Chapter 10

Errata: Volume I: Theory

1. Chapter 4: Page 162: Section: Real Symmetric Generalized Eigenvalue Problems
   (a) Line 10: $Ax = \lambda x$ should be $Ax = \lambda Bx$
   (b) In Eqn(4.9.11),
   $$|\beta_{i+1}| = \|L^{-1}(Av_i - \alpha_i v_i - \beta_i v_{i-1})\|$$
   should be
   $$|\beta_{i+1}| = \|L^{-1}(Av_i - \alpha_i Bv_i - \beta_i Bv_{i-1})\|$$

REFERENCES

[1] Bjorck,Å. (1967). *Solving linear least square problems by Gram-Schmidt orthogonalization.* BIT, **7**, 1 – 21.

[2] Bunch J. R. and Kaufman, L. (1977). *Some stable methods for calculating inertia and solving symmetric linear systems.* Math. Comp., **31**, 163 – 179.

[3] Cullum, J., and Donath, W. E. (1974). *A block generalization of the symmetric s-step Lanczos algorithm.* IBM T. J. Watson Research Center, Research Report RC 4845, Yorktown Heights, New York, USA, 10598. (May 1974).

[4] Cullum, J., and Donath, W. E. (1974). *A block Lanczos algorithms for computing the q algebraically largest eigenvalues and a corresponding eigenspace for large, sparse symmetric matrices.* In Proceedings 1974 IEEE Conference on Decision and Control, 505–509.

[5] Cullum, Jane K, and Willoughby, Ralph A. (1985, 2002). *Lanczos Algorithms for Large Symmetric Eigenvalue Computations, Vol. I, Theory.* Birkhäuser, Basel 1985. (Republished as Volume **41**, SIAM Classics in Applied Mathematics, 2002.)

[6] Cullum, J. (1978). *The simultaneous computation of a few of the algebraically largest and smallest eigenvalues of a large, symmetric, sparse matrix.* BIT, **18**, 265-275.

[7] Dongarra, J. J., Bunch, J. R., Moler, C. B., and Stewart, G. W.(1979) *LINPACK User's Guide.* SIAM, Philadelphia, PA, USA.

[8] Garbow, B. S., Boyle, J. M., Dongarra, J. J., and Moler, C. B. (1977) *Matrix Eigensystem Routines - EISPACK Guide Extension.* Lecture Notes in Computer Science **51**, Second Edition, Springer, New York.

[9] George, A., Liu, J. W. H., and Ng, E.(1979). *SPARSPAK User Guide.* CS Dept. Tech. Report, U. Waterloo. Waterloo, Canada.

[10] George, A., and Liu, J. W. H. (1981). *Computer Solution of Large Sparse Positive Definite Systems.* Prentice-Hall, Englewood Cliffs, NJ.

[11] Golub, G. H., and Kahan, W. (1965). *Calculating the singular values and pseudoinverse of a matrix.* SIAM J. Numer. Anal. **2**, 205-224.

[12] Golub, G. H., and Underwood, R. (1977). *The block Lanczos method for computing eigenvalues.* In Mathematical Software III. Rice, J. R. (Ed.), Academic Press, New York, 361-377.

[13] Golub, G. H., Luk, F. T., and Overton, M. L. (1981). *A block Lanczos method for computing the singular values and corresponding singular vectors of a matrix.* Trans. Math. Software, **7**, 149-169.

[14] Lanczos, C. (1950). *An iterative method for the solution of the eigenvalue problem of linear differential and integral operators.*, J. Res. Nat. Bur. Standards, Sect. B, **45**, 255-282.

[15] Lanczos, C. (1961). *Linear Differential Operators.* Van Nostrand, New York.

[16] Moro, G., and Freed, J. H. (1981). *Calculation of ESR spectra and related Fokker-Planck forms by the use of the Lanczos algorithm.* J. Chem. Phys. **74**, 3757-3773.

[17] Paige, C. C. (1971). *The computation of eigenvalues and eigenvectors of very large sparse matrices.* Ph.D. Thesis, U. London.

[18] Paige, C. C. (1972). *Computational variants of the Lanczos method for the eigenproblem.* J.Inst. Math. Appl. **10**, 373-381.

[19] Paige, C. C. (1976). *Error analysis of the Lanczos algorithms for tridiagonalizing a symmetric matrix.* J. Inst. Math. Appl. **18**, 341-349.

[20] Paige, C. C. (1980). *Accuracy and effectiveness of the Lanczos algorithm for the symmetric eigenproblem.* Linear Algebra Appl. **34**, 235-258.

[21] Ryder, B. G. (1974). *The PFORT Verifier.* Software-Practice and Experience, **4**, 359-377.

[22] Ryder, B. G., and Hall, A. D.(1981). *PFORT Verifier.* Bell Laboratory Computer Science Technical Report 12. Bell Laboratory, Murray Hill, New Jersey, USA

[23] Smith, B. T., Boyle, J. M., Garbow, B. S., Ikebe, Y., Klema, V. C., and Moler, C. B. (1976), *Matrix Eigensystem Routines - EISPACK Guide.* Lecture Notes in Computer Science, **6**, Second Edition, Springer, New York.

