PROFESSIONAL RESUME

January 29, 2003

NAME John *Alan* George

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BIRTH DATE November 9, 1943

CITIZENSHIP Canadian

EDUCATION Public Schools of Alberta and Saskatchewan, Canada.

The University of Alberta, Edmonton, Alberta
B.Sc. (Mathematics, graduated with distinction) 1964
M.Sc. (Computer Science) 1966

Stanford University, Stanford, California 94305
Ph.D. (Computer Science) 1971

AWARDS, HONOURS

University of Alberta First Class Standing Prizes (1963,1964)
Canadian National Research Council Bursary (1964-1965)
IBM National Graduate Fellowship (1969-1970)
G.E. Forsythe Award for Leadership in Numerical Mathematics (1982)
Fellow, Institute for Mathematics and its Applications (1981)
Fellow, Institute for Combinatorics and its Applications (1989)
Fellow, Royal Society of Canada (1992)
Fellow, Institute for Electrical and Electronics Engineers (1993)
Governor-General's Commemorative Medal for the 125th Anniversary of Canada (1992)

PROFESSIONAL MEMBERSHIPS

Association for Computing Machinery (ACM)
Institute for Electrical and Electronics Engineers (IEEE)
Institute for Mathematics and its Applications (IMA)
New York Academy of Sciences
Society for Industrial and Applied Mathematics (SIAM)

ACADEMIC EXPERIENCE

1998-present	Dean, Faculty of Mathematics, University of Waterloo.
2001 (Jan.-Aug.)	Vice-President, Academic & Provost (Interim), University of Waterloo
1988-1993	Vice-President, Academic & Provost, University of Waterloo
1986-1988	Professor of Computer Science, University of Tennessee, Knoxville, and Distinguished Scientist, Oak Ridge National Laboratory (on leave from UW).
1980-1986	Dean, Faculty of Mathematics, University of Waterloo.
1971-	Member of faculty, Dept. of Computer Science, University of Waterloo.
1967-1971	Research Assistant, Computer Science Department, Stanford University.
1966-1967	Instructor, Department of Computer Science, University of Alberta.
1964-1966	Research Assistant, Department of Computing Science, University of Alberta.

INDUSTRIAL EXPERIENCE

1965-1967	Consultant, Datamation and Consulting Limited, Alberta
1966	Consultant, Peace River Mining and Smelting Company, Alberta
1972	Visiting Research Scientist, (June-August), IBM Research, New York
1973-1978	Consultant, NASA Langley Research Center, Virginia
1975-1979	Consultant, Canada Centre for Inland Waters, Environment Canada
1979	Visiting Research Scientist, (Oct.-Dec.), IBM Research, New York
1980-1994	Consultant, Mathematical Sciences, Oak Ridge National Laboratory
1987-1990	Consultant, Structural Mechanics, NASA Langley Research Center, Virginia
1998-Present	Consultant, Compaq Computer Corp. (US)
1999-2000	Consultant, US Dept. of Agriculture

RESEARCH INTERESTS

I am interested in scientific computation generally, but mainly in numerical linear algebra and related scientific software. My primary focus is the (numerous and varied) problems associated with solving very large sparse systems of equations. Some examples include analysis of the complexity of certain algorithms, numerical stability issues, design of efficient data structures, design of software packages with good user interfaces, and automatic identification of exploitable parallelism in sparse matrix computations.

TEACHING ACTIVITIES

My teaching has been limited in recent years due to administrative responsibilities. Mainly, I teach third and fourth year courses in scientific computation using MATLAB as the computing environment, and graduate seminars on large scale sparse matrix computations.

I have delivered lecture series at a number of workshops, notably at the Summer School in Numerical Analysis at the University of Lancaster in 1987, at the University of Tennessee during the Special Year in Numerical Linear Algebra that was held in 1987-88, and at a two-week NATO Advanced Study Institute held June 23-July 5, 1996 at the University of Gran Canaria, Spain.

TECHNOLOGY TRANSFER ACTIVITIES

Research with my graduate students and colleagues on the design, analysis and implementation of algorithms for solving large sparse linear systems of equations has led to the development of a widely distributed software package called SPARSPAK for solving such problems. The first version was completed in 1980, and has subsequently been distributed under license by the University of Waterloo. It has been acquired by more than 150 companies, research and educational institutions, and government agencies from more than 20 countries around the world. It has been steadily updated and enhanced over the years, as research produces new or improved algorithms and software.

MISCELLANEOUS PROFESSIONAL ACTIVITIES

- Member of the Editorial Boards of:
  - *Aequationes Mathematicae* (1974–89)
  - *ACM Trans. on Math. Software* (1977–81)
  - *SIAM J. Scientific and Statistical Computing* (1980–90)
  - *Linear Algebra and Its Applications* (1982–93)
  - *Electronic Transactions on Numerical Analysis* (1992–)
- Society for Industrial and Applied Mathematics (SIAM)
  - Member, SIAM Council (1987–90)

- Member, Executive Committee of the Council (Sept. 1987–90)
- Member of the Nominating Committee for the Council (1981–3)
- SIAM Visiting Lecturer (1978–80)

