

SHORT VITA
Frank J. Hall
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Education

- Ph.D. North Carolina State University, Raleigh
 North Carolina, December, 1973
- M.S. University of Houston, August, 1967
- B.A. St. Mary's University, San Antonio, Texas, May, 1965

Professional Experience

- 1988-Present Professor of Mathematics,
 Georgia State University
- 1982-1988 Associate Professor of Mathematics,
 Georgia State University
- 1978-1982 Assistant Professor of Mathematics,
 Georgia State University
- 1974-1978 Assistant Professor, Pembroke State University,
 North Carolina
- 1973-1974 Instructor, North Carolina State University
- 1970-1973 Teaching Assistant, North Carolina State University
- 1969-1970 Mathematics Instructor, Kaduna Polytechnic, Kaduna Nigeria,
 as member of the United States Peace Corps
- 1967-1968 Teaching Assistant, University of Houston

Scholarship:**Publications**

1. Generalized inverses of the fundamental bordered matrix used in linear estimation, Sankhya, 37A(1975), 428-438, with C.D. Meyer, Jr.

2. Generalized inverses of a bordered matrix of operators, *SIAM J. Appl. Math.*, 29(1975), 152-163.
3. On the independence of blocks of generalized inverses of bordered matrices, *Lin. Alg. and Appl.*, 14(1976), 53-61.
4. Further results on generalized inverses of partitioned matrices, *SIAM J. Appl. Math.*, 30(1976), 617-624, with R.E. Hartwig.
5. On general bordered matrices, *Bull. of the Calcutta Math. Soc.*, 70(1978), 395-403.
6. Pseudo-similarity for matrices over a field, *Proc. of Amer. Math. Soc.*, 71(1978), 6-10, with R.E. Hartwig.
7. A note on Pseudo-similarity of matrices, *The Journal of the Industrial Math. Soc.*, 28(1978), 25-36, with R.E. Hartwig and I.J. Katz.
8. Further results on integral generalized inverses of integral matrices, *Lin. and Multilinear Alg.*, 6(1978), 233-241, with D.R. Batigne and I.J. Katz.
9. The Moore-Penrose inverse of particular bordered matrices, *The Journal of the Australian Math. Soc.*, 27(1979), 467-478.
10. On ranks of integral generalized inverses of integral matrices, *Lin. and Multilinear Alg.*, 7(1979), 73-85, with I.J. Katz.
11. More on integral generalized inverses of integral matrices, *Lin. and Multilinear Alg.*, 9(1980), 201-209, with I.J. Katz.
12. Algebraic properties of governing matrices used in Cesaro-Neumann iterations, *Revue Roumaine de Mathematiques*, 26(1981), 959-978, with R.E. Hartwig.
13. Nonnegative integral generalized inverses, *Lin. Alg. and Appl.*, 39(1981), 23-39, with I.J. Katz.
14. Integer generalized inverses of incidence matrices, *Lin. Alg. and Appl.*, 39(1981), 247-258, with J.H. Bevis and I.J. Katz.
15. Applications of the Drazin Inverse to Cesaro-Neumann iterations, in *Recent Applications of Generalized Inverses*, edited by S.L. Campbell, Pitman Advanced Publishing Program, No. 66, 1982, 145-195, with R.E. Hartwig.
16. Some classes of integral matrices, *Lin. Alg. and Appl.*, 48(1982), 473-483, with J.H. Bevis.

17. Pseudo-similarity and partial unit regularity, Czechoslovak Math. J., 33(1983), 361-372, with R.E. Hartwig, I. J. Katz and M. Newman.
18. Monotonicity of integral matrices, Math. Japonica, 28(1983), 501-508, with J.H. Bevis.
19. Block striped and block nested matrices, in Contemporary Mathematics, Linear Algebra and Its Role in Systems Theory, edited by R.A. Brualdi, et al, Amer. Math. Soc., Vol. 47, 1985, 177-201, with R.E. Hartwig and I.J. Katz.
20. Pseudo-consimilarity and semi-consimilarity of complex matrices, Lin. Alg. and Appl., 90 (1987), 73-80, with J.H. Bevis and R.E. Hartwig.
21. Consimilarity and the matrix equation $AX-XB=C$, in Current Trends In Matrix Theory, edited by F. Uhlig and R. Grone, North-Holland, 1987, 51-64, with J.H. Bevis and R.E. Hartwig.
22. The Drazin inverse of a semi-linear transformation and its matrix representation, Lin. Alg. and Appl., 97 (1987), 229-242, with J.H. Bevis and R.E. Hartwig.
23. The matrix equation $AX-XB=C$ and its special cases, SIAM J. Matrix Anal. Appl., 9(1988), 348-359, with J.H. Bevis and R.E. Hartwig.
24. Conpseudosimilarity and consemsimilarity over a division ring, Lin. Alg. and Appl., 136 (1990), 181-188, with J.H. Bevis and R.E. Hartwig.
25. Integer LU- Factorizations, Lin. Alg. and Appl., 150 (1991), 267-285, with J.H. Bevis.
26. LDL^T - factorizations of adjacency matrices where D is block diagonal, Lin. Alg. and Appl., V. 162-164 (1992), 651-662, with J.H. Bevis.
27. Nested range conditions for LU-factorizations of integer matrices, Lin. Alg. and Appl., 172(1992), 97-108, with J.H. Bevis.
28. Self-inverse sign patterns, in IMA Volumes in Mathematics and Its Applications, Vol. 50, 1993, 245-256, Springer-Verlag publisher, with C.A. Eschenbach and C.R. Johnson.
29. Eigenvalue frequency and consistent sign pattern matrices, Czechoslovak Mathematical Journal, 44(1994), 461-479, with C.A. Eschenbach and Z. Li.
30. Sign pattern matrices and generalized inverses, Lin. Alg. and Appl., 211(1994), 53-66, with C.A. Eschenbach and Z. Li.
31. On the period and base of a sign pattern matrix, Lin. Alg. and Appl., v. 212-213(1994), 101-120, with C.A. Eschenbach and Z. Li.

