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Yousef Saad

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Education

Doctorat d'Etat	University of Grenoble, France	1983
Doctorat de troisieme cycle	University of Grenoble, France	1974
B. S. in Mathematics	University of Algiers, Algeria	1970

Professional Experience

- CSE Distinguished Professor, University of Minnesota, Department of Computer Science, May 2005 – present.
- Professor, University of Minnesota, Department of Computer Science, Nov. 1990–present.
- Head of the department of Computer Science and Engineering, University of Minnesota. Jan 1997 – June 2000.
- Senior Scientist, Research Institute for Advanced Computer Science (RIACS), Jul. 1988–Nov. 1990.
- Senior Computer Scientist, Center for Supercomputing Research and Development (CSRD) and Associate Professor, Mathematics Department, University of Illinois at Urbana-Champaign. Aug. 1986–June 1988.
- Research Scientist, then Senior Research Scientist, Computer Science Department, Yale University. July 1984–Aug. 1986.
- Associate professor, University of Tizi-Ouzou, Algeria. Sept. 1983–June 1984.
- Research Scientist, Computer Science Department, Yale University. Aug. 1981–Aug. 1983.
- Visiting Lecturer, Mathematics and Computer Science departments, University of California at Berkeley, Berkeley, CA. January 1981–July 1981.
- Visiting Assistant Professor, Department of Computer Science, University of Illinois at Urbana-Champaign, Urbana, Illinois. January 1980–December 1980.

Research Interests

Iterative methods for solving large sparse linear systems and eigenvalue problems; Sparse matrix computations; Parallel algorithms in numerical linear algebra. Numerical algorithms for materials science. Matrix methods for information sciences.

Awards and Honors

- SIAM John von Neumann Prize, 2023.
- SIAM Fellow class of 2010.

- Fellow of the AAAS, 2011.
- CSE Distinguished professor (as of May 2005)
- William Norris chair, Jan. 2006 to Aug. 2021.

PhD Students (graduated)

- Shashanka Ubaru, Univ. Minnesota, May 2018
- Vasileios Kalantzis, Univ. Minnesota, July 2018
- Ruipeng Li, Univ. Minnesota, Jun. 2015
- Thanh Ngo, Univ. of Minnesota, Jun. 2014
- D. Osei-Kuffuor, Phd in Scientific computation, Sept. 2011.
- Jie Chen, Univ. of Minnesota, Jun. 2011.
- Na Li, PhD, Univ. of Minnesota, Jun. 2006.
- Bernard Sheehan, PhD, Univ. of Minnesota, Nov. 2005.
- Irene Moulitsas, PhD, Univ. of Minnesota, Nov. 2005. [Co-adviser. Main advisor: G. Karypis]
- Abdelkader Baggag, PhD, Univ. of Minnesota, Feb. 2003. [Co-adviser. Main advisor: A. Sameh]
- Edmond Chow, PhD, Univ. of Minnesota, Dec. 1997.
- Kesheng Wu, PhD, Univ. of Minnesota, Mar. 1997.
- Sangback Ma, PhD, Univ. of Minnesota, Aug. 1993.

Graduate Students Supervised (current)

- Tianshi Xu 6th year PhD student
- Ziyuan Tang 3rd year PhD student
- Zechen Zhang 3rd year PhD student
- Camden Sikes 2nd year PhD student

