

# Thibaut Verron

Post-doctoral researcher, Johannes Kepler University

**Date of birth:** 21 March 1991

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## Research interests

- Computer algebra, algorithms for commutative algebra and algebraic geometry
- Polynomial system solving, Gröbner bases, signature-based algorithms
- Algorithmic and algebraic structures of polynomial systems
- Tropical Gröbner bases, Gröbner bases for Tate series, Gröbner bases over rings
- Algorithms for real algebraic geometry
- D-finite functions and sequences

## Employment

**2017 – 2020 Post-doctoral researcher at JKU (Linz, Austria)**

Supervisor: Manuel Kauers (Institute for Algebra)

Keywords: computer algebra, algorithmic combinatorics, D-finite functions

**2016 – 2017 Post-doctoral researcher at INP-ENSEEIH (Toulouse, France)**

Supervisors: Joseph Gergaud, Olivier Cots

(Team *Parallel algorithms and optimization*)

Keywords: optimal control

## Education

**2012 – 2016 Ph.D thesis, University Pierre et Marie Curie (Paris, France)**

Computer science

**2011 – 2012 Masters degree, University Paris-Sud 11 (Orsay, France)**

Pure and Applied Mathematics, specialty Algebra, Analysis and Geometry

**2009 – 2013 École Normale Supérieure de Paris (France)**

Diploma of the ENS, Major in Mathematics, minor in Computer Science

## Ph.D. thesis

**Dates** September 2012 – September 2016 (defense: 26 September 2016)

**Location** PolSys team, LIP6, Université Pierre et Marie Curie (Paris, France)

**Supervisors** Jean-Charles Faugère, Mohab Safey El Din

**Title** Regularization of Gröbner basis computations for weighted and determinantal systems, and an application to medical imagery

**Keywords** polynomial systems; Gröbner bases; structured systems; weighted-homogeneous systems; determinantal systems; real algebraic geometry

## Committee

<b>Director</b>	Jean-Charles Faugère	Research director, Inria
<b>Advisor</b>	Mohab Safey El Din	Professor, UPMC
<b>Reviewer</b>	Laurent Busé	Researcher, Inria, HdR
<b>Reviewer</b>	Bruno Salvy	Research director, Inria
<b>Examiner</b>	Bernard Bonnard	Professor, Université de Bourgogne
<b>Examiner</b>	Stef Graillat	Professor, UPMC

## Publications

### Journal papers

1. Tristan Vaccon, Thibaut Verron, and Kazuhiro Yokoyama. “On affine tropical F5 algorithms”. In: *Journal of Symbolic Computation* (Oct. 2019). Extended version of an article published in the Proceedings of ISSAC’18. ISSN: 0747-7171. DOI: [10.1016/j.jsc.2019.10.012](https://doi.org/10.1016/j.jsc.2019.10.012)
2. Maria Francis and Thibaut Verron. “A Signature-Based Algorithm for Computing Gröbner Bases over Principal Ideal Domains”. In: *Mathematics in Computer Science, special issue on the ACA 2018 conference* (2019). To appear. arXiv: [1802.01388](https://arxiv.org/abs/1802.01388) [cs.SC]
3. Bernard Bonnard, Olivier Cots, Jérémy Rouot, and Thibaut Verron. “Time minimal saturation of a pair of spins and application in Magnetic Resonance Imaging”. In: *Mathematical Control & Related Fields* 10.1 (2020), pp. 47–88. ISSN: 2156-8499. DOI: [10.3934/mcrf.2019029](https://doi.org/10.3934/mcrf.2019029). URL: <https://www.archives-ouvertes.fr/hal-01764022>
4. Jean-Charles Faugère, Mohab Safey El Din, and Thibaut Verron. “On the complexity of computing Gröbner bases for weighted homogeneous systems”. In: *Journal of Symbolic Computation* 76 (2016), pp. 107–141. ISSN: 0747-7171. DOI: [http://dx.doi.org/10.1016/j.jsc.2015.12.001](https://doi.org/10.1016/j.jsc.2015.12.001). URL: <https://hal.archives-ouvertes.fr/hal-01097316v2>

