
Bibliography

- [ABG04] P.-A. Absil, C. G. Baker, and K. A. Gallivan. Trust-region methods on Riemannian manifolds with applications in numerical linear algebra. In *Proceedings of the 16th International Symposium on Mathematical Theory of Networks and Systems (MTNS2004), Leuven, Belgium, 5–9 July 2004*, 2004.
- [ABG06a] P.-A. Absil, C. G. Baker, and K. A. Gallivan. Convergence analysis of Riemannian trust-region methods. Technical Report FSU-SCS-2006-175, School of Computational Science, Florida State University, <http://www.scs.fsu.edu/publications/>, 2006.
- [ABG06b] P.-A. Absil, C. G. Baker, and K. A. Gallivan. A truncated-CG style method for symmetric generalized eigenvalue problems. *J. Comput. Appl. Math.*, 189(1–2):274–285, 2006.
- [ABG07] P.-A. Absil, C. G. Baker, and K. A. Gallivan. Trust-region methods on Riemannian manifolds. *Found. Comput. Math.*, 7(3):303–330, July 2007.
- [ABGS05] P.-A. Absil, C. G. Baker, K. A. Gallivan, and A. Sameh. Adaptive model trust region methods for generalized eigenvalue problems. In Vaidy S. Sunderam, Geert Dick van Albada, and Peter M. A. Sloot, editors, *International Conference on Computational Science*, volume 3514 of *Lecture Notes in Computer Science*, pages 33–41. Springer-Verlag, 2005.
- [ABM06] F. Alvarez, J. Bolte, and J. Munier. A unifying local convergence result for Newton’s method in Riemannian manifolds. *Found. Comput. Math.*, to appear. Published online, <http://dx.doi.org/10.1007/s10208-006-0221-6>, 2006.
- [Abs03] P.-A. Absil. *Invariant Subspace Computation: A Geometric Approach*. PhD thesis, Faculté des Sciences Appliquées, Université de Liège, Secrétariat de la FSA, Chemin des Chevreuils 1 (Bât. B52), 4000 Liège, Belgium, 2003.
- [AC98] Shun-ichi Amari and Andrzej Cichocki. Adaptive blind signal processing—neural network approaches. *Proc. IEEE*, 86(10):2026–2048, 1998.

- [ACC00] Shun-ichi Amari, Tian-Ping Chen, and Andrzej Cichocki. Non-holonomic orthogonal learning algorithms for blind source separation. *Neural Comput.*, 12:1463–1484, 2000.
- [ADM⁺02] Roy L. Adler, Jean-Pierre Dedieu, Joseph Y. Margulies, Marco Martens, and Mike Shub. Newton’s method on Riemannian manifolds and a geometric model for the human spine. *IMA J. Numer. Anal.*, 22(3):359–390, July 2002.
- [AG05] P.-A. Absil and K. A. Gallivan. Accelerated line-search and trust-region methods. Technical Report FSU-SCS-2005-095, School of Computational Science, Florida State University, <http://www.scs.fsu.edu/publications/>, 2005.
- [AG06] P.-A. Absil and K. A. Gallivan. Joint diagonalization on the oblique manifold for independent component analysis. In *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, volume 5, pages V–945–V–948, 2006.
- [AHLT05] Peter Arbenz, Ulrich L. Hetmaniuk, Richard B. Lehoucq, and Raymond S. Tuminaro. A comparison of eigensolvers for large-scale 3D modal analysis using AMG-preconditioned iterative methods. *Int. J. Numer. Meth. Eng.*, 64(2):204–236, 2005.
- [AK04] Bijan Afsari and P. S. Krishnaprasad. Some gradient based joint diagonalization methods for ICA. In Springer LCNS Series, editor, *Proceedings of the 5th International Conference on Independent Component Analysis and Blind Source Separation*, 2004.
- [AMA05] P.-A. Absil, R. Mahony, and B. Andrews. Convergence of the iterates of descent methods for analytic cost functions. *SIAM J. Optim.*, 6(2):531–547, 2005.
- [AMR88] R. Abraham, J. E. Marsden, and T. Ratiu. *Manifolds, Tensor Analysis, and Applications*, volume 75 of *Applied Mathematical Sciences*. Springer-Verlag, New York, second edition, 1988.
- [AMS04] P.-A. Absil, R. Mahony, and R. Sepulchre. Riemannian geometry of Grassmann manifolds with a view on algorithmic computation. *Acta Appl. Math.*, 80(2):199–220, January 2004.
- [AMSV02] P.-A. Absil, R. Mahony, R. Sepulchre, and P. Van Dooren. A Grassmann-Rayleigh quotient iteration for computing invariant subspaces. *SIAM Rev.*, 44(1):57–73, 2002.
- [Arm66] Larry Armijo. Minimization of functions having Lipschitz continuous first partial derivatives. *Pacific J. Math.*, 16:1–3, 1966.

- [AS04] P.-A. Absil and R. Sepulchre. Continuous dynamical systems that realize discrete optimization on the hypercube. *Systems Control Lett.*, 52(3-4):297–304, 2004.
- [ASVM04] P.-A. Absil, R. Sepulchre, P. Van Dooren, and R. Mahony. Cubically convergent iterations for invariant subspace computation. *SIAM J. Matrix Anal. Appl.*, 26(1):70–96, 2004.
- [Axe94] Owe Axelsson. *Iterative Solution Methods*. Cambridge University Press, Cambridge, 1994.
- [BAG06] C. G. Baker, P.-A. Absil, and K. A. Gallivan. An implicit Riemannian trust-region method for the symmetric generalized eigenproblem. In Vassil N. Alexandrov, Geert Dick van Albada, Peter M.A. Sloot, and Jack Dongarra, editors, *Computational Science—ICCS 2006*, volume 3991 of *LNCS*, pages 210–217. Springer, New York, 2006.
- [BC70] F. Brickell and R. S. Clark. *Differentiable Manifolds*. Van Nostrand Reinhold, London, 1970.
- [BCS00] D. Bao, S.-S. Chern, and Z. Shen. *An Introduction to Riemann-Finsler Geometry*, volume 200 of *Graduate Texts in Mathematics*. Springer-Verlag, New York, 2000.
- [BDDR00] Zhaojun Bai, James Demmel, Jack Dongarra, and Axel Ruhe, editors. *Templates for the Solution of Algebraic Eigenvalue Problems. Software, Environments, and Tools*. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2000. A practical guide.
- [BDJ99] Michael W. Berry, Zlatko Drmač, and Elizabeth R. Jessup. Matrices, vector spaces, and information retrieval. *SIAM Rev.*, 41(2):335–362, 1999.
- [BDR05] Roland Badeau, Bertrand David, and Gaël Richard. Fast approximated power iteration subspace tracking. *IEEE Trans. Signal Process.*, 53(8, part 1):2931–2941, 2005.
- [Ber95] Dimitri P. Bertsekas. *Nonlinear Programming*. Athena Scientific, Belmont, MA, 1995.
- [BGL05] Michele Benzi, Gene H. Golub, and Jörg Liesen. Numerical solution of saddle point problems. *Acta Numer.*, 14:1–137, 2005.
- [BGLS03] J. Frédéric Bonnans, J. Charles Gilbert, Claude Lemaréchal, and Claudia A. Sagastizábal. *Numerical Optimization*. Universitext. Springer-Verlag, Berlin, 2003. Theoretical and practical aspects. Translated and revised from the 1997 French original.