Post-docs and Visitors

Xin Ye, (Aug. 2018– July 2019, Post-doc); Mohamed El-Guide, (Oct. 2018 – March 2019, Post-doc); QinQing Zhang, (2017 - 2019, Visiting graduate student); Naoufal Nifa, (2016 - 2017, Visiting graduate student); Yuanzhe Xi (2014 – 2018, Post-doc); Geoffrey Dillon (2014 – 2015, Post-doc); Amokrane Mehi (2015-2016, Visiting graduate student); Agnieszka Miedlar (2015 – 2016, Post-doc); Pierre Carrier (2008-2012, Post-Doc); Da Gao (2009-2012, Post-doc); Jok Tang (2009-2010, Post-Doc); Haw-Ran Fang (2006-2008, and 2010-2012 Post-Doc); Scott Mac Lachlan (2006-2007, Post-Doc); Prakash Dayal (2006-2007, Post-Doc); Suzanne Shontz (2004-2006, Post-Doc); Yunkai Zhou (2004-2006, Post-Doc); Kostas Bekas (2003-2005) Post-Doc); Pascal Henon (2002, Post-doc); Laurent Smoch (2001, Post-doc); Matthias Bollhoeffer (1999, Post-doc); Emmanuel Lorin de la Grandmaison (2002, Post-doc); Leigh Little (1998-2000, Post-doc); Zhongze Li (1999-2001, Post-doc); Caroline Lecalvez (1998, Post-doc); Philippe Guillaume (1999, Visiting faculty); Brian Suchomel (1997-1999, Post-doc); Thierry Braconnier (1997-1998, Post-doc); Jun Zhang (1997-1998, Post-doc); Sergey Kuznetsov (1997, Post-doc); Laurent Jay (Post-doc 1995-1996); Andrew Chapman (1995-1996, Post-doc); Andrei Malevsky (1995, Post-doc); Jen-Chin Lo (1994-1995, Post-doc); Andreas Stathopoulos (Post-doc 1993-1995); Xiao-Chuan Cai (1991 Post-Doc).

Recent Research Grants (Past 10 years)

- *Collaborative Research: Robust Acceleration and Preconditioning Methods for Data-Related Applications: Theory and Practice*, PI: Y. Saad; 07/21/2022–08/31/2025/. NSF. Budget: $ 200,000.
- *Multilevel graph-based methods for efficient data exploration.* PI: Y. Saad; 08/01/2020–07/31/2023/. NSF. Budget: $ 244,217.
- *Advances in robust preconditioning methods for sparse linear systems.* PI: Y. Saad; 08/01/2019–07/31/2022/. NSF. Budget: $ 299,990.
- *AF:Small:Collaborative research: effective numerical algorithms and software for non-linear eigenvalue problems* PI: Y. Saad; 09/01/18 08/31/21. NSF. Budget: $ 140,000.
- *Tenth international conference on preconditioning techniques for scientific and industrial applications* (Conference support) PI: Y. Saad; 07/01/17 /06/31/18. NSF. Budget: $ 15,000.
- *AF: Medium: Collaborative research: Advanced algorithms and high-performance software for large scale eigenvalue problems* PI: Y. Saad; 07/15/15-07/14/2018. NSF. Budget: $ 300,00.
- *AF: Medium: Collaborative research: Advanced algorithms and high-performance software for large scale eigenvalue problems* PI: Y. Saad; 07/15/15-07/14/2018. NSF. Budget: $ 300,00.
- *"Advances in robust multilevel preconditioners for linear systems".* NSF. (sole) PI: Y. Saad. 08/1/2015 – 07/31/2018. Budget: $265,500.
- *"Advances in robust multilevel preconditioners for linear systems". NSF. (sole) PI: Y. Saad. 08/15/2012 – 07/31/2015.* Budget: $300,000.
- *Scalable Computational Tools for Discovery and Design: Excited State Phenomena in Energy Materials,* PI: J. Chelikowsky (UT Austin); 4-5 other co-PIs from U. cal Berkeley; 09/01/2012 – 08/31/2017. DOE-SCIDAC, U of Minn. Budget: $ 746,000.
- "SI2-SSE: Collaborative: Extensible Languages for Sustainable Development of High Performance Software in Materials Science", NSF, PI: E. Van Wyk (Univ. Minnesota), co-PIs: Y. Saad, J. Chelikowsky (UT Austin); 09/15/2010 – 08/31/2013. Total amount $300,000.

Journal Editorships

- Associate editor, SIAM J. on Matrix Analysis (Oct. 2007 – 2010)
- Associate editor, Computer Physics Communications, Jan 2007 – Jan 2008.
- Associate editor, Electronic Transactions of Numerical Analysis (ETNA), March 2001 to date.
- Associate editor, J. of Numerical Linear Algebra with Applications, 1992 to date.
- Associate editor, IEEE J. Parallel and Distributed Computing. Jan. '96– Jan. '99.
- Associate editor, SIAM J. on Numerical Analysis (June '85 – '94)
- Associate editor, series *Algorithms and Architectures for Advanced Scientific Computing*, Manchester University Press, 1989 – 1992.