## Conference papers

5. Xavier Caruso, Tristan Vaccon, and Thibaut Verron. “Signature-based algorithms for Gröbner bases over Tate algebras”. In: *Proceedings of the 2020 International Symposium on Symbolic and Algebraic Computation - ISSAC '20* (2020). DOI: [10.1145/3373207.3404035](https://doi.org/10.1145/3373207.3404035). URL: <https://arxiv.org/abs/2002.04491>
6. Shaoshi Chen, Lixin Du, Manuel Kauers, and Thibaut Verron. “Integral P-Recursive Sequences”. In: *Proceedings of the 2020 International Symposium on Symbolic and Algebraic Computation - ISSAC '20* (2020). DOI: [10.1145/3373207.3404004](https://doi.org/10.1145/3373207.3404004). URL: <https://arxiv.org/abs/2002.02783>
7. Xavier Caruso, Tristan Vaccon, and Thibaut Verron. “Gröbner bases over Tate algebras”. In: *Proceedings of the 2019 International Symposium on Symbolic and Algebraic Computation*. ISSAC '19. Beijing, China, 2018. arXiv: [1901.09574](https://arxiv.org/abs/1901.09574) [math.AG]. URL: <https://arxiv.org/abs/1901.09574>
8. Tristan Vaccon, Thibaut Verron, and Kazuhiro Yokoyama. “On Affine Tropical F5 Algorithms”. In: *Proceedings of the 2018 ACM on International Symposium on Symbolic and Algebraic Computation - ISSAC '18* (2018). DOI: [10.1145/3208976.3209012](https://doi.org/10.1145/3208976.3209012). URL: <https://arxiv.org/abs/1805.06183>
9. Bernard Bonnard, Jean-Charles Faugère, Alain Jacquemard, Mohab Safey El Din, and Thibaut Verron. “Determinantal Sets, Singularities and Application to Optimal Control in Medical Imagery”. In: *Proceedings of the ACM on International Symposium on Symbolic and Algebraic Computation - ISSAC '16* (2016). DOI: [10.1145/2930889.2930916](https://doi.org/10.1145/2930889.2930916). URL: <https://hal.archives-ouvertes.fr/hal-01307073v2>
10. Jean-Charles Faugère, Mohab Safey El Din, and Thibaut Verron. “On the complexity of computing gröbner bases for quasi-homogeneous systems”. In: *Proceedings of the 38th international symposium on International symposium on symbolic and algebraic computation - ISSAC '13* (2013). DOI: [10.1145/2465506.2465943](https://doi.org/10.1145/2465506.2465943). URL: <https://hal.archives-ouvertes.fr/hal-00780388v2>

## Note on the conferences:

- The *International Symposium on Symbolic and Algebraic Computations* (ISSAC) is the reference conference in computer algebra. Presentations are selected after peer-review, and articles are published in proceedings.

## Other publications

11. Manuel Kauers and Thibaut Verron. “Why you should remove zeros from data before guessing”. In: *ACM Communications in Computer Algebra* 53.3 (Dec. 2019). Extended abstract of a poster presented at ISSAC 2019, pp. 126–129. ISSN: 1932-2240. DOI: [10.1145/3377006.3377017](https://doi.org/10.1145/3377006.3377017)

## Preprints and submitted papers

12. Maria Francis and Thibaut Verron. “Signature-based Möller’s algorithm for strong Gröbner bases over PIDs”. In: *ArXiv e-prints* (2019). arXiv: [1901.09586](https://arxiv.org/abs/1901.09586) [cs.SC]

13. Bernard Bonnard, Olivier Cots, Jean-Charles Faugère, Alain Jacquemard, Jérémy Rouot, Mohab Safey El Din, and Thibaut Verron. *Algebraic-geometric techniques for the feedback classification and robustness of the optimal control of a pair of Bloch equations with application to Magnetic Resonance Imaging*. In preparation. 2017. URL: <https://hal.inria.fr/hal-01556806>

## Software

### Tate Algebras

- SageMath package for working with Tate series over  $\mathbb{Z}_p$  and  $\mathbb{Q}_p$
- Implementation of algorithms presented at ISSAC 2019
- Distributed with SageMath since version 8.5 (22/12/2018)
- 5200 lines of code (Python, Cython)
- Joint development with X. Caruso and T. Vaccon
- Link: [https://doc.sagemath.org/html/en/reference/power\\_series/sage/rings/tate\\_algebra.html](https://doc.sagemath.org/html/en/reference/power_series/sage/rings/tate_algebra.html)

