14:30 - 15:00	Amir Shahzad, Eric C. Kerrigan, George A. Constantinides

A Well-conditioned Interior Point Method for Quadratic Programming with an Application to Optimal Control

Interior point methods (IPMs) have proven to be an efficient way of solving convex quadratic programming problems. A linear system of equations needs to be solved in each iteration of an IPM. The ill-conditioning of this linear system in the later iterations of the IPM prevents the use of an iterative method in solving the linear system due to a very slow rate of convergence; in some cases the solution never reaches the desired accuracy. In this paper we propose the use of a well-conditioned, approximate linear system, which increases the rate of convergence of an iterative method. A computational advantage is obtained by the use of an inexact Newton method along with the use of novel preconditioners. Numerical results indicate that the computational complexity of our proposed method scales well when applied to solving finite horizon optimal control problems with linear dynamics, quadratic cost and linear inequality constraints.

15:00 - 15:30	Nick Gould, Dominique Orban, Daniel Robinson

CQP: a Fortran 90 module for large-scale convex quadratic programming

We describe the design of a new software package CQP for large-scale convex quadratic programming. The method is based on high-order Taylor and Puiseux approximation to a variety of infeasible arcs connecting the current iterate to a better target point. Possible arcs include those by Zhang and by Zhou and Sun based on work by Stoer, Mizuno, Potra and others. The resulting algorithm is provably both globally and polynomially convergent at an ultimately high-order (depending on the series used) in both non-degenerate and degenerate cases. We will illustrate a number of algorithmic options on the CUTEr QP test set. CQP is available as part of the fortran 90 library GALAHAD.

⊙ Beginning of Poster Session ⊙

15:30 - 16:30	Bruno Defraene, Toon van Waterschoot, Moritz Diehl, Marc Moonen

Real-time perception-based clipping of audio signals using a fast projected gradient optimization method

Clipping is an essential signal processing operation in many real-time audio applications (e.g. hearing aids, mobile phones). Still, the application of existing clipping techniques introduces a considerable amount of distortion, which results in a significant reduction of the sound quality of the audio signal. We will present a novel perception-based approach to clipping, in which clipping is formulated as a sequence of convex quadratic programming optimization problems aimed at minimizing perceptible clipping-induced distortion. A fast projected gradient optimization method allows the medium-scale QPs to be solved in real-time. A comparative

perceptual evaluation shows that the application of the presented perception-based clipping technique results in consistently higher sound quality scores than existing clipping techniques.

15:30 - 16:30	Minh Dang Doan, Tamás Keviczky, Bart De Schutter

A dual method for solving large-scale QPs in distributed MPC

Large-scale Quadratic Programs (QP) are often encountered in distributed model predictive control (MPC) problems. Several types of large-scale interconnecting systems require using distributed methods to solve MPC optimization problems that are convex QPs with large numbers of variables and constraints. In the literature a number of distributed algorithms have been proposed that can be applied to large-scale QPs, many of them are based on dual decomposition approach. One issue of dual decomposition-based methods is to find a feasible primal value, so that MPC feasibility is assured. We present a dual subgradient-based algorithm that provides a feasible solution for the distributed MPC problem. Moreover, a bound on suboptimality is given, so that the resulting MPC controller is a stabilizing controller.

15:30 - 16:30	Joachim Ferreau, Moritz Diehl

Real-World Applications of the Online Active Set Strategy

Model predictive control (MPC) relies on the fast and reliable solution of convex quadratic programs (QPs) in real-time. We developed an online active set strategy for dealing with MPC sampling times in the order of milliseconds. Its efficient opensource C++ implementation qpOASES has been successfully applied to several real-world academic as well as industrial applications.

15:30 - 16:30	François Glineur

Complexity of Low-Rank Matrix Approximation with Weights and Missing Data

Weighted low-rank approximation (WLRA) is a dimensionality reduction technique for data analysis which has been successfully used in several applications, e.g., in collaborative filtering to design recommender systems or in computer vision to recover structure from motion.

In this paper, we study the computational complexity of WLRA and prove that it is NP-hard to find an approximate solution even in the rank-one case. The proof is based on a reduction of the maximum-edge biclique problem, and applies for both positive and binary weights (the latter corresponding to low-rank matrix approximation with missing data).