



# Leonardo Robol

## Curriculum Vitae

### Personal data

- o Born on May, 2, 1988 in Rovereto (TN), Italy.

### Academic positions

- 2018 – Now **Assistant professor, non-tenure track.**  
Department of Mathematics, University of Pisa, Italy.  
November, 5, 2018 – current position.
- 2017 – 2018 **Researcher.**  
ISTI, Area della Ricerca CNR, Pisa, Italy.  
April, 3, 2017 – November, 2, 2018.
- 2015 – 2017 **Postdoc researcher.**  
Department of Computer Science, KU Leuven, Belgium.  
November, 1, 2015 – March, 31, 2017.
- 2011 – 2012 **Research scholarship.**  
Scholarship on the study of numerical methods for the computation of the zeros of matrix and scalar polynomials at arbitrary precision and their implementation.  
March, 1, 2011 – February, 29, 2012.

### Education

- 2012 – 2015 **PhD in Mathematics, *Scuola Normale Superiore, Pisa, Italy.***  
**Thesis** Exploiting rank structures for the numerical treatment of matrix polynomials.  
**Advisor** Prof. Dario A. Bini.  
**Date** November, 30, 2015.  
**Final mark** 70/70 cum laude.
- 2010 – 2012 **Master degree in Mathematics, *Università di Pisa, Italy.***  
**Thesis** A rootfinding algorithm for polynomials and secular equations.  
**Advisor** Prof. Dario A. Bini.  
**Date** September, 17, 2012.  
**Final mark** 110/110 cum laude.
- 2007 – 2010 **Bachelor degree in Mathematics, *Università di Pisa, Italy.***  
**Thesis** Compressione di immagini mediante trasformata wavelet: l'algoritmo EZW.  
**Advisor** Prof. Dario A. Bini.  
**Date** September, 24, 2010.  
**Final mark** 110/110 cum laude.

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## Research interests

- **Low-rank approximation:** fast methods for approximating low-rank matrices and tensors, study of matrices with a hierarchical rank-structure.
- Efficient methods for the solution of large scale **matrix equations**.
- Analysis of **Toeplitz-like** matrices.
- Analysis of matrix polynomials and design of **structure-preserving** linearizations. Design of fast methods for **polynomial and nonlinear eigenvalue problems**.
- **Rootfinding methods** to approximate polynomials' roots. Design of efficient methods for particular classes of polynomials.

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## Teaching experience

2019 **PhD course on Low-rank approximation.**

20 hours at the PhD school of the University of Cagliari, Italy.

2012 – 2020 **Courses at the Department of Mathematics and Computer Science, Pisa.**

- *Laboratorio di Comunicazione mediante calcolatore*
  - Academic year 2018 – 2019, 24 hours.
  - Academic year 2019 – 2020, 32 hours.
  - Academic year 2019 – 2020, 34 hours.
- *Laboratorio Sperimentale di Matematica Computazionale*
  - Academic year 2018 – 2019, 14 hours.
  - Academic year 2019 – 2020, 22 hours.
- *Computational methods for Learning and Data Analysis* – Master degree
  - Academic year 2017 – 2018, 20 hours of exercise sessions.
- *Numerical analysis* – Bachelor degree
  - Academic year 2012 – 2013, 22 hours of exercise sessions.
  - Academic year 2013 – 2014, 22 hours of exercise sessions.
  - Academic year 2017 – 2018, 20 hours of exercise sessions.
  - Academic year 2018 – 2019, 22 hours of exercise sessions.
  - Academic year 2019 – 2020, 20 hours of exercise sessions.
  - Academic year 2020 – 2021, 20 hours of exercise sessions.

2015 – 2016 **Exercise sessions.**

- *Numerical Linear Algebra* – Master degree, Computer Science Department, KU Leuven, Belgium
  - Academic year 2015 – 2016, 16 hours of exercise sessions.
  - Academic year 2016 – 2017, 16 hours of exercise sessions.

2014 – 2015 **Tutorato.**

- Complementi di analisi, Scuola Normale Superiore, Pisa.
  - Academic year 2013 – 2014, 1 hour per week (equivalent to approximately 35 hours).

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## Prizes and awards

2018–2019 **YRA (Young Researcher Award).**

The ISTI Young Researcher Award (YRA) is an annual award that honors its staff of less than 35 years old for a distinct contribute to the Institute activity with their scientific production. Obtained for two consecutive years.

