} estimators. *SIAM J. Matrix Anal. Appl.*, 13(1):90–101, 1992.
- [330] Bo Kågström and Axel Ruhe. An algorithm for numerical computation of the Jordan normal form of a complex matrix. *ACM Trans. Math. Software*, 6(3):398–419, 1980.
- [331] W. Kahan. Conserving confluence curbs ill-condition. Technical Report 6, Computer Science Department, University of California, Berkeley, August 1972.
- [332] W. Kahan. Branch cuts for complex elementary functions or much ado about nothing’s sign bit. In A. Iserles and M. J. D. Powell, editors, *The State of the Art in Numerical Analysis*, pages 165–211. Oxford University Press, 1987.
- [333] W. Kahan. Derivatives in the complex z -plane. Course notes available from <http://www.cs.berkeley.edu/~wkahan/Math185/>, September 2006.
- [334] W. Kahan and Richard J. Fateman. Symbolic computation of divided differences. *ACM SIGSAM Bulletin*, 33(2):7–28, 1999.
- [335] Thomas Kailath, Ali H. Sayed, and Babak Hassibi. *Linear Estimation*. Prentice-Hall, Upper Saddle River, NJ, USA, 2000.
- [336] J. D. Kalbfleisch and J. F. Lawless. The analysis of panel data under a Markov assumption. *J. Amer. Statist. Assoc.*, 80(392):863–871, 1985.
- [337] G. Kalogeropoulos and Panayiotis Psarrakos. The polar decomposition of block companion matrices. *Computers Math. Applic.*, 50(3):529–537, 2005.

- [338] Christian Kanzow and Christian Nagel. Semidefinite programs: New search directions, smoothing-type methods, and numerical results. *SIAM J. Optim.*, 13(1):1–23, 2002.
- [339] Alan H. Karp and Peter Markstein. High-precision division and square root. *ACM Trans. Math. Software*, 23(4):561–589, 1997.
- [340] Robert Karplus and Julian Schwinger. A note on saturation in microwave spectroscopy. *Phys. Rev.*, 73(9):1020–1026, 1948.
- [341] Aly-Khan Kassam and Lloyd N. Trefethen. Fourth-order time-stepping for stiff PDEs. *SIAM J. Sci. Comput.*, 26(4):1214–1233, 2005.
- [342] Tosio Kato. *Perturbation Theory for Linear Operators*. Springer-Verlag, Berlin, second edition, 1976.
- [343] A. D. Kennedy. Approximation theory for matrices. *Nuclear Physics B (Proc. Suppl.)*, 128:107–116, 2004.
- [344] A. D. Kennedy. Fast evaluation of Zolotarev coefficients. In Artan Boriçi, Andreas Frommer, Báalint Joó, Anthony Kennedy, and Brian Pendleton, editors, *QCD and Numerical Analysis III*, volume 47 of *Lecture Notes in Computational Science and Engineering*, pages 169–189. Springer-Verlag, Berlin, 2005.
- [345] Charles S. Kenney and Alan J. Laub. Condition estimates for matrix functions. *SIAM J. Matrix Anal. Appl.*, 10(2):191–209, 1989.
- [346] Charles S. Kenney and Alan J. Laub. Padé error estimates for the logarithm of a matrix. *Internat. J. Control*, 50(3):707–730, 1989.
- [347] Charles S. Kenney and Alan J. Laub. Polar decomposition and matrix sign function condition estimates. *SIAM J. Sci. Statist. Comput.*, 12(3):488–504, 1991.
- [348] Charles S. Kenney and Alan J. Laub. Rational iterative methods for the matrix sign function. *SIAM J. Matrix Anal. Appl.*, 12(2):273–291, 1991.
- [349] Charles S. Kenney and Alan J. Laub. On scaling Newton’s method for polar decomposition and the matrix sign function. *SIAM J. Matrix Anal. Appl.*, 13(3):688–706, 1992.
- [350] Charles S. Kenney and Alan J. Laub. A hyperbolic tangent identity and the geometry of Padé sign function iterations. *Numer. Algorithms*, 7:111–128, 1994.
- [351] Charles S. Kenney and Alan J. Laub. Small-sample statistical condition estimates for general matrix functions. *SIAM J. Sci. Comput.*, 15(1):36–61, 1994.

- [352] Charles S. Kenney and Alan J. Laub. The matrix sign function. *IEEE Trans. Automat. Control*, 40(8):1330–1348, 1995.
- [353] Charles S. Kenney and Alan J. Laub. A Schur–Fréchet algorithm for computing the logarithm and exponential of a matrix. *SIAM J. Matrix Anal. Appl.*, 19(3):640–663, 1998.
- [354] Charles S. Kenney, Alan J. Laub, and Edmond A. Jonckheere. Positive and negative solutions of dual Riccati equations by matrix sign function iteration. *Systems and Control Letters*, 13:109–116, 1989.
- [355] Charles S. Kenney, Alan J. Laub, and P. M. Papadopoulos. A Newton-squaring algorithm for computing the negative invariant subspace of a matrix. *IEEE Trans. Automat. Control*, 38(8):1284–1289, 1993.
- [356] Andrzej Kielbasiński, Pawel Zieliński, and Krystyna Ziętak. Numerical experiments with Higham’s scaled method for polar decomposition. Technical report, Institute of Mathematics and Computer Science, Wrocław University of Technology, Wrocław, Poland, May 2006.
- [357] Andrzej Kielbasiński and Krystyna Ziętak. Numerical behaviour of Higham’s scaled method for polar decomposition. *Numer. Algorithms*, 32:105–140, 2003.
- [358] Fuad Kittaneh. On Lipschitz functions of normal operators. *Proc. Amer. Math. Soc.*, 94(3):416–418, 1985.
- [359] Fuad Kittaneh. Inequalities for the Schatten p -norm. III. *Commun. Math. Phys.*, 104:307–310, 1986.
- [360] Leonard F. Klosinski, Gerald L. Alexanderson, and Loren C. Larson. The fifty-first William Lowell Putnam mathematical competition. *Amer. Math. Monthly*, 98(8):719–727, 1991.
- [361] Leonid A. Knizhnerman. Calculation of functions of unsymmetric matrices using Arnoldi’s method. *U.S.S.R. Comput. Maths. Math. Phys.*, 31(1):1–9, 1991.
- [362] Donald E. Knuth. *The Art of Computer Programming, Volume 2, Seminumerical Algorithms*. Addison-Wesley, Reading, MA, USA, third edition, 1998.
- [363] Çetin Kaya Koç and Bertan Bakkaloğlu. Halley’s method for the matrix sector function. *IEEE Trans. Automat. Control*, 40(5):944–949, 1995.
- [364] Plamen Koev and Alan Edelman. The efficient evaluation of the hypergeometric function of a matrix argument. *Math. Comp.*, 75(254):833–846, 2006.
- [365] S. Koikari. An error analysis of the modified scaling and squaring method. *Computers Math. Applic.*, 53:1293–1305, 2007.

