

# Michele Benzi

## Personal:

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- Place of birth: Bologna, Italy
- Citizenship: Italian; US Permanent Resident

## Education:

- Ph.D. Mathematics, North Carolina State University, 1993.
- M.S. Mathematics, North Carolina State University, 1991.
- Laurea Mathematics, University of Bologna, 1987 (*summa cum laude*).

**Doctoral Dissertation:** A Direct Row-Projection Method for Sparse Linear Systems, October 1993. Carl D. Meyer, advisor.

## Research Interests:

Numerical Linear Algebra, Sparse Matrix Computations, Iterative Methods for Systems of Linear Equations, Preconditioning Techniques, Algebraic Multilevel Methods, Computational Fluid Dynamics, Numerical Methods for Markov Chains, Parallel Scientific Computing, Scientific and Engineering Applications of Matrix Theory, History of Mathematics and Computing.

## Positions Held:

- 8/00-present **Full Professor**, 2006–present;  
**Winship Distinguished Research Professor**, 2003–2006;  
**Associate Professor**, 2000–2006;  
Department of Mathematics and Computer Science  
Emory University  
Atlanta, Georgia, USA
- 7/98-7/00 **Technical Staff Member**  
Computer Research and Applications Group (CIC-3)  
Los Alamos National Laboratory  
Los Alamos, New Mexico, USA
- 7/97-6/98 **Post-Doctoral Fellow (Director-Funded)**  
Scientific Computing Group (CIC-19)  
Los Alamos National Laboratory  
Los Alamos, New Mexico, USA

- 1/96-6/97      **Post-Doctoral Researcher**  
Parallel Algorithms Group  
Centre Européen de Recherche et de Formation Avancée  
en Calcul Scientifique (CERFACS)  
Toulouse, France
- 6/93-9/96      **Researcher**  
Department of Mathematics  
University of Bologna, Italy
- 8/92-4/93      **Research and Teaching Assistant**  
Supported by the U.S. National Science Foundation.  
Department of Mathematics,  
North Carolina State University, Raleigh, NC, USA

### Teaching Experience:

Undergraduate: Finite Mathematics, including Discrete Probability, Finite Markov Chains, and Linear Programming at North Carolina State University; Calculus, Linear Algebra, and Ordinary Differential Equations at the University of Bologna; Differential Equations, Numerical Analysis, Linear Algebra, History and Philosophy of Mathematics at Emory University. Graduate: Numerical Analysis I-II, Functional Analysis, Matrix Analysis, and Computational Science Case Studies (a special topics course) at Emory University.

### Grants:

- University Research Committee grant (“New Algorithms for Solving the Incompressible Navier–Stokes Equations”), April 2009 (US \$30,000).
- National Science Foundation grant DMS-0810862 (“Approximation of Matrix Functions: Theory, Algorithms, and Software”), 08/2008-07/2011 (US \$229,481).
- University Research Committee grant (“Parallel Algorithms and Software for Large-Scale Saddle Point Problems”), January 2006 (US \$28,500).
- National Science Foundation grant DMS-0511336 (“Scalable Iterative Solution of Large Linear Systems with Applications in Fluid Dynamics, Radiation Transport and Markov Chains”), 08/2005-07/2008 (US \$237,008).
- Two DOE grants in support of “The 2005 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Scientific and Industrial Applications”, totalling US \$14,000 (Spring 2005).
- National Science Foundation grant DMS-0435964 (“The 2005 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Scientific and Industrial Applications”), Emory University, Atlanta, GA, May 19–21 (US \$11,300).
- National Science Foundation grant DMS-0207599 (“Development, Analysis, and Implementation of Robust Algebraic Preconditioners for Sparse Linear Systems”), 8/2002-7/2005 (US \$138,200 + 15,710 supplement, total amount = US \$153,910).
- Computing, Information, and Communication Division (LANL) grant in support of the Conference on Linear Algebra: Theory, Applications and Computation held at Wake Forest University, Winston–Salem, NC, January 8–9, 1999 (US \$10,000).

- LDRD Exploratory Research grant on Multilevel Sparse Approximate Inverse Preconditioners (1998/99–2000/01), US \$175,000/year (co-PI with M. DeLong).
- Joint CNR - Czech Academy of Sciences grants to support exchanges with the Institute of Computer Science in Prague (1995).
- Travelling scholarships funded by the Italian National Research Council for the period 8/1989–7/1992 (net amount: US \$50,000).

### Honors and Awards:

- Outstanding referee, SIAM (Society for Industrial and Applied Mathematics), 2009.
- Member of the Householder Prize Committee (since June 2008).
- SIAM Visiting Lecturer, September 2006–present.
- Recipient with B. Uçar of the “Best Paper Award” presented at the *2006 Markov Anniversary Meeting* (Charleston, SC, June 12-14, 2006) for paper [48] (see publication list below).
- Recipient of the Winship Distinguished Research Professorship, Emory University, 2003–2006.
- SIAG/LA (SIAM Activity Group on Linear Algebra) speaker at the Tenth ILAS International Conference, Auburn, Alabama, June 10–13, 2002.
- Recipient with M. Tůma of the 2001 SIAM Outstanding Paper Prize for paper [16] (see publication list below).
- Director-Funded Postdoctoral Fellow, Los Alamos National Laboratory (July 1997 – June 1998).
- Winner of the \$3300 Winton-Rose Award for best PhD student, Department of Mathematics, North Carolina State University (May 1993).

### Research Papers:

- [1] M. Benzi, “Un Algoritmo Iterativo Parallelo per la Soluzione di Sistemi Lineari (A Parallel Iterative Algorithm for the Solution of Linear Systems),” *Atti Accad. Sc. Ist. Bologna*, XIV, 6 (1991), 35–41.
- [2] M. Benzi, “Solution of Equality-Constrained Quadratic Programming Problems by a Projection Iterative Method,” *Rend. Mat. Applic.*, VII, 13 (1993), 275–296.
- [3] M. Benzi and C. D. Meyer, “An Explicit Preconditioner for the Conjugate Gradient Method,” in J. D. Brown et al. (Eds.), *Proceedings of the Cornelius Lanczos International Centenary Conference*, SIAM, Philadelphia (1994), 294–296.
- [4] M. Benzi, F. Sgallari and G. Spaletta, “A Parallel Block Projection Method of the Cimmino Type for Finite Markov Chains,” in W. J. Stewart (Ed.), *Computations with Markov Chains: Proceedings of the Second International Workshop on the Numerical Solution of Markov Chains*, Kluwer Academic Publishers, Boston (1995), 65–80.
- [5] M. Benzi and T. Dayar, “The Arithmetic Mean Method for Finding the Stationary Vector of Markov Chains,” *Parallel Algorithms and Applications*, 6 (1995), 25–37.

