Multi-body design centering (MBDC) deals with the optimal embedding of several parametrized bodies (the designs) into another body (the container). Naturally, the designs are required to be non-overlapping, but in practice it is often necessary, that they can be separated by a sequence of guillotine cuts. In our problem, two objectives have to be considered, and the guillotine patterns aren't restricted to orthogonal ones. We formulate bi-criteria MBDC problems with guillotine constraints in a semi-infinite way and present first numerical results for a practical problem with few designs.

3 - Semi-infinite optimization with implicit functions

Matthew Stuber, Department of Chemical Engineering, MIT, 77 Massachusetts Ave., Bldg 66-363, 02139, Cambridge, MA, United States, stuber@mit.edu, *Paul I. Barton*

A method for globally solving nonlinear nonconvex semi-infinite optimization problems constrained by implicit functions using interval methods is presented. Implicit functions arise when the infinite inequality constraint in an SIP is dependent not only on the index variables and decision variables, but also on variables that are implicit functions of the index and decision variables. Using interval methods, convex relaxations of the implicit infinite inequality constraint are calculated and refined in the Branch-and-Bound framework allowing for the calculation of global optima.

■ MD-25

Monday 13:35-14:55
GSI - S 25

Ordered Structured in Games and Decision

Stream: Cooperative Game Theory

Invited session

Chair: *Michel Grabisch*, CES, Universite Paris I - Pantheon-Sorbonne, 106-112 Bd de l'Hopital, 75013, Paris, France, michel.grabisch@univ-paris1.fr

1 - Monge extensions and convexity of cooperation structures

Michel Grabisch, CES, Universite Paris I - Pantheon-Sorbonne, 106-112 Bd de l'Hopital, 75013, Paris, France, michel.grabisch@univ-paris1.fr, *Ulrich Faigle*

We study cooperative games defined on a set F of feasible coalitions, whithout any assumption on the structure. By considering an activity bound for each player, we define a Monge algorithm which provides an extension of the game, similar to the Lovasz extension. The Monge extension permits to define the core of the game, keeping the essential properties which hold in for classical games. The Monge extension suggests a natural notion of convexity, independent of the combinatorial structure of the set F. When F is closed under union, we prove that convexity is characterized by supermodularity.

2 - A matrix approach to tu games with coalition and communication structures

Gerard Hamiache, Mathematiques Economie et Sciences Sociales, Universite Lille 3, Maison de la recherche, Domaine universitaire du Pont de Bois, 59653, Villeneuve d'Ascq, France, gerard.hamiache@univ-lille3.fr

The present article offers a technique to construct extensions of the Shapley value for TU games. Only basic matrix algebra is used. We define an efficient Aumann-Dreze value and an efficient Myerson value. We also define two families of values, the first being a convex combination of the efficient Aumann-Dreze value and of the Shapley value and the second a convex combination of the efficient Myerson value and of the Shapley value. We show that the Myerson value, the Aumann-Dreze value, the Shapley value and the four new solutions above are linked by a relationship of "similarity".

3 - Moebius inversion of cooperative games involving partitions of players

Giovanni Rossi, Computer Science, University of Bologna, Mura Anteo Zamboni 7, 40126, Bologna, roxyjean@gmail.com

Cooperative games involving partitions of players are (1) games in partition function form PFF, (2) global G games, (3) global coalitional GC games. Moebius inversion is used for analyzing them in terms of both solutions and cooperation restrictions. A solution of any cooperative game, regarded as a function taking real values on an atomic lattice, is defined as a cooperative game of the same type (i.e. taking values on the same lattice elements as the game to be solved) and with Moebius inversion living only on atoms. The implications are discussed for G, GC and PFF games.

■ MD-26

Monday 13:35-14:55
GSI - S 35

Lot Sizing I

Stream: Discrete Optimization

Contributed session

Chair: *Horst Tempelmeier*, Supply Chain Management and Production, University of Cologne, Albertus-Magnus-Platz, D-50923, Cologne, Germany, tempelmeier@wiso.uni-koeln.de

1 - A comparative study of three fast algorithms for the single item dynamic lot sizing problem

Nadjib Brahimi, Industrial Engineering and Management, University of Sharjah, POBox 27272, Sharjah, United Arab Emirates, POBox 27272, Sharjah, Sharjah, United Arab Emirates, nbrahimi@sharjah.ac.ae, *Dali Chen*

Three improved algorithms for the uncapacitated single item dynamic lot sizing problem (USILSP) are analyzed and compared. The three algorithms were introduced independently by Aggarwal and Park (1993), Federguen and Tsur (1991) and Wagelmans, Van Hoesel, and Kolen (1992). The three algorithms solve the USILSP in O(TlogT), where T is the number of periods in the planning horizon. The three algorithms are implemented and compared based on their level of simplicity, ease of implementation and integration in other algorithms, their constant computational section and other aspects.

2 - Solution methods for an integrated lot sizing and scheduling problem

Carina Pimentel, Departamento de Produção e Sistemas, Universidade do Minho, Campus de Gualtar, Portugal, 4710-057, Braga, Braga, Portugal, carina@dps.uminho.pt, *Filipe Alvelos*, *J. M. Valério de Carvalho*, *António Duarte*

In this talk we present results of an ongoing study, based on a problem of a textile factory. The core problem is an integrated lotsizing and scheduling one, characterized by sets of parallel machines, arbitrary demands and due dates for products, a compatibility matrix between machines and components and release dates of machines. In a solution, the quantities to produce by product/component/size are split among smaller lots, the machines in which those lots will be produced are determined, as well as the order in which they will be done. We present a MIP model and results of a VNS heuristic.

