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BOOK OF ABSTRACTS

UNIVERSITÄT SIEGEN

Ministerium für Innovation, Wissenschaft, Forschung und Technologie des Landes Nordrhein-Westfalen

EURO

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GOR

INFORM

We make a comparative study of several mixed integer linear programming (MILP) formulations for the resource-constrained project scheduling problem (RCPSP). First, we present standard discrete and continuous time MILP formulations. Second, instead of relying on the traditional discretization of the time horizon, we propose two new MILP formulations based on the concept of event: the Start/End and the On/Off formulations. Experimental results allow us to provide guidelines for the choice of the accurate formulation with respect to the RCPSP instance characteristics.

■ TD-16

Tuesday 12:55-14:15
Koenig

Multiple Criteria Integer Programming

Stream: Multi-Objective Optimization and Decision Theory 1

Invited session

Chair: *Ralf Borndörfer*, Optimization, Zuse-Institute Berlin, 14195, Berlin, Germany, borndoerfer@zib.de

1 - An exact method to generate the non-dominated set for the moilp problem

Chergui Mohamed El-Amine, Recherche Opérationnelle, Université des Sciences et de la Technologie H.B., BP. 32, Bab Ezzouar, 16111, Alger, ALGERIE., Algeria, mohamedelaminec@yahoo.com, *Ait-mehdi Meriem*, *Abbas Moncef*

We describe an exact method to generate the non-dominated set for the MOILP problem. While most of researchers solve initially an ILP problem, the proposed method starts with an optimal point of an LP problem and uses a branching process to find locally an integer point. Then, an efficient cut which deletes only dominated vectors is built. The results show that our method is better than Sylva & Crema's one since it's 15 times faster, makes thrice less simplex iterations and generates almost 4 times fewer nodes on average. As an application, the artificial insemination problem is treated.

2 - An approximation algorithm to generate the extreme supported nondominated points for multiobjective mixed integer programs

Ozgur Ozpeynirci, Department of Logistics Management, Izmir University of Economics, 35330, Izmir, Turkey, ozgur.ozpeynirci@ieu.edu.tr, *Murat Koksalan*

We consider finding the extreme supported nondominated (ESN) points for multiobjective mixed integer programming problems. We develop an approximation algorithm (ApA) that generates a representative subset of ESN points. ApA keeps lower and upper bound sets for ESN points and provides a nonincreasing worst case proximity measure between the bound sets. This property allows ApA to provide a performance guarantee. We develop lower bound sets and variations of the algorithm to enhance its computational performance and demonstrate the results on a set of assignment problems.

3 - Multicriteria optimization in public transportation

Ralf Borndörfer, Optimization, Zuse-Institute Berlin, 14195, Berlin, Germany, borndoerfer@zib.de

This talk discusses multi-criteria versions of Lagrangean relaxation and column generation optimization approaches to optimization problems in public transportation including line planning, vehicle scheduling, and duty scheduling. In this way, we can analyze tradeoffs between conflicting objectives such as quality of service, operational stability, and employee satisfaction.

■ TD-17

Tuesday 12:55-14:15
Rheinaue

Cutting and Packing 6

Stream: Cutting and Packing

Invited session

Chair: *Socorro Rangel*, DCCE, UNESP, Rua Cristovão Colombo, 2265, 15054000, S.J. do Rio Preto, São Paulo, Brazil, socorro@ibilce.unesp.br

1 - Large scale production planning in the stainless steel industry

Janne Karelahti, Accenture, Finlaysoninkuja 21 A, 33210, Tampere, Finland, janne.karelahti@accenture.com, *Pekka Vainiomäki*, *Tapio Westerlund*

We introduce a new formulation for a two-dimensional trim loss problem in the stainless steel industry. In this model, the dimensions of the mother coils are considered variables. To enable reuse of scrap material, the trim loss at the end of a coil is collected into a single coil. Also, the scattering of an order to multiple coils is minimized to facilitate shipping. For numerical solution, the inherently non-linear problem is transformed to a linear one by a decomposition technique. The procedure has been successfully applied in industrial environment at Outokumpu Stainless Tornio Works.

2 - Skiving stock problem

Martina Stuber, Uni Bonn, Rheinische Friedrich-Wilhelms-Universität Bonn, Wegeler Str. 10, 53115, Bonn, Germany, martina.stuber@uni-bonn.de

In this talk we will discuss the socalled Skiving Stock Problem. This problem appears by the manufacturing paper rolls and was first descripted by Eugen Zak. It descripes the situation where by technical reasons the customer's orders can not be executed. This means that the desired length of the ordered paper roll is to be cut more than a half the roll length. The technical solution is to cut one jumbo roll into smaller rolls and to skive these rolls to the desired roll length. A mathematical model of this problem will be given and some properties of this model will be discussed.

3 - Arc-flow model for the two-dimensional cutting stock problem

Rita Macedo, Departamento de Produção e Sistemas, Universidade do Minho, Universidade do Minho, Escola de Engenharia, Departamento de Produção e Sistemas, Campus de Gualtar, 4710-057, Braga, Portugal, rita@dps.uminho.pt, *Cláudio Alves*, *J. M. Valério de Carvalho*

We describe an exact model for the two-dimensional Cutting Stock Problem with two stages and the guillotine constraint. It is a linear programming arc-flow model, formulated as a minimum flow problem. We explicitly consider all its variables and constraints, apply reduction criteria to reduce the size and symmetry of the model and solve it with CPLEX, considering a new family of cutting planes. We also consider some variants of the original problem. The model was tested on a set of real instances from the wood industry, with promising results.

