

# Igor Simunec — Curriculum Vitae

## Contact information

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## Employment

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**École Polytechnique Fédérale de Lausanne, Switzerland**

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

*Nov 2024 – now*

## Education

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**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

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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

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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

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**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

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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

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### 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

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**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

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**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

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### **FWO Grant for a scientific stay in Flanders**

**2025**

*Travel grant (4950 €) to visit a research group in Flanders, funded by the FWO*

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**

*Award for a doctoral thesis defended in 2024–2025 in the field of numerical analysis*

### **SIAM Student Travel Award**

**2024**

*Travel grant (650 \$) for participation in the 2024 SIAM Conference on Applied Linear Algebra*

## Other activities

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**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*.