Polynomial optimization problems with symmetry

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Scientific context. Polynomial optimization problems arising from applications frequently feature strong symmetries that one would like to take advantage of. One possible approach tries to detect the symmetries in SDP relaxations automatically, and then to reduce size using block decomposition. While one may find symmetries in this way even when they are hidden or poorly understood, such a technique can only be expected to work for small size problems. Another possibility is to analyze symmetries of SDP relaxations in advance. In principle, very large (even infinite) SDPs can often be reduced to small (in particular finite) SDPs in this way. But such an approach requires a considerable machinery of harmonic analysis tailored towards the specific problem, in particular for higher order relaxations. Instead we want to pursue a third approach, where the symmetry reduction is already done on the level of the original optimization problem before relaxation. The main difficulty then is to generalize Timofte's degree principles to general group actions of reductive groups on affine varieties, and to relate them to the Procesi-Schwarz result describing the orbit variety.

Working Context. The PhD candidate will be hosted by the Real Algebra and Geometry (RAG) group (https://www.mathematik.uni-konstanz.de/en/rag) in the Mathematics and Statistics Department of Konstanz University. The city of Konstanz is beautifully located at Lake Constance in the south of Germany, bordering Switzerland. Konstanz University has been successful in all three funding lines of the German Excellence Initiative, both in 2007 and in 2012, and is therefore considered one of Germany's elite universities. The local RAG group has a strong expertise in real algebraic geometry and its applications to optimization, in particular moment problems.

Planned secondments. The candidate will have research stays (secondments) at INRIA (Sophia Antipolis, Nice), working with E. Hubert, and at RTE, working with J. Maeght.

Required Skills. The candidate should hold — at the date of recruitment — a Master's degree in Mathematics, Computer Science or Engineering, or an equivalent diploma. He or she should have a solid background in at least one of either algebra, (real) algebraic geometry or optimization. Good programming skills are also a plus. Language skills in German are not required. Candidates are kindly requested to send e-mail with "POEMA candidate" in the subject, containing CV and a motivational letter, to Claus Scheiderer, and to submit their documents at https://easychair.org/cfp/POEMA-19-22.