Essays and Surveys in Metaheuristics

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Contents

Preface ix

1
Selected Topics in Simulated Annealing 1
E. Aarts and J. Korst

2
Reactive Tabu Search with Path-Relinking for the Steiner Problem in Graphs 39
M.P. Bastos and C.C. Ribeiro

3
A GRASP for Job Shop Scheduling 59
S. Binato, W.J. Hery, D.M. Loewenstern, and M.G.C. Resende

4
A Reactive GRASP for Transmission Network Expansion Planning 81
S. Binato and G.C. Oliveira

5
Tabu Search for Two-Dimensional Irregular Cutting 101
J. Błażewicz, A.M. Salvador, and R. Walkowiak

6
A Study of Global Convexity for a Multiple Objective Travelling Salesman Problem 129
P.C. Borges and M.P. Hansen

7
A Lower Bound Based Meta-Heuristic for the Vehicle Routing Problem 151
J. Brandão

8
A Simulated Annealing Approach for Minimum Cost Isolated Failure Immune Networks 169
A. Candia and H. Bravo

9
A GRASP Interactive Approach to the Vehicle Routing Problem with Backhauls 185
C. Carreto and B. Baker

10
Parallel Cooperative Approaches for the Labor Constrained Scheduling Problem 201
C.C.B. Cavalcante, V.F. Cavalcante, C.C. Ribeiro, and C.C. de Souza

11
A Scatter Search Algorithm for the Maximum Clique Problem 227
L. Cavique, C. Rego, and I. Themido

12
The Noising Methods: A Survey 245
I. Charon and O. Hudry

13
Strategies for the Parallel Implementation of Metaheuristics 263
V.-D. Cung, S.L. Martins, C.C. Ribeiro, and C. Roucairol

14
Accelerating Strategies in Column Generation Methods for Vehicle Routing and Crew Scheduling Problems 309
G. Desaulniers, J. Desrosiers, and M.M. Solomon

15
GRASP: An Annotated Bibliography 325
P. Festa and M.G.C. Resende

16
Recent Advances in Tabu Search 369
M. Gendreau

17
Lagrangean Tabu Search 379
T. Grünert

18
A GIDS Metaheuristic Approach to the Fleet Size and Mix Vehicle Routing Problem 399
A.F.-W. Han and Y.-J. Cho

19
Developments of Variable Neighborhood Search 415
P. Hansen and N. Mladenović

20
Analyzing the Performance of Local Search Algorithms Using Generalized Hill Climbing Algorithms 441
S.H. Jacobson

21
Ant Colony Optimization: An Overview 469
V. Maniezzo and A. Carbonaro

22
Intensification Neighborhoods for Local Search Methods 493
T. Mautor

23
New Heuristics for the Euclidean Steiner Problem in R^n 509
F. Montenegro, N. Maculan, G. Plateau, and P. Boucher

24
Mathematical Analysis of Evolutionary Algorithms 525
H. Mühlenbein and Th. Mahnig

25
Formulation and Tabu Search Algorithm for the Resource Constrained Project Scheduling Problem 557
K. Nonobe and T. Ibaraki

26
Analysing the Run-Time Behaviour of Iterated Local Search for the Travelling Salesman Problem 589
T. Stützle and H.H. Hoos

27
POPMUSIC — Partial Optimization Metaheuristic under Special Intensification Conditions 613
E.D. Taillard and S. Voss

28
Subcost-Guided Simulated Annealing 631
M. Wright

29
A Pruning Pattern List Approach to the Permutation Flowshop Scheduling Problem 641
T. Yamada

Preface

Finding exact solutions to many combinatorial optimization problems in business, engineering, and science still poses a real challenge, despite the impact of recent advances in mathematical programming and computer technology. New fields of applications, such as computational biology, electronic commerce, and supply chain management, bring new challenges and needs for algorithms and optimization techniques. Metaheuristics are master procedures that guide and modify the operations of subordinate heuristics, to produce improved approximate solutions to hard optimization problems with respect to more simple algorithms. They also provide fast and robust tools, producing high-quality solutions in reasonable computation times.

The field of metaheuristics has been fast evolving in recent years. Techniques such as simulated annealing, tabu search, genetic algorithms, scatter search, greedy randomized adaptive search, variable neighborhood search, ant systems, and their hybrids are currently among the most efficient and robust optimization strategies to find high-quality solutions to many real-life optimization problems. A very large number of successful applications of metaheuristics are reported in the literature and spread throughout many books, journals, and conference proceedings. A series of international conferences entirely devoted to the theory, applications, and computational developments in metaheuristics has been attracting an increasing number of participants, from universities and the industry.