- [6] M. Benzi and C. D. Meyer, “A Direct Projection Method for Sparse Linear Systems,” *SIAM J. Scientific Computing*, 16, 5 (1995), 1159–1176.
- [7] M. Benzi and M. Tũma, “A Comparison of Some Preconditioning Techniques for General Sparse Matrices,” in S. Margenov and P. Vassilevski (Eds.), *Iterative Methods in Linear Algebra, II*, IMACS Series in Computational and Applied Mathematics, Vol. 3, IMACS, New Brunswick, NJ (1996), 191–203.
- [8] M. Benzi, C. D. Meyer and M. Tũma, “A Sparse Approximate Inverse Preconditioner for the Conjugate Gradient Method,” *SIAM J. Scientific Computing*, 17, 5 (1996), 1135–1149.
- [9] M. Benzi and M. Tũma, “Preconditioning with Sparse Approximate Inverses,” in I. Marek (Ed.), *Proceedings of the XI Summer School on Software and Algorithms of Numerical Mathematics*, Źelezna Ruda, Czech Republic (1996), 5–16.
- [10] G. Spaletta, F. Sgallari, M. Benzi and R. Ansaloni, “A Block Cimmino Method for Finite Markov Chains on the Cray T3D,” in G. Erbacci and M. Voli (Eds.), *Science and Supercomputing at CINECA*, Bologna, Italy (1996), 512–518.
- [11] M. Benzi and M. Tũma, “Approximate Inverse Preconditioning for the Conjugate Gradient Method on a Vector Computer,” in K. Segeth (Ed.), *Proceedings of the Prague Mathematical Conference ‘96*, (1996), 29–34.
- [12] M. Benzi and D. B. Szyld, “Existence and Uniqueness of Splittings for Stationary Iterative Methods with Applications to Alternating Methods,” *Numerische Mathematik*, 76, 3 (1997), 309–321.
- [13] M. Benzi, “Remarks on the Numerical Solution of Certain Linear Complementarity Problems,” *J. Computational and Applied Mathematics*, 83 (1997), 137–143.
- [14] M. Benzi, H. Choi and D. B. Szyld, “Threshold Ordering for Preconditioning Nonsymmetric Problems,” in G. H. Golub, S. H. Lui, F. T. Luk, and R. J. Plemmons, *Proceedings of the Workshop on Scientific Computing, Hong Kong, 10–12 March, 1997*, Springer Verlag, Singapore (1997), 159–165.
- [15] G. Alleon, M. Benzi and L. Giraud, “Sparse Approximate Inverse Preconditioning for Dense Linear Systems Arising in Computational Electromagnetics,” *Numerical Algorithms*, 16, 1 (1997), 1–15.
- [16] M. Benzi and M. Tũma, “A Sparse Approximate Inverse Preconditioner for Nonsymmetric Linear Systems,” *SIAM J. Scientific Computing*, 19, 3 (1998), 968–994.
- [17] M. Benzi and M. Tũma, “Numerical Experiments with Two Approximate Inverse Preconditioners,” *BIT*, 38, 2 (1998), 234–241.
- [18] M. Benzi, D. B. Szyld and A. van Duin, “A Study of Different Orderings for Incomplete Factorization Preconditioning of Nonsymmetric Linear Systems,” *Proceedings of the World Congress on Computational Mechanics (Buenos Aires 1998)*, Centro Internac. Metodos Numer. Ing., Barcelona, 1998 [CD-ROM].
- [19] M. Benzi, R. Kouhia and M. Tũma, “An Assessment of Some Preconditioning Techniques in Shell Problems,” *Communications in Numerical Methods in Engineering*, 14 (1998), 897–906.

- [20] M. Benzi, J. Marín and M. Tũma, “Parallel Preconditioning with Factorized Sparse Approximate Inverses,” in B. Hendrickson et al., eds., *Proceedings of the Ninth SIAM Conference on Parallel Processing for Scientific Computing*, SIAM, Philadelphia, 1999 [CD-ROM, ISBN: 0-89871-435-4], 5 pages.
- [21] M. Benzi and M. Tũma, “A Comparative Study of Sparse Approximate Inverse Preconditioners,” *Applied Numerical Mathematics*, 30 (1999), 305–340.
- [22] M. Benzi, W. D. Joubert and G. Mateescu, “Numerical Experiments with Parallel Orderings for ILU Preconditioners,” *Electronic Transactions on Numerical Analysis*, 8 (1999), 88–114.
- [23] M. Benzi, D. B. Szyld and A. van Duin, “Orderings for Incomplete Factorization Preconditioning of Nonsymmetric Problems,” *SIAM J. Scientific Computing*, 20 (1999), 1652–1670.
- [24] M. Benzi and G. H. Golub, “Bounds for the Entries of Matrix Functions with Applications to Preconditioning,” *BIT*, 39 (1999), 417–438.
- [25] M. Benzi, W. D. Joubert and G. Mateescu, “Can Incomplete LU Factorizations Give Both Robust and Parallel Preconditioners?,” in D. R. Kincaid and A. C. Elster, eds., *Iterative Methods in Scientific Computation IV*, IMACS Series in Computational and Applied Mathematics vol. 5, IMACS, New Brunswick, NJ (1999), 155–166.
- [26] M. Benzi, J. Marín and M. Tũma, “A Two-Level Parallel Preconditioner Based on Sparse Approximate Inverses,” in D. R. Kincaid and A. C. Elster, eds., *Iterative Methods in Scientific Computation IV*, IMACS Series in Computational and Applied Mathematics vol. 5, IMACS, New Brunswick, NJ (1999), 167–178.
- [27] M. Benzi and M. Tũma, “Orderings for Factorized Sparse Approximate Inverse Preconditioners,” *SIAM J. Scientific Computing*, 21 (2000), 1851–1868.
- [28] M. Benzi and M. A. DeLong, “Approximate Schur Complement Multilevel Methods for General Sparse Systems,” in E. Dick, K. Riemsdagh and J. Vierendeels, eds., *Multigrid Methods VI. Proceedings of the Sixth European Multigrid Conference Held in Gent, Belgium, September 27-30, 1999*, Lecture Notes in Computational Science and Engineering, Springer-Verlag, New York and Berlin (2000), 52–58.
- [29] M. Benzi, R. Kouhia and M. Tũma, “On Some New Developments in Approximate Inverse Preconditioning,” in E. Oñate, G. Bugeba and B. Suárez, eds., *Proceedings of the European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2000)*, Barcelona, Spain (2000) [CD-ROM, ISBN: 84-89925-70-4], 11 pages.
- [30] M. Benzi, J. K. Cullum and M. Tũma, “Robust Approximate Inverse Preconditioning for the Conjugate Gradient Method,” *SIAM J. Scientific Computing*, 22 (2000), 1318–1332.
- [31] M. Benzi, J. C. Haws and M. Tũma, “Preconditioning Highly Indefinite and Nonsymmetric Matrices,” *SIAM J. Scientific Computing*, 22 (2000), 1333–1353.
- [32] M. Benzi, R. Kouhia and M. Tũma, “Stabilized and Block Approximate Inverse Preconditioners for Problems in Solid and Structural Mechanics,” *Computer Methods in Applied Mechanics and Engineering*, 190 (2001), 6533–6554.
- [33] M. Benzi, A. Frommer, R. Nabben and D. B. Szyld, “Algebraic Theory of Multiplicative Schwarz Methods,” *Numerische Mathematik*, 89 (2001), 605–639.