4 - The two-dimensional cutting stock problem with saw machine set ups

Socorro Rangel, DCCE, UNESP, Rua Cristovão Colombo, 2265, 15054000, S.J. do Rio Preto, São Paulo, Brazil, socorro@ibilce.unesp.br, *Gabriela Mosquera*, *Horacio Yanasse*

In this paper we present solution approaches to the two-dimensional cutting stock problem considering both the minimization of the total number of plates and the cutting machine set ups. The relationship between the number of cutting patterns and the number of saw cycles (machine set ups) is studied. Results of a computational study using real data from a Brazilian furniture plant are also presented. Acknowledgement: Brazilian agencies CNPq and FAPESP.

■ TD-18

Tuesday 12:55-14:15
Lenné

Mathematical Programming Problems in Machine Learning

Stream: Mathematical Programming

Invited session

Chair: *Annabella Astorino*, ISTITUTO DI CALCOLO E RETI AD ALTE PRESTAZIONI, CONSIGLIO NAZIONALE DELLE RICERCHE, VIA PIETRO BUCCI 41C, 87030, RENDE, Italy, astorino@icar.cnr.it

1 - Mathematical programming for multiple kernel learning

Alexander Zien, Group Rätsch, Friedrich Miescher Laboratory of the Max Planck Society, Spemannstraße 39, 72076, Tübingen, Germany, Alexander.Zien@tuebingen.mpg.de

Many machine learning problems (e.g. training SVMs) have a mathematical programming (MP) formulation. An important advantage of SVMs is elegant non-linear modelling via kernel functions; however, a proper choice of kernel is crucial for accurate predictions. Multiple kernel learning (MKL) is an extension to SVMs that allows to optimize a linear combination of kernels during training. We review MKL, present its different MP formulations, and investigate their time complexity. Finally we discuss what is key for tuning mathematical programming to achieve the required computational efficiency.

2 - Parallel nonlinear svm regression through gradient-projection methods

Thomas Serafini, Department of Physiscs, INFM - National Research Council, via Campi 213/a, 41100, Modena, Italy, thomas.serafini@unimore.it, *Gaetano Zanghirati*, *Luca Zanni*

A number of effective supervised learning methodologies are available for the computation of the optimal classifier/regressor of a given data set, which are used in many application areas. However, the increasing amount of the data and of their dimensionality calls for software tools able to exploit the power of modern parallel machines. We present a well parallelizable approach to the solution of the standard nonlinear Support Vector Machine (SVM) regression problem: it is based on a gradient-projection decomposition technique and it is very suitable for distributed-memory systems.

3 - A new look to the primal problem in svm training

Gaetano Zanghirati, Department of Mathematics, University of Ferrara, Building B, Scientific-Technological Campus, via Saragat, 1, 44100, Ferrara, Italy, g.zanghirati@unife.it, *Roger Fletcher*

Given two clusters of points, the Support Vector Machine (SVM) is a very powerful method to obtain a separating hypersurface with optimal generalization properties, via the maximum margin principle. The NLP problem it generates is usually faced through its dual, which is a simply constrained, convex QP problem. While the dual has been extensively studied, less is known about the primal SVM problem: we present a new SQP approach to the solution of the latter, which is shown to converge to the optimal solution. Some experiments will be presented and numerical aspects will be discussed.

4 - A two phase approach to semisupervised classification

Annabella Astorino, ISTITUTO DI CALCOLO E RETI AD ALTE PRESTAZIONI, CONSIGLIO NAZIONALE DELLE RICERCHE, VIA PIETRO BUCCI 41C, 87030, RENDE, Italy, astorino@icar.cnr.it, *Antonio Fuduli*, *Manlio Gaudioso*, *Enrico Gorgone*, *Diethard Pallaschke*

Pattern classification deals with the identification of the class label for each object of two or more classes. Standard supervised approach uses only the features of objects with known class label. The idea behind the semisupervised learning is to make use also of information coming from unlabelled objects. Typically, the semisupervised approach requires solution of large scale problems. Our objective is to present a preprocessing of the dataset which, on the basis of the concept of separating set, reduces the number of unlabelled objects to be entered in the classification phase.

■ TD-19

Tuesday 12:55-14:15
Haber

Location and Routing with metaheuristics

Stream: Metaheuristics

Invited session

Chair: *Mahmut Ali Gokce*, Industrial Systems Engineering, Izmir University of Economics, Sakarya Cad. No: 155, Balcova/ Izmir TURKEY, 35050, Izmir, Turkey, ali.gokce@ieu.edu.tr

1 - Motorcycle-courier routing problems in urban areas

Tsung-Sheng Chang, Institute of Global Operations Strategy and Logistics Management, National Dong Hwa University, 1, Sec.2, Da-Hsueh Rd., Shou-Feng, 974, Hualien, Taiwan, ts@mail.ndhu.edu.tw

Motorcycles have been becoming one of the major transportation modes for distributing small packages in urban areas. This research intends to help the motorcycle couriers promote their competitive power by efficiently and effectively solving their routing problems. In this study, the motorcycle-courier routing problem is modeled as a multiple traveling salesman problem with workload balancing and time window constraints. Since the problem is NP-hard, our proposed solution algorithm is a heuristic. To our knowledge, this research topic has not been studied in the literature.

2 - New metaheuristics for the reliability p-median problem

Javier Alcaraz, Estadística, Matemáticas e Informática, Universidad Miguel Hernández, Av. Universidad s/n, 03202, Elche, Alicante, Spain, jalcaraz@umh.es, *Mercedes Landete*, *Juan Francisco Monge*