- Association for Computing Machinery (ACM)
  - Member, Advisory Board, ACM Special Interest Group on Numerical Mathematics (1977–80, 1983–84)
  - Chair, ACM Special Interest Group on Numerical Mathematics (1981–83)
- Advisory Committees
  - Member, Computer Science Advisory Committee, Rensselaer Polytechnic Institute, Troy, New York. (1982–90)
  - External member of the Review Committee, Masters Program in Computer Science, Dalhousie University, March, 1984.
  - Consultant to the Ontario Council on Graduate Studies for the M. Sc. program in Computer Science at McMaster University, October, 1986.
  - Member of the Board, Information Technology Research Center, Government of Ontario Center of Excellence (1988–93)
  - Member of the Board, Institute for Mathematics and its Applications (IMA), University of Minnesota. (1988–1991)
  - Chair, External Review Committee for the Computer Science Department, University of Tennessee, Knoxville, January 1990 and January 1993.
  - Chair, NSERC[1] Committee on Research Computation (1989–1991).
  - Member, Advisory Committee on High Performance Computing, Government of Ontario, 1993.
  - Chair, NSERC Special Task Force on Research Computation (1994).
  - Member of the Evaluation Panel on Modelling, Information Technology Research Center (ITRC), June, 1995. Also served on the ITRC Research Program Committee.
  - Chair, External Review Panel for the Scientific Computing and Computational Mathematics program, College of Engineering, Stanford University, May, 1997.
  - Chair, External Review Committee for the Computer Science Department, University of Tennessee, Knoxville, March, 1998.
  - Member of 3-person Canadian Advanced Technology Association Scholarship Jury Committee.
  - Member of the Board, Communications and Information Technology Ontario (CITO), Government of Ontario Center of Excellence (1998–2000)
  - Member of the Board, The Fields Institute for Research in the Mathematical Sciences, a mathematics research center, funded by NSERC and the Government of Ontario, similar to MSRI at Berkeley or the IMA in Minnesota (1998-2001).
- Conference Organization
  - Member, Organizing Committee Symposium on Sparse Matrix Computations and Their Applications, Knoxville, TN, Nov.2–3, 1978

[1] Natural Sciences and Engineering Research Council, the Canadian analog of the US National Science Foundation

- Member, Organizing Committee, Sparse Matrix Symposium, Fairfield Glade, TN., Oct. 25–27, 1982
- Chair, Organizing Committee for Gatlinburg IX, Symposium on Numerical Algebra, University of Waterloo, July 9–14, 1984
- Member, Organizing Committee for Gatlinburg X, Symposium on Numerical Algebra, Fairfield Glade, Tennessee, October 19–23, 1987.
- Organizer, Minisymposium on Sparse Matrix Computation and Parallel Computing, SIAM National Meeting, Denver, Colorado, October 12–15, 1987.
- Member of the Organizing Committee, SIAM Sparse Matrix Symposium held at Salishan, Oregon, May 22–24, 1989.
- Member, Organizing Committee for Householder-Gatlinburg XI, Symposium on Numerical Algebra, Halmstad, Sweden, June 18–22, 1990.
- Co-organizer (with R. Brualdi and G. Golub), Special Year on Applied Linear Algebra at the IMA, University of Minnesota, Sept. 1991–June, 1992.
- Member, Organizing Committee for Householder-Gatlinburg XII, Symposium on Numerical Algebra, Los Angeles, CA, June 14–19, 1993.
- Member, Organizing Committee for the Linear Algebra Year at CERFACS, Toulouse, France, Sept. 1995 – August 1996.
- Member, Organizing Committee for Householder-Gatlinburg XIII, Symposium on Numerical Algebra, Pontresina, Switzerland, June 17–21, 1996.
- Member, Organizing Committee, Second SIAM Symposium on Large Scale Sparse Matrix Computations, October 9-11, 1996, Coeur de Loene, Idaho.
- General Chair, Sixth SIAM Conference on Applied Linear Algebra, held Oct. 29 – Nov. 1, 1997, Snowbird, Utah.
- Member, Organizing Committee for Householder-Gatlinburg XIV, Symposium on Numerical Algebra, Whistler, British Columbia, June 20–26, 1999.

• Referee for various journals and granting agencies.

STUDENTS SUPERVISED:

Ph.D.	**Masters**
J.W-H. Liu (1976)	K.W. Kwok (1973)
Gaston H. Gonnet (1977)	J.W-H. Liu (1972)
David R. McIntyre (1978)	A. Haycock (1976)
Esmond G.Y. Ng (1983)	H.H. Yang (1976)
Hamza Rashwan (1983)	Y.M. Lau (1976)
E. Chu (1988)	E.W. Chionh (1978)
Fletcher Lu (joint, 1999 –)	J. Towers (1978)
	E. Ng (1979)
	Alex Liu (1979)
	J.L. Drummond (1979)
	E. Chu (1984)
	Wing Hong Wong (1997)
	Lamees Abourahma (1998)
	Fletcher Lu (1998)
	Rod Affleck (1999)
	Ye Yang (1999)
	Ya Dan Wu (joint, 2000)

BOOKS:

1. Alan George and Joseph Liu, *Computer Solution of Large Sparse Positive Definite Systems*, Prentice Hall Inc., 1981.
2. Alan George, G. W. Stewart and R. G. Voigt (Editors), *Parallel Computing* (special issue of *Linear Algebra and its Applications*), Vol. 77, May 1986.
3. Alan George, John Gilbert and Joseph Liu (Editors), *Graph Theory and Sparse Matrix Computations*, IMA Volumes in Mathematics and its Applications, Vol. 56, Springer Verlag, 1993.
4. Eleanor Chu and Alan George, *Inside the FFT Black Box: Serial and Parallel Fast Fourier Transform Algorithms*, CRC Press LLC, Computational Mathematics Series, ISBN 0-8493-0270-6, Library of Congress Number 99-048017, 1999, 312 pages.

Currently, I am collaborating with Joseph Liu and Esmond Ng on a major revision and update of the book that Joseph Liu and I wrote in 1981 ([1] above). One chapter remains to be completed.