- [366] Zdislav Kovarik. Some iterative methods for improving orthonormality. *SIAM J. Numer. Anal.*, 7(3):386–389, 1970.
- [367] Alexander Kreinin and Marina Sidelnikova. Regularization algorithms for transition matrices. *Algo Research Quarterly*, 4(1/2):23–40, 2001.
- [368] H. Kreis. Auflösung der Gleichung $X^n = A$. *Vierteljschr. Naturforsch. Ges. Zürich*, 53:366–376, 1908.
- [369] V. N. Kublanovskaya. On certain iteration processes for the symmetrisation of a matrix. *U.S.S.R. Computational Math. and Math. Phys.*, 2(5):859–868, 1963.
- [370] J. Kuczyński and H. Woźniakowski. Estimating the largest eigenvalue by the power and Lanczos algorithms with a random start. *SIAM J. Matrix Anal. Appl.*, 13(4):1094–1122, 1992.
- [371] Pentti Laasonen. On the iterative solution of the matrix equation $AX^2 - I = 0$. *M.T.A.C.*, 12:109–116, 1958.
- [372] Edmond Nicolas Laguerre. Le calcul des systèmes linéaires, extrait d’une lettre adressé à M. Hermite. In Ch. Hermite, H. Poincaré, and E. Rouché, editors, *Oeuvres de Laguerre*, volume 1, pages 221–267. Gauthier–Villars, Paris, 1898. The article is dated 1867 and is “Extrait du Journal de l’École Polytechnique, LXII^e Cahier”.
- [373] S. Lakić. On the computation of the matrix k -th root. *Z. Angew. Math. Mech.*, 78(3):167–172, 1998.
- [374] Peter Lancaster. *Lambda-Matrices and Vibrating Systems*. Pergamon Press, Oxford, 1966. Reprinted by Dover, New York, 2002.
- [375] Peter Lancaster and Leiba Rodman. *Algebraic Riccati Equations*. Oxford University Press, 1995.
- [376] Peter Lancaster and Miron Tismenetsky. *The Theory of Matrices*. Academic Press, London, second edition, 1985.
- [377] B. Laszkiewicz and Krystyna Ziętak. Approximation of matrices and a family of Gander methods for polar decomposition. *BIT*, 46(2):345–366, 2006.
- [378] Guy Latouche and V. Ramaswami. *Introduction to Matrix Analytic Methods in Stochastic Modeling*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1999.
- [379] Alan J. Laub. Invariant subspace methods for the numerical solution of Riccati equations. In Sergio Bittanti, Alan J. Laub, and Jan C. Willems, editors, *The Riccati Equation*, pages 163–196. Springer-Verlag, Berlin, 1991.

- [380] P.-F. Lavallée, A. Malyshev, and M. Sadkane. Spectral portrait of matrices by block diagonalization. In Lubin Vulkov, Jerzy Waśniewski, and Plamen Yalamov, editors, *Numerical Analysis and Its Applications*, volume 1196 of *Lecture Notes in Computer Science*, pages 266–273. Springer-Verlag, Berlin, 1997.
- [381] J. Douglas Lawson. Generalized Runge-Kutta processes for stable systems with large Lipschitz constants. *SIAM J. Numer. Anal.*, 4(3):372–380, September 1967.
- [382] Jimmie D. Lawson and Yongdo Lim. The geometric mean, matrices, metrics, and more. *Amer. Math. Monthly*, 108(9):797–812, 2001.
- [383] Dean J. Lee and Ilse C. F. Ipsen. Zone determinant expansions for nuclear lattice simulations. *Physical Review C*, 68:064003, 2003.
- [384] R. B. Leipnik. Rapidly convergent recursive solution of quadratic operator equations. *Numer. Math.*, 17:1–16, 1971.
- [385] Randall J. LeVeque. *Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2007.
- [386] Jack Levine and H. M. Nahikian. On the construction of involutory matrices. *Amer. Math. Monthly*, 69(4):267–272, 1962.
- [387] Bernard W. Levinger. The square root of a 2×2 matrix. *Math. Mag.*, 53(4):222–224, 1980.
- [388] Malcolm H. Levitt. *Spin Dynamics: Basics of Nuclear Magnetic Resonance*. Wiley, Chichester, UK, 2001.
- [389] Jing Li. *An Algorithm for Computing the Matrix Exponential*. PhD thesis, Mathematics Department, University of California, Berkeley, CA, USA, 1988.
- [390] Ren-Cang Li. A perturbation bound for the generalized polar decomposition. *BIT*, 33:304–308, 1993.
- [391] Ren-Cang Li. New perturbation bounds for the unitary polar factor. *SIAM J. Matrix Anal. Appl.*, 16(1):327–332, 1995.
- [392] Ren-Cang Li. Relative perturbation bounds for the unitary polar factor. *BIT*, 37(1):67–75, 1997.
- [393] Ren-Cang Li. Relative perturbation bounds for positive polar factors of graded matrices. *SIAM J. Matrix Anal. Appl.*, 27(2):424–433, 2005.
- [394] Wen Li and Weiwei Sun. Perturbation bounds of unitary and subunitary polar factors. *SIAM J. Matrix Anal. Appl.*, 23(4):1183–1193, 2002.