2017 **Honorable mention at the Householder symposium HHXX.**

Awarded for the PhD thesis.

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## Other scientific activities

### Conference and workshop organization

- 2018 **SIAM ALA 2018**, *Hong Kong*.  
Organizer of the minisymposium “Recent applications of rank structures in matrix analysis”.  
**Research in pairs**, *Luminy, France*.  
Co-organizer of a “Research in pairs” workshop at the CIRM in Luminy, titled “Fast solvers for fractional differential equations”.
- 2016 **ILAS 2016**, *Leuven, Belgium*.  
Member of the local organizing committee.

### Plenary lectures

1. **SIAM UKIE National Student Chapter Conference**, Manchester, UK, 2019  
Rank structures in matrix equations and matrix functions.
2. **Householder symposium XX**, Blacksburg, VA, USA, 2017.  
Fast and backward stable computation of the eigenvalues of matrix polynomials.

### Invitation to conferences

3. **Congresso UMI 2019**, Pavia, Italy, 2019.  
When is a matrix unitary or Hermitian plus low-rank?
4. **ICIAM2019**, Valencia, Spain, 2019.  
Low-rank updates for linear matrix equations.
5. **ILAS2019**, Rio de Janeiro, Brazil, 2019.  
Fast solvers for 2D fractional differential equations using rank structured matrices — Fast computation of the eigenvalues of matrix polynomials.
6. **ETNA25**, Cagliari, Italy, 2019.  
Solving quadratic matrix equations with infinite size coefficients.
7. **SIMAI 2018**, Rome, Italy, 2018.  
A Krylov-based trust region scheme for model updating.
8. **Structured Matrices in Numerical Linear Algebra**, Cortona, Italy, 2017.  
Backward error analysis for structured polynomial root-finders.
9. **ILAS 2017**, minisymposium “Matrix Polynomials”, Ames, Iowa, USA, 2017.  
Fast and backward stable computation of the eigenvalues of matrix polynomials.
10. **CMMSE 2017**, minisymposium “Rank structured matrices: recent developments and new perspectives”, Cadiz, Spain, 2017.  
Solving large scale quasiseparable Lyapunov equations.
11. **NL2A**, Luminy, France, 2016.  
Fast and backward stable computation of the eigenvalues of matrix polynomials.
12. **ILAS 2016**, Leuven, Belgium, minisymposium “Polynomial and rational eigenvalue problems”, 2016.  
A Framework for Structured Linearizations of Matrix Polynomials in Various Bases.
13. **Structured Matrix Days 2016**, Limoges, France, 2016.  
A Framework for Structured Linearizations of Matrix Polynomials in Various Bases.
14. **Structured Matrix Computations with Applications**, Sanya, China, 2016.  
Ehrlich–Aberth iteration for rank structured pencils.
15. **SIAM ALA 2015**, minisymposium “Polynomial eigenvalue problems”, Atlanta, USA, 2015.

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- A Diagonal Plus Low Rank Family of Linearizations for Matrix Polynomials.
16. **Congresso UMI 2015**, session on *Linear Algebra and Optimization*, Siena, Italy, 2015.  
A new class of rank structured linearizations for matrix polynomials.
  17. **IWOTA 2015**, session on *Structured linear algebra*, Tbilisi, Georgia, 2015.  
Efficient cyclic reduction for QBDs with rank structured blocks.
  18. **SLA2014**, Kalamata, Greece, 2014.  
Hessenberg reduction of diagonal plus low rank matrices.
  19. **Workshop on Nonlinear Eigenvalue Problems**, Manchester, UK, 2014.  
Solving matrix polynomials of large degrees: some computational issues.
  20. **ILAS 2013**, Providence, Rhode Island, USA, 2013.  
Solving secular and polynomial equations: a multiprecision algorithm.

