

Igor Simunec — Curriculum Vitae

Contact information

Name: Igor Simunec

Affiliation: Institute of Mathematics, École Polytechnique Fédérale de Lausanne (Lausanne, Switzerland)

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Employment

École Polytechnique Fédérale de Lausanne, Switzerland

Postdoctoral researcher in HPNALGS group (Chair: Prof. Laura Grigori)

Nov 2024 – now

Education

Scuola Normale Superiore di Pisa, Italy

PhD in Computational Methods and Mathematical Models for Sciences and Finance

2020 – 2024

Supervisor: Prof. Michele Benzi

Thesis title: *Advances in polynomial and rational Krylov methods for matrix functions with applications*
(PhD defended on 25 October 2024, *cum laude*)

University of Pisa, Italy

Laurea magistrale in Matematica (Master's degree in Mathematics), 110/110 *cum laude*

2018 – 2020

Thesis advisor: Prof. Michele Benzi

Thesis title: *Local and nonlocal dynamics on graphs: theory and computation*

University of Pisa, Italy

Laurea triennale in Matematica (Bachelor's degree in Mathematics), 110/110 *cum laude*

2015 – 2018

Thesis advisor: Prof. Dario A. Bini

Thesis title: *Localizzazione di zeri di funzioni analitiche mediante integrali di contorno*
(*Finding zeros of analytic functions via contour integrals*)

Scuola Normale Superiore di Pisa, Italy

Allievo ordinario (merit-based scholarship covering tuition and living expenses)

2015 – 2020

Schools

1. *Iterative Methods for Large Scale Saddle-Point Problems*
8-20 May 2022, Cortona (Italy)
2. *Recent Stability Issues for Linear Dynamical Systems: Matrix Nearness Problems and Eigenvalue Optimization*
6-10 September 2021, Cetraro (Italy)
3. *Rome-Moscow School of Matrix Methods and Applied Linear Algebra*
28 July - 11 August 2018, Moscow (Russia) & 9 - 23 September 2018, Rome (Italy)

Publications

1. Laura Grigori, Daniel Kressner, Nian Shao, Igor Simunec, *Restoring similarity in randomized Krylov methods with applications to eigenvalue problems and matrix functions*, arXiv:2601.10248, 2026.
<https://arxiv.org/abs/2601.10248>
2. Jean-Guillaume de Damas, Laura Grigori, Igor Simunec, Edouard Timsit, *Randomized orthogonalization and Krylov subspace methods: principles and algorithms*, arXiv:2512.15455, 2025.
<https://arxiv.org/abs/2512.15455>
3. Laura Grigori, Lorenzo Piccinini, Igor Simunec, *Randomized biorthogonalization through a two-sided Gram-Schmidt process*, arXiv:2509.04386, 2025.
<https://arxiv.org/abs/2509.04386>
4. Michele Benzi, Michele Rinelli, Igor Simunec, *Estimation of spectral gaps for sparse symmetric matrices*, arXiv:2410.15349, 2024. To appear in Numerische Mathematik.
<https://arxiv.org/abs/2410.15349>
5. Angelo A. Casulli, Igor Simunec, *A low-memory Lanczos method with rational Krylov compression for matrix functions*, SIAM Journal on Scientific Computing 47(3), 2025.
<https://doi.org/10.1137/24M1644699>
6. Igor Simunec, *Advances in polynomial and rational Krylov methods for matrix functions with applications*, PhD Thesis, Scuola Normale Superiore, 2024.
<https://ricerca.sns.it/handle/11384/157683>
7. Igor Simunec, *Error bounds for the approximation of matrix functions with rational Krylov methods*, Numerical Linear Algebra with Applications 31(5), 2024.
<https://doi.org/10.1002/nla.2571>
8. Stefan Güttel, Igor Simunec, *A sketch-and-select Arnoldi process*, SIAM Journal on Scientific Computing 46(4), 2024.
<https://doi.org/10.1137/23M1588007>
9. Michele Benzi, Michele Rinelli, Igor Simunec, *Computation of the von Neumann entropy of large matrices via trace estimators and rational Krylov methods*, Numerische Mathematik 155, 2023.
<https://doi.org/10.1007/s00211-023-01368-6>
10. Angelo A. Casulli, Igor Simunec, *Computation of generalized matrix functions with rational Krylov methods*, Mathematics of Computation 92, 2023.
<https://doi.org/10.1090/mcom/3788>
11. Michele Benzi, Igor Simunec, *Rational Krylov methods for fractional diffusion problems on graphs*, BIT Numerical Mathematics 62, 2022.
<https://doi.org/10.1007/s10543-021-00881-0>
12. Michele Benzi, Daniele Bertaccini, Fabio Durastante, Igor Simunec, *Non-local network dynamics via fractional graph Laplacians*, Journal of Complex Networks 8(3), 2020.
<https://doi.org/10.1093/comnet/cnaa017>