- [395] Pietr Liebl. Einige Bemerkungen zur numerischen Stabilität von Matrizeniterationen. *Aplikace Matematiky*, 10(3):249–254, 1965.
- [396] Yongdo Lim. The matrix golden mean and its applications to Riccati matrix equations. *SIAM J. Matrix Anal. Appl.*, 29(1):54–66, 2007.
- [397] Chih-Chang Lin and Earl Zmijewski. A parallel algorithm for computing the eigenvalues of an unsymmetric matrix on an SIMD mesh of processors. Report TRCS 91-15, Department of Computer Science, University of California, Santa Barbara, July 1991.
- [398] Lu Lin and Zhong-Yun Liu. On the square root of an H-matrix with positive diagonal elements. *Annals of Operations Research*, 103:339–350, 2001.
- [399] Charles F. Van Loan. A study of the matrix exponential. Numerical Analysis Report No. 10, University of Manchester, Manchester, UK, August 1975. Reissued as MIMS EPrint 2006.397, Manchester Institute for Mathematical Sciences, The University of Manchester, UK, November 2006.
- [400] Charles F. Van Loan. On the limitation and application of Padé approximation to the matrix exponential. In E. B. Saff and R. S. Varga, editors, *Padé and Rational Approximation: Theory and Applications*, pages 439–448. Academic Press, New York, 1977.
- [401] Charles F. Van Loan. The sensitivity of the matrix exponential. *SIAM J. Numer. Anal.*, 14(6):971–981, 1977.
- [402] Charles F. Van Loan. Computing integrals involving the matrix exponential. *IEEE Trans. Automat. Control*, AC-23(3):395–404, 1978.
- [403] Charles F. Van Loan. A note on the evaluation of matrix polynomials. *IEEE Trans. Automat. Control*, AC-24(2):320–321, 1979.
- [404] Ya Yan Lu. Computing the logarithm of a symmetric positive definite matrix. *Appl. Numer. Math.*, 26:483–496, 1998.
- [405] Ya Yan Lu. Exponentials of symmetric matrices through tridiagonal reductions. *Linear Algebra Appl.*, 279:317–324, 1998.
- [406] Ya Yan Lu. A Padé approximation method for square roots of symmetric positive definite matrices. *SIAM J. Matrix Anal. Appl.*, 19(3):833–845, 1998.
- [407] Ya Yan Lu. Computing a matrix function for exponential integrators. *J. Comput. Appl. Math.*, 161:203–216, 2003.
- [408] Cyrus Colton MacDuffee. *Vectors and Matrices*. Number 7 in The Carus Mathematical Monographs. Mathematical Association of America, 1943.

- [409] Cyrus Colton MacDuffee. *The Theory of Matrices*. Chelsea, New York, 1946. Corrected reprint of first edition (J. Springer, Berlin, 1933). Also available as Dover edition, 2004.
- [410] D. Steven Mackey, Niloufer Mackey, and Françoise Tisseur. Structured factorizations in scalar product spaces. *SIAM J. Matrix Anal. Appl.*, 27:821–850, 2006.
- [411] Arne Magnus and Jan Wynn. On the Padé table of $\cos z$. *Proc. Amer. Math. Soc.*, 47(2):361–367, 1975.
- [412] Jan R. Magnus and Heinz Neudecker. *Matrix Differential Calculus with Applications in Statistics and Econometrics*. Wiley, Chichester, UK, revised edition, 1999.
- [413] Wilhelm Magnus. On the exponential solution of differential equations for a linear operator. *Comm. Pure Appl. Math.*, 7:649–673, 1954.
- [414] P. J. Maher. Partially isometric approximation of positive operators. *Illinois Journal of Mathematics*, 33(2):227–243, 1989.
- [415] Jianqin Mao. Optimal orthonormalization of the strapdown matrix by using singular value decomposition. *Computers Math. Applic.*, 12A(3):353–362, 1986.
- [416] Marvin Marcus and Henryk Minc. Some results on doubly stochastic matrices. *Proc. Amer. Math. Soc.*, 13(4):571–579, 1962.
- [417] Jerrold E. Marsden and Tudor S. Ratiu. *Introduction to Mechanics and Symmetry*. Springer-Verlag, New York, second edition, 1999.
- [418] Roy Mathias. Evaluating the Frechet derivative of the matrix exponential. *Numer. Math.*, 63:213–226, 1992.
- [419] Roy Mathias. Approximation of matrix-valued functions. *SIAM J. Matrix Anal. Appl.*, 14(4):1061–1063, 1993.
- [420] Roy Mathias. Perturbation bounds for the polar decomposition. *SIAM J. Matrix Anal. Appl.*, 14(2):588–597, 1993.
- [421] Roy Mathias. Condition estimation for matrix functions via the Schur decomposition. *SIAM J. Matrix Anal. Appl.*, 16(2):565–578, 1995.
- [422] Roy Mathias. A chain rule for matrix functions and applications. *SIAM J. Matrix Anal. Appl.*, 17(3):610–620, 1996.
- [423] *Control Systems Toolbox Documentation*. The MathWorks, Inc., Natick, MA, USA. Online version.
- [424] *MATLAB*. The MathWorks, Inc., Natick, MA, USA. <http://www.mathworks.com>.

- [425] Neal H. McCoy. On the characteristic roots of matrix polynomials. *Bull. Amer. Math. Soc.*, 42:592–600, 1936.
- [426] A. McCurdy, K. C. Ng, and B. N. Parlett. Accurate computation of divided differences of the exponential function. *Math. Comp.*, 43(168):501–528, 1984.
- [427] Robert I. McLachlan and G. Reinout W. Quispel. Splitting methods. *Acta Numerica*, 11:341–434, 2002.
- [428] Volker Mehrmann. *The Autonomous Linear Quadratic Control Problem: Theory and Numerical Solution*, volume 163 of *Lecture Notes in Control and Information Sciences*. Springer-Verlag, Berlin, 1991.
- [429] Volker Mehrmann and Werner Rath. Numerical methods for the computation of analytic singular value decompositions. *Electron. Trans. Numer. Anal.*, 1:72–88, 1993.
- [430] Madan Lal Mehta. *Matrix Theory: Selected Topics and Useful Results*. Hindustan Publishing Company, Delhi, second edition, 1989.
- [431] Beatrice Meini. The matrix square root from a new functional perspective: Theoretical results and computational issues. *SIAM J. Matrix Anal. Appl.*, 26(2):362–376, 2004.
- [432] Brian J. Melloy and G. Kemble Bennett. Computing the exponential of an intensity matrix. *J. Comput. Appl. Math.*, 46:405–413, 1993.
- [433] Michael Metcalf and John K. Reid. *Fortran 90/95 Explained*. Oxford University Press, second edition, 1999.
- [434] W. H. Metzler. On the roots of matrices. *Amer. J. Math.*, 14(4):326–377, 1892.
- [435] Gérard Meurant. A review on the inverse of symmetric tridiagonal and block tridiagonal matrices. *SIAM J. Matrix Anal. Appl.*, 13(3):707–728, 1992.
- [436] Carl D. Meyer. *Matrix Analysis and Applied Linear Algebra*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2000.
- [437] Charles A. Micchelli and R. A. Willoughby. On functions which preserve the class of Stieltjes matrices. *Linear Algebra Appl.*, 23:141–156, 1979.
- [438] L. M. Milne-Thompson. *The Calculus of Finite Differences*. Macmillan, London, 1933.
- [439] Henryk Minc. *Nonnegative Matrices*. Wiley, New York, 1988.
- [440] Borislav V. Minchev. Computing analytic matrix functions for a class of exponential integrators. Reports in Informatics 278, Department of Informatics, University of Bergen, Norway, June 2004.