- [Bha87] Rajendra Bhatia. *Perturbation bounds for matrix eigenvalues*, volume 162 of *Pitman Research Notes in Mathematics Series*. Longman Scientific & Technical, Harlow, 1987.
- [BI04] Anthony M. Bloch and Arieh Iserles. On the optimality of double-bracket flows. *Int. J. Math. Math. Sci.*, 2004(61-64):3301–3319, 2004.
- [BL89a] D. A. Bayer and J. C. Lagarias. The nonlinear geometry of linear programming. I. Affine and projective scaling trajectories. *Trans. Amer. Math. Soc.*, 314(2):499–526, 1989.
- [BL89b] D. A. Bayer and J. C. Lagarias. The nonlinear geometry of linear programming. II. Legendre transform coordinates and central trajectories. *Trans. Amer. Math. Soc.*, 314(2):527–581, 1989.
- [Boo75] William M. Boothby. *An Introduction to Differentiable Manifolds and Riemannian Geometry*. Academic Press [A subsidiary of Harcourt Brace Jovanovich, Publishers], New York-London, 1975. Pure and Applied Mathematics, No. 63.
- [Bra03] Jan Brandts. The Riccati algorithm for eigenvalues and invariant subspaces of matrices with inexpensive action. *Linear Algebra Appl.*, 358:335–365, 2003. Special issue on accurate solution of eigenvalue problems (Hagen, 2000).
- [Bro91] R. W. Brockett. Dynamical systems that sort lists, diagonalize matrices, and solve linear programming problems. *Linear Algebra Appl.*, 146:79–91, 1991.
- [Bro93] Roger W. Brockett. Differential geometry and the design of gradient algorithms. In *Differential geometry: partial differential equations on manifolds (Los Angeles, CA, 1990)*, volume 54 of *Proc. Sympos. Pure Math.*, pages 69–92. Amer. Math. Soc., Providence, RI, 1993.
- [BS89] Steve Batterson and John Smillie. The dynamics of Rayleigh quotient iteration. *SIAM J. Numer. Anal.*, 26(3):624–636, 1989.
- [BSS88] Richard H. Byrd, Robert B. Schnabel, and Gerald A. Shultz. Approximate solution of the trust region problem by minimization over two-dimensional subspaces. *Math. Programming*, 40(3, (Ser. A)):247–263, 1988.
- [BX05] Stephen Boyd and Lin Xiao. Least-squares covariance matrix adjustment. *SIAM J. Matrix Anal. Appl.*, 27(2):532–546, 2005.

- [CA01] T. P. Chen and S. Amari. Unified stabilization approach to principal and minor components extraction algorithms. *Neural Networks*, 14(10):1377–1387, 2001.
- [CD00] Jann-Long Chern and Luca Dieci. Smoothness and periodicity of some matrix decompositions. *SIAM J. Matrix Anal. Appl.*, 22(3):772–792, 2000.
- [CDLP05] M. Chu, N. Del Buono, L. Lopez, and T. Politi. On the low-rank approximation of data on the unit sphere. *SIAM J. Matrix Anal. Appl.*, 27(1):46–60, 2005.
- [CE75] Jeff Cheeger and David G. Ebin. *Comparison Theorems in Riemannian Geometry*. North-Holland Publishing Co., Amsterdam, 1975. North-Holland Mathematical Library, Vol. 9.
- [CG90] P. Comon and G. H. Golub. Tracking a few extreme singular values and vectors in signal processing. *Proc. IEEE*, 78(8):1327–1343, 1990.
- [CG02] Moody T. Chu and Gene H. Golub. Structured inverse eigenvalue problems. *Acta Numer.*, 11:1–71, 2002.
- [CG03] Andrzej Cichocki and Pando Georgiev. Blind source separation algorithms with matrix constraints. *IEICE Trans. Fundam.*, E86-A(1):1–9, 2003.
- [CGT00] Andrew R. Conn, Nicholas I. M. Gould, and Philippe L. Toint. *Trust-Region Methods*. MPS/SIAM Series on Optimization. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2000.
- [Cha84] Françoise Chatelin. Simultaneous Newton’s iteration for the eigenproblem. In *Defect correction methods (Oberwolfach, 1983)*, volume 5 of *Comput. Suppl.*, pages 67–74. Springer, Vienna, 1984.
- [Chu92] Moody T. Chu. Numerical methods for inverse singular value problems. *SIAM J. Numer. Anal.*, 29(3):885–903, 1992.
- [Chu94] Moody T. Chu. A list of matrix flows with applications. In *Hamiltonian and gradient flows, algorithms and control*, volume 3 of *Fields Inst. Commun.*, pages 87–97. Amer. Math. Soc., Providence, RI, 1994.
- [CI01] E. Celledoni and A. Iserles. Methods for the approximation of the matrix exponential in a Lie-algebraic setting. *IMA J. Numer. Anal.*, 21(2):463–488, 2001.