GRANTS AND CONTRACTS

Grants (1980–)

Natural Sciences and Engineering Research Council	1980-83	$100,323
"Direct Methods for Solving Large Sparse	1984-86	$164,742
Linear Algebraic Systems"	1986-87	$20,000
Natural Sciences and Engineering Research Council	1988-92	$262,000
"Solution of Large Sparse Systems on	1992-94	$150,000
Parallel Architectures"	1994-97	$162,000
	1997-2001	$296,500
	2001-2006	$375,000
Natural Sciences and Engineering Research Council (Equipment grant - with Buhr, Buss and Larsen)	1991	$33,823
Natural Sciences and Engineering Research Council (Equipment grant - with Conn, Larsen and Wong)	1989	$88,000
Natural Sciences and Engineering Research Council (Principal Investigator, with 9 others - Major Installation Grant) "Research and Development of Computational Support for Symbolic Mathematics, Data Structures and Document Preparation Systems"	1982	$400,000

GRANTS AND CONTRACTS – continued

Contracts (1978–)

Fisheries and Environment Canada (CCIW) "Development of Variable Mesh Models of Thermal and Waste Concentrate Transport " (with R.B. Simpson)	1978-80	$15,600
U.S. Air Force Office of Scientific Research "Research on Algorithms for Solving Sparse Matrix Problems on Vector and Parallel Computers" (co-investigator with Dr. M.T. Heath at the Oak Ridge National Laboratory)	1983-86	$158,000
U.S. Air Force Office of Scientific Research (continuation of the contract above)	1986-87	$120,000
U.S. Air Force Office of Scientific Research	1987-88	$107,000
U.S. National Security Agency	1987-88	$45,000
U.S. National Science Foundation "Special Year in Numerical Linear Algebra" (co-investigator with R.C.Ward at the Oak Ridge National Laboratory)	1987-88	$25,000
NASA Langley Research Center "Algorithms and Software for Solving Finite Element Equations on Serial and Parallel Architectures"	1987-88	$75,000
NASA Langley Research Center (Continuation of the contract above)	1988-89	$82,000
NASA Langley Research Center (Continuation of the contract above)	1989-90	$96,700
U.S. National Science Foundation "Design and Implementation of Software for Sparse Matrix Computations on Parallel Architectures" (Awarded, but declined due to my return to Canada)	1988-91	$560,000
Compaq Computer Corporation "Portable Parallel Software for Sparse Matrix Computations on Shared Memory Architectures"	1999-00	$155,000
Bell University Labs (BUL)	1998-01	$20,000,000
U.S. Department of Agriculture "Software for Rank-Deficient Sparse systems Arising in Breeding Analysis"	2000-01	$57,000
Canadian Foundation for Innovation (CFI) "Waterloo High-Performance Computing Facility"	2000-01	$850,000

The BUL and CFI projects involved numerous applicants. I am the PI on both projects, .

ARTICLES PUBLISHED OR ACCEPTED FOR PUBLICATION:

1. Alan George and Khakim Ikramov, "Gaussian Elimination for the Inverse of a Diagonally Dominant Matrix is Stable", Math. Comp., (to appear)
2. Alan George and Khakim Ikramov, "Unitary Similarity of Matrices with Quadratic Minimal Polynomial", Linear Algebra and its Applics., Vol 349 (2002), pp. 11–16.
3. Alan George and Khakim Ikramov, "The Closedness of Certain Classes of Matrices with Respect to Pseudoinversion", Comp. Math. & Math. Physics, Vol. 42 (2002), pp. 1242-1246.
4. Alan George, Khakim Ikramov, and Andrew Kucherov, "On the Growth Factor in Gaussian Elimination for Generalized Higham Matrices," Numer. Linear Algebra Appl., Vol. 9 (2002), pp. 107-114.
5. Alan George and Wei-Pai Tang and Ya Dan Wu, "Multi-level One-way Dissection Factorization," SIAM J. Matrix Anal., Vol. 22 (2001), pp. 752-771.
6. Alan George and Lan Chieh Huang and Wei-Pai Tang and Ya Dan Wu, "Numerical Simulation of High Re Unsteady State Incompressible Flow on a Curvilinear Half-staggered Grid," SIAM J. Sci. Comp., Vol. 21 (2000), pp. 2331-2351.
7. Alan George, Khakim Ikramov, and Andrew Kucherov, "Some Properties of Symmetric Quasidefinite Matrices", SIAM J. Matrix Anal., Vol. 21 (2000), pp. 1318–1323.
8. Alan George and Khakim Ikramov, "On the Qausidiagonalizability of 3-Self-Adjoint Matrices.", Comp. Math. & Math. Physics 40 (2000), pp. 963-973.
9. Yurii A. Al'pin, Alan George, and Khakim Ikramov, "Solving the Two-dimensional CIS Problem by a Rational Algorithm", Linear Algebra and its Applics., Vol. 312 (2000), pp. 115–123.
10. Alan George and Khakim Ikramov, "On the Condition of Symmetric Quasidefinite Matrices", SIAM J. Matrix Anal., 21 (2000), pp. 970-977.
11. Alan George and Joseph Liu, "An Object-Oriented Approach to the Design of a User Interface for a Sparse Matrix Package", SIAM J. Matrix Anal., 20 (1999), pp. 953-969.
12. Alan George and Khakim Ikramov, "On Quasidefinite Matrices with a Parameter in the Off-Diagonal Block," Comp. Math. and Math. Physics 39, (1999), pp. 1553-1557.
13. Alan George and Khakim Ikramov, "Common Invariant Subspaces of Two Matrices," Linear Algebra and its Applics., Vol 287 (1999), pp. 171–179.
14. Eleanor Chu and Alan George, "FFT Algorithms and their Adaptation to Parallel Processing", Linear Algebra and its Applics., Vol 284 (1998), pp. 95-124.
15. Alan George and Alex Pothen, "Analysis of a Spectral Envelope Reduction Algorithm via Quadratic Assignment Problems," SIAM J. Matrix Anal., 18 (1997), pp. 706-732.
16. Alan George and Khakim Ikramov, "On Hankel Matrices which Commute with Tridiagonal Matrices.", Comp. Math. & Math. Physics 36 (1996), pp. 3-10.
17. A. George, K. Ikramov. W.-P. Tang and V.N. Tchugunov, "On Doubly Symmetric Tridiagonal Forms for Complex Matrices," SIAM J. Matrix Anal., 17 (1996), pp. 680-690.
18. Alan George and Khakim Ikramov, "Is the Polar Decomposition Finitely Computable?," SIAM J. Matrix Anal., 17 (1996), pp. 348-354.

