

# Beatrice Meini

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## Education

<b>University of Pisa, Italy</b>	1993
<b>Laurea in Matematica</b> , 110/110 cum laude	
<b>University of Pisa, Italy</b>	1997
<b>PhD in Mathematics</b>	
<i>Title of the thesis:</i> Fast algorithms for the numerical solution of structured Markov chains	
<i>Advisor:</i> Dario A. Bini	

## Academic career

<b>Assistant Professor of Numerical Analysis</b>	1998 – 2004
Department of Mathematics, University of Pisa (Italy)	
<b>Associate Professor of Numerical Analysis</b>	2005 – 2016
Department of Mathematics, University of Pisa (Italy)	
<b>Full Professor of Numerical Analysis</b>	2016 –
Department of Mathematics, University of Pisa (Italy)	

## Research interests

The scientific activity concerns various aspects of numerical linear algebra, with special attention to application problems, computational problems in applied probability, Markov chains and queueing theory, graph theory, nonlinear matrix equations, matrix functions, algebraic Riccati equations, and structured linear systems.

The early papers concern the numerical solution of structured Markov chains and nonlinear matrix equations arising in queueing problems. The nonlinear matrix equations are rewritten in terms of an infinite-dimensional structured linear system, which is solved through ad hoc numerical methods. In particular, the cyclic reduction algorithm is reinterpreted in functional form, leading to an efficient numerical method for solving polynomial and power series matrix equations. The obtained results led to the publication of a research book on numerical methods for structured Markov chains: D. Bini, G. Latouche, B. Meini, “Numerical Methods for Structured Markov Chains”, Oxford University Press, 2005.

The research on nonlinear matrix equations expanded to include other types, in particular algebraic Riccati equations arising in fluid queues. New doubling algorithms, related to cyclic reduction, have been designed, and a relationship between algebraic Riccati equations and unilateral quadratic matrix equation has been introduced. The book D. Bini, B. Iannazzo, B. Meini, “Numerical Solution of Algebraic Riccati Equations”, SIAM Fundamentals of Algorithms 2012, is a comprehensive treatment of the numerical issues arising in the solution of algebraic Riccati equations.

Other lines of research concern the definition of the concept of geometric mean of several positive definite matrices and the computation of matrix functions, in particular the matrix  $p$ th root and the exponential of large triangular Toeplitz matrices. Recently, the problem of computing the stochastic approximation of the  $p$ th root of a stochastic matrix has been addressed. Concerning structured matrices, the algebra of quasi-Toeplitz matrices has been introduced, which is used to model random walks in the quarter plane.

Currently, research is also focused on the study and design of centrality measures in complex networks, based on the properties of Kemeny’s constant, in addition to the already mentioned topics.

## Services (selected)

- Member of the Householder Prize Committee (starting with the 2028 Householder Symposium).
- Member of the board of the PhD Programme in Mathematics, University of Pisa, since 2012.

- Editorial activity:
  - Co-Editor in Chief of the journal *Linear and Multilinear Algebra* (since 2023).
  - Associate editor of the journal *SIAM Journal on Matrix Analysis and Applications* (since 2015).
  - Associate editor of the journal *Linear Algebra and its Applications* (since 2009).
  - Associate editor of the journal *Stochastic Models* (1999–2023).
  - Handling editor of the journal *Linear and Multilinear Algebra* (2016–2023).
  - Member of the editorial board of the SIAM book series “Fundamentals of Algorithms” (2009–2014).
- Services to ILAS (International Linear Algebra Society):
  - Member of the Advisory Committee (2010–2013, one 4-year term).
  - Member of the Board of Directors (2014–2017, one 4-year term).
  - Chair of the Journal Committee (2020–2023, one 4-year term).
  - Member of the Nominating Committee (2022).
  - Chair of the Nominating Committee (2023).
- Organization of conferences (selected):
  - Member of the scientific committee of the 15-th International Linear Algebra Society (ILAS) conference, Cancun 2008.
  - Member of the scientific committee of the SIAM Applied Linear Algebra conference, Atlanta, 2015.
  - Member of the steering committee of the conference series “Matrix equations and tensor techniques” (METT), for the editions Pisa 2017, Magdeburg 2019, Perugia 2021, Aachen 2023, Leuven 2026.
  - Member of the advisory committee of the conference series *Matrix Analytic Methods in Stochastic Models*, for the editions Leuven 2000, Adelaide 2002, Pisa 2005 (program co-chair), Kerala 2014, Budapest 2016, Hobart 2019, Toronto 2025.
  - Member of the scientific committee of the INdAM Workshop: *Low-rank Structures and Numerical Methods in Matrix and Tensor Computations*, Cortona (Italy), 2025.

## Grants

Local PI of the University of Pisa research group of the PRIN 2022 project “Low-rank Structures and Numerical Methods in Matrix and Tensor Computations and their Application” (PI Valeria Simoncini).

