

# Curriculum Vitae

Ali AYAD

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Citizenship : French

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## Areas of research specialization

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- Symbolic algebraic computation
- Design and complexity analysis of algorithms
- Real algebraic geometry and solving polynomial systems
- Non-linear differential equations
- Floating-point arithmetic
- Formal methods for static analysis of programs
- Deductive verification of floating-point C programs
- Value analysis of C programs by abstract interpretation

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## Education

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- **2003–2006** : PhD in Mathematics (symbolic computation) at the [university of Rennes 1](#).  
Title : [Complexity of solving parametric polynomial systems](#).  
Advisor : [Dimitry Grigoryev](#), director of research at the National Center of Scientific Research (CNRS) in Rennes, France.  
Laboratory : [IRMAR](#), Institute of Mathematical Research of Rennes.  
I defended my PhD on October 13, 2006, with honors.  
Members of the jury of defense : [Dimitry Grigoryev](#) (Advisor), [Pascal Koiran](#) (Reporter), [Bernard Mourrain](#) (Reporter), [Fabrice Rouillier](#) (Inspector), [Marie-Françoise Roy](#) (Inspector), [Eric Schost](#) (Inspector).
- **2002–2003** : Master II research in Mathematics and their applications at the [university of Claude Bernard Lyon 1](#), France.  
Memory : The Schubert polynomials and varieties.  
Advisor : [Philippe Caldero](#), professor at the university of Claude Bernard Lyon 1.
- **2001–2002** : Master I of Mathematics with honors at the faculty of sciences of the [Lebanese university](#), Beirut (Hadath).
- **2000–2001** : Licence of Mathematics with honors at the faculty of sciences of the [Lebanese university](#), Beirut (Hadath).

- **1998–2000** : DEUG MP (Maths-Physics) with honors at the faculty of sciences of the [Lebanese university](#), Beirut (Hadath).
- **1997–1998** : Lebanese scientific Baccalaureate in Deir Kifia (Sour, Lebanon), with honors.

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## Teaching experiences

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- **2007–2008** : ATER (Temporary position for teaching and research) at the [university of Rennes 2](#).
  - Teaching TD of "Analysis" in the department [MASS](#), S1 (24 hours).
  - Teaching CM and TD of "Statistics" in the department [AES](#), S2 (48 hours).
  - Teaching TD of "Introduction to Statistics" in L2 Geography (12 hours).
  - Teaching "Preparation to mathematical QCM", [IUFM](#), in L3 (18 hours).
  - Teaching CM and TD "Mathematics applied to social sciences" in Licence 1, [AES](#) (24 hours).
  - Teaching CM and TD of "UED Mathematics", L2, S4 (84 hours).
- **2006–2007** : ATER at the [university of Rennes 1](#).
  - Teaching TD, B03 (Sets, applications, relations and groups) in L2 (24 hours).
  - Teaching TP (Practical Work), C05 (Matrices and linear systems) in L2 (12 hours in Maple).
  - Teaching of the course "Education to career choices" in L1 (30 hours).
  - Teaching "Preparation to mathematical QCM" in L3 at the university of Rennes 2 (36 hours).
- **2004–2005** : Course in Mathematics in Rennes, France. Classes "Seconde", "Première S" and "Terminal S".
- **2000–2002** : Teaching Maths, algebra, in a private school.
- **1999** : Courses of Mathematics for three months in Lebanon.

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## Positions and scientific experiences

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- **2009–2010** : Post-doc (Engineering researcher) in Software Engineering at [CEA-LIST](#), [LSL](#) (Software Safety Laboratory). Project [Hisseo](#), position funded by the [DGA](#) (Délégation Générale pour l'Armement).
- **2008–2009** : Post-doc in Software Engineering at [CNRS](#), university of Paris Sud ([Paris 11](#)), laboratory [LRI](#) (Laboratoire de Recherche en Informatique), member of the "[démons](#)" team ([Paris 11](#)) and [ProVal](#) team of [INRIA-Île-de-France](#). Project [CerPAN](#).
- **2007–2008** : Guest researcher at [IRISA](#) (Institut de recherche en informatique et systèmes aléatoires) in Rennes, France. Research group : [SISYPHE](#), [SIGNAUX](#) et [SYSTÈMES](#) en [PHYSIOLOGIE](#) et [INGÉNIERIE](#) (ex. [SOSSO2](#)). I was working on the "inverse Scattering transformation" and its applications to the analytic resolution of nonlinear partial differential equations and on the representation of signals by a small number of parameters. Implementations in [Matlab2007a](#).

