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Title	An artificial bee colony algorithm for the capacitated vehicle routing problem
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Citation	The 24th European Conference on Operational Research (EURO 24), Lisbon, Portual, 11-14 July 2010. In Abstract Book of EURO 24, 2010, p. 89, MF-03-3
Issued Date	2010
URL	http://hdl.handle.net/10722/136206
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Monday, 17:20-18:40

■ MF-02

Monday, 17:20-18:40
3.2.14

Flexible shop scheduling by Metaheuristics and solutions for real problems

Stream: Combinatorial Optimization
Invited session

Chair: *Lorena Pradenas*, Industrial, Universidad de Concepción, Barrio Universitario, Concepción, casilla 160 C, correo 3, Concepción, Concepción, Concepción, Chile, lpradena@udec.cl

1 - A genetic algorithm for the flexible job shop problem

Lorena Pradenas, Industrial, Universidad de Concepción, Barrio Universitario, Concepción, casilla 160 C, correo 3, Concepción, Concepción, Concepción, Chile, lpradena@udec.cl, *Rosa Medina, Víctor Parada*

The Flexible Job Shop Problem is part of the family of scheduling problems. It extends the job shop problem in order to optimize the use of resources in a flexible production system, that is, those with machines that can process more than one type of operation. This problem has been studied by many authors, who have proposed mathematical models and heuristics approaches. Due to its' combinatorial complexity, the exact methods that solve the mathematical models only solve small instances. Among the heuristics approaches, the metaheuristics of local search have demonstrated a better performance. In this study, a sequential genetic algorithm is presented to solve The Flexible Job Shop Problem. The proposed algorithm is tested using literature instances. The results show that the algorithm is effective for finding good solutions for the problem.

2 - The inverse power index problem

Sascha Kurz, Mathematics, Physics and Informatics, University of Bayreuth, Universitätsstraße 30, 95440, Bayreuth, Bavaria, Germany, sascha.kurz@uni-bayreuth.de

Weighted voting games are frequently used in decision making. Each player has a weight and each proposal is accepted if the weight sum of the supporting players exceeds a quota. One line of research is the efficient computation of so-called power indices measuring the influence of a player. We treat the inverse problem: Given an influence vector and a power index, determine a weighted voting game such that the distribution of influence among the players is a close as possible to the given target value. We present exact algorithms and computational results for the Shapley-Shubik index.

3 - Signal decoding in multi-antenna systems using second-order cone programming

Edmund Burke, School of Computer Science & IT, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, ekb@cs.nott.ac.uk, *Jakub Marecek, Andrew J. Parkes*

Receivers in modern wireless communications (WiFi N, WiMAX, LTE, LTE Advanced) all implement a solver for integer least squares, a problem in integer non-linear programming. We first present an overview of solvers currently implemented, and subsequently compare them to a solver of our own, based on second-order cone programming cuts. Extensive computational results are presented.

4 - A binary programming model to the Dynamic Search Problem

Carlos Diego Rodrigues, Informatique, Université d'Avignon, 334, Chemin des Meinajaries, Agroparc, 84411, Avignon, PACA, France, cdiegor@gmail.com, *Boris Detienne, Dominique Quadri, Philippe Michelon*

Search problems are among the first problems studied by Operations Research in several fields (game theory, graph theory, stochastic programming, etc). They are associated to many practical applications, notably in security. We present the first binary programming model to this problem and how this model can be adapted to most of the cases already appearing in the literature. A statistical validation process, that can evaluate any given solution plan, is also shown and used to corroborate with our model, allowing us to establish some numerical results concerning its performance.

■ MF-03

Monday, 17:20-18:40
3.2.15

Population-based metaheuristics for routing problems

Stream: Metaheuristics
Invited session

Chair: *Caroline Prodhon*, University of Technology of Troyes, 12 rue Marie Curie, 10000, Troyes, France, caroline.prodhon@utt.fr

Chair: *Philippe Lacomme*, Université de Clermont-Ferrand, 63177, Clermont Ferrand, France, placomme@sp.isima.fr

1 - Memetic algorithm with diversity enhancement: an efficient approach for hard multi-attribute vehicle routing problems

Thibaut Vidal, Informatique et recherche opérationnelle, Université de Montréal / Université de Technologie de Troyes, 5536 chemin de la Cote des Neiges, apt 4, H3T1Y9, MONTREAL, QC, Canada, thibaut.vidal@cirrelt.ca, *Teodor Gabriel Crainic, Michel Gendreau, Nadia Lahrichi, Walter Rei*

We introduce a new memetic algorithm for a hard class of multi-depot periodic vehicle routing problems with time-windows, where very few efficient algorithms could be found. New genetic operators for periodic problems are proposed. Furthermore, in contrast with other population management methods operating solely during survivor selection, our algorithm favors diversity through the very evaluation of individuals, which is driven by fitness as well as contribution to the population diversity. Comparative studies underline the efficiency of our "diversity enhancement" method on these problems.

2 - A new Ant Colony Optimization on Vehicle Routing Problem with heterogeneous fleet, mixed backhauls, and time windows

Farah Belmecheri, LOSI, University of Technology of Troyes, 12, Rue marie curie, 10010, Troyes, France, France, farah.belmecheri@utt.fr, *Christian Prins, Farouk Yalaoui, Lionel Amodeo*

This paper presents a new Ant Colony Optimization to solve the Vehicle Routing Problem (VRP) with: Heterogeneous fleet (H), Mixed Backhauls (MB), Time Windows (TW) which is called HVRPMBTW. This metaheuristic consists to construct the routes using the probabilities of insertion of customers; the local searches are added to improve the solutions. In computational results, this method is applied on the sets of instances of HVRPMBTW and the classical HVRP with limited and unlimited vehicles (instances of Taillard 1996). The results confirm the efficiency of this new ACO.

3 - An Artificial Bee Colony Algorithm for the Capacitated Vehicle Routing Problem

Sin C. Ho, Department of Business Studies, Aarhus School of Business, Aarhus University, Fuglesangs Allé 4, 8210, Aarhus V, Denmark, sinch@asb.dk, *Wai Yuen Szeto, Yongzhong Wu*

This paper introduces an artificial bee colony heuristic for the capacitated vehicle routing problem. The artificial bee colony heuristic is a swarm-based heuristic, which mimics the foraging behavior of a honey bee swarm. The performance of the heuristic is evaluated on two sets of benchmark instances. A new scheme is also developed to improve the performance of the artificial bee colony heuristic. Computational results show that the heuristic with the new scheme produces good solutions.

4 - A Hybrid Genetic Algorithm (HGA) for the Multi-Depot Pickup and Delivery Problem (MDPDP)

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The problem of serving a number of pickup and delivery locations using a heterogeneous fleet of vehicles located at several depots is formulated as a mixed-integer linear programming problem. The objective is to find minimum-distance routes subject to precedence, capacity and maximum-route length constraints. This is an NP-hard problem and we use ILOG CPLEX for optimally solving instances of small size only. A new meta-heuristic approach (HGA) is proposed, implemented and computationally tested on various test instances from the literature. Competitive near-optimal solutions are reported.