# Numerical Optimization of Symmetric Eigenvalues

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In this talk we consider the problem of minimizing or maximizing a prespecified eigenvalue (i.e. jth largest eigenvalue) over a space of parameterized symmetric matrices. These are non-smooth optimization problems due to the ordering of the eigenvalues. But the real challenge from a computational point of view is the non-convex nature of eigenvalues. The first part of the talk is devoted to some simple applications from control theory where symmetric eigenvalue optimization problems arise.

The second part addresses the numerical solutions of these optimization problems. Standard smooth optimization techniques such as quasi-Newton methods (e.g. BFGS) are guaranteed to converge only to a local minimizer, whereas the common techniques for non-smooth optimization such as bundle methods are not effective for non-convex problems in general. Here we discuss two numerical techniques. One of them is a level-set approach, the second exploits the fact that the symmetric eigenvalues are Lipschitz continuous.