#### Other conferences

21. **SIAM ALA 18**, Hong Kong, 2018.  
Solving 2D fractional differential equations using rank-structured matrix equations.
22. **Due Giorni di Algebra Lineare 2018**, Padova, Italy, 2018.  
A Krylov-based trust region scheme for model updating.
23. **METT 2017**, Pisa, Italy, 2017.  
Off-diagonal singular values decay in cyclic reduction.
24. **Due Giorni di Algebra Lineare**, Como, Italy, 2017.  
Decay bounds for the numerical quasiseparable preservation in matrix functions.
25. **ALAMA 2016**, León, Spain, 2016.  
A Framework for Structured Linearizations of Matrix Polynomials in Various Bases.
26. **Journees Approximation 2016**, Lille, France, 2016.
27. **NETNA2015**, Falerna, Italy, 2015.  
A new class of rank structured linearizations for matrix polynomials.
28. **Structured Matrix Days 2015**, Limoges, France, 2015.  
Quasiseparable Hessenberg triangular reduction for some diagonal plus low rank matrices.
29. **GAMM 2015**, Lecce, Italy, 2015.  
Hessenberg reduction of diagonal plus low rank matrices.
30. **ILAS 2014**, Seoul, South Korea, 2014.  
A new class of block companion matrices related to matrix polynomials.
31. **SNC 2014**, Shanghai, China, 2014.  
A multiprecision algorithm for the solution of polynomials and polynomial eigenvalue problems.
32. **Due Giorni di Algebra Lineare**, Rome, Italy, 2013.  
Solving secular and polynomial equations: a multiprecision algorithm.

#### Summer schools

- 2013 **Gene Golub Summer School**, *Shanghai, China*.

#### Seminars

- 2019 **EPFL**, *Lausanne, Switzerland*.  
Fractional diffusion equations and rank-structured matrices.
- 2018 **EPFL**, *Lausanne, Switzerland*.  
Distance from rank-structured matrices.

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**ICMAT, Madrid, Spain.**

Low-rank updates for linear matrix equations.

2017 **Max Planck Institute for Plasma Physics, Munich, Germany.**

Solving PDEs using rank-structured matrix equations.

**EPFL, Lausanne, Switzerland.**

Backward error analysis for polynomial root-finders.

**Dipartimento di Matematica, Pisa, Italy.**

Backward error analysis for polynomial root-finders.

2016 **KU Leuven, Leuven, Belgium.**

A multiprecision algorithm for polynomial rootfinding

**Université des Sciences et Technologies de Lille, Lille, France.**

On the decay of the off-diagonal singular values in cyclic reduction.

2015 **KU Leuven, Leuven, Belgium.**

Solving polynomial eigenvalue problems (and other related issues).

2014 **KU Leuven, Leuven, Belgium.**

MPSolve: how it works.

### Projects and Grants

2020 **Progetto GNCS “Metodi low-rank per problemi di algebra lineare con struttura data-sparse”.**

Coordinator of the research project “Metodi low-rank per problemi di algebra lineare con struttura data-sparse”, supported by INdAM/GNCS with a grant of 4400 euros.

2019 **Progetto Giovani Ricercatori GNCS.**

Grant of 1200 euros for the GNCS Giovani Ricercatori project “Metodi di proiezione per equazioni di matrici e sistemi lineari con operatori definiti tramite somme di prodotti di Kronecker, e soluzioni con struttura di rango.”

2018 **Grant for Young Mobility.**

Grant of 4000 euros by ISTI-CNR supporting research visits to the department of Computer Science at KU Leuven, Belgium.

2017 **Research in pairs.**

Granted travel and lodging support for the project “Fast solvers for fractional differential equations”, requested to organize a workshop “Research in pairs” at CIRM in Luminy.

2017 **ProgettISTI.**

1 year project funded by ISTI-CNR: “Tensor algorithms for performability analysis of large systems”. Grant of 2500 euros.

2016 – 2017 **C1 project / KU Leuven.**

Participation to the project “Inverse-free Rational Krylov Methods: Theory and Applications”

2015 – 2017 **Participation in INdAM/GNCS projects.**

- GNCS 2020 “Metodi low-rank per problemi di algebra lineare con struttura data-sparse”
- GNCS 2018 “Tecniche innovative per problemi di algebra lineare”;
- GNCS 2017 “Metodi numerici avanzati per equazioni e funzioni di matrici con struttura”;
- GNCS 2016 “Equazioni e funzioni di matrici con struttura: analisi e algoritmi”;
- GNCS 2015 “Metodi numerici per autovalori e funzioni di matrici con strutture”;

### Peer review

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5/10

2020 – now **Associate editor**, *Applied Mathematics and Computation*.

2015 – now **Referee**.