- [Cou20] R. Courant. Über die Eigenwert bei den Differentialgleichungen der Mathematischen physik. *Math. Z.*, 7:1–57, 1920.
- [Dar94] R. W. R. Darling. *Differential Forms and Connections*. Cambridge University Press, Cambridge, 1994.
- [dC76] Manfredo P. do Carmo. *Differential Geometry of Curves and Surfaces*. Prentice-Hall Inc., Englewood Cliffs, NJ, 1976. Translated from the Portuguese.
- [dC92] M. P. do Carmo. *Riemannian geometry*. Mathematics: Theory & Applications. Birkhäuser Boston Inc., Boston, MA, 1992. Translated from the second Portuguese edition by Francis Flaherty.
- [DDL99] R. D. DeGroat, E. M. Dowling, and A. D. Linebarger. Subspace tracking. In V. K. Madiesetti and D. B. Williams, editors, *Digital Signal Processing Handbook*. CRC, Boca Raton, FL, 1999.
- [DE99] Luca Dieci and Timo Eirola. On smooth decompositions of matrices. *SIAM J. Matrix Anal. Appl.*, 20(3):800–819, 1999.
- [Deh95] Jeroen Dehaene. *Continuous-time matrix algorithms, systolic algorithms and adaptive neural networks*. PhD thesis, Katholieke Universiteit Leuven, Faculteit Toegepaste Wetenschappen, Departement elektrotechniek-ESAT, Kard. Mercierlaan 94, 3001 Leuven, Belgium, 1995. <ftp://ftp.esat.kuleuven.ac.be/pub/SISTA/dehaene/phd/>.
- [Dem87] J. W. Demmel. Three methods for refining estimates of invariant subspaces. *Computing*, 38(1):43–57, 1987.
- [Den71] J. E. Dennis, Jr. Toward a unified convergence theory for Newton-like methods. In *Nonlinear Functional Anal. and Appl. (Proc. Advanced Sem., Math. Res. Center, Univ. of Wisconsin, Madison, WI., 1970)*, pages 425–472. Academic Press, New York, 1971.
- [Die69] J. Dieudonné. *Foundations of Modern Analysis*, volume 10-I of *Pure and Applied Mathematics*. Academic Press, New York, 1969. Enlarged and corrected printing.
- [DM79] J. E. Dennis, Jr. and H. H. W. Mei. Two new unconstrained optimization algorithms which use function and gradient values. *J. Optim. Theory Appl.*, 28(4):453–482, 1979.
- [DMV99] Jeroen Dehaene, Marc Moonen, and Joos Vandewalle. Analysis of a class of continuous-time algorithms for principal component analysis and subspace tracking. *IEEE Trans. Circuits Systems I Fund. Theory Appl.*, 46(3):364–372, 1999.

- [DN05] Jean-Pierre Dedieu and Dmitry Nowicki. Symplectic methods for the approximation of the exponential map and the Newton iteration on Riemannian submanifolds. *J. Complexity*, 21(4):487–501, 2005.
- [Dou00] Scott C. Douglas. Self-stabilized gradient algorithms for blind source separation with orthogonality constraints. *IEEE Trans. Neural Networks*, 11(6):1490–1497, 2000.
- [DPM03] Jean-Pierre Dedieu, Pierre Priouret, and Gregorio Malajovich. Newton’s method on Riemannian manifolds: Covariant alpha theory. *IMA J. Numer. Anal.*, 23(3):395–419, 2003.
- [DS83] John E. Dennis, Jr. and Robert B. Schnabel. *Numerical methods for unconstrained optimization and nonlinear equations*. Prentice Hall Series in Computational Mathematics. Prentice Hall Inc., Englewood Cliffs, NJ, 1983.
- [DV00] J. Dehaene and J. Vandewalle. New Lyapunov functions for the continuous-time QR algorithm. In *Proceedings CD of the 14th International Symposium on the Mathematical Theory of Networks and Systems (MTNS2000), Perpignan, France, July 2000*, 2000.
- [DW92] Marc De Wilde. Géométrie différentielle globale. course notes, Institut de Mathématique, Université de Liège, 1992.
- [EAS98] Alan Edelman, Tomás A. Arias, and Steven T. Smith. The geometry of algorithms with orthogonality constraints. *SIAM J. Matrix Anal. Appl.*, 20(2):303–353, 1998.
- [EP99] Lars Eldén and Haesun Park. A Procrustes problem on the Stiefel manifold. *Numer. Math.*, 82(4):599–619, 1999.
- [EY36] C. Eckart and G. Young. The approximation of one matrix by another of lower rank. *Psychometrika*, 1:211–218, 1936.
- [Fan49] Ky Fan. On a theorem of Weyl concerning eigenvalues of linear transformations. I. *Proc. Nat. Acad. Sci. U.S.A.*, 35:652–655, 1949.
- [Fat98] Jean-Luc Fattebert. A block Rayleigh quotient iteration with local quadratic convergence. *Electron. Trans. Numer. Anal.*, 7:56–74, 1998. Large scale eigenvalue problems (Argonne, IL, 1997).
- [Fay91a] L. Faybusovich. Dynamical systems which solve optimization problems with linear constraints. *IMA J. Math. Control Inform.*, 8(2):135–149, 1991.