## Invited plenary lectures (since 2010 - selected)

- “Nonsymmetric algebraic Riccati equations associated with M-matrices: theoretical results and algorithms”, ILAS Conference 2010, Pisa
- “Quasi-Toeplitz matrices: analysis, algorithms and applications”, *Linear Algebra, Matrix Analysis and Applications (ALAMA)*, Alicante, 2018
- “Matrix-analytic Methods from an algebraic and computational point of view”, *INFORMS Applied Probability conference*, Nancy, 2023 (Marcel Neuts Lecture)
- “A Journey in the Kemeny Constant: Centrality Measures, Stochastic Complementation and Infinite-dimensional Matrices”, *SIAM Conference on Applied Linear Algebra (LA24)*- Paris 2024 (ILAS Lecturer)

## Bibliometrics

- Scopus. H-index: 21. Citations: 1659. Co-authors: 47. Documents: 86.
- Web of Science. H-index: 20. Citations: 1423. Documents: 84.
- Google Scholar. H-index: 30. i-10 index: 64. Citations: 3794.

In the list of publications, the number of citations is from Google Scholar.

## Books

- [BLM05] D. A. Bini, G. Latouche, and B. Meini. *Numerical methods for structured Markov chains*. Numerical Mathematics and Scientific Computation. Cited by: 468. Oxford University Press, New York, 2005, pp. xii+327. ISBN: 0-19-852768-3.
- [BIM12] D. A. Bini, B. Iannazzo, and B. Meini. *Numerical solution of algebraic Riccati equations*. Vol. 9. Fundamentals of Algorithms. Cited by: 334. Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2012, pp. xvi+250. ISBN: 978-1-611972-08-5.

## Papers (selected)

- [BM95] D. Bini and B. Meini. “On cyclic reduction applied to a class of Toeplitz-like matrices arising in queueing problems”. In: *Computations with Markov Chains: Proceedings of the 2nd International Workshop on the Numerical Solution of Markov Chains*. Cited by: 122. Springer. 1995, pp. 21–38.
- [BM96] D. Bini and B. Meini. “On the solution of a nonlinear matrix equation arising in queueing problems”. In: *SIAM Journal on Matrix Analysis and Applications* 17.4 (1996). Cited by: 194, pp. 906–926.
- [BM99] D. A. Bini and B. Meini. “Effective methods for solving banded Toeplitz systems”. In: *SIAM Journal on Matrix Analysis and Applications* 20.3 (1999). Cited by: 95, pp. 700–719.
- [BGM02] D. A. Bini, L. Gemignani, and B. Meini. “Computations with infinite Toeplitz matrices and polynomials”. In: *Linear algebra and its applications* 343 (2002). Cited by: 101, pp. 21–61.
- [HMR02] C. He, B. Meini, and N. Rhee. “A shifted cyclic reduction algorithm for quasi-birth-death problems”. In: *SIAM Journal on Matrix Analysis and Applications* 23.3 (2002). Cited by: 72, pp. 673–691.
- [Mei02] B. Meini. “Efficient computation of the extreme solutions of  $X + A^*X^{-1}A = Q$  and  $X - A^*X^{-1}A = Q$ ”. In: *Mathematics of Computation* 71.239 (2002). Cited by: 160, pp. 1189–1204.
- [BHM05] D. A. Bini, N. J. Higham, and B. Meini. “Algorithms for the matrix  $p$ th root”. In: *Numerical Algorithms* 39.4 (2005). Cited by: 155, pp. 349–378.
- [Mei05] B. Meini. “The matrix square root from a new functional perspective: Theoretical results and computational issues”. In: *SIAM Journal on Matrix Analysis and Applications* 26.2 (2005). Cited by: 75, pp. 362–376.
- [Bin+06b] D. A. Bini, B. Meini, S. Steffè, and B. Van Houdt. “Structured Markov chains solver: software tools”. In: *Proceeding from the 2006 workshop on Tools for solving structured Markov chains*. Cited by: 126. 2006, 14–es.
- [GIM07] C.-H. Guo, B. Iannazzo, and B. Meini. “On the doubling algorithm for a (shifted) nonsymmetric algebraic Riccati equation”. In: *SIAM Journal on Matrix Analysis and Applications* 29.4 (2007). Cited by: 106, pp. 1083–1100.
- [BM09] D. A. Bini and B. Meini. “The cyclic reduction algorithm: From Poisson equation to stochastic processes and beyond: in memoriam of Gene H. Golub”. In: *Numerical Algorithms* 51.1 (2009). Cited by: 87, pp. 23–60.
- [BMP10a] D. A. Bini, B. Meini, and F. Poloni. “An effective matrix geometric mean satisfying the Ando-Li-Mathias properties”. In: *Mathematics of Computation* 79.269 (2010). Cited by: 131, pp. 437–452.
- [BMP10b] D. A. Bini, B. Meini, and F. Poloni. “Transforming algebraic Riccati equations into unilateral quadratic matrix equations”. In: *Numerische Mathematik* 116.4 (2010). Cited by: 67, pp. 553–578.
- [IM11] B. Iannazzo and B. Meini. “Palindromic matrix polynomials, matrix functions and integral representations”. In: *Linear Algebra and Its Applications* 434.1 (2011). Cited by: 19, pp. 174–184.
- [MP11] B. Meini and F. Poloni. “A Perron iteration for the solution of a quadratic vector equation arising in Markovian binary trees”. In: *SIAM Journal on Matrix Analysis and Applications* 32.1 (2011). Cited by: 10, pp. 248–261.