- Applied Mathematics and Computation.
- Applied Numerical Mathematics
- BIT Numerical Mathematics.
- Calcolo.
- Computer Methods in Applied Mechanics and Engineering.
- Electronic Journal of Linear Algebra.
- Electronic Transactions of Numerical Analysis
- Journal of Nonlinear Mathematical Physics.
- Journal of Numerical Mathematics.
- Linear Algebra and its Applications.
- Linear and Multilinear Algebra
- Mathematics of Computations.
- Numerical Algorithms.
- Numerical Linear Algebra with Applications.
- SIAM Journal on Matrix Analysis and Applications.
- ACM Transactions on Mathematical Software.

#### Research visits

2019 **EPFL**, (1 week).

Visit to Daniel Kressner to collaborate on the design of fast methods for HSS matrices.

**KU Leuven**, (8 days).

Visit to Raf Vandebril to continue an ongoing collaboration on stability of polynomial rootfinding.

2018 **EPFL**, (1 week).

Visit to Daniel Kressner to collaborate on the design of fast methods for HSS matrices.

**ICMAT**, (10 days).

Workshop “Autumn of Eigenvalues” on fast methods for computing eigenvalues of rank structured matrices and rootfinding problems.

**KU Leuven**, (2 weeks).

Visit to Raf Vandebril to continue an ongoing collaboration on computing eigenpairs of matrix polynomials.

**Department of Mathematics, University of Essex**, (1 week).

Visit to Vanni Noferini to collaborate on the backward error analysis of structured root-finders.

2017 **Max Planck Institute for Plasma Physics**, (1 week).

Visit to Mariarosa Mazza to collaborate on solver for fractional order PDEs based on rank-structured matrix equations.

**EPFL**, (1 week).

Visit to Daniel Kressner to collaborate on the design of fast methods for rank-structured Lyapunov equations.

**KU Leuven**, (2 weeks).

Visit to Raf Vandebril to continue an ongoing collaboration on computing eigenpairs of matrix polynomials.

2016 **Lille**, (1 day).

Visit to Bernhard Beckermann to give a seminar in the Numerical analysis seminar series in Lille.

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6/10

### Perugia, (1 day).

Visit to continue an ongoing collaboration with B. Iannazzo, F. De Terán and F. Poloni.

### 2015 Perugia, (2 days).

Visit that started the collaboration with B. Iannazzo, F. De Terán and F. Poloni on the uniqueness of solutions for generalized Sylvester equations.

### 2014 KU Leuven, (1 week).

Visited Raf Vandebril in Leuven to start the collaboration on the topic of polynomial eigenvalue problems.

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## Foreign languages

Italian Mother tongue

English C1 Level

*Fluent speaking and writing skills*

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## Publications

To see an up-to-date list of my publications, you can check my Google Scholar profile or my personal web page.

**Google Scholar** [https://scholar.google.com/citations?user=j9WP\\_U4AAAAJ](https://scholar.google.com/citations?user=j9WP_U4AAAAJ)

**Scopus** <https://www.scopus.com/authid/detail.uri?authorId=55748770500>

### Books

1. **Core-Chasing Algorithms for the Eigenvalue Problem**, J. L. Aurentz, T. Mach, L. Robol, R. Vandebril, D. S. Watkins, SIAM, 2018.

### Journal papers

2. **Rational Krylov for Stieltjes matrix functions: convergence and pole selection**, S. Massei, L. Robol, BIT Numerical Mathematics, 2020 — DOI: 10.1007/s10543-020-00826-z.
3. **A computational framework for two-dimensional random walks with restarts**, D. A. Bini, S. Massei, B. Meini, L. Robol, SIAM Journal on Scientific Computing, 2020 — DOI: 10.1137/19M1304362.
4. **Rational Krylov and ADI iteration for infinite size quasi-Toeplitz matrix equations**, L. Robol, Linear Algebra and Its Applications, 2020 — DOI: 10.1016/j.laa.2020.06.013.
5. **hm-toolbox: Matlab software for HODLR and HSS matrices**, S. Massei, L. Robol, D. Kressner, SIAM Journal on Scientific Computing, 2020 — DOI: 10.1137/19M1288048.
6. **Finite element model updating for structural applications**, M. Girardi, C. Padovani, D. Pellegrini, L. Robol, Journal of Computational and Applied Mathematics, 2020 — DOI: 10.1016/j.cam.2019.112675.
7. **Computing performability measures by means of matrix functions**, G. Masetti, L. Robol, Journal of Computational and Applied Mathematics, 2020 — DOI: 10.1016/j.cam.2019.112534.
8. **When is a matrix unitary or Hermitian plus low rank?**, G. M. Del Corso, F. Poloni, L. Robol, R. Vandebril, Numerical Linear Algebra with Applications, 2019 — DOI: 10.1002/nla.2266.
9. **Nonsingular systems of generalized Sylvester equations: an algorithmic approach**, F. De Terán, B. Iannazzo, F. Poloni, L. Robol, Numerical Linear Algebra with Applications, 2019 — DOI: 10.1002/nla.2261.
10. **Model Updating Procedure to Enhance Structural Analysis in FE Code NOSA-ITACA**, M. Girardi, C. Padovani, D. Pellegrini, L. Robol, Journal of Performance of