- [Fay91b] Leonid Faybusovich. Hamiltonian structure of dynamical systems which solve linear programming problems. *Phys. D*, 53(2-4):217–232, 1991.
- [FD95] Zuqiang Fu and Eric M. Dowling. Conjugate gradient eigenstructure tracking for adaptive spectral estimation. *IEEE Trans. Signal Process.*, 43:1151–1160, 1995.
- [FF63] D. K. Faddeev and V. N. Faddeeva. *Computational Methods of Linear Algebra*. Translated by Robert C. Williams. W. H. Freeman and Co., San Francisco, 1963.
- [FGP94] J. Ferrer, Ma. I. García, and F. Puerta. Differentiable families of subspaces. *Linear Algebra Appl.*, 199:229–252, 1994.
- [Fis05] Ernst Fischer. Über quadratische Formen mit reellen Koeffizienten. *Monatsch Math. Phys.*, 16:234–249, 1905.
- [Fle01] R. Fletcher. *Practical Methods of Optimization*. Wiley-Interscience [John Wiley & Sons], New York, second edition, 2001.
- [FR64] R. Fletcher and C. M. Reeves. Function minimization by conjugate gradients. *Comput. J.*, 7:149–154, 1964.
- [FS02] O. P. Ferreira and B. F. Svaiter. Kantorovich’s theorem on Newton’s method in Riemannian manifolds. *J. Complexity*, 18(1):304–329, 2002.
- [Gab82] D. Gabay. Minimizing a differentiable function over a differential manifold. *J. Optim. Theory Appl.*, 37(2):177–219, 1982.
- [GD04] J. C. Gower and G. B. Dijksterhuis. *Procrustes Problems*, volume 30 of *Oxford Statistical Science Series*. Oxford University Press, Oxford, 2004.
- [GDS05] L. M. Graña Drummond and B. F. Svaiter. A steepest descent method for vector optimization. *J. Comput. Appl. Math.*, 175(2):395–414, 2005.
- [GH83] John Guckenheimer and Philip Holmes. *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*, volume 42 of *Applied Mathematical Sciences*. Springer-Verlag, New York, 1983.
- [GHL90] Sylvestre Gallot, Dominique Hulin, and Jacques Lafontaine. *Riemannian Geometry*. Universitext. Springer-Verlag, Berlin, second edition, 1990.

- [GL93] Michel Gevers and Gang Li. *Parametrizations in Control, Estimation and Filtering Problems: Accuracy Aspects*. Communications and Control Engineering Series. Springer-Verlag London Ltd., London, 1993.
- [GLR86] I. Gohberg, P. Lancaster, and L. Rodman. *Invariant subspaces of matrices with applications*. Canadian Mathematical Society Series of Monographs and Advanced Texts. John Wiley & Sons Inc., New York, 1986. , A Wiley-Interscience Publication.
- [GLRT99] Nicholas I. M. Gould, Stefano Lucidi, Massimo Roma, and Philippe L. Toint. Solving the trust-region subproblem using the Lanczos method. *SIAM J. Optim.*, 9(2):504–525, 1999.
- [GOST05] Nicholas I. M. Gould, Dominique Orban, Annick Sartenaer, and Phillippe L. Toint. Sensitivity of trust-region algorithms to their parameters. *4OR*, 3(3):227–241, 2005.
- [GP74] Victor Guillemin and Alan Pollack. *Differential Topology*. Prentice-Hall Inc., Englewood Cliffs, NJ, 1974.
- [GP07] Igor Grubišić and Raoul Pietersz. Efficient rank reduction of correlation matrices. *Linear Algebra Appl.*, 422(2-3):629–653, 2007.
- [GR97] M. Géradin and D. Rixen. *Mechanical Vibrations: Theory and Applications to Structural Dynamics*. John Wiley & Sons, Chichester, U.K., 1997.
- [GS01] F. Grogard and R. Sepulchre. Global stability of a continuous-time flow which computes time-optimal switchings. In *Proceedings of the 16th IEEE Conference on Decision and Control*, pages 3826–3831, 2001.
- [GvdV00] Gene H. Golub and Henk A. van der Vorst. Eigenvalue computation in the 20th century. *J. Comput. Appl. Math.*, 123(1-2):35–65, 2000. Numerical analysis 2000, Vol. III. Linear algebra.
- [GVL96] Gene H. Golub and Charles F. Van Loan. *Matrix Computations*. Johns Hopkins Studies in the Mathematical Sciences. Johns Hopkins University Press, Baltimore, MD, third edition, 1996.
- [Hag01] William W. Hager. Minimizing a quadratic over a sphere. *SIAM J. Optim.*, 12(1):188–208, 2001.
- [Hal74] Paul R. Halmos. *Finite-Dimensional Vector Spaces*. Undergraduate Texts in Mathematics. Springer-Verlag, New York, second edition, 1974.

- [Hei03] Long Hei. A self-adaptive trust region algorithm. *J. Comput. Math.*, 21(2):229–236, 2003.
- [Hel78] Sigurdur Helgason. *Differential Geometry, Lie Groups, and Symmetric Spaces*, volume 80 of *Pure and Applied Mathematics*. Academic Press Inc. [Harcourt Brace Jovanovich Publishers], New York, 1978.
- [Hel93a] U. Helmke. Balanced realizations for linear systems: a variational approach. *SIAM J. Control Optim.*, 31(1):1–15, 1993.
- [Hel93b] U. Helmke. Isospectral flows and linear programming. *J. Austral. Math. Soc. Ser. B*, 34(4):495–510, 1993.
- [HH00] U. Helmke and K. Hüper. A Jacobi-type method for computing balanced realizations. *Systems Control Lett.*, 39(1):19–30, 2000.
- [HHLM07] Uwe Helmke, Knut Hüper, Pei Yean Lee, and John B. Moore. Essential matrix estimation using Gauss-Newton iterations on a manifold. *Int. J. Computer Vision*, 74(2), 2007.
- [Hir76] Morris W. Hirsch. *Differential Topology*, volume 33 of *Graduate Texts in Mathematics*. Springer-Verlag, New York, 1976.
- [HJ85] Roger A. Horn and Charles R. Johnson. *Matrix Analysis*. Cambridge University Press, Cambridge, 1985.
- [HJ91] Roger A. Horn and Charles R. Johnson. *Topics in Matrix Analysis*. Cambridge University Press, Cambridge, 1991.
- [HK51] Magnus R. Hestenes and William Karush. A method of gradients for the calculation of the characteristic roots and vectors of a real symmetric matrix. *J. Research Nat. Bur. Standards*, 47:45–61, 1951.
- [HL06] U. Hetmaniuk and R. Lehoucq. Basis selection in LOBPCG. *J. Comput. Phys.*, 218(1):324–332, 2006.
- [HM94] Uwe Helmke and John B. Moore. *Optimization and Dynamical Systems*. Communications and Control Engineering Series. Springer-Verlag London Ltd., London, 1994. With a foreword by R. Brockett.
- [Hop84] J. J. Hopfield. Neurons with graded response have collective computational capabilities like those of two-state neurons. *Proc. Natl. Acad. Sci. USA*, 81:3088–3092, 1984.
- [HP05] William W. Hager and Soonchul Park. Global convergence of SSM for minimizing a quadratic over a sphere. *Math. Comp.*, 74(251):1413–1423, 2005.

