# CONTENTS

## CONTRIBUTORS

CONTENTS

## FOREWORD

CONTENTS

## PREFACE

CONTENTS

## PART I METHODOLOGIES FOR COMPLEX PROBLEM SOLVING

1 Generating Automatic Projections by Means of Genetic Programming

*C. Estébanez and R. Aler*

1.1 Introduction  
1.2 Background  
1.3 Domains  
1.4 Algorithmic Proposal  
1.5 Experimental Analysis  
1.6 Conclusions

2 Neural Lazy Local Learning

*J. M. Valls, I. M. Galván, and P. Isasi*

2.1 Introduction  
2.2 Lazy Radial Basis Neural Networks  
2.3 Experimental Analysis  
2.4 Conclusions

3 Optimization Using Genetic Algorithms with Micropopulations

*Y. Sáez*

3.1 Introduction  
3.2 Algorithmic Proposal  
3.3 Experimental Analysis: The Rastrigin Function  
3.4 Conclusions

## REFERENCES

CONTENTS
# CONTENTS

## 4 Analyzing Parallel Cellular Genetic Algorithms \[49\]
*G. Luque, E. Alba, and B. Dorronsoro*

4.1 Introduction \[49\]
4.2 Cellular Genetic Algorithms \[50\]
4.3 Parallel Models for cGAs \[51\]
4.4 Brief Survey of Parallel cGAs \[52\]
4.5 Experimental Analysis \[55\]
4.6 Conclusions \[59\]
References \[59\]

## 5 Evaluating New Advanced Multiobjective Metaheuristics \[63\]
*A. J. Nebro, J. J. Durillo, F. Luna, and E. Alba*

5.1 Introduction \[63\]
5.2 Background \[65\]
5.3 Description of the Metaheuristics \[67\]
5.4 Experimental Methodology \[69\]
5.5 Experimental Analysis \[72\]
5.6 Conclusions \[79\]
References \[80\]

## 6 Canonical Metaheuristics for Dynamic Optimization Problems \[83\]
*G. Leguizamón, G. Ordoñez, S. Molina, and E. Alba*

6.1 Introduction \[83\]
6.2 Dynamic Optimization Problems \[84\]
6.3 Canonical MHs for DOPs \[88\]
6.4 Benchmarks \[92\]
6.5 Metrics \[93\]
6.6 Conclusions \[95\]
References \[96\]

## 7 Solving Constrained Optimization Problems with Hybrid Evolutionary Algorithms \[101\]
*C. Cotta and A. J. Fernández*

7.1 Introduction \[101\]
7.2 Strategies for Solving CCOPs with HEAs \[103\]
7.3 Study Cases \[105\]
7.4 Conclusions \[114\]
References \[115\]

## 8 Optimization of Time Series Using Parallel, Adaptive, and Neural Techniques \[123\]
*J. A. Gómez, M. D. Jaraiz, M. A. Vega, and J. M. Sánchez*

8.1 Introduction \[123\]
8.2 Time Series Identification \[124\]
9 Using Reconfigurable Computing for the Optimization of Cryptographic Algorithms
J. M. Granado, M. A. Vega, J. M. Sánchez, and J. A. Gómez

9.1 Introduction
9.2 Description of the Cryptographic Algorithms
9.3 Implementation Proposal
9.4 Experimental Analysis
9.5 Conclusions
References

10 Genetic Algorithms, Parallelism, and Reconfigurable Hardware
J. M. Sánchez, M. Rubio, M. A. Vega, and J. A. Gómez

10.1 Introduction
10.2 State of the Art
10.3 FPGA Problem Description and Solution
10.4 Algorithmic Proposal
10.5 Experimental Analysis
10.6 Conclusions
References

11 Divide and Conquer: Advanced Techniques
C. León, G. Miranda, and C. Rodríguez

11.1 Introduction
11.2 Algorithm of the Skeleton
11.3 Experimental Analysis
11.4 Conclusions
References

12 Tools for Tree Searches: Branch-and-Bound and A* Algorithms
C. León, G. Miranda, and C. Rodríguez

12.1 Introduction
12.2 Background
12.3 Algorithmic Skeleton for Tree Searches
12.4 Experimentation Methodology
12.5 Experimental Results
12.6 Conclusions
References
### CONTENTS

13 Tools for Tree Searches: Dynamic Programming  
*C. León, G. Miranda, and C. Rodríguez*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.1 Introduction</td>
<td>209</td>
</tr>
<tr>
<td>13.2 Top-Down Approach</td>
<td>210</td>
</tr>
<tr>
<td>13.3 Bottom-Up Approach</td>
<td>212</td>
</tr>
<tr>
<td>13.4 Automata Theory and Dynamic Programming</td>
<td>215</td>
</tr>
<tr>
<td>13.5 Parallel Algorithms</td>
<td>223</td>
</tr>
<tr>
<td>13.6 Dynamic Programming Heuristics</td>
<td>225</td>
</tr>
<tr>
<td>13.7 Conclusions</td>
<td>228</td>
</tr>
<tr>
<td>References</td>
<td>229</td>
</tr>
</tbody>
</table>

PART II APPLICATIONS

14 Automatic Search of Behavior Strategies in Auctions  
*D. Quintana and A. Mochón*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.1 Introduction</td>
<td>233</td>
</tr>
<tr>
<td>14.2 Evolutionary Techniques in Auctions</td>
<td>234</td>
</tr>
<tr>
<td>14.3 Theoretical Framework: The Ausubel Auction</td>
<td>238</td>
</tr>
<tr>
<td>14.4 Algorithmic Proposal</td>
<td>241</td>
</tr>
<tr>
<td>14.5 Experimental Analysis</td>
<td>243</td>
</tr>
<tr>
<td>14.6 Conclusions</td>
<td>246</td>
</tr>
<tr>
<td>References</td>
<td>247</td>
</tr>
</tbody>
</table>