19. A. George, K. Ikramov. L. Matushkina and W-P. Tang, "On a QR-Like Algorithm for Some Structured Eigenvalue Problems", SIAM J. Matrix Anal., 16 (1995), pp. 1107–1126.

20. A.George and Kh. D. Ikramov, "On Conditionality and Expected Error of two Methods for Computing the Pseudo-eigenvalues of a Complex Matrix," Comp. Math. and Math. Physics 35, (1995), pp. 1597-1604 (in Russian).

21. A. George, K. Ikramov, A.N. Krivoshapova, and W-P. Tang, "A Finite Procedure for the Tridiagonalization of a General Matrix", SIAM J. Matrix Anal., 16 (1995), pp.377-386.

22. Eleanor Chu, Alan George and D. Quesnel, "Parallel Matrix Inversion on a Subcube-grid", Parallel Computing 19 (1993), pp. 243-256.

23. Phil Edmonds, Eleanor Chu, and Alan George, "Dynamic Programming on a Shared-Memory Multiprocessor", Parallel Computing 19 (1993), pp. 9-22.

24. Eleanor Chu and Alan George, "Parallel Algorithms and Subcube Embedding on a Hypercube", SIAM J. Sci. Stat. Comput. 14 (1993), pp. 81-94.

25. Eleanor Chu and Alan George, "A Balanced Submatrix Merging Algorithm for Multiprocessor Architectures", Parallel Computing 18 (1992), pp. 1-10.

26. Alan George and Esmond Ng, "Parallel Sparse Gaussian Elimination with Partial Pivoting", Annals of Operations Research 22 (1990), pp. 219-240.

27. Eleanor Chu and Alan George, "Sparse Orthogonal Decomposition on a Hypercube Multiprocessor", SIAM J. Sci. & Stat. Comput. 11(3) (1990), pp. 453-465.

28. Eleanor Chu and Alan George, "QR Factorization of a Dense Matrix on a Hypercube Multiprocessor", SIAM J. Sci. Stat. Comput., 11(5) (1990), pp. 990-1028.

29. Alan George and Joseph Liu, "The Evolution of the Minimum Degree Ordering Algorithm", SIAM Review, 31 (1989), pp. 1-19.

30. Alan George, Joseph Liu and Esmond Ng, "Communication Results for Parallel Sparse Cholesky Factorization on a Hypercube", Parallel Computing, 10 (1989), pp. 287-298.

31. Eleanor Chu and Alan George, "QR Factorization of a Dense Matrix on a Shared-Memory Multiprocessor", Parallel Computing, 11 (1989), pp. 55-71.

32. Alan George, Michael Heath, Joseph Liu and Esmond Ng, "Solution of Sparse Positive Definite Systems on a Hypercube", J. Computat. and Appl. Math., 27 (1989), pp. 129-156.

33. Alan George and Esmond Ng, "On the Complexity of Sparse QR and LU Factorization of Finite Element Matrices", SIAM J. Sci. and Stat. Computing, 9 (1988), pp. 849-861.

34. Alan George, Joseph Liu and Esmond Ng, "A Data Structure for Sparse QR and LU Factorizations", SIAM J. Sci. and Stat. Computing, 9 (1988), pp. 100-121.

35. Alan George, Michael T. Heath, Joseph Liu and Esmond Ng, "Sparse Cholesky Factorization on a Local-Memory Multiprocessor", SIAM J. Sci. and Stat. Computing, 9 (1988), 327-340.

36. Alan George and Joseph W-H. Liu, "Householder Reflections Versus Givens Rotations for Sparse Orthogonal Decomposition", Linear Algebra and its Applics., 88/89 (1987), pp. 223-238.

37. Alan George and Esmond Ng, "Symbolic Factorization for Sparse Gaussian Elimination with Partial Pivoting", SIAM J. Sci. and Stat. Computing, 8 (1987), pp. 877-898.

38. Alan George, Michael T. Heath, Joseph W-H. Liu and Esmond Ng, "Symbolic Cholesky Factorization on a Local-Memory Multiprocessor", Parallel Computing, 5 (1987), pp. 85-95.

39. Eleanor Chu and Alan George, "Gaussian Elimination with Partial Pivoting and Load Balancing on a Multiprocessor", Parallel Computing, 5 (1987), pp. 65-74.

40. Alan George, Joseph W-H. Liu and Esmond Ng, "Row Ordering Schemes for Sparse Givens Transformations II. Implicit Graph Model", Linear Algebra and its Applics., 75 (1986), pp. 203-224.

41. Alan George and Esmond Ng, "Orthogonal Reduction of Sparse Matrices to Upper Triangular Form Using Householder Transformations", SIAM J. Sci. and Stat. Computing, 7 (1986), pp. 460-472.

42. Alan George, Joseph W-H. Liu and Esmond Ng, "Row Ordering Schemes for Sparse Givens Transformations III. Analyses of a Model Problem", Linear Algebra and its Applics., 75 (1986), pp. 225-240.

43. Alan George, Michael T. Heath and Joseph W-H. Liu, "Parallel Cholesky Factorization on a Shared-Memory Multiprocessor", Linear Algebra and its Applics., 77 (1986), pp. 165-188.

44. Alan George, Michael T. Heath, Joseph Liu and Esmond Ng, "Solution of Sparse Positive Definite Systems on a Shared-Memory Multiprocessor", Internat. J. Parallel Programming, 15 (1986), pp. 309-325.