- [34] M. Benzi and M. Tũma, “A Parallel Solver for Large-Scale Markov Chains,” *Applied Numerical Mathematics*, 41 (2002), 135–153.
- [35] M. Benzi, “Preconditioning Techniques for Large Linear Systems: A Survey,” *J. Computational Physics*, 182 (2002), 418–477 (invited survey paper).
- [36] J. S. Warsa, M. Benzi, T. Wareing and J. Morel, “Two-Level Preconditioning of a Discontinuous Galerkin Method for Radiation Diffusion,” in F. Brezzi, A. Buffa, S. Corsaro and A. Murli, eds., *Numerical Mathematics and Advanced Applications. Proceedings of ENUMATH 2001*, Springer-Verlag, New York and Berlin (2003), 967–978.
- [37] M. Benzi and M. Tũma, “A Robust Incomplete Factorization Preconditioner for Positive Definite Matrices,” *Numerical Linear Algebra with Applications*, 10 (2003), 385–400.
- [38] M. Benzi and D. Bertaccini, “Approximate Inverse Preconditioning for Shifted Linear Systems,” *BIT*, 43 (2003), 231–244.
- [39] M. Benzi and M. Tũma, “A Robust Preconditioner with Low Memory Requirements for Large Sparse Least Squares Problems,” *SIAM J. Scientific Computing*, 25 (2003), 499–512.
- [40] M. Benzi, M. J. Gander, and G. H. Golub, “Optimization of the Hermitian and Skew-Hermitian Splitting Iteration for Saddle-Point Problems,” *BIT*, 43 (2003), 881–900.
- [41] M. Benzi, “A Direct Projection Method for Markov Chains,” *Linear Algebra and its Applications*, 386 (2004), 27–49.
- [42] M. Benzi and G. H. Golub, “A Preconditioner for Generalized Saddle Point Problems,” *SIAM J. Matrix Analysis and Applications*, 26 (2004), 20–41.
- [43] M. Benzi, “HSS Preconditioning for the Oseen Problem,” in P. Neittaanmäki, T. Rossi, S. Kotorov, E. Oñate, J. Périaux, and D. Knörzer, eds., *Proceedings of the European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2004)*, Jyväskylä, Finland (2004) [CD-ROM], 8 pages.
- [44] J. S. Warsa, M. Benzi, T. Wareing and J. Morel, “Preconditioning a Mixed Discontinuous Finite Element Method for Radiation Diffusion,” *Numerical Linear Algebra with Applications*, 11 (2004), 795–811.
- [45] V. Simoncini and M. Benzi, “Spectral Properties of the Hermitian and Skew-Hermitian Splitting Preconditioner for Saddle Point Problems,” *SIAM J. Matrix Analysis and Applications*, 26 (2004), 377–389.
- [46] M. Benzi, G. H. Golub and J. Liesen, “Numerical Solution of Saddle Point Problems,” *Acta Numerica*, 14 (2005), 1–137 (invited survey paper).
- [47] M. Benzi and M. K. Ng, “Preconditioned Iterative Methods for Weighted Toeplitz Least Squares Problems,” *SIAM J. Matrix Analysis and Applications*, 27 (2006), 1106–1124.
- [48] M. Benzi and B. Uçar, “Product Preconditioning for Markov Chain Problems,” in A. N. Langville and W. J. Stewart, eds., *Proceedings of the 2006 Markov Anniversary Meeting (Charleston, SC, June 14–16, 2006)*, Boson Books, Raleigh, NC, 2006, 239–256.
- [49] M. Benzi and V. Simoncini, “On the Eigenvalues of a Class of Saddle Point Matrices,” *Numerische Mathematik*, 103 (2006), 173–196.