- [441] Borislav V. Minchev and Will M. Wright. A review of exponential integrators for first order semi-linear problems. Preprint 2/2005, Norwegian University of Science and Technology, Trondheim, Norway, 2005.
- [442] L. Mirsky. Symmetric gauge functions and unitarily invariant norms. *Quart. J. Math.*, 11:50–59, 1960.
- [443] L. Mirsky. *An Introduction to Linear Algebra*. Oxford University Press, 1961. Reprinted by Dover, New York, 1990.
- [444] Maher Moakher. Means and averaging in the group of rotations. *SIAM J. Matrix Anal. Appl.*, 24(1):1–16, 2002.
- [445] Maher Moakher. A differential geometric approach to the geometric mean of symmetric positive-definite matrices. *SIAM J. Matrix Anal. Appl.*, 26(3):735–747, 2005.
- [446] Cleve B. Moler. *Numerical Computing with MATLAB*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2004. Also available electronically from www.mathworks.com.
- [447] Cleve B. Moler and Charles F. Van Loan. Nineteen dubious ways to compute the exponential of a matrix. *SIAM Rev.*, 20(4):801–836, 1978.
- [448] Cleve B. Moler and Charles F. Van Loan. Nineteen dubious ways to compute the exponential of a matrix, twenty-five years later. *SIAM Rev.*, 45(1):3–49, 2003.
- [449] Pierre Montagnier, Christopher C. Paige, and Raymond J. Spiteri. Real Floquet factors of linear time-periodic systems. *Systems and Control Letters*, 50:251–262, 2003.
- [450] I. Moret and P. Novati. The computation of functions of matrices by truncated Faber series. *Numer. Funct. Anal. Optim.*, 22(5&6):697–719, 2001.
- [451] Jean-Michel Muller. *Elementary Functions: Algorithms and Implementation*. Birkhäuser, Boston, MA, USA, 1997.
- [452] David Mumford, Caroline Series, and David Wright. *Indra’s Pearls: The Vision of Felix Klein*. Cambridge University Press, 2002.
- [453] H. Z. Munthe-Kaas, G. R. W. Quispel, and A. Zanna. Generalized polar decompositions on Lie groups with involutive automorphisms. *Found. Comput. Math.*, 1(3):297–324, 2001.
- [454] Noël M. Nachtigal, Satish C. Reddy, and Lloyd N. Trefethen. How fast are nonsymmetric matrix iterations? *SIAM J. Matrix Anal. Appl.*, 13(3):778–795, 1992.

- [455] Igor Najfeld and Timothy F. Havel. Derivatives of the matrix exponential and their computation. *Advances in Applied Mathematics*, 16:321–375, 1995.
- [456] Herbert Neuberger. Exactly massless quarks on the lattice. *Phys. Lett. B*, 417(1-2):141–144, 1998.
- [457] Arnold Neumaier. *Introduction to Numerical Analysis*. Cambridge University Press, 2001.
- [458] Kwok Choi Ng. Contributions to the computation of the matrix exponential. Technical Report PAM-212, Center for Pure and Applied Mathematics, University of California, Berkeley, February 1984. PhD thesis.
- [459] Jorge Nocedal and Stephen J. Wright. *Numerical Optimization*. Springer-Verlag, New York, 1999.
- [460] Paolo Novati. A polynomial method based on Fejér points for the computation of functions of unsymmetric matrices. *Appl. Numer. Math.*, 44:201–224, 2003.
- [461] Jeffrey Nunemacher. Which matrices have real logarithms? *Math. Mag.*, 62(2):132–135, 1989.
- [462] G. Opitz. Steigungsmatrizen. *Z. Angew. Math. Mech.*, 44:T52–T54, 1964.
- [463] James M. Ortega and Werner C. Rheinboldt. *Iterative Solution of Non-linear Equations in Several Variables*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2000. Republication of work first published by Academic Press in 1970.
- [464] E. E. Osborne. On pre-conditioning of matrices. *J. Assoc. Comput. Mach.*, 7:338–345, 1960.
- [465] A. M. Ostrowski. *Solution of Equations in Euclidean and Banach Spaces*. Academic Press, New York, 1973. Third edition of Solution of Equations and Systems of Equations.
- [466] C. C. Paige. Krylov subspace processes, Krylov subspace methods, and iteration polynomials. In J. David Brown, Moody T. Chu, Donald C. Ellison, and Robert J. Plemmons, editors, *Proceedings of the Cornelius Lanczos International Centenary Conference*, pages 83–92. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1994.
- [467] Pradeep Pandey, Charles S. Kenney, and Alan J. Laub. A parallel algorithm for the matrix sign function. *Int. J. High Speed Computing*, 2(2):181–191, 1990.
- [468] Michael James Parks. *A Study of Algorithms to Compute the Matrix Exponential*. PhD thesis, Mathematics Department, University of California, Berkeley, CA, USA, 1994.