45. Alan George and Esmond Ng, "An Implementation of Gaussian Elimination with Partial Pivoting for Sparse Systems", SIAM J. Sci. and Stat. Computing, 6 (1985), pp. 390-409.

46. Alan George and Hamza Rashwan, "Auxiliary Storage Methods for Solving Finite Element Systems", SIAM J. Sci. and Stat. Computing, 6 (1985), pp. 882-910.

47. Alan George, Joseph W-H. Liu and Esmond Ng, "Row Ordering Schemes for Sparse Givens Transformations I. Bipartite Graph Model", Linear Algebra and its Applics., 61 (1984), pp. 55-81.

48. Alan George, Michael T. Heath and Esmond Ng, "Solution of Sparse Underdetermined Systems of Linear Equations", SIAM J. Sci. and Stat. Computing, 4 (1984), pp. 988-997.

49. Alan George, Michael T. Heath and Esmond Ng, "A Comparison of Some Methods for Solving Sparse Linear Least Squares Problems", SIAM J. Sci. and Stat. Computing, 4 (1983), pp. 177-187.

50. Alan George and Esmond Ng, "On Row and Column Orderings for Sparse Least Squares Problems", SIAM J. on Numer. Anal., 20 (1983), pp. 326-344.

51. Alan George, Michael T. Heath and Robert J. Plemmons, "Solution of Large Scale Sparse Least Squares Problems Using Auxiliary Storage", SIAM J. Sci. and Stat. Computing, 2 (1981), pp. 416-429.

52. Alan George and Joseph W-H. Liu, "A Minimal Storage Implementation of the Minimum Degree Algorithm", SIAM J. Numer. Anal., 17 (1980), pp. 282-299.

53. G.H. Gonnet, L.D. Rogers, and J.A. George, "An Algorithmic and Complexity Analysis of Interpolation Search", Acta Informatica, 13 (1980), pp. 39-52.

54. Alan George and Joseph W-H. Liu, "An Optimal Algorithm for Symbolic Factorization of Symmetric Matrices", SIAM J. on Computing, 9 (1980), pp. 583-593.

55. Alan George and Joseph W-H. Liu, "A Fast Implementation of the Minimum Degree Algorithm Using Quotient Graphs", ACM Trans. on Math. Software, 6 (1980), pp. 337-358.

56. W.M. Chan and Alan George, "A Linear Time Implementation of the Reverse Cuthill-McKee Algorithm", BIT., 20 (1980) pp. 8-14.

57. Alan George, "An Automatic One-Way Dissection Algorithm for Irregular Finite Element Problems", SIAM J. Numer. Anal., 17 (1980), pp. 740-751.

58. Alan George and Hamza Rashwan, "On Symbolic Factorization of Partitioned Sparse Symmetric Matrices", Linear Algebra and its Applics., 34 (1980), pp. 145-157.

59. Alan George and Michael T. Heath, "Solution of Sparse Linear Least Squares Problems Using Givens Rotations", Linear Algebra and its Applics., 34 (1980), pp. 69-83.

60. Alan George and Joseph W-H. Liu, "The Design of a User Interface for a Sparse Matrix Package", A.C.M. Trans. on Math. Software, 5 (1979), pp. 139-162.

61. Alan George and Joseph W-H. Liu, "An Implementation of a Pseudo-Peripheral Node Finder", ACM Trans. on Math. Software, 5 (1979), pp. 284-295.

62. Alan George and Joseph W-H. Liu, "Algorithms for Matrix Partitioning and the Numerical Solution of Finite Element Systems", SIAM J. Numer. Anal., 15 (1978), pp. 297-327.

63. Alan George and David R. McIntyre, "On the Application of the Minimum Degree Algorithm to Finite Element Systems", SIAM J. Numer. Anal., 15 (1978), pp. 90-112.

64. Alan George, W.G. Poole, Jr., and R.G. Voigt, "Incomplete Nested Dissection for Solving n by n Grid Problems", SIAM J. Numer. Anal., 15 (1978), pp. 662-673.

65. Alan George and Joseph W-H. Liu, "An Automatic Nested Dissection Algorithm for Irregular Finite Element Problems", SIAM J. Numer. Anal., 15 (1978), pp. 1053-1069.

66. Alan George, W.G. Poole, Jr., and R.G. Voigt, "Analysis of Dissection Algorithms for Vector Computers", J. Computers and Mathematics with Applications, 4 (1978), pp. 287-304.

67. Alan George, "Numerical Experiments Using Dissection Methods to Solve n by n Grid Problems", SIAM J. Numer. Anal., 14 (1977), pp. 161-179.

68. Alan George, "A Negative Result on Sparse Matrix Splitting and Gaussian Elimination", SIAM J. Numer. Anal., 13 (1976), pp. 846-853.

69. Victor Barwell and Alan George, "A Comparison of Algorithms for Solving Symmetric Indefinite Systems of Linear Equations", ACM Trans. on Math. Software, 2 (1976), pp. 242-251.

70. Alan George and W-H. Liu, "A Note on Fill for Sparse Matrices", SIAM J. Numer. Anal., 12 (1975), pp. 452-455.

71. Alan George, "On Block Elimination for Sparse Linear Systems", SIAM J. Numer. Anal., 11 (1974), pp. 585-603.

72. Alan George, "Nested Dissection of a Regular Finite Element Mesh", SIAM J. Numer. Anal., 10 (1973), pp. 345-363.

73. Alan George, "On the Density of Finite Element Matrices", Internat. J. Numer. Meth. Engrg., 5 (1972), pp. 297-300.

74. B.L. Buzbee, F.W. Dorr, J.A. George and G.H. Golub, "The Direct Solution of the Discrete Poisson Equation on Irregular Regions", SIAM J. Numer. Anal., 8 (1971), pp. 722-736.