Professional Activities

- Householder committee, 2009-2014
- Org. Committee, International conference on preconditioning methods, Chemniz, Germany, June 8-10, 2022 (post-poned from 2021)

- Conference Chair, *International conference on preconditioning methods, Twin Cities, Jul. 1–3, 2019.*
- Org. Committee, International conference on preconditioning methods, Vancouver, Canada, Jul. 31 – Aug. 2, 2017.
- Org. Committee, *International conference on preconditioning methods, Einhhoven, The Netherlands, Jun. 17-19, 2015*.
- International Org. Committee, *Parallel Matrix Algorithms and Applications* (PMAA 2016) July 6–8, Bordeaux, France.
- NSF Panels: 2017, 2018,2019
- Org. committee of the "International conference on preconditioning methods," meetings, every other year since 1999 (co-founder of this series of meetings).
- International Org. Committee, *Parallel Matrix Algorithms and Applications* (PMAA 2012) 28-30 June 2012, Birkbeck University of London, UK.
- Conference co-Chair 6th International Workshop on Parallel Matrix Algorithms and Applications (PMAA'10). June 29 - July 02, 2010, University of Basel, Switzerland.
- Organizing committee for IMA Workshop on "Development and Analysis of Multiscale Methods", U of M, Nov. 3-7, 2008.
- Organizing committee for IMA Workshop on "Classical and Quantum Approaches in Molecular Modeling", U of M, July 23-August 3, 2007.
- Committee co-chair for 5th International Workshop on Parallel Matrix Algorithms and Applications (PMAA'08), 20-22 June 2008, Neuchatel Switzerland,
- Committee co-chair for the series of "Precondiontiong xx" meetings, every 2 years since 1999 (Started the first one in June 1999, in Minneapolis).
- Consultant for: Scientific Computing Associates (1985–1986), Kuck and Associates Inc. (1986–1988), Dassault Aviation (1988-1989), Object Reservoir (1996), Chevron-Texaco (2002–2004).

University and Department Service

- Faculty recruiting committee, 2019-2020, and 2020-2021
- Graduate Affairs committee 2017-2018, 2017-2018, 2020-2021
- Tenured Faculty Evaluation Committee: 2016-2017, 2017-2018, 2018-2019, 2019-2020
- Graduate admissions committee: 2016-2017.
- Member of the mentoring committee for H. Park, F'2016 – S'2021
- Chair of mentoring committee for J. Sun, F'2019 – S'2021
- Member of the Ad-hoc committee to review the faculty evaluation committee – Fall 2015
- Tenured Faculty Evaluation Committee: 2010 – 2013 (chair in 2013).
- MSI committee for seed-grants selection 2008-2009
- CSE Dept. head evaluation committee, 2010.
- IMA committee for post-doc selection, 2008.
- Department Head, Jan. 1997 - June 2000.
- Director of Graduate Studies, Program in Scientific Computation, Sept 15, F 1996 - F 1998.
- Chair, Head search committee, academic year 1992-1993.
- Chair, faculty search committee, Academic year 1991-1992.
- Planning Committee, Minnesota Supercomputer Institute (MSI), 1992-1999. Various other committees with MSI since 1991.

Recent Invited Presentations (Past 10 years)

Note: a ⊛sign indicates a *plenary invited speaker* or a *special colloquium* presentation.

⊛ International Conference on New Trends in Computational and Data Sciences, Dec 19 – Dec 21, 2022, Caltech

⊛ 75th Anniversary of Mathematics and Statistics at NIST[virtual meeting], Jun 28 – Jun 30, 2022

- 47th Univ. of Arkansas Spring Lecture SeriesUniv. May 04 – May 06, 2022, Arkansas, Fayetteville, AK
- e-NLA on Numerical Linear Algebra, Apr 27 – Apr 27, 2022 (Online forum)

⊛ Copper Mountain Iterative Methods, Mar 31, 2022. Tutorial on iterative methods

- Numerical Methods and Scientific Computing, Luminy, France Nov 8-12, 2021. (Invited speaker - in person meeting)