- [50] M. Benzi and M. A. Olshanskii, “An Augmented Lagrangian-Based Approach to the Oseen Problem,” *SIAM J. Scientific Computing*, 28 (2006), 2095–2113.
- [51] M. Noskov, M. Benzi, and M. D. Smooke, “An Implicit Compact Scheme Solver for Two-Dimensional Multicomponent Flows,” *Computers & Fluids*, 36 (2007), 376–397.
- [52] M. Benzi and N. Razouk, “On the Iwasawa Decomposition of a Symplectic Matrix,” *Applied Mathematics Letters*, 20 (2007), 260–265.
- [53] M. Benzi and B. Uçar, “Block Triangular Preconditioners for  $M$ -matrices and Markov Chains,” *Electronic Transactions on Numerical Analysis*, 26 (2007), 209–227.
- [54] M. Benzi and N. Razouk, “Decay Bounds and  $O(n)$  Algorithms for Approximating Functions of Sparse Matrices,” *Electronic Transactions on Numerical Analysis*, 28 (2007), 16–39. Special Volume in Honor of Gene H. Golub’s 75th Birthday.
- [55] M. Benzi and J. Liu, “Block Preconditioning for Saddle Point Systems with Indefinite (1,1) Block,” *International Journal of Computer Mathematics*, 84 (2007), 1117–1129. Special Issue on Fast and Preconditioned Iterative Methods for Linear and Nonlinear Systems.
- [56] M. Benzi and J. Liu, “An Efficient Solver for the Navier–Stokes Equations in Rotation Form,” *SIAM J. Scientific Computing*, 29 (2007), 1959–1981.
- [57] M. A. Olshanskii and M. Benzi, “An Augmented Lagrangian Approach to Linearized Problems in Hydrodynamic Stability,” *SIAM J. Scientific Computing*, 30 (2008), 1459–1473.
- [58] M. Benzi and D. Bertaccini, “Block Preconditioning of Real-valued Iterative Algorithms for Complex Linear Systems,” *IMA J. Numerical Analysis*, 28 (2008), 598–618.
- [59] M. Benzi and A. J. Wathen, “Some Preconditioning Techniques for Saddle Point Problems,” in W. Schilders, H. A. van der Vorst and J. Rommes, eds., *Model Order Reduction: Theory, Research Aspects and Applications*, Springer-Verlag (Series: Mathematics in Industry), 2008, 195–211.
- [60] M. Benzi, “Splittings of Symmetric Matrices and a Question of Ortega,” *Linear Algebra and its Applications*, 429 (2008), 2340–2343. Special Issue in Honor of Richard Varga.
- [61] S. Hamilton, M. Benzi, and J. Warsa, “Negative-Flux Fixups in Discontinuous Finite Element  $S_N$  Transport,” in *Proceedings of the 2009 International Conference on Mathematics, Computational Methods & Reactor Physics (M&C 2009)*, Saratoga Springs, NY, 2009 [CD-ROM; 10 pages].
- [62] M. Benzi, “A Generalization of the Hermitian and Skew-Hermitian Splitting Iteration,” *SIAM J. Matrix Analysis and Applications*, 31 (2009), 360–374.
- [63] M. Benzi, E. Haber, and L. Taralli, “Multilevel Algorithms for Large-Scale Interior Point Methods,” *SIAM J. Scientific Computing*, 31 (2009), 4152–4175.
- [64] M. Benzi, L. Ferragut, M. Pennacchio, and V. Simoncini, “Solution of Linear Systems from an Optimal Control Problem Arising in Wind Simulation,” *Numerical Linear Algebra with Applications*, published online November 2009, 21 pages.

- [65] C. Zhang and M. Benzi, “ $P$ -regular Splitting Iterative Methods for Non-Hermitian Positive Definite Linear Systems,” Technical Report TR-2009-014, Department of Mathematics and Computer Science, Emory University, April 2009. Revised August 2009 (15 pages). To appear in *Electronic Transactions on Numerical Analysis* (Special volume in Honor of Richard Varga).
- [66] M. Benzi, M. A. Olshanskii, and Z. Wang, “Modified Augmented Lagrangian Preconditioners for the Incompressible Navier–Stokes Equations,” Technical Report TR-2009-023, Department of Mathematics and Computer Science, Emory University, July 2009. Revised November 2009 (26 pages). To appear in *International Journal for Numerical Methods in Fluids*.
- [67] M. Benzi and X. Guo, “A Dimensional Split Preconditioner for Stokes and Linearized Navier–Stokes Equations,” Technical Report TR-2009-010, Department of Mathematics and Computer Science, Emory University, March 2009 (20 pages). Submitted to *Applied Numerical Mathematics*.
- [68] S. Hamilton, M. Benzi, and E. Haber, “New Multigrid Smoothers for the Oseen Problem,” Technical Report TR-2009-001, Department of Mathematics and Computer Science, Emory University, January 2009. Revised, November 2009 (18 pages). Submitted to *Numerical Linear Algebra with Applications*.
- [69] Z.-Z. Bai, M. Benzi, and F. Chen, “Modified HSS Iteration Methods for a Class of Complex Symmetric Linear Systems,” Technical Report TR-2009-021, Department of Mathematics and Computer Science, Emory University, July 2009 (18 pages). Submitted to *Computing*.
- [70] M. Benzi, E. Haber, and L. Taralli, “A Preconditioning Technique for a Class of PDE-Constrained Optimization Problems,” Technical Report TR-2009-027, Department of Mathematics and Computer Science, Emory University, October 2009 (20 pages). Submitted to *Advances in Computational Mathematics*.

### Other Published Work:

- M. Benzi, “Book Review: *The Story of Mathematics*, by L. Motz and J. H. Weaver,” *American Scientist*, 82 (1994), 490–491 .
- M. Benzi and C. C. Douglas, “ILAY Workshop on Iterative Methods,” *IEEE Computational Science and Engineering*, 3, 3 (1996), 84–86.
- M. Benzi and J. G. Nagy, “Dedication to Robert J. Plemmons,” *Linear Algebra and its Applications*, 316 (2000), 1–12.
- M. Benzi, “Computational Linear Algebra with Applications: Milovy, Czech Republic, 4–10 August 2002,” *IMAGE 29* (2002), 6–7.
- M. Benzi, “Gianfranco Cimmino’s Contributions to Numerical Mathematics,” *Atti del Seminario di Analisi Matematica*, Dipartimento di Matematica dell’Università di Bologna. Volume Speciale: Ciclo di Conferenze in Ricordo di Gianfranco Cimmino, Marzo-Maggio 2004, Tecno-print, Bologna (2005), 87–109.
- M. Benzi, L. Cvetković, and M. Neumann, “Preface,” *Numerical Algorithms*, 42 (2006), 205–206. Special issue in honor of Richard S. Varga.
- M. Benzi, “International Conference in Beijing Highlights Advances in Numerical Algebra and Scientific Computing,” *SIAM News*, 40(1), January-February 2007, 8.

M. Benzi, “Book Review: *Numerical Methods for Structured Markov Chains*, by D. A. Bini, G. Latouche, and B. Meini,” *SIAM Review*, 49(1) (2007), 131–133.