75. J.W. Carmichael, J.A. George, and R.S. Julius, "Finding Natural Clusters", Systematic Zoology, 17 (1968), pp. 144-152.

ARTICLES IN REFEREED CONFERENCE PROCEEDINGS:

1. Alan George, Lan Chieh Huang, Wei-Pai Tang, and Ya Dan Wu, "Numerical Solution for the Time-Dependent Three-Dimensional Incompressible Navier-Stokes Equations on a Curvilinear Grid", Sixth Annual Conference of the CFD Society of Canada, University of Laval, June 6-7, 1998.

2. Alan George, Wei-Pai Tang, and Ya Dan Wu, "Multi-Level One-Way Dissection for Unsteady Incompressible Navier-Stokes Flows", Fifth Conference of the CFD Society of Canada, University of Victoria, May 25-27, 1997.

3. Alan George, "On Finding and Analyzing the Structure of the Cholesky Factor", Proceedings of the NATO Conference on *Algorithms for Large Scale Linear Algebraic Systems: State of the Art and Applications in Science and Engineering*, University of Gran Canaria, Spain, June 23-July 5, 1996, Kluwer Academic Publishers, G. Althous Winter and E. Spedicato, editors, pp. 73-105.

4. Alan George, "Solution of Sparse Systems of Equations on Multiprocessor Architectures", Proceedings of the SERC Numerical Analysis Summer School, University of Lancaster, England, (edited by Peter Turner), Lecture Notes in Mathematics # 1394, Springer Verlag, 1989, pp. 31-94.

5. Eleanor Chu and Alan George, "Updating and Downdating the Inverse Cholesky Factor on a Hypercube Multiprocessor", in *Hypercube and Distributed Computers*, Proceedings of the First European Workshop on Hypercube and Distributed Computers, Elsevier North-Holland Publishing Co., October 1989, F. André and J.P. Verjus, Editors, pp. 117-131, 1989.

6. Alan George, Michael T. Heath, Joseph Liu and Esmond Ng, "Sparse Cholesky Factorization on a Local-Memory Multiprocessor", Proceedings of the ARO Workshop on Parallel Processing and Medium-Scale Multiprocessors (edited by A. Wouk), SIAM Publications (1989), 58-75.

7. Alan George and Esmond Ng, "Shared versus Local Memory in Parallel Sparse Matrix Computations", ACM SIGNUM Newsletter, Vol. 23, No. 2, pp. 9-13, 1988.

8. Alan George, Joseph Liu and Esmond Ng, "Communication Reduction in Parallel Sparse Cholesky Factorization", in Hypercube Multiprocessors, M. T. Heath (editor), SIAM Publications, pp. 576-586, 1987. pp. 31-94.

9. Alan George and Joseph W-H. Liu, "Compact Structural Representation of Sparse Cholesky, QR, and LU Factors", Computing Methods in Applied Science and Engineering VII, R. Glowinski and J-L Lions (Editors), Elsevier Science Publishers B. V. (North Holland), pp. 93-106, 1986.

10. Eleanor Chu and Alan George, "A Note on Estimating the Error in Gaussian Elimination Without Pivoting", ACM SIGNUM Newsletter, Vol. 20, No. 2, pp. 2-7, 1985.

11. Alan George and Esmond Ng, "A New Release of SPARSPAK: The Waterloo Sparse Linear Equations Package", ACM SIGNUM Newsletter, Vol. 19, No. 4, pp. 9-13, 1984.

12. Alan George and Esmond Ng, "A Package for Solving Large Sparse Linear Least Squares Problems", Computer Science & Statistics: 15th Symposium on the Interface, J. E. Gentle (editor), North-Holland, pp. 140-147, 1983.

13. Alan George and Esmond Ng, "A Brief Description of SPARSPAK: The Waterloo Sparse Linear Equations Package", ACM SIGNUM Newsletter, Vol. 16, No. 2, pp. 17-20, 1981.

14. J.A. George, G.H. Golub, M.T. Heath and R.J. Plemmons, "Least Squares Adjustment of Large-Scale Geodetic Networks by Orthogonal Decomposition", Proc. Symposium on Geodetic Networks and Computations, Munich, August 30-September 4, 1981.

15. Alan George and Hamza Rashwan, "Input/Output Traffic Analysis of an Auxiliary Storage Scheme for Solving Finite Element Systems", Proc. Fifth International Symposium on Computing Methods in Applied Sciences and Engineering, INRIA, Versailles, France, December 14-18, 1981.

16. Alan George, "Direct Solution of Sparse Positive Definite Systems: Some Basic Ideas and Open Problems", Proc. IMA Conference on Sparse Matrices and their Uses, Reading, England, July 9-11, 1980.

17. Alan George, "Direct Methods for the Solution of Large Sparse Systems of Linear Equations" Part 1 - SIAM News 13 No. 3, June, 1980. Part 2 - SIAM News 13 No. 4, September, 1980.

18. Alan George and Joseph W-H. Liu, "Finding Diagonal Block Envelopes of Triangular Factors of Partitioned Matrices", Proc. 10th Manitoba Conference on Numerical Analysis and Computing, October 1-4, 1980.

19. Alan George and Esmond Ng, "A Comparison of Some Methods for Solving Sparse Linear Least Squares Problems", Proc. 10th Manitoba Conference on Numerical Analysis and Computing, October 1-4, 1980.

20. S. Eisenstat, J.A. George, R. Grimes, D. Kincaid, and A. Sherman, "Some Comparisons of Software Packages for Large Sparse Linear Systems", Proceedings Third IMACS International Symposium on Computer Methods for Partial Differential Equations, Lehigh University, June 20-22, 1979.

21. Alan George and Hamza Rashwan, "On Symbolic Factorization of Partitioned Sparse Symmetric Matrices", Proc. 9th Manitoba Conference on Numerical Mathematics, University of Manitoba, Sept. 27-29, 1979.