⊛ IEEE International Workshop on Machine Learning for Signal Processing (MLSP 2021), Oct 25 – Oct 28, 2021, Gold Coast, Queensland, Australia (virtual meeting)

⊛ CEDYA 2021 – Conference of the Spanish Society of Applied Mathematics, Jun 15 – Jun 19, 2021, Gijon, Spain (virtual meeting)

- SIAM conference on Applied Linear Algebra Atlanta, GA May 17 – May 21, 2021. (Invited mini-symposium speaker; virtual meeting)

⊛ Dec 07, 2019, Annual Meeting of the Mathematical Society of the Republic of China (Taiwan) – TMS 2019.

⊛ Oct 04, 2019 Cornell Applied Math. (CAM) colloquium

⊛ Sep 20, 2019. Mathematical modelling and computational methods in applied sciences and engineering (Modelling 2019) Olomouc, Czech Republic

⊛ Apr 03, 2019. Numerical Analysis and Mathematical Modeling (NA2M_2019)- Mohammed V University, Rabat, Morocco

- Feb 22, Emory University - Mathematics department colloquium

⊛ Dec 11 – Dec 14, 2018. CRM Workshop: Mathematical and Computational Methods for quantum systems, CRM, Montreal, Canada.

⊛ Nov 1-3, 2018 Nov. 2, 2018. ICERM, Celebrating 75 years of Math. Comp. *A brief journey into the past of iterative methods for solving sparse linear systems.*

- Oct. 5th, 2018 Colloquium, University of Wisconsin-Milwaukee, Department of Mathematics.

⊛ Sep 27, 2018, University of Kansas, Mathematics department, Smith colloquium, Lawrence, KS

- Jul 24, 2018 "(Multilevel) low-rank correction methods for highly indefinite linear systems", Invited Minisymposium speaker, Domain Decomposition 25, St. John's, Newfoundland, Canada

⊛ July 6th, 2018, *Dimension reduction techniques: Algorithms and Applications.* NASCA 2018, Kalamata, Greece.

⊛ June 7th, 2018 Padua University, Padua, Math. seminar (Italy), *Dimension reduction techniques: Algorithms and Applications.*

- June 28, 2018 *The EVSL package for symmetric eigenvalue problems* Parallel Matrix Algorithms and Applications (PMAA 2018), invited mini-symposium speaker. Zurich, Switzerland.
- 15th Copper Mountain Conference On Iterative Methods, March 26-29, 2018, Copper Mountain, CO The EVSL package for symmetric eigenvalue problems

⊛ Nov. 23, 2017, Centrale-Supelec, France, Colloquium. "Recent progress on solution methods for large eigenvalue problems.".

- July 25, 2017, Ames, IA "Polynomial and rational filtering for eigenvalue problems and the EVSL package"; 2017 Meeting of the International Linear Algebra Society (ILAS-2017); Invited minisymposium speaker.
- June 28, 2017, " Polynomial and rational filtering for eigenvalue problems and the EVSL project " Platform for Advanced Scientific Computing (PASC17), Lugano, Switzerland. Invited minisymposium speaker.

⊛ June 6th, 2017, "Low-rank correction preconditioning techniques." Invited plenary speaker. SMAI 2017 Bi-annual French Congress in Industrial and Applied Mathematics Ronce les Bains, France.

⊛ May 30th, 2017, Amiens, France "Applications of trace estimation techniques". Rencontre en Algebre Lineaire Numerique Amiens-Calais.

⊛ May 24, 2017. "Applications of trace estimation techniques" High Performance Computing in Science and Engineering (HPCSE17) Beskydy Mountains (near Ostrawa), Czech republic.

- Feb 28, 2017 *"Polynomial and rational function filtering techniques for Hermitian eigenvalue problems"*, SIAM Conference on Computational Science and Engineering (CSE17) Atlanta, GA.; Invited Minisymposium speaker (topic: excited states).

⊛ Jan 19, 2017. *Divide and conquer algorithms and software for large Hermitian eigenvalue problems.* Math + X Symposium on Seismology and Inverse Problems, Rice University, Houston, TX.

⊛ Nov 12 – Nov 13, 2016 - Workshop on Fast Direct Solvers, CCAM, Purdue Univ., Lafayette, IN .