- [HR57] André Haeffliger and Georges Reeb. Variétés (non séparées) à une dimension et structures feuilletées du plan. *Enseignement Math. (2)*, 3:107–125, 1957.
- [HS52] Magnus R. Hestenes and Eduard Stiefel. Methods of conjugate gradients for solving linear systems. *J. Research Nat. Bur. Standards*, 49:409–436 (1953), 1952.
- [HS03] Michiel E. Hochstenbach and Gerard L. G. Sleijpen. Two-sided and alternating Jacobi-Davidson. *Linear Algebra Appl.*, 358:145–172, 2003. Special issue on accurate solution of eigenvalue problems (Hagen, 2000).
- [HSS06] Knut Hüper, Hao Shen, and Abd-Krim Seghouane. Local convergence properties of FastICA and some generalisations. In *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, volume 5, pages V–1009–V–1012, 2006.
- [HT85] J. J. Hopfield and D. W. Tank. “Neural” computation of decision optimization problems. *Biol. Cybernet.*, 52:141–152, 1985.
- [HT04] Knut Hüper and Jochen Trumpf. Newton-like methods for numerical optimization on manifolds. In *Proceedings of the 38th IEEE Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, November 7–10, 2004*, 2004.
- [Hüp02] Knut Hüper. A calculus approach to matrix eigenvalue algorithms. Habilitation Dissertation, July 2002. Mathematisches Institut, Universität Würzburg, Germany.
- [HXC⁺99] Y. Hua, Y. Xiang, T. Chen, K. Abed-Meraim, and Y. Miao. A new look at the power method for fast subspace tracking. *Digital Signal Process.*, 9(4):297–314, Oct. 1999.
- [HZ03] Richard Hartley and Andrew Zisserman. *Multiple View Geometry in Computer Vision*. Cambridge University Press, Cambridge, second edition, 2003. With a foreword by Olivier Faugeras.
- [IMKNZ00] Arieh Iserles, Hans Z. Munthe-Kaas, Syvert P. Nørsett, and Antonella Zanna. Lie-group methods. *Acta Numer.*, 9:215–365, 2000.
- [IZ05] Arieh Iserles and Antonella Zanna. Efficient computation of the matrix exponential by generalized polar decompositions. *SIAM J. Numer. Anal.*, 42(5):2218–2256, 2005.

- [JH05] Christopher J. James and Christian W. Hesse. Independent component analysis for biomedical signals. *Physiol. Meas.*, 26:R15–R19, 2005.
- [JM02] Marcel Joho and Heinz Mathis. Joint diagonalization of correlation matrices by using gradient methods with application to blind signal separation. In *Proceedings of the IEEE Sensor Array and Multichannel Signal Processing Workshop SAM*, pages 273–277, 2002.
- [JR02] Marcel Joho and Kamran Rahbar. Joint diagonalization of correlation matrices by using Newton methods with applications to blind signal separation. In *Proceedings of the IEEE Sensor Array and Multichannel Signal Processing Workshop SAM*, pages 403–407, 2002.
- [JW92] Richard A. Johnson and Dean W. Wichern. *Applied Multivariate Statistical Analysis*. Prentice Hall Inc., Englewood Cliffs, NJ, third edition, 1992.
- [Kan52] L. V. Kantorovich. *Functional analysis and applied mathematics*. NBS Rep. 1509. U. S. Department of Commerce National Bureau of Standards, Los Angeles, CA, 1952. Translated by C. D. Benster.
- [Kli82] Wilhelm Klingenberg. *Riemannian Geometry*, volume 1 of *de Gruyter Studies in Mathematics*. Walter de Gruyter & Co., Berlin, 1982.
- [KN63] Shoshichi Kobayashi and Katsumi Nomizu. *Foundations of Differential Geometry*. Interscience Publishers, a division of John Wiley & Sons, New York-London, 1963. Volumes 1 and 2.
- [Kny01] Andrew V. Knyazev. Toward the optimal preconditioned eigensolver: locally optimal block preconditioned conjugate gradient method. *SIAM J. Sci. Comput.*, 23(2):517–541, 2001. Copper Mountain Conference (2000).
- [Lan99] Serge Lang. *Fundamentals of Differential Geometry*, volume 191 of *Graduate Texts in Mathematics*. Springer-Verlag, New York, 1999.
- [LE02] Eva Lundström and Lars Eldén. Adaptive eigenvalue computations using Newton’s method on the Grassmann manifold. *SIAM J. Matrix Anal. Appl.*, 23(3):819–839, 2001/02.
- [LE00] R. Lippert and A. Edelman. Nonlinear eigenvalue problems with orthogonality constraints (Section 9.4). In Zhaojun Bai,

- James Demmel, Jack Dongarra, Axel Ruhe, and Henk van der Vorst, editors, *Templates for the Solution of Algebraic Eigenvalue Problems*, pages 290–314. SIAM, Philadelphia, 2000.
- [Lei61] Kurt Leichtweiss. Zur Riemannschen Geometrie in Grassmannschen Mannigfaltigkeiten. *Math. Z.*, 76:334–366, 1961.
- [Lev44] Kenneth Levenberg. A method for the solution of certain nonlinear problems in least squares. *Quart. Appl. Math.*, 2:164–168, 1944.
- [LM04] Pei Yean Lee and John B. Moore. Pose estimation via a Gauss-Newton-on-manifold approach. In *Proceedings of the 16th International Symposium on Mathematical Theory of Network and System (MTNS)*, Leuven, 2004.
- [Loj93] Stanislas Lojasiewicz. Sur la géométrie semi- et sous-analytique. *Ann. Inst. Fourier (Grenoble)*, 43(5):1575–1595, 1993.
- [LSG04] Xiuwen Liu, Anuj Srivastava, and Kyle Gallivan. Optimal linear representations of images for object recognition. *IEEE Pattern Anal. and Mach. Intell.*, 26(5):662–666, May 2004.
- [LST98] Ralf Lösche, Hubert Schwetlick, and Gisela Timmermann. A modified block Newton iteration for approximating an invariant subspace of a symmetric matrix. *Linear Algebra Appl.*, 275/276:381–400, 1998.
- [Lue72] David G. Luenberger. The gradient projection method along geodesics. *Management Sci.*, 18:620–631, 1972.
- [Lue73] David G. Luenberger. *Introduction to Linear and Nonlinear Programming*. Addison-Wesley, Reading, MA, 1973.
- [LW00] Xue-Bin Liang and Jun Wang. A recurrent neural network for nonlinear optimization with a continuously differentiable objective function and bound constraints. *IEEE Trans. Neural Networks*, 11(6):1251–1262, 2000.
- [MA03] R. Mahony and P.-A. Absil. The continuous-time Rayleigh quotient flow on the sphere. *Linear Algebra Appl.*, 368C:343–357, 2003.
- [Mah94] Robert Mahony. *Optimization Algorithms on Homogeneous Spaces: with Applications in Linear Systems Theory*. PhD thesis, Department of Systems Engineering, Australian National University, 77 Massachusetts Avenue, Cambridge, MA 02139-4307, 1994.