32. The structure of nonnegative cyclic matrices, *Lin. and Multilinear Alg.*, 41(1996), 23-33, with C.A. Eschenbach and Z. Li.
33. Some sign patterns that allow a real inverse pair B and B^{-1} , *Lin. Alg. and Appl.*, 252(1997), 299-321, with C.A. Eschenbach and Z. Li.
34. Sign patterns of nonnegative normal matrices, *Lin. Alg. and Appl.*, 254(1997), 335-354, with Z. Li, and F. Zhang.
35. The graphs of the unambiguous entries in the product of two (+,-) sign pattern matrices, *Lin. Alg. and Appl.*, 260(1997), 95-118, with C.A. Eschenbach, Z. Li, and C.R. Johnson.
36. From real to complex sign pattern matrices, *The Bulletin of the Australian Mathematical Society*, 57(1998), 159-172, with C.A. Eschenbach and Z. Li.
37. When does the inverse have the same sign pattern as the transpose?, *Czechoslovak Mathematical Journal*, 49(124)(1999), 255-275, with C.A. Eschenbach, D. Harrell, and Z. Li.
38. Sign patterns of idempotent matrices, *Journal of Korean Mathematical Society*, 36(1999), 469-487, with Z. Li.
39. Eigenvalue distribution of certain ray patterns, *Czechoslovak Mathematical Journal*, 50(125)(2000), 749-762, with C.A. Eschenbach and Z. Li.
40. On almost regular tournament matrices, *Lin. Alg. and Appl.*, 306(2000), 103-121, with J. Weaver et al.
41. Properties of tournaments among well matched players, *The American Mathematical Monthly*, 107(2000), 881-892, with J. Weaver et al.
42. Isomorphisms involving reversing arcs of digraphs, *The Journal of Combinatorial Mathematics and Combinatorial Computing*, 36(2001), 155-160, with G.Chen, A. Kezdy, Z. Li, and H. Zhou.
43. Symmetric sign pattern matrices that require unique inertia, *Lin. Alg. and Appl.*, 338(2001), 153-169, with Z. Li and D. Wang.
44. Inertia sets of symmetric sign pattern matrices, *Numerical Math. J. of Chinese Universities*, 10(2001), 226-240, with Z. Li.
45. Irreducible powerful ray pattern matrices, *Lin. Alg. and Appl.*, 342(2002), 47-58, with Z. Li and J. Stuart.
46. On ranks of matrices associated with trees, *Graphs and Combinatorics*, 19(2003), 323-334, with G. Chen, Z. Li, and B. Wei.