⊛ Oct 24 – Oct 28, 2016, Numerical Linear Algebra and Applications (NL2A) CIRM, Luminy, France.

⊛ Oct 07, 2016. *" Divide and conquer algorithms and software for large Hermitian eigenvalue problems"*, Samuel Conte Distinguished lecture, Purdue University, West-Lafayette, IN.

- Jul 08, 2016. *" Filtered thick restart Lanczos algorithm and the EVSL package*, Parallel Matrix Algorithms and Applicatons (PMAA 2016) Bordeaux, France.
- Jul 07, 2016. *Applications of trace estimation techniques."*, Parallel Matrix Algorithms and Applicatons (PMAA 2016) Bordeaux, France.
- May 19, 2016 *"The trace ratio optimization problem.*, Special memorial meeting in Calais and Valenciennes, France

⊛ Apr 08, 2016. *"High performance numerical linear algebra: trends and new challenges."* HPC days in Lyon, Lyon, France.

- Oct 26, 2015, *"Spectrum slicing by polynomial and rational function filtering",* Minisymposia invited talk, SIAM conference on Applied Linear Algebra Atlanta, GA

⊛ Aug 31, 2015, "Acceleration, inexact Newton, and Nonlinear Krylov subspace methods", ICERM workshop on Numerical Methods for Large-Scale Nonlinear Problems and Their Applications, Brown University, Providence, RI

⊛ Jun 10, 2015 "Computing Approximate Spectral Densities with Applications", Workshop in low-rank optimization, Bonn, Germany.

⊛ Jun 3, 2015 "Divide and conquer algorithms for eigenvalue problems" Math. Colloquium, University of Paris VI (Jussieu), France.

⊛ Apr 22, 2015 "Divide and conquer algorithms for eigenvalue problems" Applied mathematics — LBL seminar, UC Berkeley.

⊛ Apr 21, 2015, ICME colloquium, Stanford University.

⊛ Mar 24, 2015, "Divide and conquer algorithms for large Hermitian eigenvalue problems" at Sparse Solvers for Exascale, Greifswald, Germany.

⊛ Mar 02, 2015, "Dimension reduction methods: Algorithms and Applications", colloquium, Juelich High Performance Computing center, Germany.

- Dec. 2, 2014, Colloquium, Ecole ENIM, Rabat, Morocco.

⊛ Nov. 20, 2014, Modeling and Scientific Computing in Engineering (MOCASIM-2014.), Marrakesh, Morrocco.

- Nov 7, 2014, "Schur complement and multilevel preconditioners", New Jersey Institute of Tech., Applied Math colloquium.
- Oct 31, 2014, College of William and Mary, Computer science colloquium.
- Sep 18, 2014, Computer Science Colloquium, University of Patras, Greece

⊛ Sep 12, 2014, Structured Linear Algebra and Multilinear Algebra (SLA 2014), Kalamata, Greece.

- Jul 4th, 2014, Invited Minisymposium speaker, 8th International Workshop on Parallel Matrix Algorithms and Applications (PMAA14), Lugano, Switzerland.

⊛ June 3rd, 2014, 5th IMACS conference on mathematical modeling and computational methods in sciences and engineering (Modelling 2014), Roznov, Czech Republic.

⊛ Mar 8, 2014, *Sampling algorithms in numerical linear algebra and their application*, EPASA14 – International workshop on Eigenvalue Problems: Algorithms, Software and Applications in Petascale Computations", Tsukuba, Japan, Mar 07 – Mar 09 2014.

- Feb 20, 2014, Invited Minisymposium speaker, SIAM PP14 SIAM conference on parallel processing. Portland, Oregon.

⊛ Jan 31, 2014, Invited colloquium speaker, NCSU (Interdisciplinary Distinguished Seminar Series)

- Nov. 11, 2013, Caltech, Applied and Computational Math. colloquium.
- Sept. 20th, 2013, Applied math colloquium, Syracuse University

⊛ June 25, 2013, NASCA13 Numerical Analysis and Scientific Computation with Applications, Calais, France.