- [Mah96] R. E. Mahony. The constrained Newton method on a Lie group and the symmetric eigenvalue problem. *Linear Algebra Appl.*, 248:67–89, 1996.
- [Man02] Jonathan H. Manton. Optimization algorithms exploiting unitary constraints. *IEEE Trans. Signal Process.*, 50(3):635–650, 2002.
- [Mar63] Donald W. Marquardt. An algorithm for least-squares estimation of nonlinear parameters. *J. Soc. Indust. Appl. Math.*, 11:431–441, 1963.
- [Meu06] Gérard Meurant. *The Lanczos and conjugate gradient algorithms*, volume 19 of *Software, Environments, and Tools*. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2006. From theory to finite precision computations.
- [MH98a] R. E. Mahony and U. Helmke. System assignment and pole placement for symmetric realisations. *J. Math. Systems Estim. Control*, 8(3):321–352, 1998.
- [MH98b] Yongfeng Miao and Yingbo Hua. Fast subspace tracking and neural network learning by a novel information criterion. *IEEE Trans. Signal Process.*, 46(7):1967–1979, Jul. 1998.
- [MHM96] R. E. Mahony, U. Helmke, and J. B. Moore. Gradient algorithms for principal component analysis. *J. Austral. Math. Soc. Ser. B*, 37(4):430–450, 1996.
- [MHM05] Jonathan H. Manton, Uwe Helmke, and Iven M. Y. Mareels. A dual purpose principal and minor component flow. *Systems Control Lett.*, 54(8):759–769, 2005.
- [MKS01] Yi Ma, Jana Kosecka, and Shankar S. Sastry. Optimization criteria and geometric algorithms for motion and structure estimation. *Int. J. Computer Vision*, 44(3):219–249, 2001.
- [MM02] Robert Mahony and Jonathan H. Manton. The geometry of the Newton method on non-compact Lie groups. *J. Global Optim.*, 23(3-4):309–327, 2002. Nonconvex optimization in control.
- [MMH94] J. B. Moore, R. E. Mahony, and U. Helmke. Numerical gradient algorithms for eigenvalue and singular value calculations. *SIAM J. Matrix Anal. Appl.*, 15(3):881–902, 1994.
- [MMH03] J. H. Manton, R. Mahony, and Y. Hua. The geometry of weighted low-rank approximations. *IEEE Trans. Signal Process.*, 51(2):500–514, 2003.

- [MS83] Jorge J. Moré and D. C. Sorensen. Computing a trust region step. *SIAM J. Sci. Statist. Comput.*, 4(3):553–572, 1983.
- [MS86] Ronald B. Morgan and David S. Scott. Generalizations of Davidson’s method for computing eigenvalues of sparse symmetric matrices. *SIAM J. Sci. Statist. Comput.*, 7(3):817–825, 1986.
- [Mun00] James R. Munkres. *Topology*. Prentice Hall, Upper Saddle River, NJ, second edition, 2000.
- [MV91] Jürgen Moser and Alexander P. Veselov. Discrete versions of some classical integrable systems and factorization of matrix polynomials. *Comm. Math. Phys.*, 139(2):217–243, 1991.
- [NA05] Yasunori Nishimori and Shotaro Akaho. Learning algorithms utilizing quasi-geodesic flows on the Stiefel manifold. *Neurocomputing*, 67:106–135, 2005.
- [NMH02] Maziar Nikpour, Jonathan H. Manton, and Gen Hori. Algorithms on the Stiefel manifold for joint diagonalization. In *Proc. ICASSP*, pages II–1481–1484, 2002.
- [Not02] Y. Notay. Combination of Jacobi-Davidson and conjugate gradients for the partial symmetric eigenproblem. *Numer. Linear Algebra Appl.*, 9(1):21–44, 2002.
- [Not03] Yvan Notay. Convergence analysis of inexact Rayleigh quotient iteration. *SIAM J. Matrix Anal. Appl.*, 24(3):627–644, 2003.
- [Not05] Yvan Notay. Is Jacobi-Davidson faster than Davidson? *SIAM J. Matrix Anal. Appl.*, 26(2):522–543, 2005.
- [NS96] Stephen G. Nash and Ariela Sofer. *Linear and Nonlinear Programming*. McGraw-Hill, New York, 1996.
- [NW99] J. Nocedal and S. J. Wright. *Numerical Optimization*. Springer Series in Operations Research. Springer-Verlag, New York, 1999.
- [NZ05] Guy Narkiss and Michael Zibulevsky. Sequential subspace optimization method for large-scale unconstrained problems. Technical Report CCIT No. 559, EE Dept., Technion, Haifa, Israel, September 2005.
- [OH05] Shan Ouyang and Yingbo Hua. Bi-iterative least-square method for subspace tracking. *IEEE Trans. Signal Process.*, 53(8, part 2):2984–2996, 2005.
- [Oja89] Erkki Oja. Neural networks, principal components, and subspaces. *Int. J. Neural Syst.*, 1:61–68, 1989.