3 - Dynamic uncapacitated lot sizing with random demand under a fillrate constraint

Horst Tempelmeier, Supply Chain Management and Production, University of Cologne, Albertus-Magnus-Platz, D-50923, Cologne, Germany, tempelmeier@wiso.uni-koeln.de, *Sascha Herpers*

This paper deals with the single-item dynamic uncapacitated lot sizing problem with random demand. We propose a model based on the "static uncertainty" strategy. In contrast to these authors, we use exact expressions for the inventory costs and we apply a fillrate constraint. We present an exact solution method and modify several well-known dynamic lot sizing heuristics such that they can be applied for the case of dynamic stochastic demands. The results of a numerical test of the heuristics are shown.

■ MD-27

Monday 13:35-14:55
GSI - S 21

Improving Container Terminal Performance

Stream: Container Terminal Operations

Invited session

Chair: *Kees Jan Roodbergen*, Erasmus University, Rotterdam School of Management, P.O. Box 1738, 3000DR, Rotterdam, Netherlands, kroodbergen@rsm.nl

1 - Efficient dispatching through utilizing twin load capability of vehicles at container terminals

Roel van Anholt, Information Systems and Logistics, VU University Amsterdam, De Boelelaan 1105, room 3A-33, 1081 HV, Amsterdam, Netherlands, ranholt@feweb.vu.nl

Self lifting vehicles (e.g. twin load straddle carriers and shuttle carriers) can be deployed to perform the quay-side transport and the stacking operation. Theoretically these vehicles can transport two 20ft containers at once. However, this capability is seldom used in practice due to the lack of an efficient dispatching strategy. We propose a dispatching strategy that utilizes this capability. With extensive simulation experiments and a sensitivity analysis we demonstrate that this newly developed heuristic algorithm outperforms simple heuristics as commonly used in practice.

2 - Dynamic storage yard allocation for a transshipment hub port

Ek Peng Chew, Industrial and Systems Engineering, Faculty of Engineering, National University of Singapore, 10 Kent Ridge Crescent, 119260, Singapore, Singapore, isecep@nus.edu.sg, *Loo Hay Lee*

A storage yard management problem in a transshipment hub is considered. A dynamic yard template is proposed to reuse the storage space for different vessels during different shifts in order to make full use of the storage space. In addition, the consignment strategy is used to reduce the number of reshuffles and the high-low workload balancing protocol is used to reduce the traffic congestion of prime movers.

3 - Scheduling of container storage and retrieval

Kees Jan Roodbergen, Erasmus University, Rotterdam School of Management, P.O. Box 1738, 3000DR, Rotterdam, Netherlands, kroodbergen@rsm.nl

We consider the problem of scheduling the storage and retrieval of containers in the stack. Some arcs in the underlying directed network must be visited; other arcs may - but need not be - visited. We can consider this problem to be a special case of the directed Rural Postman Problem. We show that this problem can be reformulated as an asymmetric Steiner Traveling Salesman Problem which can be efficiently solved to optimality by a combination of optimal assignments in bipartite networks for parts of the problem and dynamic programming for the connections between those parts.

4 - Routing multiple automated stacking cranes at container terminals

Iris F.A. Vis, Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV, Amsterdam, Netherlands, ivis@feweb.vu.nl, *Hector Carlo*

The significant growth in volumes of containers being transshipped puts a strain on all logistics processes at container terminals, including the stacking processes. This study is concerned with scheduling storage and retrieval requests for two Automated Stacking Cranes operating in the same block. We present a mathematical model to minimize the makespan for both cranes. Both an algorithm to derive a lower bound for the makespan and a simulated annealing based heuristic are proposed to efficiently solve the problem.

■ MD-28

Monday 13:35-14:55
GSI - S 1

Financial Optimization 3

Stream: Financial Optimization

Invited session

Chair: *Andrea Consiglio*, Dept. of Statistics and Mathematics, University of Palermo, Facolta' di Economia - Ed. 13, Viale delle Scienze, 90128, Palermo, Italy, consiglio@unipa.it

1 - Scenario reduction for trading in electricity markets

Miguel Carrión, Electrical Engineering, University of Castilla - La Mancha, Avda Carlos III, s/n, Campus Fábrica de Armas, 45071, Toledo, miguel.carrion@uclm.es, *Antonio J. Conejo*, *Salvador Pineda*, *Juan Miguel Morales*

To make informed decisions in futures markets of electricity stochastic programming models are commonly used. The number of scenarios to accurately represent the uncertainty involved is generally large, which renders the associated problem hard to solve. Hence, scenario reduction techniques are needed to trim down the number of scenarios while keeping most of the stochastic information embedded in such scenarios. This presentation proposes a scenario reduction procedure that advantageously compares with existing ones for electricity-market problems tackled via two-stage stochastic programming.

2 - The optimal mortgage choice: mix your loans and stay out of trouble

Kourosh Marjani Rasmussen, Management, Technical University of Denmark, Produktionstorvet, DTU — Bygning 424, 2800, Lyngby, Denmark,