- June 17, 2013 'Sparse Days' meeting, CERFACS, Toulouse, France.
- June 5, 2013, International Linear Algebra Society (ILAS) conference (ILAS 2013), Providence, Rhode Island. Invited minisymposium speaker.
- May 3, 2013 Invited speaker, ECE colloquium, University of Massachusetts, Amherst.
- April 19, 2013 "New Frontiers in Numerical Analysis and Scientific Computing," Invited Minisymposium speaker, Kent State University.
- April 5, 2013, College of Computing cpolloquium, Georgia Tech.

⊛ "Algebraic multilevel preconditioners for indefinite linear systems", International conference "High Frequency", Mar 19 - Mar 21, 2013, Nancy, France.

- "Multilevel low-rank approximation preconditioners" Invited Minisymposium speaker, SIAM CSE 2013 conference, Boston, MA, Feb. 25 - Mar 1st, 2013.

Publications: Books

[1] M. W. Berry, K. A. Gallivan, E. Gallopoulos, A. Grama, B. Philippe, Y. Saad, and F. Saied. *High-Performance scientific computing*. Pringer, New York, 2012.

[2] Y. Saad. *Numerical Methods for Large Eigenvalue Problems-classics edition*. SIAM, Philadelphia, 2011.

[3] Y. Saad. *Iterative Methods for Sparse Linear Systems, 2nd edition*. SIAM, Philadelpha, PA, 2003.

[4] Y. Saad. *Numerical Methods for Large Eigenvalue Problems*. Halstead Press, New York, 1992.

[5] A. Ferreira, J. Rolim, Y. Saad, and T. Yang. *Parallel Algorithms for Irregularly Structured Problems, Proceedings of Third International Workshop, IRREGULAR'96 Santa Barbara, CA USA, August 19-21, 1996*. Lecture notes in Computer Science, No 1117. Springer Verlag, Berlin, Heidelberg, New-York, 1996. (Conference proceedings).

[6] D. E. Keyes, Y. Saad, and D. G. Truhlar. *Domain-Based Parallelism and Problem Decomposition Methods in Computational Science and Engineering*. SIAM, Philadelphia, PA, 1995. (Conference proceedings).

[7] D. L. Boley, D. G. Truhlar, Y. Saad, R. E. Wyatt, and L. E. Collins. *Practical Iterative Methods for Large Scale Computations*. North Holland, Amsterdam, 1989. (Conference proceedings).

Publications: Journal Articles

[1] Yousef Saad. The origin and development of krylov subspace methods. *Computing in Science & Engineering*, 24(4):28–39, 2022.

[2] Tianshi Xu, Vassilis Kalantzis, Ruipeng Li, Yuanzhe Xi, Geoffrey Dillon, and Yousef Saad. parGeMSLR: A parallel multilevel schur complement low-rank preconditioning and solution package for general sparse matrices. *Parallel Computing*, 122:102956, 2022.

[3] Yousef Saad. Revisiting the (block) Jacobi subspace rotation method for the symmetric eigenvalue problem. *Numerial Algorithms*, 92:917–944, 2023.

[4] Jie Chen, Yousef Saad, and Zechen Zhang. Graph coarsening: from scientific computing to machine learning. *SeMA Journal*, 79(1):187–223, 2022.

[5] Jia Shi, Ruipeng Li, Yuanzhe Xi, Yousef Saad, and Maarten V. de Hoop. A non-perturbative approach to computing seismic normal modes in rotating planets. *Journal of Scientific Computing*, -(-):–, 2022. To appear.

[6] Qingqing Zheng, Yuanzhe Xi, and Yousef Saad. A power schur complement low-rank correction preconditioner for general sparse linear systems. *SIAM Journal on Matrix Analysis and Applications*, 42(2):659–682, 2021.

[7] Jia Shi, Ruipeng Li, Yuanzhe Xi, Yousef Saad, and Maarten V. de Hoop. Planetary normal mode computation: Parallel algorithms, performance, and reproducibility. *IEEE Transactions on Parallel and Distributed Systems*, 32(11):2609–2622, 2021.

[8] L. Fan, D. I. Shuman, S. Ubaru, and Y. Saad. Spectrum-adapted polynomial approximation for matrix functions with applications in graph signal processing. *algorithms*, 13(11):295, 2020.