- [469] Beresford N. Parlett. Computation of functions of triangular matrices. Memorandum ERL-M481, Electronics Research Laboratory, College of Engineering, University of California, Berkeley, November 1974.
- [470] Beresford N. Parlett. A recurrence among the elements of functions of triangular matrices. *Linear Algebra Appl.*, 14:117–121, 1976.
- [471] Beresford N. Parlett. *The Symmetric Eigenvalue Problem*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1998. Unabridged, amended version of book first published by Prentice-Hall in 1980.
- [472] Beresford N. Parlett and Kwok Choi Ng. Development of an accurate algorithm for $\exp(Bt)$. Technical Report PAM-294, Center for Pure and Applied Mathematics, University of California, Berkeley, August 1985. Fortran program listings are given in an appendix with the same report number printed separately.
- [473] Karen Hunger Parshall. Joseph H. M. Wedderburn and the structure theory of algebras. *Archive for History of Exact Sciences*, 32(3-4):223–349, 1985.
- [474] Karen Hunger Parshall. *James Joseph Sylvester. Life and Work in Letters*. Oxford University Press, 1998.
- [475] Karen Hunger Parshall. *James Joseph Sylvester. Jewish Mathematician in a Victorian World*. Johns Hopkins University Press, Baltimore, MD, USA, 2006.
- [476] Michael S. Paterson and Larry J. Stockmeyer. On the number of nonscalar multiplications necessary to evaluate polynomials. *SIAM J. Comput.*, 2(1):60–66, 1973.
- [477] G. Peano. Intégration par Séries des équations différentielles linéaires. *Math. Annalen*, 32:450–456, 1888.
- [478] Heinz-Otto Peitgen, Hartmut Jürgens, and Dietmar Saupe. *Fractals for the Classroom. Part Two: Complex Systems and Mandelbrot Set*. Springer-Verlag, New York, 1992.
- [479] R. Penrose. A generalized inverse for matrices. *Proc. Cambridge Philos. Soc.*, 51(3):406–413, 1955.
- [480] P. P. Petrushev and V. A. Popov. *Rational Approximation of Real Functions*. Cambridge University Press, Cambridge, UK, 1987.
- [481] Bernard Philippe. An algorithm to improve nearly orthonormal sets of vectors on a vector processor. *SIAM J. Alg. Discrete Methods*, 8(3):396–403, 1987.

- [482] George M. Phillips. *Two Millennia of Mathematics: From Archimedes to Gauss*. Springer-Verlag, New York, 2000.
- [483] H. Poincaré. Sur les groupes continus. *Trans. Cambridge Phil. Soc.*, 18:220–255, 1899.
- [484] George Pólya and Gabor Szegő. *Problems and Theorems in Analysis I. Series. Integral Calculus. Theory of Functions*. Springer-Verlag, New York, 1998. Reprint of the 1978 edition.
- [485] George Pólya and Gabor Szegő. *Problems and Theorems in Analysis II. Theory of Functions. Zeros. Polynomials. Determinants. Number Theory. Geometry*. Springer-Verlag, New York, 1998. Reprint of the 1976 edition.
- [486] Renfrey B. Potts. Symmetric square roots of the finite identity matrix. *Utilitas Mathematica*, 9:73–86, 1976.
- [487] M. J. D. Powell. *Approximation Theory and Methods*. Cambridge University Press, Cambridge, UK, 1981.
- [488] William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery. *Numerical Recipes: The Art of Scientific Computing*. Cambridge University Press, third edition, 2007.
- [489] Panayiotis J. Psarrakos. On the m th roots of a complex matrix. *Electron. J. Linear Algebra*, 9:32–41, 2002.
- [490] Péter Pulay. An iterative method for the determination of the square root of a positive definite matrix. *Z. Angew. Math. Mech.*, 46:151, 1966.
- [491] Norman J. Pullman. *Matrix Theory and its Applications: Selected Topics*. Marcel Dekker, New York, 1976.
- [492] W. Pusz and S. L. Woronowicz. Functional calculus for sesquilinear forms and the purification map. *Reports on Mathematical Physics*, 8(2):159–170, 1975.
- [493] Heydar Radjavi and Peter Rosenthal. *Simultaneous Triangularization*. Springer-Verlag, New York, 2000.
- [494] C. R. Rao. Matrix approximations and reduction of dimensionality in multivariate statistical analysis. In P. R. Krishnaiah, editor, *Multivariate Analysis—V*, pages 3–22. North Holland, Amsterdam, 1980.
- [495] Lothar Reichel. The application of Leja points to Richardson iteration and polynomial preconditioning. *Linear Algebra Appl.*, 154/156:389–414, 1991.
- [496] Matthias W. Reinsch. A simple expression for the terms in the Baker–Campbell–Hausdorff series. *J. Math. Phys.*, 41(4):2434–2442, 2000.

- [497] John R. Rice. A theory of condition. *SIAM J. Numer. Anal.*, 3(2):287–310, 1966.
- [498] Norman M. Rice. On n th roots of positive operators. *Amer. Math. Monthly*, 89(5):313–314, 1982.
- [499] A. N. Richmond. Expansions for the exponential of a sum of matrices. In M. J. C. Gover and S. Barnett, editors, *Applications of Matrix Theory*, pages 283–289. Oxford University Press, 1989.
- [500] Hans Richter. Zum Logarithmus einer Matrix. *Archiv der Mathematik*, 2(5):360–363, 1949.
- [501] Hans Richter. Über Matrixfunktionen. *Math. Ann.*, 22(1):16–34, 1950.
- [502] Frigyes Riesz and Béla Sz.-Nagy. *Functional Analysis*. Blackie & Son, London and Glasgow, second edition, 1956.
- [503] R. F. Rinehart. The equivalence of definitions of a matrix function. *Amer. Math. Monthly*, 62:395–414, 1955.
- [504] R. F. Rinehart. The derivative of a matrix function. *Proc. Amer. Math. Soc.*, 7:2–5, 1956.
- [505] R. F. Rinehart. Elements of a theory of intrinsic functions on algebras. *Duke Math. J.*, 27:1–19, 1960.
- [506] J. D. Roberts. Linear model reduction and solution of the algebraic Riccati equation by use of the sign function. *Internat. J. Control*, 32(4):677–687, 1980. First issued as report CUED/B-Control/TR13, Department of Engineering, University of Cambridge, 1971.
- [507] Gian-Carlo Rota. *Indiscrete Thoughts*. Birkhäuser, Boston, 1997. Edited by Fabrizio Palombi.
- [508] Y. Saad. Analysis of some Krylov subspace approximations to the matrix exponential operator. *SIAM J. Numer. Anal.*, 29(1):209–228, February 1992.
- [509] Youcef Saad. *Numerical Methods for Large Eigenvalue Problems*. Manchester University Press, Manchester, and Halsted Press, New York, 1992.
- [510] Yousef Saad. *Iterative Methods for Sparse Linear Systems*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, second edition, 2003.
- [511] E. B. Saff. On the degree of best rational approximation to the exponential function. *J. Approximation Theory*, 9:97–101, 1973.
- [512] Martin Schechter. *Principles of Functional Analysis*. Academic Press, New York, 1971.