M. Benzi, M. Benzi and E. Seneta, “Francesco Paolo Cantelli”, *International Statistical Review*, 75(2) (2007), 127–130.

### Invited Research Presentations:

1. *University of Bergamo, Department of Mathematics Seminar*, May 27, 1993.
2. *XII Householder Symposium on Numerical Algebra*, UCLA Conference Center, Lake Arrowhead, CA, June 13-18, 1993.
3. *Cornelius Lanczos International Centenary Conference*, NCSU, Raleigh, NC, December 12-17, 1993.
4. *University of Pavia, Institute of Numerical Analysis of the CNR Seminar*, November 16, 1994.
5. *Second International Workshop on the Numerical Solution of Markov Chains*, Raleigh, NC, January 16-18, 1995.
6. *Oak Ridge National Laboratory, Mathematical Sciences Section Seminar*, April 17, 1995.
7. *Czech Academy of Sciences, Institute of Computer Science, Applied Linear Algebra Seminar*, May 16, 1995.
8. *Czech Academy of Sciences, Institute of Computer Science, Applied Linear Algebra Seminar*, October 10, 1995.
9. *Department of Computer Engineering and Information Science, Bilkent University, Ankara, Turkey*, May 27, 1996.
10. *XIII Householder Symposium on Numerical Algebra*, Pontresina, Switzerland, June 17, 1996.
11. *Second ECCOMAS Conference on Numerical Methods in Engineering*, Paris, France, September 11, 1996.
12. *Department of Computer Science, University of Tennessee, Knoxville, TN*, October 4, 1996.
13. *Los Alamos National Laboratory, CIC Division*, Los Alamos, NM, October 7, 1996.
14. *Two-day Italian Meeting on Computational Linear Algebra*, Pavia, Italy, March 4, 1997.
15. *Oberwolfach Conference on Numerical Linear Algebra and Scientific Computing*, Oberwolfach, Germany, April 18, 1997.
16. *Czech Academy of Sciences, Institute of Computer Science, Applied Linear Algebra Seminar*, June 10, 1997.
17. *US–Czech Workshop on Iterative Methods and Parallel Computing*, Milovy, Czech Republic, June 17, 1997.
18. *Lectures on Preconditioning Methods for Sparse Linear Systems, Short Course on Iterative Methods and Preconditioners*, Swiss Center for Scientific Computing, ETH-Zentrum, Zürich, Switzerland, October 16-17, 1997.

19. *Sixth SIAM Conference on Applied Linear Algebra*, Snowbird, Utah, October 30, 1997.
20. *Stanford University, Computer Science Department, Scientific Computing and Computational Mathematics Seminar*, November 17, 1997.
21. *Southern Methodist University, Mathematics Department Research Colloquium*, Dallas, TX, February 4, 1998.
22. *Copper Mountain Conference on Iterative Methods, Workshop on Sparse Approximate Inverses*, Copper Mountain, CO, March 31, 1998.
23. *Department of Computer Science, University of Tennessee*, Knoxville, TN, April 13, 1998.
24. *Oak Ridge National Laboratory, Mathematical Sciences Section Seminar*, April 15, 1998.
25. *Temple University, Mathematics Department Colloquium*, Philadelphia, PA, April 20, 1998.
26. *Department of Mathematics, University of New Mexico*, Albuquerque, NM, April 28, 1998.
27. *Oak Ridge National Laboratory, Mathematical Sciences Section Seminar*, November 20, 1998.
28. *Department of Nuclear Engineering, University of Bologna*, Seminar, December 9, 1998.
29. *Ninth SIAM Conference on Parallel Processing for Scientific Computing*, San Antonio, TX, March 22-24, 1999.
30. *1999 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Industrial Applications*, Minneapolis, Minnesota, June 10–12, 1999.
31. *XIV Householder Symposium on Numerical Algebra*, Whistler, BC, Canada, June 14–18, 1999.
32. *University of Pavia, Institute of Numerical Analysis of the CNR Seminar*, January 25, 2000.
33. *Department of Mathematics and Computer Science Colloquium, Emory University*, Atlanta, GA, February 17, 2000.
34. *Department of Computer Science Colloquium, Old Dominion University*, Norfolk, VA, February 21, 2000.
35. *Copper Mountain Conference on Iterative Methods, Section on Preconditioning*, Copper Mountain, CO, April 3, 2000.
36. *Applied and Numerical Mathematics Department, Sandia National Laboratory*, Albuquerque, NM, July 6, 2000.
37. *Department of Mathematics, University of Michigan*, Applied and Interdisciplinary Mathematics Seminar, Ann Arbor, Michigan, January 5, 2001.
38. *Department of Mathematics, Temple University*, Colloquium, Philadelphia, PA, March 26, 2001.
39. *2001 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems*, Tahoe City, CA, April 29-May 1, 2001. Plenary speaker.

40. *2001 European Numerical Mathematics Conference (ENUMATH 2001)*, Ischia, Italy, July 23-28, 2001.
41. *Department of Mathematics, University of Michigan*, special colloquium, Ann Arbor, Michigan, January 31, 2002.
42. *Meeting of the Southeastern Section of the Mathematical Association of America and the American Mathematical Society*, Special Session on Numerical Linear Algebra and its Applications, Atlanta, GA, March 8-10, 2002.
43. *Department of Mathematics, Georgia Institute of Technology*, CDSNS/ACE Lab Seminar, Atlanta, GA, March 19, 2002.
44. *X International Linear Algebra Society (ILAS) Conference*, Auburn, Alabama, 10-13 June 2002. Special SIAG/LA plenary lecture.
45. *XV Householder Symposium on Numerical Algebra*, Peebles, Scotland, 17-21 June 2002. Plenary speaker.
46. *Sparse Days at CERFACS 2002: Workshop on Preconditioning Large, Sparse Systems of Linear Equations*, Toulouse, France, 24-25 June 2002. Plenary speaker.
47. *Computational Linear Algebra with Applications*, Milovy, Czech Republic, 4-10 August 2002. Plenary speaker.
48. *Department of Mathematics and Computer Science Colloquium, Georgia Southern University*, Statesboro, GA, January 24, 2003.
49. *Southern Methodist University, Mathematics Department Research Colloquium*, Dallas, TX, April 25, 2003.
50. *International Conference on Industrial and Applied Mathematics (ICIAM 2003)*, Sydney, Australia, July 7-12, 2003. Invited minisymposium speaker.
51. *Eight SIAM Conference on Applied Linear Algebra*, Williamsburg, Virginia, July 15-19, 2003. Invited minisymposium speaker.
52. *University of Illinois, Computer Science Department Seminar*, Urbana, IL, September 5, 2003.
53. *Theoretical and Computational Aspects of Matrix Algorithms*, Dagstuhl Seminar, Schloss Dagstuhl, Germany, October 13-17, 2003.
54. *Symposium on Scientific Computing*, University of Hong Kong, January 12, 2004. Keynote speaker.
55. *Il Contributo di Gianfranco Cimmino al Calcolo Numerico*. Ciclo di conferenze in memoria di Gianfranco Cimmino, University of Bologna, May 2004. Plenary speaker.
56. *2004 SIAM Annual Meeting*, Portland, Oregon, July 12-16, 2004. Invited topical speaker.
57. *Fourth European Congress on Computational Methods in the Applied Sciences and Engineering (ECCOMAS 2004)*, Jyväskylä, Finland, July 24-28, 2004. Invited minisymposium speaker.