15 Evolving Rules for Local Time Series Prediction  
*C. Luque, J. M. Valls, and P. Isasi*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.1 Introduction</td>
<td>249</td>
</tr>
<tr>
<td>15.2 Evolutionary Algorithms for Generating Prediction Rules</td>
<td>250</td>
</tr>
<tr>
<td>15.3 Experimental Methodology</td>
<td>250</td>
</tr>
<tr>
<td>15.4 Experiments</td>
<td>256</td>
</tr>
<tr>
<td>15.5 Conclusions</td>
<td>262</td>
</tr>
<tr>
<td>References</td>
<td>263</td>
</tr>
</tbody>
</table>

16 Metaheuristics in Bioinformatics: DNA Sequencing and Reconstruction  
*C. Cotta, A. J. Fernández, J. E. Gallardo, G. Luque, and E. Alba*

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.1 Introduction</td>
<td>265</td>
</tr>
<tr>
<td>16.2 Metaheuristics and Bioinformatics</td>
<td>266</td>
</tr>
<tr>
<td>16.3 DNA Fragment Assembly Problem</td>
<td>270</td>
</tr>
<tr>
<td>16.4 Shortest Common Supersequence Problem</td>
<td>278</td>
</tr>
<tr>
<td>16.5 Conclusions</td>
<td>282</td>
</tr>
<tr>
<td>References</td>
<td>283</td>
</tr>
</tbody>
</table>
17 Optimal Location of Antennas in Telecommunication Networks
G. Molina, F. Chicano, and E. Alba

17.1 Introduction 287
17.2 State of the Art 288
17.3 Radio Network Design Problem 292
17.4 Optimization Algorithms 294
17.5 Basic Problems 297
17.6 Advanced Problem 303
17.7 Conclusions 305
References 306

18 Optimization of Image-Processing Algorithms Using FPGAs
M. A. Vega, A. Gómez, J. A. Gómez, and J. M. Sánchez

18.1 Introduction 309
18.2 Background 310
18.3 Main Features of FPGA-Based Image Processing 311
18.4 Advanced Details 312
18.5 Experimental Analysis: Software Versus FPGA 321
18.6 Conclusions 322
References 323

19 Application of Cellular Automata Algorithms to the Parallel Simulation of Laser Dynamics
J. L. Guisado, F. Jiménez-Morales, J. M. Guerra, and F. F. Fernández

19.1 Introduction 325
19.2 Background 326
19.3 Laser Dynamics Problem 328
19.4 Algorithmic Proposal 329
19.5 Experimental Analysis 331
19.6 Parallel Implementation of the Algorithm 336
19.7 Conclusions 344
References 344

20 Dense Stereo Disparity from an Artificial Life Standpoint
G. Olague, F. Fernández, C. B. Pérez, and E. Lutton

20.1 Introduction 347
20.2 Infection Algorithm with an Evolutionary Approach 351
20.3 Experimental Analysis 360
20.4 Conclusions 363
References 363

21 Exact, Metaheuristic, and Hybrid Approaches to Multidimensional Knapsack Problems
J. E. Gallardo, C. Cotta, and A. J. Fernández

21.1 Introduction 365
21.2 Multidimensional Knapsack Problem 370
21.3 Hybrid Models 372
21.4 Experimental Analysis 377
21.5 Conclusions 379
References 380

22 Greedy Seeding and Problem-Specific Operators for GAs
Solution of Strip Packing Problems 385
C. Salto, J. M. Molina, and E. Alba

22.1 Introduction 385
22.2 Background 386
22.3 Hybrid GA for the 2SPP 387
22.4 Genetic Operators for Solving the 2SPP 388
22.5 Initial Seeding 390
22.6 Implementation of the Algorithms 391
22.7 Experimental Analysis 392
22.8 Conclusions 403
References 404

23 Solving the KCT Problem: Large-Scale Neighborhood Search
and Solution Merging 407
C. Blum and M. J. Blesa

23.1 Introduction 407
23.2 Hybrid Algorithms for the KCT Problem 409
23.3 Experimental Analysis 415
23.4 Conclusions 416
References 419

24 Experimental Study of GA-Based Schedulers in Dynamic
 Distributed Computing Environments 423
F. Xhafa and J. Carretero

24.1 Introduction 423
24.2 Related Work 425
24.3 Independent Job Scheduling Problem 426
24.4 Genetic Algorithms for Scheduling in Grid Systems 428
24.5 Grid Simulator 429
24.6 Interface for Using a GA-Based Scheduler
 with the Grid Simulator 432
24.7 Experimental Analysis 433
24.8 Conclusions 438
References 439

25 Remote Optimization Service 443
J. García-Nieto, F. Chicano, and E. Alba

25.1 Introduction 443
### 25.2 Background and State of the Art 444
### 25.3 ROS Architecture 446
### 25.4 Information Exchange in ROS 448
### 25.5 XML in ROS 449
### 25.6 Wrappers 450
### 25.7 Evaluation of ROS 451
### 25.8 Conclusions 454

### References 455

### 26 Remote Services for Advanced Problem Optimization 457

*J. A. Gómez, M. A. Vega, J. M. Sánchez, J. L. Guisado, D. Lombraña, and F. Fernández*

#### 26.1 Introduction 457
#### 26.2 SIRVA 458
#### 26.3 MOSET and TIDESI 462
#### 26.4 ABACUS 465

References 470

### INDEX 473