- [513] Thomas Schmelzer and Lloyd N. Trefethen. Evaluating matrix functions for exponential integrators via Carathéodory-Fejér approximation and contour integrals. Report Number 06/20, Numerical Analysis Group, Oxford University Computing Laboratory, Oxford, UK, 2006.
- [514] Bernhard A. Schmitt. An algebraic approximation for the matrix exponential in singularly perturbed boundary value problems. *SIAM J. Numer. Anal.*, 27(1):51–66, 1990.
- [515] Christoph Schmoeger. On the operator equation $e^A = e^B$. *Linear Algebra Appl.*, 359:169–179, 2003.
- [516] Daniel Scholz and Michael Weyrauch. A note on the Zassenhaus product formula. *J. Math. Phys.*, 47:033505.1–033505.7, 2006.
- [517] Peter H. Schönemann. A generalized solution of the orthogonal Procrustes problem. *Psychometrika*, 31(1):1–10, 1966.
- [518] Robert S. Schreiber and Beresford N. Parlett. Block reflectors: Theory and computation. *SIAM J. Numer. Anal.*, 25(1):189–205, 1988.
- [519] Ernst Schröder. Ueber unendliche viele Algorithmen zur Auflösung der Gleichungen. *Math. Annalen*, 2:317–365, 1870.
- [520] Ernst Schröder. On infinitely many algorithms for solving equations. Technical Report TR-92-121, Department of Computer Science, University of Maryland, College Park, MD, USA, November 1992. Translation of [519] by G. W. Stewart.
- [521] Manfred Schroeder. *Fractals, Chaos, Power Laws: Minutes from an Infinite Paradise*. W. H. Freeman, New York, 1991.
- [522] Günther Schulz. Iterative Berechnung der reziproken Matrix. *Z. Angew. Math. Mech.*, 13:57–59, 1933.
- [523] Hans Schwerdtfeger. *Les Fonctions de Matrices. I. Les Fonctions Univalentes*. Number 649 in Actualités Scientifiques et Industrielles. Hermann, Paris, France, 1938.
- [524] Steven M. Serbin. Rational approximations of trigonometric matrices with application to second-order systems of differential equations. *Appl. Math. Comput.*, 5(1):75–92, 1979.
- [525] Steven M. Serbin and Sybil A. Blalock. An algorithm for computing the matrix cosine. *SIAM J. Sci. Statist. Comput.*, 1(2):198–204, 1980.
- [526] Lawrence F. Shampine and Mark W. Reichelt. The MATLAB ODE suite. *SIAM J. Sci. Comput.*, 18(1):1–22, 1997.

- [527] Wyatt D. Sharpa and Edward J. Allen. Stochastic neutron transport equations for rod and plane geometries. *Annals of Nuclear Energy*, 27(2):99–116, 2000.
- [528] N. Sherif. On the computation of a matrix inverse square root. *Computing*, 46:295–305, 1991.
- [529] L. S. Shieh, Y. T. Tsay, and C. T. Wang. Matrix sector functions and their applications to system theory. *IEE Proc.*, 131(5):171–181, 1984.
- [530] Ken Shoemake and Tom Duff. Matrix animation and polar decomposition. In *Proceedings of the Conference on Graphics Interface '92*, pages 258–264. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1992.
- [531] Avram Sidi. *Practical Extrapolation Methods; Theory and Applications*. Cambridge University Press, Cambridge, UK, 2003.
- [532] Roger B. Sidje. Expokit: A software package for computing matrix exponentials. *ACM Trans. Math. Software*, 24(1):130–156, 1998.
- [533] Roger B. Sidje, Kevin Burrage, and Shev MacNamara. Inexact uniformization method for computing transient distributions of Markov chains. *SIAM J. Sci. Comput.*, 29(6):2562–2580, 2007.
- [534] Roger B. Sidje and William J. Stewart. A numerical study of large sparse matrix exponentials arising in Markov chains. *Computational Statistics & Data Analysis*, 29:345–368, 1999.
- [535] Burton Singer and Seymour Spilerman. The representation of social processes by Markov models. *Amer. J. Sociology*, 82(1):1–54, 1976.
- [536] Abraham Sinkov. *Elementary Cryptanalysis: A Mathematical Approach*. Mathematical Association of America, Washington, D.C., 1966.
- [537] Bård Skaflestad and Will M. Wright. The scaling and modified squaring method for matrix functions related to the exponential. Preprint, Norwegian University of Science and Technology, Trondheim, Norway, 2006.
- [538] David M. Smith. Algorithm 693: A FORTRAN package for floating-point multiple-precision arithmetic. *ACM Trans. Math. Software*, 17(2):273–283, 1991.
- [539] Matthew I. Smith. *Numerical Computation of Matrix Functions*. PhD thesis, University of Manchester, Manchester, England, September 2002.
- [540] Matthew I. Smith. A Schur algorithm for computing matrix p th roots. *SIAM J. Matrix Anal. Appl.*, 24(4):971–989, 2003.
- [541] R. A. Smith. Infinite product expansions for matrix n -th roots. *J. Austral. Math. Soc.*, 8:242–249, 1968.

- [542] Alicja Smoktunowicz, Jesse L. Barlow, and Julien Langou. A note on the error analysis of classical Gram–Schmidt. *Numer. Math.*, 105:299–313, 2006.
- [543] Inge Söderkvist. Perturbation analysis of the orthogonal Procrustes problem. *BIT*, 33:687–694, 1993.
- [544] Mark Sofroniou and Giulia Spaletta. Solving orthogonal matrix differential systems in Mathematica. In Peter M. A. Sloot, C. J. Kenneth Tan, Jack J. Dongarra, and Alfons G. Hoekstra, editors, *Computational Science—ICCS 2002 Proceedings, Part III*, volume 2002 of *Lecture Notes in Computer Science*, pages 496–505. Springer-Verlag, Berlin, 2002.
- [545] Irene A. Stegun and Milton Abramowitz. Pitfalls in computation. *J. Soc. Indust. Appl. Math.*, 4(4):207–219, 1956.
- [546] G. W. Stewart. Error and perturbation bounds for subspaces associated with certain eigenvalue problems. *SIAM Rev.*, 15(4):727–764, 1973.
- [547] G. W. Stewart. *Matrix Algorithms. Volume I: Basic Decompositions*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1998.
- [548] G. W. Stewart. *Matrix Algorithms. Volume II: Eigensystems*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2001.
- [549] G. W. Stewart and Ji-guang Sun. *Matrix Perturbation Theory*. Academic Press, London, 1990.
- [550] William J. Stewart. *Introduction to the Numerical Solution of Markov Chains*. Princeton University Press, Princeton, NJ, USA, 1994.
- [551] Eberhard Stickel. On the Fréchet derivative of matrix functions. *Linear Algebra Appl.*, 91:83–88, 1987.
- [552] Josef Stoer and R. Bulirsch. *Introduction to Numerical Analysis*. Springer-Verlag, New York, third edition, 2002.
- [553] David R. Stoutemyer. Crimes and misdemeanors in the computer algebra trade. *Notices Amer. Math. Soc.*, 38(7):778–785, 1991.
- [554] Gilbert Strang. On the construction and comparison of difference schemes. *SIAM J. Numer. Anal.*, 5(3):506–517, 1968.
- [555] Torsten Ström. Minimization of norms and logarithmic norms by diagonal similarities. *Computing*, 10:1–7, 1972.
- [556] Torsten Ström. On logarithmic norms. *SIAM J. Numer. Anal.*, 12(5):741–753, 1975.