### Signature Gröbner bases over PIDs

- Toy implementation in Magma of signature-enabled versions of Möller's algorithms for computing Gröbner bases over PIDs
- Implementation of algorithms presented at *Applications of Computer Algebra* 2018 and *SIAM conference on Applied Algebraic Geometry* 2019
- 1600 lines of code (Magma)
- Link: <https://github.com/ThibautVerron/SignatureMoller>

### Real algebraic classification algorithms for determinantal varieties

- Implementation in Maple of algorithms computing a classification of the real singularities of determinantal varieties
- Implementation of algorithms presented at ISSAC 2016
- 450 lines of code (Maple)
- Example run on an application to optimal control in medical imagery
- Joint development with M. Safey El Din
- Link: <http://mercurey.gforge.inria.fr>

## Communications

### Conference talks

- *Signature-based algorithms for Gröbner bases over Tate algebras*. International Symposium on Symbolic and Algebraic Computation (ISSAC). Kalamata, Greece (online), 2020

- *Gröbner bases and Tate algebras*. International Symposium on Symbolic and Algebraic Computation (ISSAC). Beihang University, Beijing, China, 2019
- *Signature-based Möller's algorithm for strong Gröbner bases over PIDs*. SIAM Conference on Applied Algebraic Geometry, Mini-symposium "Algebraic methods for polynomial system solving". University of Bern, Bern, Switzerland, 2019
- *Algorithme de Möller avec signatures pour le calcul de bases de Gröbner fortes à coefficients dans un anneau principal*. Journées Nationales de Calcul Formel 2019. CIRM, Luminy, France, 2019
- *Signature-based criteria for computing weak Gröbner bases over PIDs*. 24th Conference on Applications of Computer Algebra (ACA 2018), session "Algorithms for zero-dimensional ideals". University of Santiago de Compostela, Santiago de Compostela, Spain, 2018
- *Méthodes algébriques pour le contrôle optimal en Imagerie à Résonance Magnétique*. 8<sup>e</sup> Biennale Française des Mathématiques Appliquées et Industrielles (SMAI 2017), Mini-symposium "Contrôle et applications". La Tremblade, France, 2017
- *Determinantal set, singularities and application to optimal control in medical imagery*. International Symposium on Symbolic and Algebraic Computation (ISSAC). Wilfrid Laurier University, Waterloo, Canada, 2016
- *Algebraic classification related to contrast optimization for MRI*. Journées annuelles du GdR Mathématiques de l'Optimisation et Applications 2015. IMB, Université de Bourgogne, Dijon, France, 2015
- *Classification algébrique associée à l'optimisation de contraste pour l'IRM*. Journées Nationales de Calcul Formel 2015. ENSAM, Cluny, France, 2015
- *Complexité du calcul de bases de Gröbner pour les systèmes homogènes avec poids*. Journées Nationales de Calcul Formel 2014. CIRM, Luminy, France, 2014
- *Bases de Gröbner et systèmes structurés*. Rencontres doctorales Henri Lebesgue 2014. IRMAR, Rennes, France, 2014
- *On the complexity of computing Gröbner bases for quasi-homogeneous systems*. International Symposium on Symbolic and Algebraic Computation (ISSAC). Northeastern University, Boston, USA, 2013
- *Complexité du calcul de bases de Gröbner pour les systèmes quasi-homogènes*. Journées Nationales de Calcul Formel 2013. CIRM, Luminy, France, 2013

## Posters

- Manuel Kauers and Thibaut Verron. *Why you should remove zeros from data before guessing*. International Symposium on Symbolic and Algebraic Computation (ISSAC). Beihang University, Beijing, China, 2019

## Teaching and supervising experience

- 2018 – 2020** Guest lecturer / teaching assistant in Mathematics, JKU, Linz (Austria)  
Supervision of a bachelor thesis with M. Kauers
- 2016 – 2017** Teaching assistant in Applied Mathematics, INP Toulouse (France)
- 2013 – 2016** Teaching assistant in Computer Science, UPMC, Paris (France)

## Service

- **Software presentation award committee** for the International Symposium on Symbolic and Algebraic Computation (ISSAC) 2019
- **Poster chair** for the 6th International Congress on Mathematical Software (ICMS), 2018
- **Reviewer** for SODA, JSC, FPSAC, MACIS...

## Other information

- **Languages:** French (native), English (fluent), German (advanced), Russian, Turkish (basic)
- **Programming languages:** Python, C, C++, OCaml, Haskell
- **Computer algebra:** Sage, Magma, Maple, Mathematica
- **Others:** Bash, Emacs Lisp

## References

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