

APPLIED MATHEMATICS COLLOQUIUM

Date: Tuesday, March 10, 2015

Time: 2:30 – 3:30 p.m.

Location: Middlesex College Room 204

Facial Reduction for Cone Optimization with Applications to Systems of Polynomial Equations, Sensor Network Localization, and Molecular Conformation

Dr. Henry Wolkowicz

Department of Applied Mathematics

University of Waterloo

Abstract:

The Slater constraint qualification (SCQ) is essential for many classes of convex programs, e.g., Linear Programming (LP), ordinary convex programming (CP), and cone optimization (CO). However, SCQ fails for many problems, e.g., for many instances of semidefinite programming (SDP) that arise from relaxations of computationally hard problems. This degeneracy results in theoretical problems (possible loss of strong duality) as well as numerical problems (due to ill-posedness). A theoretical tool to regularize these problems uses facial reduction. We present a backwards stable approach for preprocessing a general SDP using facial reduction.

In addition, we consider several specific applications where the structure of the problem surprisingly allows us to exploit the degeneracy. Rather than presenting numerical difficulties, we obtain smaller stable problems that allow for efficient high accuracy solutions for many large scale instances. In particular, we look at facial reduction for systems of polynomial equations with real coefficients.

Additional applications considered are: sensor network localization (SNL) and molecular conformation (MC).