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7/10

- Constructed Facilities, 2019, 33(4) — DOI: 10.1061/(ASCE)CF.1943-5509.0001303.
11. **Fast solvers for Two-dimensional fractional diffusion equations using rank structured matrices**, S. Massei, M. Mazza, L. Robol, SIAM Journal on Scientific Computing, 2019 — DOI: 10.1137/18M1180803.
  12. **Low-rank updates and a divide-and-conquer method for linear matrix equations**, D. Kressner, S. Massei, L. Robol, SIAM Journal on Scientific Computing, 2019 — DOI: 10.1137/17M1161038.
  13. **Factoring block Fiedler Companion Matrices**, G. M. Del Corso, F. Poloni, L. Robol, R. Vandebril, Springer INdAM series, 2019 — DOI: 10.1007/978-3-030-04088-8\_7.
  14. **Fast and backward stable computation of the eigenvalues of matrix polynomials**, J. L. Aurentz, T. Mach, L. Robol, R. Vandebril, D. S. Watkins, Mathematics of Computation, Volume 88, Issue 315, 2019 — DOI: 10.1090/mcom/3338.
  15. **Solving rank structured Sylvester and Lyapunov equations**, S. Massei, D. Palitta, and L. Robol, SIAM Journal on Matrix Analysis and Applications, Volume 39 (4), 2018 — DOI: 10.1137/17M1157155.
  16. **Quasi-Toeplitz matrix arithmetic: a MATLAB toolbox**, D. A. Bini, S. Massei, and L. Robol, to appear in Numerical Algorithms, 2018 — DOI: 10.1007/s11075-018-0571-6.
  17. **Fast and backward stable computation of roots of polynomials, Part II: general backward error analysis**, J. L. Aurentz, T. Mach, L. Robol, R. Vandebril, and D. S. Watkins, SIAM Journal on Matrix Analysis and Applications, Volume 39 (3), 2018 — DOI: 10.1137/17M1152802.
  18. **On quadratic matrix equations with infinite size coefficients encountered in QBD stochastic processes**, D. A. Bini, S. Massei, B. Meini, L. Robol, Numerical Linear Algebra with Applications, Volume 25, Issue 6, 2018 — DOI: 10.1002/nla.2128.
  19. **Solvability and uniqueness criteria for generalized Sylvester-type equations**, F. De Terán, B. Iannazzo, F. Poloni and L. Robol, Linear Algebra and its Applications, Volume 542, April 2018, Pages 501–521 — DOI: 10.1016/j.laa.2017.07.010.
  20. **Efficient Ehrlich–Aberth iteration for finding intersections of interpolating polynomials and rational functions**, L. Robol and R. Vandebril, Linear Algebra and its Applications, Volume 542, April 2018, Pages 282–309 — DOI: 10.1016/j.laa.2017.05.010.
  21. **On the decay of the off-diagonal singular values in cyclic reduction**, D. A. Bini, S. Massei and L. Robol, Linear Algebra and its Applications, Volume 519, 15 April 2017, Pages 27–53 — DOI: 10.1016/j.laa.2016.12.027.
  22. **Fast Hessenberg reduction of some rank structured matrices**, L. Gemignani, L. Robol, SIAM Journal on Matrix Analysis and Applications, Volume 38 (2), 22 June 2017, Pages 574–598 — DOI: 10.1137/16M1107851.
  23. **Efficient cyclic reduction for Quasi-Birth-Death problems with rank structured blocks**, D. A. Bini, S. Massei and L. Robol, Applied Numerical Mathematics, Volume 116, 30 June 2017, Pages 37–46 — DOI: 10.1016/j.apnum.2016.06.014.
  24. **A framework for structured linearizations of matrix polynomials in various bases**, L. Robol, R. Vandebril and P. Van Dooren, SIAM Journal on Matrix Analysis and Applications, Volume 38 (1), 16 March 2017, Pages 188–216 — DOI: 10.1137/16M106296X.
  25. **Decay bounds for the numerical quasiseparable preservation in matrix functions**, S. Massei and L. Robol, Linear Algebra and its Applications, Volume 516, 1 March 2017, Pages 212–242 — DOI: 10.1016/j.laa.2016.11.041.
  26. **Quasiseparable Hessenberg reduction of real diagonal plus low rank matrices and applications**, D. A. Bini and L. Robol., Linear Algebra and Its Applications, Volume 502, 1 August 2016, Pages 186–213 — DOI: 10.1016/j.laa.2015.08.026.
  27. **On a Class of Matrix Pencils Equivalent to a Given Matrix Polynomial**, D. A. Bini and L. Robol, Linear Algebra and Its Applications, Volume 502, 1 August 2016, Pages 275–298 — DOI: 10.1016/j.laa.2015.07.017.
  28. **Solving secular and polynomial equations, a multiprecision algorithm**, D. A. Bini