22. Alan George, "An Automatic One-Way Dissection Algorithm for Irregular Finite Element Problems", Proc. 1977 Dundee Conference on Numerical Analysis, Lecture Notes in Mathematics #630, Springer Verlag, 1978, pp. 76-89.

23. Alan George and Joseph W-H. Liu, "A Quotient Graph Model for Symmetric Factorization", in *Sparse Matrix Proceedings 1978*, edited by Iain S. Duff and G.W. Stewart, SIAM Publications, 1978, pp. 154-175.

24. Alan George and Joseph W-H. Liu, "A Fast Implementation of the Minimum Degree Algorithm using Quotient Graphs", Proc. 8th Manitoba Conference on Numerical Mathematics, University of Manitoba, Sept. 28 - 30, 1978, pp. 217-250.

25. Alan George and David R. McIntrye, "On the Application of the Minimum Degree Algorithm to Finite Element Systems", in *Mathematical Aspects of Finite Element Methods*, Lecture Notes in Mathematics #606, Springer Verlag, 1977, pp. 122-149.

26. Alan George and Joseph W-H. Liu, "An Algorithm for Automatic Nested Dissection and its Application to General Finite Element Problems", Proc. 6th Manitoba Conf. on Numerical Mathematics and Computing, University of Manitoba, Winnipeg, Sept. 30 - Oct. 2, 1976, pp. 59-94.

27. Alan George, "Sparse Matrix Aspects of the Finite Element Method", in *Computing Methods in Applied Science and Engineering*, Lecture Notes in Economics and Mathematical Systems #134, Springer Verlag 1976, pp. 3-22.

28. Garrett Birkhoff and Alan George, "Elimination by Nested Dissection", in *Complexity of Sequential and Parallel Algorithms*, (J.F. Traub, editor), Academic Press, N.Y., 1973, 221-269.

29. Alan George, "A Survey of Sparse Matrix Methods in the Direct Solution of Finite Element Equations", Proc. Summer Computer Simulation Conference, Montreal, Canada, July 17-19, 1973, pp. 15-20.

30. Alan George, "An Efficient Band-Oriented Scheme for Solving n by n Grid Problems", Proc. 1972 Fall Joint Computer Conference, AFIPS Press, 210 Summit Ave., Montvale, N.J., Dec. 1972, pp. 1317-1320.

31. Alan George, "Block Elimination on Finite Element Systems of Equations", in *Sparse Matrices and Their Applications* (D.J. Rose and R.A. Willoughby, eds.), Plenum Press, N.Y., 1972

NOTE: The extent of the refereeing for the conference articles listed on pages 12–14 varies widely. Entries 14, 21, 23, 24 and 25 are preliminary or abbreviated versions of papers that were subsequently revised and extended, and then appeared as journal articles listed on pages 7–11.

ARTICLES UNDER REVIEW:

1. Alan George and Khakim Ikramov, "Block LU Factorization is Stable for Block Matrices whose Inverses are Block Diagonally Dominant", submitted to Mathematics of Computation.

2. Alan George and Khakim Ikramov, "On the Growth Factor for Gaussian Elimination for Matrices with Sharp Angular Field of Values", submitted to Mathematics of Computation.

TECHNICAL MANUALS (Mathematical Software Development)

1. Alan George and Esmond Ng, "The Design and Implementation of a Package for Sparse Constrained Least Squares Problems", Report CS-85-39, Department of Computer Science, University of Waterloo, 1985.

2. Eleanor Chu, Alan George, Joseph Liu, and Esmond Ng, "SPARSPAK: Waterloo Sparse Matrix Package - User's Guide for SPARSPAK-A", Report CS-84-36, Department of Computer Science, University of Waterloo, 1984.

3. Alan George and Esmond Ng, "SPARSPAK: Waterloo Sparse Matrix Package - User's Guide for SPARSPAK-B", Report CS-84-37, Department of Computer Science, University of Waterloo, 1984.

4. Alan George, "User Guide for Sparspak-90: A Fortran-90 Version of SPARSPAK, The Waterloo Sparse Matrix Package", July, 2000, 46 pages.

The documents listed above are user guides and implementation manuals for software packages developed by Alan George and his students. These packages are designed to solve a wide array of sparse matrix problems in numerical linear algebra, and employ state-of-the-art algorithms and software technology. The packages have been distributed under license by the University of Waterloo to approximately 150 companies, government agencies, and educational institutions around the world.

The package has been completely re-implemented in the past three years in Fortran-90. Modern programming languages such as Fortran-90 have important features that facilitate the design of flexible and "user-friendly" interfaces for software packages. These features include dynamic storage allocation, function name overloading, user-defined data types, and the ability to hide functions and data from the user. A new version of SPARSPAK called SPARSPAK-90 has been implemented in Fortran-90. A comprehensive guide describing the interface and features of the new package has been written. A system for automatically creating web-based documentation from the source code (in the spirit of javadoc) has also been developed.