- [Bin+16a] D. Bini, S. Dendievel, G. Latouche, and B. Meini. “Computing the exponential of large block-triangular block-Toeplitz matrices encountered in fluid queues”. In: *Linear Algebra and Its Applications* 502 (2016). Cited by: 34, pp. 387–419.
- [Bin+16b] D. Bini, S. Dendievel, G. Latouche, and B. Meini. “General solution of the Poisson equation for Quasi-Birth-and-Death processes”. In: *SIAM Journal on Applied Mathematics* 76.6 (2016). Cited by: 9, pp. 2397–2417.
- [Bin+18] D. Bini, J. J. Hunter, G. Latouche, B. Meini, and P. Taylor. “Why is Kemeny’s constant a constant?”. In: *Journal of Applied Probability* 55.4 (2018). Cited by: 21, pp. 1025–1036.
- [BMM18] D. A. Bini, S. Massei, and B. Meini. “Semi-infinite quasi-Toeplitz matrices with applications to QBD stochastic processes”. In: *Mathematics of Computation* 87.314 (2018). Cited by: 30, pp. 2811–2830.
- [MP18] B. Meini and F. Poloni. “Perron-based algorithms for the multilinear PageRank”. In: *Numerical Linear Algebra with Applications* 25.6 (2018). Cited by: 24.
- [BM19] D. A. Bini and B. Meini. “On the exponential of semi-infinite quasi-Toeplitz matrices”. In: *Numerische Mathematik* 141.2 (2019). Cited by: 20, pp. 319–351.
- [Bin+20] D. A. Bini, S. Massei, B. Meini, and L. Robol. “A computational framework for two-dimensional random walks with restarts”. In: *SIAM Journal on Scientific Computing* 42.4 (2020). Cited by: 11, A2108–A2133.
- [BMM20] D. A. Bini, B. Meini, and J. Meng. “Solving quadratic matrix equations arising in random walks in the quarter plane”. In: *SIAM Journal on Matrix Analysis and Applications* 41.2 (2020). Cited by: 15, pp. 691–714.
- [BLM22a] D. Bini, G. Latouche, and B. Meini. “Numerical solution of a matrix integral equation arising in Markov-modulated Lévy processes”. In: *SIAM Journal on Scientific Computing* 44.4 (2022). Cited by: 3, A2669–A2690.
- [BLM22b] D. A. Bini, G. Latouche, and B. Meini. “A family of fast fixed point iterations for M/G/1-type Markov chains”. In: *IMA Journal of Numerical Analysis* 42.2 (2022). Cited by: 8, pp. 1454–1477.
- [Alt+23] D. Altafini, D. A. Bini, V. Cutini, B. Meini, and F. Poloni. “An edge centrality measure based on the Kemeny constant”. In: *SIAM Journal on Matrix Analysis and Applications* 44.2 (2023). Cited by: 18, pp. 648–669.
- [DM24] F. Durastante and B. Meini. “Stochastic  $p$ th root approximation of a stochastic matrix: a Riemannian optimization approach”. In: *SIAM Journal on Matrix Analysis and Applications* 45.2 (2024). Cited by: 5, pp. 875–904.
- [Bin+25] D. A. Bini, S. Kirkland, G. Latouche, and B. Meini. “Cut-edge centralities in an undirected graph”. In: *Numerical Algorithms* (2025). Cited by: 0.
- [CDM25] S. Cipolla, F. Durastante, and B. Meini. “Enforcing Katz and PageRank Centrality Measures in Complex Networks”. In: *SIAM Journal on Mathematics of Data Science* 7.3 (2025). Cited by: 4, pp. 1514–1539. eprint: <https://doi.org/10.1137/24M1690849>.
- [IMP25] B. Iannazzo, B. Meini, and F. Poloni. “Deflating subspaces of T-palindromic pencils and algebraic T-Riccati equations”. In: *Linear and Multilinear Algebra* 73.9 (2025). Cited by: 2, pp. 2060–2088.
- [Mei25] B. Meini. “On certain classes of nonlinear matrix equations: theory, applications, and numerical solution”. In: *Bollettino dell’Unione Matematica Italiana* 18.1 (2025). Cited by: 1, pp. 293–309.