[9] Mohamed El-Guide, Agnieszka Miedlar, and Yousef Saad. A rational approximation method for solving acoustic nonlinear eigenvalue problems. *Engineering Analysis with Boundary Elements*, 111:44 – 54, 2020.

[10] Qingqing Zheng, Yuanzhe Xi, and Yousef Saad. Multi-color low-rank preconditioner for general sparse linear systems. *nlaa*, 27:e2316, 2020.

[11] Xin Ye, Yuanzhe Xi, and Yousef Saad. Preconditioning via GMRES in polynomial space. *SIAM Journal on Matrix Analysis and Applications*, 42(3):1248–1267, 2021.

[12] Yousef Saad. Iterative methods for linear systems of equations: A brief historical journey. *Contemporary Mathematics*, 754:197–216, 2020. Special issue: "75 years of mathematics", S. Brenner et al. editors.

[13] Xiao Liu, Yuanzhe Xi, Yousef Saad, and Maarten V. de Hoop. Solving the 3d high-frequency Helmholtz equation using contour integration and polynomial preconditioning. *SIAM Journal on Matrix Analysis and Applications*, 41:58–82, 2020.

[14] Ruipeng Li, Yuanzhe Xi, Lucas Erlandson, and Yousef Saad. The eigenvalues slicing library (EVSL): Algorithms, implementation, and software. *SIAM Journal on Scientific Computing*, 41(4):C393–C415, 2019.

[15] Shashanka Ubaru and Yousef Saad. Sampling and multilevel coarsening algorithms for fast matrix approximations. *Numerical Linear Algebra with Applications*, 26(3):e2234, 2019. e2234 nla.2234.

[16] Jie Chen and Yousef Saad. A posteriori error estimate for computing tr(f (A)) by using the Lanczos method. *Numerical Linear Algebra with Applications*, 25(5):e:2170, 2018.

[17] Y. Xi and Y. Saad. Fast computation of spectral densities for generalized eigenvalue problems. *SIAM Journal on Scientific Computing*, 40:A2749–A2773, 2018. also: ArXiv: https://arxiv.org/pdf/1706.06610.pdf.

[18] Vassilis Kalantzis, Yuanzhe Xi, and Yousef Saad. Beyond automated multilevel substructuring: Domain decomposition with rational filtering. *SIAM Journal on Scientific Computing*, 40(4):C477–C502, 2018.

[19] G. Wang, G. B. Giannakis, Y. Saad, and J. Chen. Phase retrieval via reweighted amplitude flow. *IEEE Transactions on Signal Processing*, 66(11):2818–2833, 2018.

[20] C. Brezinski, M. Redivo-Zaglia, and Y. Saad. Shanks sequence transformations and Anderson acceleration. *SIAM Review*, 60(3):646–669, 2018.

[21] Geoffrey Dillon, , Vasileos Kalantzis, Yuanxhe Xi, and Yousef Saad. A hierarchical low-rank Schur complement preconditioner for indefinite linear systems. *SIAM Journal on Scientific Computing*, 40(4):A2234–A2252, 2018.

[22] Shashanka Ubaru, Abd-Krim Seghouane, and Yousef Saad. Improving the incoherence of a learned dictionary via rank shrinkage. *Neural Computation*, 29(1), 2017.

[23] Shashanka Ubaru, Yousef Saad, and Abd-Krim Seghouane. Fast estimation of approximate matrix ranks using spectral densities. *Neural Computation*, 29(5):1317–1351, 2017.

[24] Shashanka Ubaru, Agnieszka Miedlar, and Yousef Saad. Formation enthalpies for transition metal alloys using machine learning. *Phys. Rev. B*, 95:214102, 2017.

[25] Shashanka Ubaru, Jie Chen, and Yousef Saad. Fast estimation of tr(f (A)) via stochastic Lanczos quadrature. *SIAM Journal on Matrix Analysis and Applications*, 38(4):1075–1099, 2017.

[26] Vassilis Kalantzis, James Kestyn, Eric Polizzi, and Y. Saad. Domain decomposition approaches for accelerating contour integration eigenvalue solvers for symmetric eigenvalue problems. *Numerical Linear Algebra with Applications*, 25(5), 2018.