INVITED SPEAKER AT THE FOLLOWING CONFERENCES/EVENTS:

1. Speaker, Distinguished Lecture Series, Institute for Scientific Computing, ETH, Zurich, Switzerland, Dec. 8, 1997.
2. Invited Lecturer, NATO Advanced Study Institute: *Algorithms for Large Scale Linear Algebraic Systems: State of the Art and Applications in Science and Engineering*, University of Gran Canaria, Spain, June 23-July 5, 1996 (4 lectures).
3. Speaker, Distinguished Lecture Series, Department of Computer Science, University of Illinois, Nov. 6, 1995
4. Speaker, Distinguished Lecture Series, Department of Computer Science, University of Toronto, Oct. 17, 1995.
5. Invited speaker, Workshop on Direct Methods for Sparse Systems, Linear Algebra Year at CERFACS[2], Toulouse, France, September 25-29, 1995.
6. Keynote speaker, Southern Ontario Numerical Analysis Symposium, May 12, 1995
7. Distinguished Alumni Lecture, Department of Computer Science, University of Alberta, September 30, 1991.
8. Distinguished Lecturer, 10th Anniversary Celebration of the Founding of the Computer Science Department, University of Victoria, July 30-31, 1991, (two lectures).
9. First European Workshop on Hypercube and Distributed Computers, Rennes, France, Oct. 4-6, 1989.
10. International Conference on Computing and Information, McMaster University, Hamilton, Ontario, Canada, April 23-29, 1989 (keynote speaker).
11. Conference on Numerical Linear Algebra and Parallel Computation, Oberwolfach, Germany, February 28 - March 5, 1988.
12. Southeastern Section Meeting, American Mathematical Society, Knoxville, Tennessee (hour address), March 25-6, 1988.
13. Conference on Sparse Matrix Techniques and Parallel Computation, CERFACS, Toulouse, France, April 12-14, 1988 (2 lectures).
14. Workshop on Supercomputers and Large-Scale Optimization: Algorithms, Software and Applications, University of Minnesota, Minneapolis, MN, May 16-18, 1988.
15. SIAM Conference on Applied Linear Algebra, Madison, Wisconsin, May 22-26, 1988.
16. IMA Conference on the Applications of Matrix Theory, University of Bradford, England, July 5-8, 1988.

[2] European Centre for Supercomputing

17. Workshop on Solving Large Sparse Systems, Special Year on Numerical Linear Algebra, Oak Ridge National Laboratory, September 1987 – June 1988 (10 lectures).
18. Workshop on Scientific Computing Using Parallel Architectures, Institute for Advanced Computer Studies, University of Maryland, April 6-8, 1987.
19. SERC Numerical Analysis Summer School, University of Lancaster, England, July 12-31, 1987 (10 lectures).
20. Gatlinburg X, Symposium on Numerical Algebra, held at Fairfield Glade, Tennessee, October 19-23, 1987.
21. International Conference on Vector and Parallel Computing - Issues in Applied Research and Development, Loen, Norway, June 2-6, 1986. (Sponsored by Chr. Michelsen Institute and SIAM/SIAG on Supercomputing.)
22. International Conference on Modern Problems in Numerical Analysis, USSR Academy of Sciences, Moscow, Sept. 15-17, 1986.
23. George and Sandra Forsythe Memorial Lectures, Stanford University, January 28-31, 1985.
24. Seventh International Conference on Computing Methods in Applied Science and Engineering, Versailles, France, December 9-13, 1985.
25. Computer Science and Statistics: 15th Symposium on the Interface, Houston, Texas, March 17-18, 1983.
26. SIAM Regional Conference, Clemson University, March 25-26, 1983.
27. Seminar on Numerical Analysis, University of Toronto, July 5-16, 1982. Sponsored by the Canadian Mathematics Society (4 lectures).
28. Workshop on Numerical Methods, Universidad Central de Venezuela, Caracas, Venezuela, June 8-13, 1982.
29. Conference on the Applications of Linear Algebra, University of Alberta, Edmonton, Alberta, June 21-22, 1982. Sponsored by the Canadian Applied Mathematics Society.
30. SIAM 30th Anniversary Meeting, Stanford University, July 19-23, 1982. (G.E. Forsythe Memorial Lecture).
31. Gatlinburg VIII, Symposium on Numerical Algebra, Oxford University, England, July 5-11, 1981.
32. Fifth International Symposium on Computing Methods in Engineering and Applied Science, INRIA, Le Chesnay, France, December 14-18, 1981.
33. IMA Conference on Sparse Matrices and Their Uses, University of Reading, England, July 9-11, 1980.
34. Canadian Numerical Analysis Seminar, University of British Columbia, May 8-9, 1978.
35. Dundee Conference on Numerical Analysis, The University of Dundee, Scotland, June 28-July 1, 1977.
36. Gatlinburg VII, Symposium on Numerical Algebra, Asilomar, California, Dec. 12-17, 1977 (invitee).

37. Course in Advanced Sparse Matrix Techniques, Institute for Numerical Analysis, Technical University of Denmark, Lyngby, Denmark, Aug. 9-12, 1976 (4 lectures).

38. Conference on Numerical Mathematics and Computing, University of Manitoba, Winnipeg, Sept. 20 - Oct. 2, 1976.

39. Symposium on Finite Element Methods, Brunel University, England, June18-20, 1975.

40. Symposium on Sparse Matrix Computations, Argonne National Lab., Chicago, Illinois, Sept. 9-11, 1975.

41. Conference on the Mathematical Aspects of the Finite Element Methods, Instituto per de Applicazioni del Calcolo, Rome, Italy, Dec. 10-12, 1975.

42. Second International Symposium on Computing Methods in Applied Science and Engineering, IRIA, Le Chesnay, France, Dec. 15-19, 1975.

43. Gatlinburg VI, Symposium on Numerical Algebra, Munich, West Germany, Dec. 15-22, 1974 (invitee).

44. SIAM National Meeting (Symposium on Computation Problems in Partial Differential Equations). NASA-Langley Research Center, Hampton, Virginia, June 18-21, 1973.

45. 1973 Summer Computer Simulation Conference, Montreal, Quebec, July 17-19, 1973.

46. NATO Advanced Study Institute, Numerical Solution of Partial Differential Equations, Institut for Atomenergi, Kjeller, Norway, August 1973 (discussion leader).

47. Gatlinburg V. Symposium on Numerical Algebra, Los Alamos, N.M., June 1972.

48. 1972 Fall Joint Computer Conference, Anaheim, California, December, 1972.

49. Symposium on Sparse Matrices and their Applications, IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y., Sept., 1971.