58. *Workshop on Structured Numerical Linear Algebra Problems: Algorithms and Applications*, Cortona, Italy, September 19-24, 2004. Plenary speaker.
59. *Temple University, Mathematics Department Colloquium*, Philadelphia, PA, November 22, 2004.
60. *University of Cagliari, Mathematics Department Seminar*, Cagliari, Italy, February 16, 2005.
61. *Purdue University, Computing Research Institute Seminar Series*, West Lafayette, IN, March 4, 2005.
62. *Louisiana State University, Center for Computation and Technology, "Computing the Future" Lecture Series*, Baton Rouge, LA, April 1, 2005.
63. *Auburn University, Mathematics Department, SIAM Lecturer Series*, Auburn, AL, April 11, 2005.
64. *XVI Householder Symposium*, Seven Springs Resort, PA, 23–27 May, 2005. Plenary speaker.
65. *Centro di Ricerche e Studi Scientifici Superiori in Sardegna (CRS4)*, CFD Group Seminar, Pula, Italy, June 23, 2005.
66. *Short Course on Preconditioning Techniques for Large Linear Systems*, Università di Bari, Department of Mathematics, Bari, Italy, July 25-29, 2005. 12 hrs invited course sponsored by INdAM (Istituto Nazionale di Alta Matematica).
67. *Model Order Reduction: Coupled Problems and Optimization*, Workshop held at the Lorentz Center of Leiden University, Leiden, The Netherlands, September 19-23, 2005. Plenary speaker.
68. *Computational Science and Engineering Seminar*, McGill University, Montreal, Canada, 7 October 2005.
69. *Numerical Analysis Seminar*, University of Maryland, College Park, MD, February 14, 2006.
70. *Louisiana State University, Center for Computation and Technology, "Computing the Future" Lecture Series*, Baton Rouge, LA, March 13, 2006.
71. *Numerical Algebra and Scientific Computing 2006*, Beijing, China, October 22-25. Keynote speaker.
72. *Supercomputing Institute Seminar, Chinese Academy of Sciences*, Beijing, China, October 26, 2006.
73. *State Key Laboratory of Applied Physics and Computational Mathematics Seminar*, Beijing, China, October 26, 2006.
74. *University of Bologna, School of Engineering Seminar*, Bologna, Italy, December 5, 2006.
75. *Matrix Analysis and Applications*, CIRM, Luminy, France, October 15, 2007. Plenary speaker.
76. *Oak Ridge National Laboratory, Nuclear Science and Technology Division Seminar*, January 10, 2008.
77. *XVII Householder Symposium*, Zeuthen, Germany, 3 June 2008. Plenary speaker.

78. *University of Bologna, Department of Mathematics*, Mathematical Physics Seminar, Bologna, Italy, June 30, 2008.
79. *Fifth ECCOMAS Conference*, Venice, Italy, July 3, 2008. Invited Minisymposium speaker.
80. *London Mathematical Society Durham Symposium on Computational Linear Algebra for Partial Differential Equations (CLAPDE 2008)*, Durham, UK, July 15, 2008. Plenary speaker.
81. *Structured Numerical Linear Algebra Problems: Algorithms and Applications*, Cortona, Italy, September 15–19, 2008. Plenary speaker.
82. *The Third International Conference on Scientific Computing and Partial Differential Equations*, Hong Kong Baptist University, Hong Kong, December 8–12, 2008. Plenary speaker.
83. *Texas Tech University SIAM Student Chapter Seminar*, Lubbock, TX, March 19, 2009.
84. *Texas Tech University Applied Mathematics Seminar*, Lubbock, TX, March 20, 2009.
85. *CEA-EDF-INRIA School on Robust Methods and Algorithms for Solving Large Algebraic Systems on Modern High Performance Computing Systems*, Sophia-Antipolis, France, March 30–April 3, 2009. Invited lecturer (3 hrs.).
86. *Advances and Perspective on Numerical Methods for Saddle Point Problems*, Banff International Research Station, Banff, Alberta, Canada, April 12–17, 2009. Invited speaker.
87. *Linear and Nonlinear Eigenvalue Problems for Partial Differential Equations*, Oberwolfach Workshop, Oberwolfach, Germany, August 9–15, 2009. Invited speaker.
88. *Key Moments in the History of Numerical Analysis*. SIAM Lecture, LSU SIAM Student Chapter, Louisiana State University, Baton Rouge, LA, August 28, 2009.
89. *SIAM Applied Linear Algebra Conference*, Monterey, CA, October 26, 2009. Invited plenary lecture.
90. *SIAM Applied Linear Algebra Conference*, Monterey, CA, October 26, 2009. Invited minisymposium lecture (History session).
91. *Tufts University, Department of Mathematics Colloquium*, Medford, MA, November 20, 2009.

### Other Presentations:

- Numerous contributed talks at various meetings.
- *Autarchici Teoremi: Aspects of Italian Mathematics During the Fascist Period*. Invited talk, Department of French and Italian, Emory University, 22 March 2001.
- *Autarchici Teoremi: Aspects of Italian Mathematics During the Fascist Period*. Invited “Research Horizons” talk, School of Mathematics, Georgia Institute of Technology, 16 April 2003.
- *Perron, Frobenius and Google*. An expository talk on eigenvector methods in web-based information retrieval given at Emory, Georgia Tech, the University of Hong Kong, and the University of Bologna (2003-2004).