- [OM01] Brynjulf Owren and Arne Marthinsen. Integration methods based on canonical coordinates of the second kind. *Numer. Math.*, 87(4):763–790, 2001.
- [O’N83] Barrett O’Neill. *Semi-Riemannian Geometry*, volume 103 of *Pure and Applied Mathematics*. Academic Press Inc. [Harcourt Brace Jovanovich Publishers], New York, 1983.
- [OR70] J. M. Ortega and W. C. Rheinboldt. *Iterative Solution of Non-linear Equations in Several Variables*. Academic Press, New York, 1970.
- [OW00] B. Owren and B. Welfert. The Newton iteration on Lie groups. *BIT*, 40(1):121–145, 2000.
- [Par80] Beresford N. Parlett. *The symmetric eigenvalue problem*. Prentice-Hall Inc., Englewood Cliffs, N.J., 1980. Prentice-Hall Series in Computational Mathematics.
- [Pha01] Dinh Tuan Pham. Joint approximate diagonalization of positive definite Hermitian matrices. *SIAM J. Matrix Anal. Appl.*, 22(4):1136–1152, 2001.
- [Plu05] M. D. Plumbley. Geometrical methods for non-negative ICA: Manifolds, Lie groups and toral subalgebras. *Neurocomputing*, 67:161–197, 2005.
- [PLV94] R. V. Patel, A. J. Laub, and P. M. Van Dooren. *Numerical Linear Algebra Techniques for Systems and Control*. IEEE Press, Piscataway, NJ, 1994.
- [Pol71] E. Polak. *Computational Methods in Optimization. A Unified Approach*. Mathematics in Science and Engineering, Vol. 77. Academic Press, New York, 1971.
- [Pow70] M. J. D. Powell. A new algorithm for unconstrained optimization. In *Nonlinear Programming (Proc. Sympos., Univ. of Wisconsin, Madison, Wis., 1970)*, pages 31–65. Academic Press, New York, 1970.
- [Pow84] M. J. D. Powell. Nonconvex minimization calculations and the conjugate gradient method. In *Numerical Analysis (Dundee, 1983)*, volume 1066 of *Lecture Notes in Math.*, pages 122–141. Springer, Berlin, 1984.
- [PR69] E. Polak and G. Ribière. Note sur la convergence de méthodes de directions conjuguées. *Rev. Française Informat. Recherche Opérationnelle*, 3(16):35–43, 1969.

- [Prz03] Maria Przybylska. Isospectral-like flows and eigenvalue problem. *Future Generation Computer Syst.*, 19:1165–1175, 2003.
- [PW79] G. Peters and J. H. Wilkinson. Inverse iteration, ill-conditioned equations and Newton’s method. *SIAM Rev.*, 21(3):339–360, 1979.
- [RR00] Kamran Rahbar and James P. Reilly. Geometric optimization methods for blind source separation of signals. In *International Conference on Independent Component Analysis ICA2000, Helsinki, Finland, June 2000*.
- [RR02] André C. M. Ran and Leiba Rodman. A class of robustness problems in matrix analysis. In *Interpolation theory, systems theory and related topics (Tel Aviv/Rehovot, 1999)*, volume 134 of *Oper. Theory Adv. Appl.*, pages 337–383. Birkhäuser, Basel, 2002.
- [RSS00] Marielba Rojas, Sandra A. Santos, and Danny C. Sorensen. A new matrix-free algorithm for the large-scale trust-region subproblem. *SIAM J. Optim.*, 11(3):611–646, 2000.
- [Saa92] Youcef Saad. *Numerical Methods for Large Eigenvalue Problems*. Algorithms and Architectures for Advanced Scientific Computing. Manchester University Press, Manchester, U.K., 1992.
- [Saa96] Yousef Saad. *Iterative methods for sparse linear systems*. <http://www-users.cs.umn.edu/~saad/>, 1996.
- [Sak96] Takashi Sakai. *Riemannian Geometry*, volume 149 of *Translations of Mathematical Monographs*. American Mathematical Society, Providence, RI, 1996. Translated from the 1992 Japanese original by the author.
- [SBFvdV96] Gerard L. G. Sleijpen, Albert G. L. Booten, Diederik R. Fokkema, and Henk A. van der Vorst. Jacobi-Davidson type methods for generalized eigenproblems and polynomial eigenproblems. *BIT*, 36(3):595–633, 1996. International Linear Algebra Year (Toulouse, 1995).
- [SE02] Valeria Simoncini and Lars Eldén. Inexact Rayleigh quotient-type methods for eigenvalue computations. *BIT*, 42(1):159–182, 2002.
- [SHS06] Hao Shen, Knut Hüper, and Alexander J. Smola. Newton-like methods for nonparametric independent component analysis. In Irwin King, Jun Wang, Laiwan Chan, and DeLiang Wang, editors, *Neural Information Processing*, volume 4232 of *LNCIS*, pages 1068–1077. Springer, 2006.

- [Shu86] Michael Shub. Some remarks on dynamical systems and numerical analysis. In L. Lara-Carrero and J. Lewowicz, editors, *Proc. VII ELAM.*, pages 69–92. Equinoccio, U. Simón Bolívar, Caracas, 1986.
- [SK04] Anuj Srivastava and Eric Klassen. Bayesian and geometric subspace tracking. *Adv. in Appl. Probab.*, 36(1):43–56, 2004.
- [SM06] Andreas Stathopoulos and James R. McCombs. Nearly optimal preconditioned methods for Hermitian eigenproblems under limited memory. Part II: Seeking many eigenvalues. Technical Report WM-CS-2006-02, Department of Computer Science, College of William and Mary, Williamsburg, VA, June 2006.
- [Smi93] Steven Thomas Smith. *Geometric Optimization Methods for Adaptive Filtering*. PhD thesis, Division of Applied Sciences, Harvard University, Cambridge, MA, May 1993.
- [Smi94] Steven T. Smith. Optimization techniques on Riemannian manifolds. In *Hamiltonian and gradient flows, algorithms and control*, volume 3 of *Fields Inst. Commun.*, pages 113–136. Amer. Math. Soc., Providence, RI, 1994.
- [Smi97] Paul Smit. *Numerical Analysis of Eigenvalue Algorithms Based on Subspace Iterations*. PhD thesis, CentER, Tilburg University, P.O. Box 90153, 5000 LE Tilburg, The Netherlands, 1997.
- [Sor02] Danny C. Sorensen. Numerical methods for large eigenvalue problems. *Acta Numer.*, 11:519–584, 2002.
- [Spi70] Michael Spivak. *A comprehensive introduction to differential geometry. Vol. One*. Published by M. Spivak, Brandeis Univ., Waltham, MA, 1970.
- [Sri00] Anuj Srivastava. A Bayesian approach to geometric subspace estimation. *IEEE Trans. Signal Process.*, 48(5):1390–1400, 2000.
- [SS92] J. M. Sanz-Serna. Symplectic integrators for Hamiltonian problems: an overview. *Acta Numer.*, 1:243–286, 1992.
- [SS98] Andreas Stathopoulos and Yousef Saad. Restarting techniques for the (Jacobi-)Davidson symmetric eigenvalue methods. *Electron. Trans. Numer. Anal.*, 7:163–181, 1998. Large scale eigenvalue problems (Argonne, IL, 1997).
- [ST00] Ahmed Sameh and Zhanye Tong. The trace minimization method for the symmetric generalized eigenvalue problem. *J. Comput. Appl. Math.*, 123(1-2):155–175, 2000. Numerical analysis 2000, Vol. III. Linear algebra.

