# **Thibaut Verron**

Post-doctoral researcher, Johannes Kepler University

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# Past and present research activities

- Gröbner bases for weighted homogeneous systems
- Strategy for the classification of real roots of determinantal systems, application to optimal control for medical imagery
- Signature-based Gröbner bases for polynomials over a ring
- Tropical Gröbner bases, Gröbner bases for Tate series
- D-finite functions

# **Employment**

2017 – cur.	Post-doctoral researcher at JKU	(Linz. Austria)

Supervisor: Manuel Kauers (Institute for Algebra)

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

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

Supervisors: Joseph Gergaud, Olivier Cots (Team Parallel algorithms and optimization)

Webpage: https://thibautverron.github.io

Keywords: optimal control

#### Education

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

# 2007 – 2009 Preparatory classes MPSI, MP\*, Lycée Hoche (Versailles, France)

2007 A levels

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#### 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

**Director** Jean-Charles Faugère Research director, Inria

**Advisor** Mohab Safey El Din Professor, UPMC

Reviewer Laurent Busé Researcher, Inria, HdR
Reviewer Bruno Salvy Research director, Inria

**Examiner** Bernard Bonnard Professor, Université de Bourgogne

**Examiner** Stef Graillat Professor, UPMC

#### **Publications and communications**

### **Conference papers**

- 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 [math.AG]. URL: https://arxiv.org/abs/1901.09574
- Tristan Vaccon, Thibaut Verron, and Kazuhiro Yokoyama. "On affine tropical F5 algorithms". In: *Proceedings of the 2018 International Symposium on Symbolic and Algebraic Computation*. ISSAC '18. Extended version to appear in Journal of Symbolic Computations (2019). New York, USA, 2018. URL: https://arxiv.org/abs/1805.06183
- Bernard Bonnard, Jean-Charles Faugère, Alain Jacquemard, Mohab Safey El Din, and Thibaut Verron. "Determinantal set, singularities and application to optimal control in medical imagery". In: *Proceedings of the 2016 International Symposium on Symbolic and Algebraic Computation*. ISSAC '16. Waterloo, Canada, 2016, pp. 103–110. URL: https://hal.archives-ouvertes.fr/hal-01307073v2

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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 2013 International Symposium on Symbolic and Algebraic Computation*. ISSAC '13. Boston, USA: ACM, 2013, pp. 189–196. URL: https://hal.archives-ouvertes.fr/hal-00780388v2

#### Journal papers

- Maria Francis and Thibaut Verron. "A Signature-Based Algorithm for Computing Gröbner Bases over Principal Ideal Domains". In: *Mathematics in Computer Science* (2019). To appear. arXiv: 1802.01388 [cs.SC]
- 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 and Related Fields* (2019). To appear
- 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. URL: https://hal.archives-ouvertes.fr/hal-01097316v2

#### Preprints and submitted papers

Maria Francis and Thibaut Verron. "Signature-based Möller's algorithm for strong Gröbner bases over PIDs". In: ArXiv e-prints (2019). arXiv: 1901.09586 [cs.SC]

#### **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

#### Conference talks

- *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 solving". University of Bern, Bern, Switzerland, 2019 (upcoming)
- 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

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- 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 Compostella, 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), Minisymposium "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
- 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

## 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)
- Joint development with X. Caruso and T. Vaccon
- Link: 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

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- Implementation of algorithms presented at ACA 2018 and SIAM AG 2019
- 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
- Example run on an application to optimal control in medical imagery
- Joint development with M. Safey El Din
- Link: http://mercurey.gforge.inria.fr

# Teaching and supervising experience

2018 – 2019	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)	

## **Additional activities**

- 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 (basic), Turkish (basic)
- Programming languages: Python, C, C++, OCaml, Haskell, Bash, Emacs lisp

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## References

- **J.-C. Faugère**, research director, Inria Paris, France E-mail: jean-charles.faugere@inria.fr
- M. Safey El Din, professor, Sorbonne Universités, Paris, France E-mail: mohab.safey@lip6.fr
- M. Kauers, professor, Johannes Kepler University, Linz, Austria E-mail: manuel@kauers.de
- **B. Bonnard**, professor, Université de Bourgogne, Dijon, France E-mail: bernard.bonnard@u-bourgogne.fr
- X. Caruso, research director, CNRS, Université de Bordeaux, Bordeaux, France E-mail: xavier.caruso@normalesup.org

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