Mathematical optimisation problems arise in many areas of science and engineering, including statistics, machine learning, robotics, signal/image processing, and others. This course will cover some techniques known as convex relaxations, to deal with optimisation problems involving polynomials, which are in general intractable. The emphasis of the course will be on semidefinite programming which is a far-reaching generalization of linear programming. A tentative list of topics that we will cover include:

- From linear programming to conic programming. Duality theory.
- Semidefinite optimisation and convex relaxations. Sums-of-squares and moment problems.
- Applications: binary quadratic optimisation and rounding methods (e.g., Goemans-Williamson rounding), stability of dynamical systems, matrix completion/low-rank matrix recovery, etc.

Pre-requisites

This course assumes basic knowledge in linear algebra and analysis. Some knowledge of convex analysis will be useful.

Literature


Additional support

Three examples sheets will be provided and three associated examples classes will be given. There will be a one-hour revision class in the Easter Term.