[27] Vassilis Kalantzis, A. Cristiano I. Malossi, Costas Bekas, Alessandro Curioni, Efstratios Gallopoulos, and Yousef Saad. A scalable iterative dense linear system solver for multiple right-hand sides in data analytics. *Parallel Computing*, 74:136–153, 2018.

[28] Yuanzhe Xi and Yousef Saad. A rational function preconditioner for indefinite sparse linear systems. *SIAM Journal on Scientific Computing*, 39(3), 2017.

[29] Difeng Cai, Edmond Chow, Lucas Erlandson, Yousef Saad, and Yuanzhe Xi. Smash: Structured matrix approximation by separation and hierarchy. *Numerical Linear Algebra with Applications*, 25(6):e2204, 2018. e2204 nla.2204.

[30] Jared L. Aurentz, Vassilis Kalantzis, and Yousef Saad. Cucheb: A GPU implementation of the filtered Lanczos procedure. *Computer Physics Communications*, 220:332–340, 2017.

[31] Yuanzhe Xi and Yousef Saad. Computing partial spectra with least-squares rational filters. *SIAM Journal on Scientific Computing*, 38:A3020–A3045, 2016.

[32] Yuanzhe Xi, Ruipeng Li, and Yousef Saad. An algebraic multilevel preconditioner with low-rank corrections for general sparse symmetric matrices. *SIAM Journal on Matrix Analysis and Applications*, 37(1):235–259, 2016.

[33] Edordo Di Napoli, Eric Polizzi, and Yousef Saad. Efficient estimation of eigenvalue counts in an interval. *Numerical Linear Algebra with Applications*, 23(4):674–692, 2016. nla.2048.

[34] Jiri Brabec, Lin Lin, Meiyue Shao, Niranjan Govind, Chao Yang, Yousef Saad, and Esmond G. Ng. Efficient algorithms for estimating the absorption spectrum within linear response tddft. *Journal of Chemical Theory and Computation*, 11(11):5197–5208, 2015.

[35] Lin Lin, Yousef Saad, and Chao Yang. Approximating spectral densities of large matrices. *SIAM review*, 58(1):34–65, 2016. arXiv: http://arxiv.org/abs/1308.5467.

[36] Shashanka Ubaru, Arya Mazumdar, and Yousef Saad. Low rank approximation and decomposition of large matrices using error correcting codes. *IEEE Transactions on Information Theory*, 63(9):5544–5558, 2017.

[37] Ruipeng Li, Yuanzhe Xi, Eugene Vecharynski, Chao Yang, and Yousef Saad. A Thick-Restart Lanczos algorithm with polynomial filtering for Hermitian eigenvalue problems. *SIAM Journal on Scientific Computing*, 38:A2512–A2534, 2016.

[38] Vassilis Kalantzis, Ruipeng Li, and Yousef Saad. Spectral Schur complement techniques for symmetric eigenvalue problems. *Electronic Transactions on Numerical Analysis*, 45:305–329, 2016.

[39] Pablo Salas, Luc Giraud, Yousef Saad, and Stephane Moreau. Spectral recycling strategies for the solution of nonlinear eigenproblems in thermoacoustics. *Numerical Linear Algebra with Applications*, 22(6):1039–1058, 2015. nla.1995.

[40] Yousef Saad. Analysis of subspace iteration for eigenvalue problems with evolving matrices. *SIAM Journal on Matrix Analysis and Applications*, 37(1):103–122, 2016.

[41] Y. Zhou, J. R. Chelikowsky, and Y. Saad. Chebyshev-filtered subspace iteration method free of sparse diagonalization for solving the kohnsham equation. *Journal of Computational Physics*, 274:770 – 782, 2014.

[42] Ruipeng Li, Yuanzhe Xi, and Yousef Saad. Schur complement based domain decomposition preconditioners with low-rank corrections. *Numerical Linear Algebra with Applications*, 23(2):706–729, 2016.

[43] Ruipeng Li and Yousef Saad. Low-rank correction methods for algebraic domain decomposition preconditioners. *SIAM Journal on Matrix Analysis and Applications*, 38(3):807828, 2017.

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