In every high frequency transport system, the problem of regularity is critical. Randomness can increase passenger's travel time. We focus the attention on the real-time deadheading problem, because deadheading is the only way that allows to re-establish the correct headway without increase of the lap time. When a vehicle is deadheaded, it runs empty from a terminal skipping a number of stations, typically in order to reduce expected large headways at later stations. The objective is to determine the optimal number of stations to skip in order to minimize passenger's total travel time.

4 - A General Two-directional Two-campus Transport Problem

Hagai Ilani, Industrial Eng. and management, Shamoon College of Engineering, 84 Jabotinsky st., 77245, Ashdod, Israel, Israel, hagai@sce.ac.il, *Elad Shufan*, *Tal Grinshpoun*

In the present work we extend a reduction of a simple case of a transportation problem between two destinations to the shortest path problem. Our reduction is valid for a general two directional case where a set of n requests for a ride between two destinations has to be executed by a fleet of K vehicles of given capacities, in order to minimize the total waiting time of all the passengers. Our approach can be implemented to the case where passengers have different levels of importance.

■ WB-15

Wednesday, 10:30-12h00
RB-2101

Theory and algorithms of bilevel programming I

Stream: Variational Inequalities and Bi-Level Problems
Invited session

Chair: *Stephan Dempe*, Mathematics and Computer Sciences, Technische Universitaet Freiberg, 09596, Freiberg, Germany, dempe@math.tu-freiberg.de

1 - Fuzzy bilevel optimization problem

Alina Ruziyeva, Fakultät für Mathematik und Informatik, TU Bergakademie Freiberg, Akademiestr. 6, 09596, Freiberg, Germany, ruziyeva@student.tu-freiberg.de, *Stephan Dempe*

The optimal solution of a fuzzy optimization problem is described as the set of Pareto optimal solutions of a corresponding multiobjective optimization problem. The preferable fuzzy optimal solution is supposed to have a maximal membership function value, i.e. it has the highest potential being realized by the follower. In the talk fuzzy bilevel optimization problems are considered in which the preferable fuzzy optimal solution of the fuzzy lower level problem is used. Aim of the talk is to describe a solution algorithm for this problem using the stability region of this solution.

2 - Necessary optimality conditions in pessimistic bilevel programming

Alain B. Zemkoho, Mathematics and Computer Sciences, Technical University Bergakademie Freiberg, Akademiestr. 6, 09599, Freiberg, Saxonia, Germany, zemkoho@student.tu-freiberg.de

We consider the "pessimistic version" of bilevel programming programs. Employing advanced tools of variational analysis and generalized differentiation, we provide a general frameworks ensuring the Lipschitz continuity of the value functions. Several types of lower subdifferential necessary optimality conditions are derived. We also derive upper subdifferential necessary optimality conditions of a new type. Certain links are established between the obtained necessary optimality conditions for the pessimistic and optimistic versions in bilevel programming.

3 - Vanishing Stress Constraints in Topology Optimization of Mechanical Structures

Wolfgang Achtziger, Department of Mathematics, University of Erlangen-Nuremberg, Chair of Applied Mathematics 2, Cauerstrasse 11, 91058, Erlangen, Germany, achtziger@am.uni-erlangen.de

We consider the optimization of topology of mechanical structures in a discretized finite element setting. These problems express shape optimization through a problem of optimal material distribution on a given element grid. Local stress constraints are essential for a realistic modeling. The resulting problem is a large-scaled mathematical program with vanishing constraints (MPVC). In the recent past several numerical recipes have been proposed for the treatment of MPVCs. The talk presents some of these approaches and reports on their success in the numerical treatment of topology problems.

4 - Branch and bound method for the competitive facility location problem

Andrey Melnikov, Sobolev Institute of Mathematics, Russian Federation, a.a.melnikov@hotmail.com, *Vladimir Beresnev*

We deal with the competitive facility location problem, where two players, the leader and the follower, sequentially open their facilities in finite discrete space. Every consumer chooses one opened facility according to his own preferences. The problem consists in opening the leader's facilities so as to obtain the maximum profit, taking into account the follower's reaction. The problem is formulated in terms of the bilevel integer programming. An exact procedure based on the B&B method has been developed. Computational results for the randomly generated instances are discussed.

■ WB-16

Wednesday, 10:30-12h00
RB-2103

Linear and Quadratic Programming

Stream: Linear and Conic Programming
Invited session

Chair: *David Bartl*, Department of Mathematics, University of Ostrava, 30.dubna 22, 701 03, Ostrava, Czech Republic, bartl@osu.cz

1 - On the complexity of steepest descent algorithms for minimizing quadratic functions

Clovis Gonzaga, Dept. of Mathematics, Federal Univ. of Santa Catarina, Cx. postal 5210, Florianópolis, SC, Brazil, Florianópolis, SC, Brazil, clovis@mtm.ufsc.br

In this talk we examine patterns in the distribution of step lengths in steepest descent algorithms for minimizing a convex quadratic function. We show how a large number of short steps are needed, and how these relate to the much smaller number of large steps. We note that the order in which the step lengths is used is irrelevant, and show a worst case example with a small number of variables. We also conceive a brute force algorithm which is in a certain way optimal.

2 - Convex quadratic programming applied to the stability number of a graph

Maria F Pacheco, Instituto Politécnico de Bragança - ESTiG, Quinta de Santa Apolónia, Gab. 112, 5301-857, Bragança, Portugal, pacheco@ipb.pt, *Domingos Cardoso*, *Carlos J. Luz*

We deal with graphs whose stability number can be determined by a convex quadratic program and describe algorithmic techniques for the determination of maximum stable sets in such graphs (except there is an induced subgraph with least adjancency eigenvalue and optimal value of the convex quadratic program not changing if the neighborhood of any vertex is deleted). Such a graph is called adverse. Assuming that every adverse graph has convex-QP stability number, an algorithm for the recognition of graphs with convex-QP stability number is introduced and applied to determine maximum matchings.

3 - A discrete version of Farkas' Lemma and Duality Theorem for homogeneous linear programming

David Bartl, Department of Mathematics, University of Ostrava, 30.dubna 22, 701 03, Ostrava, Czech Republic, bartl@osu.cz

We report a discrete version of Farkas' Lemma, which is formulated in the setting of a module over a linearly ordered commutative ring (e.g.