- [557] Ji-guang Sun. A note on backward perturbations for the Hermitian eigenvalue problem. *BIT*, 35:385–393, 1995.
- [558] Ji-guang Sun. Perturbation analysis of the matrix sign function. *Linear Algebra Appl.*, 250:177–206, 1997.
- [559] Ji-guang Sun and C.-H. Chen. Generalized polar decomposition. *Math. Numer. Sinica*, 11:262–273, 1989. In Chinese. Cited in [377].
- [560] Xiaobai Sun and Enrique S. Quintana-Ortí. The generalized Newton iteration for the matrix sign function. *SIAM J. Sci. Comput.*, 24(2):669–683, 2002.
- [561] Xiaobai Sun and Enrique S. Quintana-Ortí. Spectral division methods for block generalized Schur decompositions. *Math. Comp.*, 73(248):1827–1847, 2004.
- [562] Masuo Suzuki. Generalized Trotter’s formula and systematic approximants of exponential operators and inner derivations with applications to many-body problems. *Commun. Math. Phys.*, 51(2):183–190, 1976.
- [563] J. J. Sylvester. Additions to the articles, “On a New Class of Theorems,” and “On Pascal’s Theorem”. *Philosophical Magazine*, 37:363–370, 1850. Reprinted in [568, pp. 1451–151].
- [564] J. J. Sylvester. Note on the theory of simultaneous linear differential or difference equations with constant coefficients. *Amer. J. Math.*, 4(1):321–326, 1881. Reprinted in [569, pp. 551–556].
- [565] J. J. Sylvester. Sur les puissances et les racines de substitutions linéaires. *Comptes Rendus de l’Académie des Sciences*, 94:55–59, 1882. Reprinted in [569, pp. 562–564].
- [566] J. J. Sylvester. Sur les racines des matrices unitaires. *Comptes Rendus de l’Académie des Sciences*, 94:396–399, 1882. Reprinted in [569, pp. 565–567].
- [567] J. J. Sylvester. On the equation to the secular inequalities in the planetary theory. *Philosophical Magazine*, 16:267–269, 1883. Reprinted in [570, pp. 110–111].
- [568] *The Collected Mathematical Papers of James Joseph Sylvester*, volume 1 (1837–1853). Cambridge University Press, 1904.
- [569] *The Collected Mathematical Papers of James Joseph Sylvester*, volume III (1870–1883). Chelsea, New York, 1973.
- [570] *The Collected Mathematical Papers of James Joseph Sylvester*, volume IV (1882–1897). Chelsea, New York, 1973.

- [571] Henry Taber. On the theory of matrices. *Amer. J. Math.*, 12(4):337–396, 1890.
- [572] Ping Tak Peter Tang. Table-driven implementation of the `expm1` function in IEEE floating-point arithmetic. *ACM Trans. Math. Software*, 18(2):211–222, 1992.
- [573] Pham Dinh Tao. Convergence of a subgradient method for computing the bound norm of matrices. *Linear Algebra Appl.*, 62:163–182, 1984. In French.
- [574] Olga Taussky. Commutativity in finite matrices. *Amer. Math. Monthly*, 64(4):229–235, 1957.
- [575] Olga Taussky. How I became a torchbearer for matrix theory. *Amer. Math. Monthly*, 95(9):801–812, November 1988.
- [576] R. C. Thompson. On the matrices AB and BA . *Linear Algebra Appl.*, 1:43–58, 1968.
- [577] C. Thron, S. J. Dong, K. F. Liu, and H. P. Ying. Padé- Z_2 estimator of determinants. *Physical Review D*, 57(3):1642–1653, 1997.
- [578] Françoise Tisseur. Parallel implementation of the Yau and Lu method for eigenvalue computation. *International Journal of Supercomputer Applications and High Performance Computing*, 11(3):197–204, 1997.
- [579] Françoise Tisseur. Newton’s method in floating point arithmetic and iterative refinement of generalized eigenvalue problems. *SIAM J. Matrix Anal. Appl.*, 22(4):1038–1057, 2001.
- [580] Françoise Tisseur and Karl Meerbergen. The quadratic eigenvalue problem. *SIAM Rev.*, 43(2):235–286, 2001.
- [581] L. N. Trefethen and J. A. C. Weideman. The fast trapezoid rule in scientific computing. Paper in preparation, 2007.
- [582] Lloyd N. Trefethen and Mark Embree. *Spectra and Pseudospectra: The Behavior of Nonnormal Matrices and Operators*. Princeton University Press, Princeton, NJ, USA, 2005.
- [583] Lloyd N. Trefethen and David Bau III. *Numerical Linear Algebra*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 1997.
- [584] Lloyd N. Trefethen, J. A. C. Weideman, and Thomas Schmelzer. Talbot quadratures and rational approximations. *BIT*, 46(3):653–670, 2006.
- [585] H. F. Trotter. On the product of semi-groups of operators. *Proc. Amer. Math. Soc.*, 10(4):545–551, 1959.