**Editorial Work:**

- Member of the Editorial Board of *SIAM Journal on Scientific Computing*, Jan. 2002–Dec. 2007.
- Member of the Editorial Board of *SIAM Journal on Numerical Analysis*, Nov. 2002–present.
- Member of the Editorial Board of *SIAM Journal on Matrix Analysis and Applications*, Nov. 2004–present.
- Member of the Editorial Board of *Numerical Algorithms*, May 2009–present.
- Member of the Editorial Board of *Numerical Linear Algebra with Applications*, February 2008–present.
- Member of the Editorial Board of *Electronic Transactions on Numerical Analysis*, May 2003–present.
- Member of the Editorial Board of *Mathematical Modelling and Applied Computing*, June 2006–present.
- Member of the Editorial Board of *International Journal of Computing Science and Mathematics*, August 2006–present.
- Member of the Editorial Board of *Advances in Numerical Analysis*, September 2008–present.
- Member of the Editorial Board of *Communications in Applied and Industrial Mathematics*, November 2009–present.
- Guest editor of special issue of *Linear Algebra and its Applications* in occasion of Pete Stewart's 70th Birthday, 2009–2010.
- Guest editor of special issue of *Linear Algebra and its Applications* in occasion of the NASC08 Conference, 2009–2010.
- Co-editor of special issue of *ETNA* on saddle point problems, vol. 22 (2006).
- Guest editor of special issue of *Numerical Algorithms* in honor of Richard Varga (vol. 42, no. 3-4, July 2006).
- Guest editor of special issue of *SIAM Journal on Matrix Analysis and Applications* dedicated to the 2003 Preconditioning Conference, Fall 2004.
- Guest editor of special issue of *Linear Algebra and its Applications* in honor of Bob Plemmons (LAA 316, 2000).
- Reviewed book proposals for SIAM and Cambridge University Press.
- Refereed approximately 240 papers for the following journals: *Proceedings of the National Academy of Sciences*, *SIAM Journal on Matrix Analysis and Applications*, *SIAM Journal on Scientific Computing*, *SIAM Journal on Numerical Analysis*, *SIAM Journal on Optimization*, *SIAM Review*, *Numerische Mathematik*, *IMA Journal of Numerical Analysis*, *Journal of Computational Physics*, *Electronic Transactions on Numerical Analysis*, *Electronic Journal of Linear Algebra*, *Journal of Pure and Applied Algebra*, *Journal of Inequalities in Pure*

*and Applied Mathematics, Linear Algebra and its Applications, Operators and Matrices, Numerical Linear Algebra with Applications, BIT, Applied Numerical Mathematics, Calcolo, Communications in Applied Numerical Methods, Numerical Algorithms, Advances in Computational Mathematics, Numerical Methods for Partial Differential Equations, Journal of Computational and Applied Mathematics, Advances in Applied Mathematics, Journal of Scientific Computing, Communications on Numerical Methods in Engineering, Computers & Mathematics with Applications, Mathematics & Computers in Simulation, Computer Physics Communications, Mathematical Problems in Engineering, International Journal for Numerical Methods in Engineering, International Journal for Numerical Methods in Fluids, Computers & Fluids, Inverse Problems, Shock & Vibration, Journal of Zhejiang University (Science), Glasgow Mathematical Journal, Mediterranean Journal of Mathematics, Applied Mathematics and Computation, Applied Mathematics Letters, Optimization Methods and Software, Computational Optimization and Applications, ACM Transactions on Mathematical Software, Journal of Parallel and Distributed Computing, Parallel Computing, IEEE Transactions on Parallel and Distributed Systems, Methods and Applications of Analysis, International Journal of Computer Mathematics.*

- Refereed numerous papers for various conference proceedings.

### **Conferences Organized, Program/Scientific Committees:**

- Member of the organizing committee of *Linear Algebra: Theory, Applications, and Computations (a conference in honor of Professor Robert J. Plemmons on the occasion of his 60th birthday)*, held in Winston-Salem, NC, January 8–9, 1999.
- Member of the organizing committee of the *Third Annual ASCI Tri-Lab Workshop on Solvers*, Los Alamos, NM, December 1–2, 1999.
- Invited minisymposium organizer, SIAM Conference on Applied Linear Algebra, Raleigh, NC, October 23–26, 2000 (topic: *Sparse Approximate Inverses*).
- Co-organizer with Steve Damelin and Jim Nagy of a special session on *Numerical Linear Algebra and Its Applications* at the Meeting of the Southeastern Section of the Mathematical Association of America and the American Mathematical Society, Atlanta, GA, March 8-10, 2002.
- Member of the program committee of the conference *Computational Linear Algebra with Applications*, Milovy, Czech Republic, August 4-10, 2002.
- Co-organizer with Steve Campbell and Amy Langville of the conference *Matrix Analysis and Applied Linear Algebra: A meeting in honor of Carl Meyer on the occasion of his 60th birthday*, Raleigh, NC, 15 May 2003.
- Co-organizer with Martin Gutknecht (from ETH Zürich) of a session on *Krylov Subspace Methods and Preconditioning* at the International Conference on Industrial and Applied Mathematics, Sydney, Australia, July 7-11, 2003.
- Member of the program committee of the *International Conference on the Numerical Solution of Markov Chains (NSMC'03)*, Urbana-Champaign, IL, September 3-5, 2003.
- Member of the program committee of the *2003 International Conference on Preconditioning Techniques (PREC'03)*, Napa Valley, CA, October 26-28, 2003.