[24] Stewart, G. W. (1973). *Introduction to Matrix Computations.* Academic Press, New York.

[25] Wilkinson, J. H. (1965). *The Algebraic Eigenvalue Problem.* Oxford University Press, New York.

Related Work by the Authors

[1] Cullum, J. and Zhang, T. (2002). *Two-Sided Arnoldi and Nonsymmetric Lanczos Algorithms.* SIAM J. Mat. Anal. Appl., **24**, 303 – 319.

[2] Cullum, J. and Ruehli, A. (2001), *Pseudospectra analysis, nonlinear eigenvalue problems, and studying systems with time delays*, BIT, **41**, 265–281

[3] Cullum, J.K. and Ruehli. A.E. (2000), *Method for analyzing the stability and passivity of system models*, US Patent, 6058258 (May 5, 2000).

[4] Cullum, Jane (1996). *Arnoldi versus nonsymmetric Lanczos algorithms for solving matrix eigenvalue problems,* BIT **36**, 470–493.

[5] Cullum, Jane and Willoughby, Ralph A. (1996). *A QL procedure for computing the eigenvalues of complex symmetric tridiagonal matrices,* SIAM J. Matrix Anal. Appl., **17**, 83–109.

[6] Cullum, Jane and Willoughby, Ralph (1991). *Computing eigenvalues of large matrices, some Lanczos algorithms and a shift and invert strategy.* Advances in Numerical Partial Differential Equations and Optimization, Eds., S. Gomez, J.P. Hennart and R.A. Tapia, SIAM Publications Philadelphia, PA, 198–246.

[7] Cullum, J., Kerner, W. and Willoughby, R.A. (1989). *A generalized nonsymmetric Lanczos procedure.*, Computer Physics Communications, North-Holland, **53**, 19–48.

[8] Cullum, Jane and Willoughby, Ralph A., (1986). Eds., *Large Scale Eigenvalue Problems*, Mathematics Studies, **127**, North-Holland.

[9] Cullum, Jane and Willoughby, Ralph A. (1986). *A practical procedure for computing eigenvalues of large sparse nonsymmetric matrices.* In Large Scale Eigenvalue Problems, Mathematics Studies, eds., J. Cullum and R.A. Willoughby, **127**, North-Holland, 193–240.

[10] Cullum, Jane and Willoughby, Ralph A. (1984). *A Lanczos algorithm for the modal analysis of very large, nondefective, nonsymmetric matrices,* in Proceedings of the IEEE 23rd Conference on Decision and Control, Las Vegas, Nevada, Dec. 12–14, 1984, IEEE Press, 1758–1761.

[11] Chow, J.H., Cullum, Jane, and Willoughby, Ralph A. (1983). *A sparsity-based technique for identifying slow-coherent areas in large power systems*, IEEE Transactions on Power Apparatus and Systems, **103**, 463–473.

[12] Cullum, J., Willoughby, R. A., and Lake, M. (1983). *A Lanczos algorithm for computing singular values and vectors of large matrices.* SIAM J. Sci. Statist. Comput. **4**, 197–215.

[13] Cullum, J., and Willoughby, R. A. (1981). *Computing eigenvalues of very large symmetric matrices-an implementation of a Lanczos algorithm with no reorthogonalization.* J. Comput. Phys. **44**, 329–358.

[14] Cullum, Jane and Willoughby, Ralph A. (1980). *The Lanczos phenomenon: An interpretation based upon conjugate gradient optimization,* Linear Algebra and Its Applications, **29**, 63–90.

[15] Cullum, Jane and Willoughby, R. A. (1980). *Computing eigenvectors (and eigenvalues) of large, symmetric matrices using Lanczos tridiagonalization.* Lecture Notes in Mathematics No. **773**, Numerical Analysis, Proceedings Dundee, Scotland, 1979, Ed. G. A. Watson, Springer-Verlag, 46–63.

[16] Cullum, Jane (1979). *Using Lanczos tridiagonalization to compute eigenvalues and eigenvectors of large symmetric matrices,* Conjugate Gradient Methods and Similar Techniques, ed. I. S. Duff, AERE Report R-9636, Computer Science Division, A.E.R.E. Harwell, Oxfordshire, England, December 1979, 72–90.

[17] Cullum, Jane and Willoughby, R. A. (1979). *Fast modal analysis of large sparse but unstructured symmetric matrices.*. Proceedings of 17th IEEE Conference on Decision and Control, San Diego, Calif., January 1979, IEEE Press, 45–53.

[18] Cullum, J., and Willoughby, R. A. (1979). *Lanczos and the computation in specified intervals of the spectrum of large sparse real symmetric matrices.* in Proceedings of Symposium on Sparse Matrix Theory, Knoxville, Tenn., Nov. 2–3, 1978, Sparse Matrix Proceedings 1978, Eds., I. S. Duff and G. W. Stewart, SIAM, Philadelphia, 220-255.

[19] Cullum, J., Donath, W. E., and Wolfe, P. (1975). *The minimization of certain nondifferentiable sums of eigenvalues of symmetric matrices.* In Nondifferentiable Optimization, Mathematical Programming Study **3**, North-Holland, 35-55,