

## POEMA: Polynomial Optimization, Efficiency through Moments and Algebra

POEMA is a Marie Skłodowska-Curie [Innovative Training Network](#) (2019-2022), offering **15 PhD positions** starting from September 2019.

The goal of the POEMA consortium is to train scientists at the interplay of algebra, geometry and computer science for polynomial optimization problems and to foster scientific and technological advances, stimulating interdisciplinary and intersectoriality knowledge exchange between algebraists, geometers, computer scientists and industrial actors facing real-life optimization problems.

The proposed PhD projects are investigating the development of new algebraic and geometric methods combined with computer algebra techniques for global non-linear optimization problems and their applications, in particular, in smarter cities challenges, urban traffic management, water network management, energy flow control, or environmental monitoring. Detailed descriptions of the projects can be found at

<https://easychair.org/cfp/POEMA-19-22>

The POEMA consortium consists of eleven network partners:

- Inria, Sophia Antipolis, France, (Bernard Mourrain)
- CNRS, LAAS, Toulouse France (Didier Henrion)
- Sorbonne Université, Paris, France (Mohab Safey el Din)
- NWO-I/CWI, Amsterdam, the Netherlands (Monique Laurent)
- Univ. Tilburg, the Netherlands (Etienne de Klerk)
- Univ. Konstanz, Germany (Markus Schweighofer)
- Univ. degli Studi di Firenze, Italy (Giorgio Ottaviani)
- Univ. of Birmingham, UK (Mikal Kocvara)
- Friedrich-Alexander-Universitaet Erlangen, Germany (Michael Stingl)
- Univ. of Tromsø, Norway (Cordian Riener)
- Artelys SA, Paris, France (Arnaud Renaud)

and three associate partners:

- IBM Research, Ireland (Martin Mevissen)
- NAG, UK (Mike Dewar)
- RTE, France (Jean Maeght)

### PhD Topics:

- **ESR 1: Algebraic tools for exact SDP and its variants**  
Advisor: M. Safey el Din (Sorbonne University, Paris, France);
- **ESR 2: Exact algorithms for structured polynomial optimization**  
Advisor: M. Safey el Din (Sorbonne University, Paris, France);
- **ESR 3: Polynomial optimization problems with symmetry**  
Advisor: C. Scheiderer (Univ. of Konstanz, Germany);
- **ESR 4: Hyperbolic polynomials and the Generalized Lax Conjecture**  
Advisor: M. Schweighofer (Univ. of Konstanz, Germany);
- **ESR 5: Tensor Decomposition by Vector Bundles tools**  
Advisor: G. Ottaviani (Firenze, Italy)
- **ESR 6: Approximation hierarchies for (non-)commutative polynomial optimization**  
Advisor: M. Laurent (CWI, Amsterdam, the Netherlands)
- **ESR 7: Approximation hierarchies for graph parameters**  
Advisor: M. Laurent (CWI, Amsterdam, the Netherlands)
- **ESR 8: Polynomial Optimization Problems in Operations Research and Finance**  
Advisor: E. de Klerk (Univ. of Tilburg, the Netherlands)
- **ESR 9: Structure of moment problems and applications to polynomial optimization**  
Advisor: B. Mourrain (INRIA, Sophia Antipolis, France);

- **ESR 10: Alternative polynomial bases for global optimization**  
Advisor: E. Hubert (INRIA, Sophia Antipolis, France);
- **ESR 11: Numerical cubature with symmetry and applications to polynomial optimisation**  
Advisor: C. Riener (Univ. of Tromsø, Norway);
- **ESR12: Algorithms and software for nonlinear convex conic optimization**  
Advisor: M. Stingl (Friedrich Alexander Univ. Erlangen, Germany)
- **ESR 13: Algorithms and software for structured SDP**  
Advisor: M. Kocvara (Univ. of Birmingham, UK)
- **ESR 14: Polynomial Optimization: Some challenges from applications**  
Advisor: D. Henrion (CNRS, LAAS, Toulouse, France);
- **ESR 15: Polynomial Optimization Techniques for Energy Network Operation and Design**  
Advisors: J.-H. Hours, M. Gabay (ARTELYS, Paris, France);

**Submission guidelines:** To be eligible for one of these PhD positions, the applicant should fulfill the following conditions:

- Have — at the date of recruitment — a **Master’s degree** in Computer Science, Mathematics or Engineering (or any equivalent diploma).
- Should have — at the date of recruitment — less than 4 years of a research career, and not have a doctoral degree. The 4 years are measured from the date when they obtained the degree which would formally entitle them to embark on a PhD, either in the country where the degree was obtained or in the country where the PhD is provided.
- **Trans-national mobility:** The applicant — at the date of recruitment — should not have resided in the country where the research training takes place for more than 12 months in the 3 years immediately prior to recruitment, and not have carried out their main activity (work, studies, etc.) in that country. For refugees under the Geneva Convention (1951 Refugee Convention and the 1967 Protocol), the refugee procedure (i.e. before refugee status is conferred) will not be counted as ‘period of residence/activity in the country of the beneficiary’.
- Be able to **communicate fluently in English** (speaking and writing). Oral interview with the prospective advisor may be required.

Further details about the employment conditions can be found at <https://easychair.org/cfp/POEMA-19-22>

To apply for one of these 15 PhD positions, interested candidates must **submit at** <https://easychair.org/conferences/?conf=poema1922> a **document** containing

- a detailed **CV** including education, work experience, skills, dissertations, research interests, career objectives, names and contact details of two referees (including the supervisor of the master thesis) willing to provide confidential letters of recommendation, and list of publications if any;
- a **letter of motivation** regarding the position as well as the POEMA network;
- a **transcript** of the master studies’ grades (including the overall grade and an explanation of the grading system) and the master’s thesis **if available**;
- and indicate as **TITLE** your full name, add 3 **KEYWORDS**, and chose the **TOPICS** you are interested in among the list of 15 PhD topics listed at <https://easychair.org/cfp/POEMA-19-22>

**Contact:** All questions about submissions should be emailed to [bernard.mourrain@inria.fr](mailto:bernard.mourrain@inria.fr).