

Algorithms and software for nonlinear convex conic 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. Existing software packages for conic optimization, such as SeDuMi, SDPT3, or MOSEK, are almost exclusively intended for linear conic (SOCP, SDP) problems. Many practical problems, however, are formulated using nonlinear convex functions. Prominent examples are entropy maximization or sparse covariance estimation. The very popular software for convex conic optimization CVX supports general convex functions by using a successive approximation approach by a sequence of linear conic problems. Hence the linear conic solver is called multiple times to refine the solution to the required accuracy. Moreover, CVX only supports a selected set of convex functions. Our goal will be to develop dedicated algorithms and software for nonlinear convex conic optimization. The first approach will be based on the existing software PENNON, based on the augmented Lagrangian method and intended for general non-convex problems. We will use convexity and structure of the problem to develop a new version of the software and the underlying algorithms. The second approach will be based on primal-dual interior point algorithms. We will concentrate on questions connected with specific globalization techniques and with the efficient solution of arising systems of linear equations. The resulting software will be tested using benchmark problems collected in coordination with NAG as well as industrial applications.

Working Context. The PhD candidate will be hosted by the Mathematical Optimization group in the Mathematics Department of the Friedrich-Alexander-University of Erlangen-Nuremberg. The team, led by Michael Stingl, has a strong expertise in algorithmic optimization as well as optimization with (partial) differential equations.

Planned secondments. The PhD candidate will have a research stay (secondments) at University of Birmingham, UK (Mikal Kocvara) and at University of Tilburg, Netherlands (Etienne de Klerk).

Required Skills. Motivated candidates 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 optimization. Good programming skills are expected. Knowledge of German 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 michael.stingl@fau.de and to submit their documents at <https://easychair.org/cfp/POEMA-19-22>.