Research visits

Nov 2023: One-week visit at EPFL (Lausanne, Switzerland), hosted by Prof. Daniel Kressner.

Talk: *Error bounds for the approximation of matrix functions with rational Krylov methods*

Feb 2023: Three-week visit at the University of Manchester (Manchester, UK), hosted by Prof. Stefan Güttel.

Talk: *Computation of the von Neumann entropy of large matrices via trace estimators and rational Krylov methods*

Conferences

1. *Workshop GAMM ANLA 2025*
23-24 Oct 2025, Bologna (Italy)
Talk: *Compressed Golub-Kahan algorithm for Tikhonov regularization*
2. *INdAM Workshop: Low-rank Structures and Numerical Methods in Matrix and Tensor Computations*
1-5 Sep 2025, Cortona (Italy)
Invited talk: *Estimation of spectral gaps for sparse symmetric matrices*
3. *26th Conference of the International Linear Algebra Society (ILAS)*
23-27 Jun 2025, Kaohsiung (Taiwan)
Talk: *Lanczos with compression for symmetric matrix functions* (in the minisymposium *Advances in Krylov subspace methods and their applications*)
4. *Householder Symposium XXII*
8-13 Jun 2025, Ithaca, NY (USA)
Invited talk: *Estimation of spectral gaps for sparse symmetric matrices*
5. *Due Giorni di Algebra Lineare Numerica 2025*
20-21 Jan 2025, Pisa (Italy)
Talk: *Lanczos with compression for symmetric matrix functions*
6. *Numerical Linear Algebra (NLACIRM24)*
16-20 Sep 2024, CIRM Luminy (France)
Invited talk: *A low-memory Lanczos method with rational Krylov compression for matrix functions*
7. *Workshop on Algorithms' Impact on Artificial Intelligence*
24-26 Jun 2024, Bari (Italy)
Talk: *A sketch-and-select Arnoldi process*
8. *SIAM Conference on Applied Linear Algebra (SIAM-LA24)*
13-17 May 2024, Paris (France)
Talk: *A sketch-and-select Arnoldi process* (in the minisymposium *Randomized sketching and Krylov methods*)
9. *Workshop on Sketching, Mixed Precision, and Associated Algorithms for Scientific Computing*
18-19 Jan 2024, Bologna (Italy)
Talk: *A sketch-and-select Arnoldi process*
10. *The f(A)bulous workshop on matrix functions and exponential integrators*
25-27 Sep 2023, Magdeburg (Germany)
Talk: *Error bounds for the approximation of matrix functions with rational Krylov methods*
11. *BIRS Workshop: New Directions in Applied Linear Algebra*
27 Aug - 1 Sep 2023, Banff (Canada)
Invited talk: *Computation of the von Neumann entropy of large matrices via trace estimators and rational Krylov methods*
12. *25th Conference of the International Linear Algebra Society (ILAS)*
12-16 Jun 2023, Madrid (Spain)
Talk: *Error bounds for the approximation of matrix functions with rational Krylov methods* (in the minisymposium *The interplay between linear-multilinear algebra and rational approximation*)
13. *Due Giorni di Algebra Lineare Numerica 2023*
10-12 May 2023, L'Aquila (Italy)
Talk: *Computation of the von Neumann entropy of large matrices via trace estimation and rational Krylov methods*