- [586] J. S. H. Tsai, L. S. Shieh, and R. E. Yates. Fast and stable algorithms for computing the principal n th root of a complex matrix and the matrix sector function. *Comput. Math. Applic.*, 15(11):903–913, 1988.
- [587] H. W. Turnbull. The matrix square and cube roots of unity. *J. London Math. Soc.*, 2(8):242–244, 1927.
- [588] H. W. Turnbull. *The Theory of Determinants, Matrices, and Invariants*. Blackie, London and Glasgow, 1929.
- [589] H. W. Turnbull and A. C. Aitken. *An Introduction to the Theory of Canonical Matrices*. Blackie, London and Glasgow, 1932. Reprinted with appendix, 1952.
- [590] G. M. Tuynman. The derivation of the exponential map of matrices. *Amer. Math. Monthly*, 102(9):818–820, November 1995.
- [591] Frank Uhlig. Explicit polar decomposition and a near-characteristic polynomial: The 2×2 case. *Linear Algebra Appl.*, 38:239–249, 1981.
- [592] R. Vaidyanathaswamy. Integer-roots of the unit matrix. *J. London Math. Soc.*, 3(12):121–124, 1928.
- [593] R. Vaidyanathaswamy. On the possible periods of integer matrices. *J. London Math. Soc.*, 3(12):268–272, 1928.
- [594] J. van den Eshof, A. Frommer, Th. Lippert, K. Schilling, and H. A. Van der Vorst. Numerical methods for the QCD overlap operator. I. Sign-function and error bounds. *Computer Physics Communications*, 146:203–224, 2002.
- [595] Jasper van den Eshof. *Nested Iteration methods for Nonlinear Matrix Problems*. PhD thesis, Utrecht University, Utrecht, Netherlands, September 2003.
- [596] Jos L. M. van Dorsselaer, Michiel E. Hochstenbach, and Henk A. Van der Vorst. Computing probabilistic bounds for extreme eigenvalues of symmetric matrices with the Lanczos method. *SIAM J. Matrix Anal. Appl.*, 22(3):837–852, 2000.
- [597] J. L. van Hemmen and T. Ando. An inequality for trace ideals. *Commun. Math. Phys.*, 76:143–148, 1980.
- [598] R. Vandebril, M. Van Barel, G. H. Golub, and N. Mastronardi. A bibliography on semiseparable matrices. *Calcolo*, 42:249–70, 2005.
- [599] V. S. Varadarajan. *Lie Groups, Lie Algebras, and Their Representations*. Prentice-Hall, Englewood Cliffs, NJ, USA, 1974.
- [600] J. M. Varah. On the separation of two matrices. *SIAM J. Numer. Anal.*, 16(2):216–222, 1979.

- [601] Richard S. Varga. *Matrix Iterative Analysis*. Springer-Verlag, Berlin, second edition, 2000.
- [602] R. Verthey and V. Parenti-Castelli. Real-time direct position analysis of parallel spherical wrists by using extra sensors. *Journal of Mechanical Design*, 128:288–294, 2006.
- [603] Cornelis Visser. Note on linear operators. *Proc. Kon. Akad. Wet. Amsterdam*, 40(3):270–272, 1937.
- [604] John von Neumann. Über Adjungierte Funktionaloperatoren. *Ann. of Math. (2)*, 33(2):294–310, 1923.
- [605] John von Neumann. Über die analytischen Eigenschaften von Gruppen linearer Transformationen und ihrer Darstellungen. *Math. Zeit.*, 30:3–42, 1929.
- [606] Grace Wahba. Problem 65-1, A least squares estimate of satellite attitude. *SIAM Rev.*, 7(3):409, 1965. Solutions in 8(3):384–386, 1966.
- [607] Robert C. Ward. Numerical computation of the matrix exponential with accuracy estimate. *SIAM J. Numer. Anal.*, 14(4):600–610, 1977.
- [608] David S. Watkins. *Fundamentals of Matrix Computations*. Wiley, New York, second edition, 2002.
- [609] David S. Watkins. *The Matrix Eigenvalue Problem: GR and Krylov Subspace Methods*. Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2007.
- [610] G. A. Watson. *Approximation Theory and Numerical Methods*. Wiley, Chichester, UK, 1980.
- [611] Frederick V. Waugh and Martin E. Abel. On fractional powers of a matrix. *J. Amer. Statist. Assoc.*, 62:1018–1021, 1967.
- [612] J. H. M. Wedderburn. *Lectures on Matrices*, volume 17 of *American Mathematical Society Colloquium Publications*. American Mathematical Society, Providence, RI, USA, 1934.
- [613] G. H. Weiss and A. A. Maradudin. The Baker-Hausdorff formula and a problem in crystal physics. *J. Math. Phys.*, 3(4):771–777, 1962.
- [614] Edgar M. E. Wermuth. Two remarks on matrix exponentials. *Linear Algebra Appl.*, 117:127–132, 1989.
- [615] Edouard Weyr. Note sur la théorie de quantités complexes formées avec n unités principales. *Bull. Sci. Math. II*, 11:205–215, 1887.
- [616] R. M. Wilcox. Exponential operators and parameter differentiation in quantum physics. *J. Math. Phys.*, 8(4):962–982, 1967.

- [617] J. H. Wilkinson. *The Algebraic Eigenvalue Problem*. Oxford University Press, 1965.
- [618] Arthur Wouk. Integral representation of the logarithm of matrices and operators. *J. Math. Anal. and Appl.*, 11:131–138, 1965.
- [619] Pei Yuan Wu. Approximation by partial isometries. *Proc. Edinburgh Math. Soc.*, 29:255–261, 1986.
- [620] Shing-Tung Yau and Ya Yan Lu. Reducing the symmetric matrix eigenvalue problem to matrix multiplications. *SIAM J. Sci. Comput.*, 14(1):121–136, 1993.
- [621] N. J. Young. A bound for norms of functions of matrices. *Linear Algebra Appl.*, 37:181–186, 1981.
- [622] V. Zakian. Properties of I_{MN} and J_{MN} approximants and applications to numerical inversion of Laplace transforms and initial value problems. *J. Inst. Maths. Applics.*, 50:191–222, 1975.
- [623] Hongyuan Zha and Zhenyue Zhang. Fast parallelizable methods for the Hermitian eigenvalue problem. Technical Report CSE-96-041, Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, May 1996.
- [624] Xingzhi Zhan. *Matrix Inequalities*, volume 1790 of *Lecture Notes in Mathematics*. Springer-Verlag, Berlin, 2002.
- [625] Fuzhen Zhang, editor. *The Schur Complement and Its Applications*. Springer-Verlag, New York, 2005.
- [626] Pawel Zieliński and Krystyna Ziętak. The polar decomposition—properties, applications and algorithms. *Applied Mathematics, Ann. Pol. Math. Soc.*, 38:23–49, 1995.