47. Sign patterns, inverses, and generalized inverses – a brief survey, Numerical Math. J. of Chinese Universities, 12(Supplement) (2003), 8-11, with Z. Li.
48. On ranks of matrices associated with trees, Numerical Math. J. of Chinese Universities, 12(Supplement) (2003), 76-79, with Z. Li.
49. From Boolean to sign pattern matrices, Lin. Alg. and Appl., 393(2004), 233-251, with Z. Li and B. Rao.
50. An interlacing result for Normalized Laplacians, SIAM J. on Discrete Mathematics, 18(2004), 353-361, with G. Chen et al.
51. Reducible powerful ray pattern matrices, Lin. Alg. and Appl., 399(2005), 125-140, with Z. Li and J. Stuart.
52. Rational realizations of the minimum rank of a sign pattern matrix, Lin. Alg. and Appl., 409(2005), 111-125, with M. Arav, S. Koyuncu, Z. Li, and B. Rao.
53. Sign pattern matrices, in the Handbook of Linear Algebra, published by Chapman & Hall/CRC, Chapter 33 (invited), 2007, with Z. Li.
54. Inherited LU-factorizations, Lin. Alg. and Appl., 427(2007), 26-41, with M. Arav and J. Bevis.
55. A Cauchy-Schwarz inequality for triples of vectors, Mathematical Inequalities and Applications journal, 11(2008), 629-634, with M. Arav and Z. Li.
56. Interlacing results on matrices associated with graphs, The Journal of Combinatorial Mathematics and Combinatorial Computing, 68(2009), 113-127, with K. Patel and M. Stewart.
57. Sign patterns that require almost unique rank, Lin. Alg. and Appl., 430(2009), 7-16, with M. Arav, Z. Li, A. Merid, and Y. Gao.
58. Rational solutions of certain matrix equations, Lin. Alg. and Appl., 430(2009), 660-663, with M. Arav, Z. Li, and B. Rao.
59. ZPC matrices and zero cycles, International Journal of Combinatorics, (2009), Article ID 520923, 5 pages, with M. Arav, Z. Li, and B. Rao.
60. Sign patterns that allow eventual positivity, Electronic Journal of Linear Algebra, 19(2010), 108-120, with A. Berman et al. (rigorously refereed)
61. Spectrally arbitrary tree sign patterns of order 4, Electronic Journal of Linear Algebra,

- 20(2010), 180-197, with M. Arav, K. Kaphle, Z. Li, and N. Manzagol. (rigorously refereed)
62. Some inheritance properties for complementary basic matrices, *Lin. Alg. and Appl.*, 433(2010), 2060-2069, with M. Fiedler.
 63. G-matrices, *Lin. Alg. and Appl.*, 436(2012), 731-741, with M. Fiedler.
 64. A note on permanents and generalized complementary basic matrices, *Lin. Alg. and Appl.*, 436(2012), 3553-3569, with M. Fiedler.
 65. Gersgorin discs revisited, *Lin. Alg. and Appl.*, 438(2013), 598-603, with M. Fiedler and R. Marsli.
 66. Geometric multiplicities and Gersgorin discs, *The American Mathematical Monthly*, 120 (2013), 452-455, with R. Marsli.
 67. Sign patterns with minimum rank 2 and upper bounds on minimum ranks, to appear in *Linear and Multilinear Algebra*, with Z. Li, Y. Gao, M. Arav, F. Gong, W. Gao, and H. van der Holst.
 68. Sign pattern matrices, in the *Handbook of Linear Algebra*, 2nd edition, published by Chapman & Hall/CRC, Chapter 42 (invited), 2013, with Z. Li.
 69. Some graph theoretic properties of generalized complementary basic matrices, *Lin. Alg. and Appl.*, 438(2013), 3365-3374, with M. Fiedler.
 70. Permanents, determinants, and generalized complementary basic matrices, to appear in *Operators and Matrices*, with M. Fiedler and M. Stroeve.
 71. Combinatorial aspects of generalized complementary basic matrices, to appear in the *Central European Journal of Mathematics*, with M. Fiedler.
 72. Further results on Gersgorin discs, *Lin. Alg. and Appl.*, 439(2013), 189-195, with R. Marsli.
 73. The inertia set of a signed graph, to appear in *Lin. Alg. and Appl.*, with M. Arav, Z. Li and H. van der Holst.
 74. A graph minors characterization of signed graphs whose Colin de Verdiere parameter is two, submitted to *J. of Comb.Theory B*, with M. Arav, Z. Li, and H. van der Holst.

Articles 37, 43, 50, 52, 56, 57, 60, 61, 65, 66, 67, 70, 72 were published with students.

The articles with M. Fiedler originated from research done as a result of F. Hall's Fulbright Award.

Professional Service

On the Editorial Boards of the Czech Mathematics Journal, the Central European Journal of Mathematics, the Journal of Advanced Research in Pure Mathematics, and the JP Journal of Algebra, Number Theory and Applications.

Reviewer for Mathematical Reviews, National Science Foundation, and Fulbright.

Referee for SIAM Journal on Algebraic and Discrete Methods, SIAM Journal on Mathematical Analysis, Canadian Mathematical Bulletin, Linear Algebra and Its Applications Journal, Houston Journal of Mathematics, Linear and Multilinear Algebra Journal, Compositio Mathematica, American Mathematical Monthly, Rocky Mountain Journal of Mathematics, Electronic Journal of Linear Algebra, Journal of Algebra and Number Theory and Applications, Proceedings of the American Mathematical Society, Mathematical Programming B Journal, International Journal of Systems and Information Systems, Czech Mathematical Journal, Ars Combinatoria, Matrices and Operators, Journal of Applied Mathematics.