Kluwer published two books [1,2] which grew out of the two first *Metaheuristics International Conferences* (MIC'95 held in Breckenridge, United States, in 1995; MIC'97 held in Sophia-Antipolis, France, in 1997). Similarly, this new book grows out of the *Third Metaheuristics International Conference* held in Angra dos Reis, Brazil, in July 1999, chaired by Celso C. Ribeiro (Catholic

[1] S. Voss, S. Martello, I.H. Osman, and C.Roucairol (editors), *Meta-heuristics: Advances and Trends in Local Search Paradigms for Optimization*, Kluwer Academic Publishers, 1999.
[2] I.H. Osman and J.P. Kelly (editors), *Meta-heuristics: Theory and Applications*, Kluwer Academic Publishers, 1996.

University of Rio de Janeiro, Brazil) and Pierre Hansen (École des Hautes Études Commerciales, Montréal, Canada) and attended by approximately 150 participants.

Essays and Surveys in Metaheuristics is not only a conference proceedings. This book innovates with respect to the two previous ones, in containing a series of surveys on recent developments of the main metaheuristics. Well-known specialists have written surveys on the following subjects: simulated annealing (E. Aarts and J. Korst, The Netherlands), noising methods (I. Charon and O. Hudry, France), parallel implementation of metaheuristics (V.-D. Cung and C. Roucairol, France, and S.L. Martins and C.C. Ribeiro, Brazil), greedy randomized adaptive search procedures (P. Festa, Italy, and M.G.C. Resende, USA), tabu search (M. Gendreau, Canada), variable neighborhood search (P. Hansen and N. Mladenovic, Canada), ant colonies (V. Maniezzo and A. Carbonaro, Italy), and evolutionary algorithms (H. Mühlenbein and Th. Mahnig, Germany).

Several further essays address issues or variants of metaheuristics: use of metaheuristics within exact algorithms (G. Desaulniers and J. Desrosiers, Canada, and M.M. Solomon, USA), performance of metaheuristics (S.H. Jacobson, USA), intensification neighborhoods (T. Mautor, France), Lagrangean tabu search (T. Grünert, Germany), partial optimization (E. Taillard, Switzerland, and S. Voss, Germany), and subcost guided simulated annealing (M. Wright, UK).

Finally, a large part of the book is devoted to innovative or successful applications of metaheuristics to classical or new combinatorial optimization problems: job-shop, flow-shop, and resource-constrained scheduling (S. Binato, Brazil, W.J. Hery, D.M. Loewenstern, and M.G.C. Resende, USA; T. Yamada, Japan; C.C.B. Cavalcante, V.C. Cavalcante, C.C. Ribeiro, and C.C. de Souza, Brazil; K. Nonobe and T. Ibaraki, Japan), the Steiner problem in graphs (M.P. Bastos and C.C. Ribeiro, Brazil; F. Montenegro and N. Maculan, Brazil, G. Plateau and P. Boucher, France), vehicle routing (J. Brandão, Portugal; C. Carreto, Portugal, and B. Baker, England; A.F.-W. Han and Y.-J. Cho, Taiwan), travelling salesman (P.C. Borges, Portugal, and M.P. Hansen, Danemark; T. Stützle and H.H. Hoos, Germany), network reliability and design (A. Candia and H. Bravo, Chile; S. Binato and G.C. Oliveira, Brazil), 2-dimensional cutting (J. Blazewicz, A.M. Salvador, and R. Walkowiak, Poland), and maximum clique (L. Cavique, C. Rego, and I. Themido, Portugal).

As the organizers of MIC'99, we wish to acknowledge FAPERJ - *Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro*, Brazil, for the generous financial support for the conference, which strongly contributed to the participation of many researchers and graduate students. We are also thankful to the staff of the Department of Computer Science of the Catholic University of Rio de Janeiro, for their administrative support, and to Simone Martins and Geraldo Veiga, for their help with the editorial work involving the pre-conference volume of extended abstracts, from which this book emerged. As the editors of *Essays and Surveys in Metaheuristics*, we are very grateful to Carole Dufour, for her secretarial assistance along the refereeing procedure, and to Nicole Paradis, for her patience and splendorous editorial work, both of them helped by Francine Benoît. We are thankful to GERAD - *Groupe d'études et de recherche en analyse des décisions* and AT&T Labs Research, for the good environment and appropriate conditions offered for the conclusion of the editorial work of this book. Finally, we are also grateful to Gary Folven, for his encouragements and support at different stages of the production of this book, and to the anonymous and generous work of almost one hundred devoted referees.

Holmdel and Montréal, April 2001

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