Tuesday, 14:00-15:20

■ TD-01

Tuesday, 14:00-15:20
Aula Magna

Keynote Talk 8

Stream: Keynote Speakers
Invited session

Chair: *David Pisinger*, DTU Management, Produktionstorvet 424, 2800, Kgs. Lyngby, Denmark, pisinger@diku.dk

1 - Can the computer make scientific discoveries?

Pierre Hansen, MQG, GERAD and HEC Montreal, 3000 Chemin de la Cote-Sainte-Catherine, H3T 2A7, Montreal, Quebec, Pierre.Hansen@gerad.ca

Is there a systematic method leading to scientific discovery? To this question, Francis Bacon answers yes, while both Albert Einstein and Karl Popper answer no. As in so many cases, enormous progress in computer power, and in its efficient use, renew the question. Taking examples from geometry, graph and number theory, physics and chemistry, we will illustrate some clear successes (and some failures). This will lead to some speculation on the balance between automation and inspiration in discovery.

■ TD-02

Tuesday, 14:00-15:20
3.2.14

Topics in Combinatorial Optimization

Stream: Combinatorial Optimization [c]
Contributed session

Chair: *Marek Libura*, Systems Research Institute, Polish Academy of Sciences, Newelska 6, 01-447, Warszawa, Poland, libura@ibspan.waw.pl

1 - Robustness analysis in combinatorial optimization.

Marek Libura, Systems Research Institute, Polish Academy of Sciences, Newelska 6, 01-447, Warszawa, Poland, libura@ibspan.waw.pl

We consider the generic combinatorial optimization problem in which the set of feasible solutions is fixed, but the weights of the ground set elements may vary. For such a problem we study subsets of weights for which an initially optimal solution remains robust. Our approach is therefore a natural extension of the standard stability analysis. We present results concerning the robustness region, robustness radius and robustness tolerances, which are defined as direct analogues of the stability region, stability radius and stability tolerances considered in the sensitivity analysis framework.

2 - Cooperative Cuts: Graph Cuts with Submodular Edge Weights

Stefanie Jegelka, Empirical inference, Max Planck Institute for Biological Cybernetics, Spemannstr. 38, 72076, Tuebingen, Germany, jegelka@tuebingen.mpg.de, *Jeff Bilmes*

We introduce cooperative cut, a minimum cut problem whose cost is a submodular function on sets of edges: the cost of an edge that is added to a cut set depends on the edges in the set. Applications are e.g. in probabilistic graphical models and image processing. We prove NP hardness and a polynomial lower bound on the approximation factor, and upper bounds via four approximation algorithms based on different techniques. Our additional heuristics have attractive practical properties, e.g., to rely only on standard min-cut. Both our algorithms and heuristics appear to do well in practice.

3 - New formulations for the k-club problem — a comparative study

Maria Almeida, Instituto Superior de Economia e Gestão-UTL/Centro de Investigação Operacional, Rua do Quelhas, 6, 1200-781, Lisboa, talmeida@iseg.utl.pt, *Filipa Carvalho*

A k-club is a clique relaxation which represents a dense structure in a graph if k is small (a 1-club is simply a clique). Finding a maximum cardinality k-club is NP-hard for any k. In this talk two types of formulations for the k-club problem are considered: formulations with node variables only and formulations that combine them with edge variables. We show how to strengthen these formulations with valid inequalities and how to embed the strengthened models in exact and heuristic algorithms to solve the problem. Comparative computational results are presented.

4 - Solving the Quadratic Assignment Problem by Means of General Purpose Mixed Integer Linear Programming Solvers

Huizhen Zhang, Statistics and Operations Research, Rey Juan Carlos University, C/ Tulipán s/n, 28933 , Móstoles, Madrid, Spain, zhzzywz@gmail.com, *Cesar Beltran-Royo*

The Quadratic Assignment Problem (QAP) is one of the most difficult combinatorial optimization problems with a diversity of applications. Linearization is a well-known solution method for the QAP where one formulates the QAP as a (mixed) integer linear programming ((M)ILP) problem. Kauffmann and Broeckx's linearization (1978) is the smallest QAP-MILP formulation but it is also one of the weakest ones. In this work we analyze how Kauffmann and Broeckx's formulation can be tightened and used in the framework of the semi-Lagrangian relaxation in order to solve the QAP by means of general purpose mixed integer linear programming solvers.

■ TD-03

Tuesday, 14:00-15:20
3.2.15

Transportation and logistics

Stream: Metaheuristics
Invited session

Chair: *Christophe Duhamel*, LIMOS, Université Blaise Pascal, campus des Cézeaux, 63173, Aubière, France, christophe.duhamel@isima.fr

Chair: *Jalel Euchi*, Quantitatives Methods, Faculty of Economics and Management of Sfax, Route de l'aéroport km 4.5, 3018, Sfax, Sfax, Tunisia, jalel.euchi@fsegs.rnu.tn

1 - A Hybrid Tabu Search to Solve the Heterogeneous Fixed Fleet Vehicle Routing Problem

Jalel Euchi, Quantitatives Methods, Faculty of Economics and Management of Sfax, Route de l'aéroport km 4.5, 3018, Sfax, Sfax, Tunisia, jalel.euchi@fsegs.rnu.tn, *Habib Chabchoub*

The Heterogeneous Fixed Fleet Vehicle Routing Problem (HFFVRP) is a variant of the Vehicle Routing Problem (VRP) that aims to provide service to a specific customer group with minimum cost using a limited number of vehicles. We assume that the number of vehicles is fixed. We must decide how to make the best use of the fixed fleet of vehicles. In this paper we describe a Tabu Search algorithm embedded in the Adaptive Memory (TSAM) procedure to solve the HFFVRP. Computational experiments indicating the performance of the algorithm concerning quality of solution and processing time are reported.

2 - Scheduling of road construction projects by means of tabu search algorithm

Jacek Hejducki, Electronics, University of Technology Wrocław Poland, Wybrzeże Wyspiańskiego 27, 50-370, Wrocław, Dolnoslaskie, Poland, 163646@student.pwr.wroc.pl, *Zdzisław Hejducki*

This paper deals with some problems of synchronizing construction activities differing in their execution times. A matrix methodology of calculating the times of execution of the activities, ensuring that there will be no collisions between them, is presented. The methodology is illustrated with numerical examples showing the successive steps of the algorithm and is applied to road works modelled as the flow shop problem. Negative transport times are used to model the specific constraints of the road construction problem. The tabu search algorithm is adapted to solve the problem.

3 - Parallel Cooperative Grasp for the HVRP

Christophe Duhamel, LIMOS, Université Blaise Pascal, campus des Cézeaux, 63173, Aubière, France,