Title: Constrained polynomial optimization on commutative and non-commutative variables

Speaker: prof. Janez Povh

Abstract:
Polynomial optimization problems are in the intersection between mathematical programming society and real algebraic geometry.
Advances in each area accelerates development in the other area and vice versa.

In the talk we will first present state of the art in commutative polynomials optimization, especially topics related to semidefinite programming approximation hierarchies.

The main part of the talk will be devoted to non-commutative extensions, more precisely to constrained
trace and
eigenvalue optimization of noncommutative polynomials.

We will present Lasserre's relaxation scheme for trace and eigenvalue optimization
based on semidefinite programming (SDP)
and demonstrate its convergence properties.
Finite convergence of these relaxation schemes is governed
by flatness, i.e., a rank-preserving property
for associated dual SDPs. If flatness is observed, then
optimizers can be extracted using the Gelfand-Naimark-Segal construction
and the Artin-Wedderburn theory
verifying exactness of the relaxation.
To enforce flatness we employ a noncommutative version of the randomization technique championed by Nie.

The implementation of these procedures in our computer algebra system NCSOStools will be presented together with several examples illustrating our results.