- Co-chair of the *2005 International Conference on Preconditioning Techniques (PREC'05)*, Atlanta, GA, May 19-21, 2005.
- Member of the Program Committee, *International Conference on Computational Science (ICCS 2005)*, Atlanta, GA, May 2005.
- Member of the Scientific Committee, *International Conference on Computational Science and Engineering (ICCSE 2005)*, Ankara, Turkey, June 2005.
- Minisymposium organizer, 2005 SIAM Annual Meeting, New Orleans, LA, July 11-15, 2005 (topic: *Historical Aspects of Numerical Linear Algebra*).
- Member of the Scientific Committee, *Applied Linear Algebra: A Conference in Honor of Professor Richard S. Varga*, Pali'c, Yugoslavia, October 2005.
- Member of the Program Committee, *The A. A. Markov Anniversary Conference*, Charleston, SC, June 14-16, 2006.
- Member of the Program Committee, *GAMM-SIAM Conference on Applied Linear Algebra*, Düsseldorf, Germany, July 2006.
- Member of the Program Committee, *2006 International Conference on Computational Science (ICCSE 2006)*, Rochester, NY, August 7–10, 2006.
- Member of the Scientific Committee, *The First International Conference on Numerical Algebra and Scientific Computing*, Beijing, China, October 2006.
- Member of the program committee, *2007 International Conference on Preconditioning Techniques (PREC'07)*, Toulouse, France, July 2007.
- Member of the Scientific Committee, *Computational Methods and Applications*, Harrachov, Czech Republic, August 2007.
- Minisymposium organizer, *ECCOMAS 2008*, Venice, Italy, June 30–July 5, 2008 (topic: *Iterative Solvers for the Incompressible Navier–Stokes Equations*).
- Member of the Scientific Committee, *The Second International Conference on Numerical Algebra and Scientific Computing*, Nanjing, China, November 2008.
- Member of the Program Committee, *Copper Mountain Conference on Iterative Methods*, since 2008.
- Member of the program committee, *2009 International Conference on Preconditioning Techniques (PREC'09)*, Hong Kong, China, August 2009.
- Member of the Scientific Committee, *16th ILAS Conference*, Pisa, Italy, June 2010.
- Co-chair of the *International Conference on the Numerical Solution of Markov Chains (NSMC'10)*, Williamsburg, VA, September 2010.
- Minisymposium organizer, *ECCOMAS Conference on Computational Fluid Dynamics*, Lisboa, Portugal, June 14-17, 2010 (topic: *Iterative Solvers for Incompressible Flows*).

**Students and post-docs:**

- Past PhD students:
  1. Jia Liu (“Preconditioned Krylov Subspace Methods for Incompressible Flow Problems,” June 2006).
  2. Lauren R. Hanson (“Techniques in Constrained Optimization Involving Partial Differential Equations,” July 2007). Co-advisor: Eldad Haber.
  3. Nader Razouk (“Localization Phenomena in Matrix Functions: Theory and Algorithms,” May 2008).
- Current PhD students: Steven Hamilton (DOE CSG Fellow), Zhen Wang, Verena Kuhlemann.
- Past MSc students: Mili Shah (M.Sc., March 2002), Aruna Talapatra (M.Sc., March 2002).
- Post-docs supervised: Bora Uçar (2005–2006); Paola Boito (2009–present).
- Long-term visitor supervised: Cheng-yi Zhang (October 2008–present).

**Other Professional Activities:**

- Member of the SIAM Council (01/2009–present).
- Vice Chair, SIAM Activity Group for Linear Algebra (2007–2009).
- Program Director, SIAM Activity Group for Linear Algebra (2004–2006).
- Affiliate, Los Alamos National Laboratory, Los Alamos, NM (01/2001–present).
- Adjunct professor, Computer Science Department, Old Dominion University, Norfolk, VA (02/2000—present).
- Co-developer of Emory’s PhD track in Computational Mathematics (2002) and of Applied Mathematics undergraduate minor (2006).
- Emory University Math/CS Graduate studies committee (2003–present).
- Emory University Hiring Committee, Computational Mathematics (2002–2003 and 2006–2007).
- Emory University Hiring Committee, Cluster Hire in Computational Number Theory, 2008–present.
- Emory University Emerson Center Lectureship Award Selection Committee (2003–2005).
- Emory University Research Committee (2004–2005).
- Faculty Adviser, Emory University SIAM Student Chapter (2003–present).
- Supervised the following PhD students in LANL’s GRA program: Gabriel Mateescu (Virginia Tech), José Marín (Polytechnic University of Valencia, Spain) and John C. Haws (North Carolina State University).

- Member of PhD committee of David Hysom, Computer Science Department, Old Dominion University (thesis defended in June 2001).
- Member of M.Sc. committee of Shaariah Sulaiman (Emory University, 2001), Ryan Wright (Emory University, 2002), Adam Sherwood (Emory University, 2004), Jonathan Toebe (Emory University, 2005).
- Member of PhD committee of Katrina Palmer (Emory University, 2004), Lisa Perrone (Emory University, 2004), Julianne Chung (Emory University, 2009), Piotr Wendykier (Emory University, 2009).
- Member of selection committee for the Student and Recent Ph.D. Paper Competition for the Conference on Computational Linear Algebra with Applications, August 4-10, 2002, Milovy, Czech Republic (funded by the NSF).
- Member of review committee for DOE's Applied Mathematical Sciences Program, Los Alamos National Laboratory, 1999.
- Member of LANL's review committee for Laboratory-Directed Research and Development (Exploratory Research), in the Mathematics, Simulation, and Modeling category, 1999-2000.
- External member of LANL's review committee for Laboratory-Directed Research and Development (Exploratory Research) in the Mathematics, Simulation, and Modeling category, Spring 2002.
- External member of LANL's review committee for Laboratory-Directed Research and Development (Exploratory Research) in the Information Science and Technology Category, May 2004.
- External reviewer for Italy's *Ministerial Committee for the Evaluation of Research*, May 2005.
- Grant proposal reviewer for the Dutch National Science Foundation, April 2002.
- Grant proposal reviewer for ETH Zürich (internal proposals), October 2002.
- Grant proposal reviewer for NSF (Division of Mathematical Sciences), 2003-present.
- Grant proposal reviewer for DoE (Applied Mathematics), Spring 2003.
- Grant proposal reviewer for the Cooperative Grants Program of the U.S. Civilian Research and Development Foundation (CRDF), September 2004.
- Grant proposal reviewer for the Swiss National Science Foundation, 2004 and 2006.
- Grant proposal reviewer for the Israeli National Science Foundation, 2008.
- NSF Panelist, January 2006.
- DoE Panelist, March 2009.
- External reviewer for tenure and promotion cases (since 2001): University of British Columbia (twice), Rice University (twice), University of Iowa, Virginia Tech, College of William & Mary, University of Hong Kong, Bilkent University, University of Colorado at Denver, University of Regina, Strathclyde University, University of Minnesota at Duluth.

**Professional Memberships:** AMS, SIAM, SIAGLA, SIAGSC, ILAS, UMI (Unione Matematica Italiana).