Structure of moment problems and applications to polynomial optimization

This PhD is funded by the Marie Curie program of European Union through the innovative training network (ITN) POEMA on polynomial optimization.

More info and positions at https://easychair.org/cfp/POEMA-19-22.
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Scientific context. Moment relaxation methods for solving polynomial optimization problems rely on the solution of one or several Semidefinite Programs. The efficiency of the approach is closely connected to the size and the number of parameters of these convex optimization problems. The objective of this project is to develop new relaxation methods that improve the capabilities of existing relaxation methods, by exploiting the structure of the optimization constraints and the objective function, that derive from the equality and positivity constraints of the optimization problem, and from properties such as symmetry or sparsity. To validate these algorithmic developments, an application from urban network optimization will be considered. The objective is to develop efficient moment and SDP relaxation approaches for polynomial optimization problems arising in this type of problems. It should demonstrate the scalability of the approach on optimal operation of water supply or optimal power flow in power systems.

Working Context. The PhD candidate will be hosted by the team AROMATH (AlgebRa, geOmetry, Modelling and AlgorimTHs), located at the centre of Inria Sophia Antipolis Méditerranée. The team, led by Bernard Mourrain, has a strong expertise in effective algebraic geometry, symbolic-numeric computation, algorithms and software for polynomial equations for real algebraic geometry and geometric modeling.

Planned secondments. The PhD candidate will have a research stay (secondments) at University of Birmingham, UK (Mikal Kocvara) and at Artelys, Paris, France (Arnaud Renaud).

Required Skills. Motivated candidate should hold — at the date of recruitment — a Master's degree in Computer Science, Mathematics or Engineering (or any equivalent diploma). The applicant should have a solid background in either optimization, real algebraic geometry or computer algebra. Good programming skills are also a plus. Knowledge of French does not constitute a pre-requisite.

The candidates are kindly asked to send an e-mail with "POEMA candidate" in the title, a CV and motivation letter to bernard.mourrain@inria.fr and to submit their documents at https://easychair.org/cfp/POEMA-19-22.