Co-chair of the Fifth International Linear Algebra Society Conference held at Georgia State University, August 16-19, 1995. Also chair of the Local Arrangements Committee. This highly successful conference had approximately 200 participants from 26 countries and was supported by a number of grants.

Special editor for the Linear Algebra and Applications journal for the Fifth International Linear Algebra Society Conference proceedings (refereed). Also co-authored the conference report.

Member of Committee on Arrangements for the joint AMS-MAA 1988 Annual Meeting, January, Atlanta, GA.

Co-Organizer and Co-Chair of the Special Session "Modern Trends in matrix analysis and applications" at the joint AMS-MAA 1988 Annual Meeting.

Co-Organizer of the NSF/CBMS sponsored conference "Qualitative and Structured Matrix Theory", August 19-24, 1991 at Georgia State University.

Co-Organizer and Co-Chair of the four part Special Session "Linear Algebra and Matrix Theory" at the joint AMS-MAA Sectional Meeting, March 8-10, 2002 at Georgia Tech.

Co-Organizer of the Special Session "Sign Pattern Matrices" at the 2013 ILAS meeting.

Masters Theses

The Drazin Inverse, Laurence Grodd, completed 3/81, thesis director.

The Inverse Transpose Problem, Deborah Harrell, completed 3/96, thesis committee.

Fisher's Linear Discriminant Analyses for Pairwise Correlated Data, Sharon Annan, completed 4/97, thesis committee.

Possible inertias of matrices with a specified sign pattern, Di Wang, completed 8/98, thesis committee.

Some eigenvalue results for certain matrices associated with graphs, Kinnari Patel, completed 4/04, thesis co-director.

Minimum rank 2 sign pattern matrices, Emmanuel Des-Bordes, completed 4/04, thesis committee.

Characterization of bar visibility graphs with bounded lengths for trees, Ken Keating, completed 6/04, thesis committee.

Rational realizations of the minimum rank of a sign pattern matrix, Selcuk Koyuncu, completed 11/05, thesis co-director.

On some aspects of the differential operator, Panakkal Mathew, completed 5/06, thesis committee.

Spectrally arbitrary tree sign pattern matrices, Krishna Kaphle, completed 11/06, thesis committee.

Spectrally arbitrary and inertially arbitrary sign pattern matrices, Nilay Demir, completed 3/07, thesis director.

The square root function of a matrix, Crystal Gordon, completed 4/07, thesis co-director.

Singular value decomposition and principal component analysis in image processing, Wasuta Renkjunong, completed 6/07, thesis committee.

The exponential function of matrices, Nathalie Smalls, completed 11/07, thesis committee.

Sign patterns that require almost unique rank, Assefa Merid, completed 4/08, thesis co-director.

Intersections of longest paths and cycles, Thomas Hippchen, completed 4/08, thesis committee.

Riccati equations in optimal control theory, James Bellon, completed 4/08, thesis committee.

Singular value decomposition in image noise filtering and reconstruction, Tsegaselassie Workalemahu, completed 5/08, thesis committee.

Noetherian filtrations and finite intersection algebras, Sara Malec, completed 7/08, thesis committee.

Factorization of quasiseparable matrices, Paul Johnson, completed 11/08, thesis committee.

Examination of initialization techniques for nonnegative matrix factorization, John Frederic, completed 11/08, thesis committee.

Applications of linear algebra to information retrieval, Jhansi Vasireddy, completed 3/09, thesis director.

Method for improving the efficiency of image super-resolution algorithms based on Kalman filters, William Dobson, completed 12/09, thesis committee.

On the 4 by 4 irreducible sign pattern matrices that require four distinct eigenvalues, Paul Kim, completed 7/11, thesis co-director.

Geometric multiplicities and Gersgorin discs, Rachid Marsli, completed 11/12, thesis director.

The topology and algebraic functions on affine algebraic sets over an arbitrary field, Anthony Preslicka, completed 11/12, thesis committee.

Leslie Matrices, Darci Chambers, to be completed 2013, thesis director.

PhD Theses: Generalized complementary basic matrices, Mike Stroeve, dissertation director.
Miniversal deformations, Rachid Marsli, dissertation director.
On the intersection algebra of principal ideals, Sarah Malec, completed 6/13, dissertation committee.

Masters Research Papers

Irreducible normalized maximal SNS patterns, Kim Hunter, completed 8/98, director.

Sign pattern matrices that require exactly two real eigenvalues, Eugenia Rubinshtein, completed 6/98, reader.

Sign pattern matrices that require distinct eigenvalues, Laura Harris, completed 12/98, reader.

Applications of algebra in coding theory, Chris Smith, completed 8/2000, reader.