Eigenvalue optimization via low-rank ODEs.

Nicola Guglielmi (Gran Sasso Science Institute, Italia)

Stability and robustness analysis of linear continuous and discrete dynamical systems is a vast and active interdisciplinary research area. Although the word stability is used in many different contexts, in this talk it is meant to indicate the broad spectrum of issues that arise in the analytical and numerical study of dynamical and control systems, especially in relation to qualitative information of the system under study. These issues result from the need to develop stable and reliable systems robustly preserving essential qualitative properties.

The analysis of these features is often based on eigenvalue optimization or on pseudospectral measures of a certain matrix A, where the structure of A (e.g., sparse, Hamiltonian, nonnegative, Toeplitz, etc.) plays an important role.

The main goal of this talk is to show how these structured distances can be approximated. The proposed method is a two-level iterative algorithm, where in an inner iteration a gradient flow drives perturbations to the original matrix of a fixed size into a minimum of a functional that depends on eigenvalues (and possibly eigenvectors), and in an outer iteration the perturbation size is optimized such that the functional reaches some target value (for example 0).

An interesting point - related to certain low-rank properties of extremizers - lies in the possibility of considering gradient flows on low-rank manifolds.

The talk is mainly inspired by joint works with Christian Lubich (Tuebingen).