- [Sta05] Andreas Stathopoulos. Nearly optimal preconditioned methods for Hermitian eigenproblems under limited memory. Part I: Seeking one eigenvalue. Technical Report WM-CS-2005-03, Department of Computer Science, College of William and Mary, Williamsburg, VA, July 2005.
- [Ste83] Trond Steihaug. The conjugate gradient method and trust regions in large scale optimization. *SIAM J. Numer. Anal.*, 20(3):626–637, 1983.
- [Ste01] G. W. Stewart. *Matrix Algorithms. Vol. II*. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2001. Eigensystems.
- [Str97] P. Strobach. Bi-iteration SVD subspace tracking algorithms. *IEEE Trans. Signal Process.*, 45(5):1222–1240, 1997.
- [SVdV96] Gerard L. G. Sleijpen and Henk A. Van der Vorst. A Jacobi-Davidson iteration method for linear eigenvalue problems. *SIAM J. Matrix Anal. Appl.*, 17(2):401–425, 1996.
- [SvdVM98] Gerard L. G. Sleijpen, Henk A. van der Vorst, and Ellen Meijerink. Efficient expansion of subspaces in the Jacobi-Davidson method for standard and generalized eigenproblems. *Electron. Trans. Numer. Anal.*, 7:75–89, 1998. Large scale eigenvalue problems (Argonne, IL, 1997).
- [SW82] Ahmed H. Sameh and John A. Wisniewski. A trace minimization algorithm for the generalized eigenvalue problem. *SIAM J. Numer. Anal.*, 19(6):1243–1259, 1982.
- [TA98] Pham Dinh Tao and Le Thi Hoai An. A d.c. optimization algorithm for solving the trust-region subproblem. *SIAM J. Optim.*, 8(2):476–505, 1998.
- [TL02] Nickolay T. Trendafilov and Ross A. Lippert. The multimode Procrustes problem. *Linear Algebra Appl.*, 349:245–264, 2002.
- [Toi81] Ph. L. Toint. Towards an efficient sparsity exploiting Newton method for minimization. In I. S. Duff, editor, *Sparse Matrices and Their Uses*, pages 57–88. Academic Press, London, 1981.
- [Tre99] Nickolay T. Trendafilov. A continuous-time approach to the oblique Procrustes problem. *Behaviormetrika*, 26:167–181, 1999.
- [Udr94] Constantin Udriște. *Convex functions and optimization methods on Riemannian manifolds*, volume 297 of *Mathematics and its Applications*. Kluwer Academic Publishers Group, Dordrecht, 1994.

- [vdE02] Jasper van den Eshof. The convergence of Jacobi-Davidson iterations for Hermitian eigenproblems. *Numer. Linear Algebra Appl.*, 9(2):163–179, 2002.
- [vdV03] Henk A. van der Vorst. *Iterative Krylov Methods for Large Linear Systems*, volume 13 of *Cambridge Monographs on Applied and Computational Mathematics*. Cambridge University Press, Cambridge, 2003.
- [Vid95] M. Vidyasagar. Minimum-seeking properties of analog neural networks with multilinear objective functions. *IEEE Trans. Automat. Control*, 40(8):1359–1375, 1995.
- [Vid02] M. Vidyasagar. *Nonlinear Systems Analysis*, volume 42 of *Classics in Applied Mathematics*. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2002. Reprint of the second (1993) edition.
- [War83] Frank W. Warner. *Foundations of differentiable manifolds and Lie groups*, volume 94 of *Graduate Texts in Mathematics*. Springer-Verlag, New York, 1983. Corrected reprint of the 1971 edition.
- [WD05] Jérôme M. B. Walmag and Éric J. M. Delhez. A note on trust-region radius update. *SIAM J. Optim.*, 16(2):548–562, 2005.
- [Wil65] J. H. Wilkinson. *The Algebraic Eigenvalue Problem*. Clarendon Press, Oxford, 1965.
- [Yan95] Bin Yang. Projection approximation subspace tracking. *IEEE Trans. Signal Process.*, 43(1):95–107, Jan. 1995.
- [Yan07] Y. Yang. Globally convergent optimization algorithms on Riemannian manifolds: Uniform framework for unconstrained and constrained optimization. *J. Optim. Theory Appl.*, 132(2):245–265, 2007.
- [Yer02] Arie Yeredor. Non-orthogonal joint diagonalization in the least-squares sense with application in blind source separation. *IEEE Trans. Signal Process.*, 50(7):1545–1553, 2002.
- [YL99] Wei-Yong Yan and James Lam. An approximate approach to H^2 optimal model reduction. *IEEE Trans. Automat. Control*, 44(7):1341–1358, 1999.
- [Zho06] Yunkai Zhou. Studies on Jacobi-Davidson, Rayleigh quotient iteration, inverse iteration generalized Davidson and Newton updates. *Numer. Linear Algebra Appl.*, 13(8):621–642, 2006.