- **2007–2008** : ATER (Temporary position for teaching and research) at the [university of Rennes 2](#) in France. Department [MASS](#) (Applied Mathematics and Social Sciences). Head of the department : [Jacques Carpentier](#). Teaching in Licence L1, L2, L3.
- **2006–2007** : Qualification to the "Maître de conférences" position in the CNU (Conseil National des Universités) sections 25 (Mathematics) and 26 (Applied Mathematics) in France.
- **2006–2007** : ATER position at the [university of Rennes 1](#) in France. Member of the research group "[Real algebraic geometry, symbolic computation and complexity](#)" at [IRMAR](#). I was working on the complexity of solving nonlinear ordinary differential equations in terms of Puiseux series and on the complexity of factoring linear ordinary differential operators .
- **January 2006** : Two weeks of research stay at the [Max Planck Institute for Mathematics](#) at Bonn in Germany. Stay funded by the [DAAD](#) (German academic exchange service).
- **May-June 2005** : Two months of research stay at the [university of Paderborn](#) in Germany in the research group of Professor [Peter Bürgisser](#) "[Algebraic Complexity and Algorithmic Algebra](#)". Participation to the seminars and discussions with the members of this group during the stay. Subjects studied : Absolute factorization of parametric multivariate polynomials and the complexity theory. Stay funded by the [DAAD](#).

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### Participation to research projects

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- **Project CerPAN** : Certification of numerical programs. White project 2005, [ANR-05-BLAN-0281-04](#).
- **Project Hisseo** : Static and dynamic analysis of floating-point programs, [Digiteo DIM 2008](#), [CEA list](#), [INRIA Proval](#) and [Gallium](#).
- **Project U3CAT** : Unification of Critical C Code Analysis Technique, [ANR Arpege 2008](#), [CEA list](#), [INRIA \(Proval, Gallium, lande\)](#), [CNAM cedric](#), [Airbus France](#), [ATOS origin](#), [CS communications et systemes](#), [Dassault Aviation](#), [Hispano-Suiza](#).

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### Publications

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#### Journal articles

- **A. Ayad**, Complexity of solving parametric polynomial systems. To appear in [Zap. Nauchn. Sem. S.-Peterburg . Otdel. Mat. Inst. Steklov. \(POMI\)](#). vol. 387 (2011).
- **A. Ayad**, Newton polygons of polynomial ordinary differential equations. To appear in [International Journal of Mathematical Analysis](#), (2011).
- **A. Ayad**, A note on the computation of Puiseux series solutions of the Riccati equation associated with a homogeneous linear ordinary differential equations. To appear in [International Mathematical Forum](#), (2011).

- [A. Ayad](#), On computing absolutely irreducible components of parametric algebraic varieties of arbitrary dimension. *Computing*, Springer Wien New York, vol. 89, no. 1-2 (2010), p. 45-68.
- [A. Ayad](#), On factoring parametric multivariate polynomials. *Adv. in Appl. Math*, Elsevier, vol. 45, no. 4 (2010), p. 607-623.
- [A. Ayad](#) and [Claude Marché](#), Behavioral Properties of Floating-Point Programs. Submitted.
- [A. Ayad](#), A survey on the complexity of solving algebraic systems. *International Mathematical Forum*, vol. 5, no. 7 (2010), p. 333 - 353.
- [A. Ayad](#), Complexity of algorithms for computing greatest common divisors of parametric univariate polynomials. *International Journal of Algebra*, vol. 4, no. 4 (2010), p. 173 - 188.
- [A. Ayad](#), A lecture on the complexity of factoring polynomials over global fields. *International Mathematical Forum*, vol. 5, no. 10 (2010), p. 477 - 486.
- [A. Ayad](#), Puiseux series solutions of ordinary polynomial differential equations : Complexity study. *Acta Universitatis Apulensis*, vol. 22 (2010), p. 79 - 92.
- [A. Ayad](#), On the Riccati differential polynomials. *Acta Mathematica Universitatis Comenianae*, vol. 2 (2010), p. 245 - 251.
- [A. Ayad](#), An algorithm for solving zero-dimensional parametric systems of polynomial homogeneous equations. Submitted.
- [A. Ayad](#), Complexity bound for the absolute factorization of parametric polynomials. *Zap. Nauchn. Sem. S.-Peterburg. Otdel. Mat. Inst. Steklov. (POMI)* 316, Teor. Slozhn. Vychisl. 9, 5–29, 224 (2004). Translation to *Journal of Mathematical Sciences* (N. Y.), 134 (2006), no. 5, p. 2325-2339.