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and L. Robol, Journal of Computational and Applied Mathematics, Volume 272, 15 December 2014, Pages 276-292 — DOI: 10.1016/j.cam.2013.04.037.

### Proceedings

29. **Fea for masonry structures and vibration-based model updating using NOSA-ITACA**, M. Girardi, C. Padovani, D. Pellegrini, L. Robol, 10th International Masonry Conference, Milano, 9-11 July 2018.
30. **NOSA-ITACA: a free FE program for historic masonry buildings**, M. Girardi, C. Padovani, D. Pellegrini, L. Robol, CoRASS 2017 - ECCOMAS Conference on Recent Advances in Nonlinear Models - Design and Rehabilitation of Structures (Coimbra, Portugal, 16-17 November 2017) — ISBN: 978-989-96461-8-6.
31. **A multiprecision algorithm for the solution of polynomials and polynomial eigenvalue problems**, D. A. Bini, L. Robol, Proceedings of the 2014 Symposium on Symbolic-Numeric Computation Pages 17-18, 28 July 2014 — ISBN: 978-1-4503-2963-7.

### Under review

32. **Rank-structured QR for Chebyshev rootfinding**, A. Casulli, L. Robol, arXiv preprint arXiv:2010.11416, 2020.
33. **Sampling the eigenvalues of random orthogonal matrices**, M. Fasi, L. Robol, arXiv preprint arXiv:2009.11515, 2020.
34. **Structured backward errors in linearizations**, V. Noferini, L. Robol, R. Vandebril, arXiv preprint arXiv:1912.04157, 2019.

### Theses

35. **Exploiting rank structures for the numerical treatment of matrix polynomials**, L. Robol, PhD thesis, Scuola Normale Superiore di Pisa, 2015.
36. **A rootfinding algorithm for polynomials and secular equations**, L. Robol, Master thesis, Università di Pisa, 2012.

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## Software

I developed and contributed to a wide range of software. Most of my contributions are available on my Github page at <https://github.com/robol>.

- 2011 – Now **MPSolve**, *multiprecision polynomial solver that computes the roots of univariate polynomial at arbitrary precision*, The project is written in C/C++, and it amounts to more than 50k LOC. The code is open source and available at <http://numpi.dm.unipi.it/software/mpsolve/>. Bindings for several languages (Python, MATLAB, Octave, Fortran, ...), a desktop user interface, and an Android app are available. The implementation relies on pthreads for parallelism.
- 2015 – 2016 **h2lib-matlab**, *a MATLAB interface to the H2Lib library*, <https://github.com/robol/h2lib-matlab/>.
- 2017 – Now **cqt-toolbox**, *a MATLAB toolbox to compute with infinite Toeplitz matrices with finite corrections*, <https://github.com/numpi/cqt-toolbox/>.
- 2017 – Now **hm-toolbox**, *a MATLAB toolbox to compute with Hierarchical matrices and HSS, and to solve some kinds of matrix equations*, <https://github.com/numpi/hm-toolbox/>.

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2017 – Now **NOSA**, a *finite element code for masonry-like structures, with modules for static, dynamic, and modal analysis, as well as support for advanced model updating features*, <http://www.nosaitaca.it/>.

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10/10