14. *Linear Algebra, Matrix Analysis and Applications (ALAMA 2022)*
1-3 Jun 2022, Alcalá de Henares (Spain)
Talk: *Rational Krylov methods for fractional diffusion problems on graphs*
15. *Due Giorni di Algebra Lineare Numerica 2022*
14-15 Feb 2022, Naples (Italy)
Talk: *Computation of generalized matrix functions with rational Krylov methods*
16. *INdAM Workshop on Fractional Differential Equations: Modeling, Discretization and Numerical Solvers*
12-14 July 2021, Rome (Italy)
Talk: *Rational Krylov methods for fractional diffusion problems on graphs*

Invited seminars

Jan 2026, Università della Campania, Caserta (Italy)

Talk: Advances in polynomial and rational Krylov methods for matrix functions with applications

Nov 2025, University of Pisa, Pisa (Italy)

PYSANUM Talk: Krylov subspace methods for matrix functions: polynomial vs. rational approximation

Teaching

Sep 2025 – Dec 2025: Teaching assistant for the course *Mathematics for Geosciences* at UNIL (University of Lausanne).

Feb 2025 – Jun 2025: Teaching assistant for the course *Advanced Analysis II - Vector Analysis* at EPFL.

Sep 2023 – Dec 2023: Teaching assistant, held the MATLAB laboratory sessions of the course *Numerical analysis* for second-year Mathematics students of the University of Pisa.

Sep 2022 – Dec 2022: Teaching assistant, held the MATLAB laboratory sessions of the course *Numerical analysis* for second-year Mathematics students of the University of Pisa.

Nov 2021 – Jun 2022: Tutoring for first-year PhD students at Scuola Normale Superiore di Pisa.

Sep 2021 – Dec 2021: Online teaching assistant for the MATLAB laboratory sessions of the course *Numerical analysis* for second-year Mathematics students of the University of Pisa.

Oct 2019 – Jun 2020: Tutoring for the course *Geometry I* for first-year Mathematics students of the University of Pisa.

Oct 2018 – May 2019: Assistant in grading tests of the course *Geometry I* for first-year Physics students of the University of Pisa.

Oct 2017 – May 2019: Maths tutor for students of the *Liceo Classico G. Galilei* in Pisa.

Student supervision

Yuekai Yan: master student at EPFL, semester project (fall 2025), co-supervised with Laura Grigori and Taejun Park, *Improving stability and performance of s-step Krylov subspace methods with randomization*.

Vincent Escola: master student at EPFL, semester project (spring 2025), co-supervised with Laura Grigori, *Implementation of a stabilization procedure for Krylov subspaces via randomized sketching*.

Grants and awards

FWO Grant for a scientific stay in Flanders	2025
<i>Travel grant (4950 €) to visit a research group in Flanders, funded by the FWO</i>	
This grant will fund a three-month research visit in Prof. Raf Vandebril's research group at KU Leuven, Leuven (Belgium), starting 16 February 2026.	
"Daniela di Serafino" International Doctoral Award 2025	2025
<i>Award for a doctoral thesis defended in 2024–2025 in the field of numerical analysis</i>	
SIAM Student Travel Award	2024
<i>Travel grant (650 \$) for participation in the 2024 SIAM Conference on Applied Linear Algebra</i>	

Other activities

- Jun 2025:** Organization of the minisymposium *Advances in Krylov subspace methods and their applications* within the 26th ILAS Conference in Kaohsiung (Taiwan), together with Michele Rinelli (KU Leuven).
- Oct 2023 – Oct 2024:** Organization of the PYSANUM seminar series in numerical analysis aimed at master students in Pisa (<https://pysanum.dm.unipi.it>), together with PhD students from Scuola Normale Superiore and University of Pisa.
- Reviewer tasks:** Reviewed journal articles for *SIAM Journal on Scientific Computing*, *SIAM Journal on Matrix Analysis and Applications*, *Journal of Computational Physics*, *Applied Mathematics and Computation*.