### Conference articles

- [A. Ayad](#) and [Claude Marché](#), Multi-Prover Verification of Floating-Point Programs. In *IJCAR 2010 - 5th International Joint Conference on Automated Reasoning*, J. Giesl and R. Hahnle (Eds.) : IJCAR 2010, LNAI 6173, pp. 127-141, 2010. Springer-Verlag Berlin Heidelberg 2010 Edinburgh, UK, July 16-19, 2010.
- [A. Ayad](#), Deductive verification of floating-point programs in Frama-C. In *MajecSTIC2009*, Avignon, France, November 16-18, 2009.
- [A. Ayad](#), Factorization and Resolution of parametric polynomials. French national days for symbolic computations, *JNCF 2005*, *CIRM*, Luminy.

### Research reports

- [A. Ayad](#), On formal methods for certifying floating-point C programs. INRIA Research report RR-6927-INRIA-2009, projects : [CerPAN](#), [Hisseo](#), [U3CAT](#), teams : [ProVal](#) and [démons](#)

### Thesis and Master

- [A. Ayad](#), Complexity of solving parametric polynomial systems. PhD thesis at the university of Rennes 1, October 2006.
- [A. Ayad](#), The Schubert polynomials and varieties. Memory of Master II in Mathematics and their applications at the [university of Claude Bernard Lyon 1](#). Advisor : Philippe Caldero, 2003.

## Preprints

- [A. Ayad, A note on the computation of Puiseux series solutions of the Riccati equation associated with a homogeneous linear ordinary differential equation](#), Preprint IRMAR, Rennes 2008.
- [A. Ayad, On the complexity of solving ordinary differential equations in terms of Puiseux series](#), Preprint IRMAR, Rennes 2007.

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## Talks

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- **October 2009** : [Behavioral study of floating-point numbers in C programs](#). Talk in the seminary of the Software Safety Laboratory (LSL), CEA List, Saclay, France.
- **May 2006** : Complexity of computing parametric G.C.Ds. [Doctoral mathematics meetings](#), Rennes, France.
- **April 2006** : Talk in the seminary of the research group "[Real algebraic geometry, symbolic computation and complexity](#)" on the "Complexity of the decomposition of parametric projective varieties into absolutely irreducible components", Rennes, France.
- **November 2005** : Participation to the "French national days for symbolic computations" (JNCF 2005). Talk on the "[Factorization and resolution of parametric polynomials](#)", CIRM, Luminy, France.
- **February 2005** : Talk in the seminary of the research group "Real algebraic geometry, symbolic computation and complexity" on an "Algorithm of absolute factorization of parametric multivariate polynomials".

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## Computer skills

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- **Operating systems** : Windows, Linux, Mac OS X .
- **Mathematic softwares** : [Maple](#), [Matlab](#).
- **Programming languages** : C, [Caml](#).
- **Other softwares** :
  - [Coq](#) : Interactive proof assistant.
  - [Why](#) : Platform for deductive verification of C programs ([Caduceus](#)) and Java programs ([Krakatoa](#)).
  - [Frama-C](#) : Framework for modular analyses of C codes (deductive verification and value analysis).
- **Word processing** : Latex , Emacs, Word, PowerPoint.

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## Other skills

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**Languages** : French, English : read, written, spoken.