Pierre Liardet
Pierre Collet
Cyril Fonlupt
Evelyne Lutton
Marc Schoenauer (Eds.)

LNCS 2936

Artificial Evolution

6th International Conference, Evolution Artificielle, EA 2003
Marseille, France, October 2003
Revised Selected Papers

Springer

Pierre Liardet Pierre Collet
Cyril Fonlupt Evelyne Lutton
Marc Schoenauer (Eds.)

Artificial Evolution

6th International Conference, Evolution Artificielle, EA 2003
Marseille, France, October 27-30, 2003
Revised Selected Papers

Springer

Volume Editors

Pierre Liardet
Université de Provence, Centre de Mathématiques,
Informatique et Mécanique, Laboratoire LATP, UMR-CNRS 6632
39, rue F. Joliot-Curie, 13453 Marseille cedex 13, France
E-mail: liardet@cmi.univ-mrs.fr

Pierre Collet
Cyril Fonlupt
Université du Littoral Côte d'Opale
Laboratoire d'Informatique du Littoral
BP 719, 62228 Calais Cedex, France
E-mail: Pierre.Collet@inria.fr,fonlupt@lil.univ-littoral.fr

Evelyne Lutton
INRIA - Rocquencourt
B.P. 105, 78153 Le Chesnay Cedex, France
E-mail: Evelyne.Lutton@inria.fr

Marc Schoenauer
Université Paris-Sud, Equipe TAO - INRIA Futurs, LRI
Bat 490, 91405 Orsay Cedex, France
E-mail: Marc.Schoenauer@inria.fr

Library of Congress Control Number: 2004103455

CR Subject Classification (1998): F.1, F.2.2, I.2.6, I.5.1, G.1.6, J.3

ISSN 0302-9743
ISBN 3-540-21523-9 Springer-Verlag Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Protago-TeX-Production GmbH
Printed on acid-free paper SPIN: 10992227 06/3142 5 4 3 2 1 0

Lecture Notes in Computer Science 2936
Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

Springer
Berlin
Heidelberg
New York
Hong Kong
London
Milan
Paris
Tokyo

Lecture Notes in Computer Science

For information about Vols. 1–2891

please contact your bookseller or Springer-Verlag

Vol. 3015: C. Barakat, I. Pratt (Eds.), Passive and Active Network Measurement. XI, 300 pages. 2004.

Vol. 3009: F. Bomarius, H. Iida (Eds.), Product Focused Software Process Improvement. XIV, 584 pages. 2004.

Vol. 3007: J.X. Yu, X. Lin, H. Lu, Y. Zhang (Eds.), Advanced Web Technologies and Applications. XXII, 936 pages. 2004.

Vol. 3006: M. Matsui, R. Zuccherato (Eds.), Selected Areas in Cryptography. XI, 361 pages. 2004.

Vol. 3005: G.R. Raidl, S. Cagnoni, J. Branke, D.W. Corne, R. Drechsler, Y. Jin, C.G. Johnson, P. Machado, E. Marchiori, F. Rothlauf, G.D. Smith, G. Squillero (Eds.), Applications of Evolutionary Computing. XVII, 562 pages. 2004.

Vol. 3004: J. Gottlieb, G.R. Raidl (Eds.), Evolutionary Computation in Combinatorial Optimization. X, 241 pages. 2004.

Vol. 3003: M. Keijzer, U.-M. O'Reilly, S.M. Lucas, E. Costa, T. Soule (Eds.), Genetic Programming. XI, 410 pages. 2004.

Vol. 2999: E.A. Boiten, J. Derrick, G. Smith (Eds.), Integrated Formal Methods. XI, 541 pages. 2004.

Vol. 2998: Y. Kameyama, P.J. Stuckey (Eds.), Functional and Logic Programming. X, 307 pages. 2004.

Vol. 2997: S. McDonald, J. Tait (Eds.), Advances in Information Retrieval. XIII, 427 pages. 2004.

Vol. 2996: V. Diekert, M. Habib (Eds.), STACS 2004. XVI, 658 pages. 2004.

Vol. 2995: C. Jensen, S. Poslad, T. Dimitrakos (Eds.), Trust Management. XIII, 377 pages. 2004.

Vol. 2994: E. Rahm (Ed.), Data Integration in the Life Sciences. X, 221 pages. 2004. (Subseries LNBI).

Vol. 2993: R. Alur, G.J. Pappas (Eds.), Hybrid Systems: Computation and Control. XII, 674 pages. 2004.

Vol. 2992: E. Bertino, S. Christodoulakis, D. Plexousakis, V. Christophides, M. Koubarakis, K. Böhm, E. Ferrari (Eds.), Advances in Database Technology - EDBT 2004. XVIII, 877 pages. 2004.

Vol. 2991: R. Alt, A. Frommer, R.B. Kearfott, W. Luther (Eds.), Numerical Software with Result Verification. X, 315 pages. 2004.

Vol. 2989: S. Graf, L. Mounier (Eds.), Model Checking Software. X, 309 pages. 2004.

Vol. 2988: K. Jensen, A. Podelski (Eds.), Tools and Algorithms for the Construction and Analysis of Systems. XIV, 608 pages. 2004.

Vol. 2987: I. Walukiewicz (Ed.), Foundations of Software Science and Computation Structures. XIII, 529 pages. 2004.

Vol. 2986: D. Schmidt (Ed.), Programming Languages and Systems. XII, 417 pages. 2004.

Vol. 2985: E. Duesterwald (Ed.), Compiler Construction. X, 313 pages. 2004.

Vol. 2984: M. Wermelinger, T. Margaria-Steffen (Eds.), Fundamental Approaches to Software Engineering. XII, 389 pages. 2004.

Vol. 2983: S. Istrail, M.S. Waterman, A. Clark (Eds.), Computational Methods for SNPs and Haplotype Inference. IX, 153 pages. 2004. (Subseries LNBI).

Vol. 2982: N. Wakamiya, M. Solarski, J. Sterbenz (Eds.), Active Networks. XI, 308 pages. 2004.

Vol. 2981: C. Müller-Schloer, T. Ungerer, B. Bauer (Eds.), Organic and Pervasive Computing – ARCS 2004. XI, 339 pages. 2004.

Vol. 2980: A. Blackwell, K. Marriott, A. Shimojima (Eds.), Diagrammatic Representation and Inference. XV, 448 pages. 2004. (Subseries LNAI).

Vol. 2978: R. Groz, R.M. Hierons (Eds.), Testing of Communicating Systems. XII, 225 pages. 2004.

Vol. 2977: G. Di Marzo Serugendo, A. Karageorgos, O.F. Rana, F. Zambonelli (Eds.), Engineering Self-Organising Systems. X, 299 pages. 2004. (Subseries LNAI).

Vol. 2976: M. Farach-Colton (Ed.), LATIN 2004: Theoretical Informatics. XV, 626 pages. 2004.

Vol. 2973: Y. Lee, J. Li, K.-Y. Whang, D. Lee (Eds.), Database Systems for Advanced Applications. XXIV, 925 pages. 2004.

Vol. 2972: R. Monroy, G. Arroyo-Figueroa, L.E. Sucar, H. Sossa (Eds.), MICAI 2004: Advances in Artificial Intelligence. XVII, 923 pages. 2004. (Subseries LNAI).

Vol. 2971: J.I. Lim, D.H. Lee (Eds.), Information Security and Cryptology -ICISC 2003. XI, 458 pages. 2004.

Vol. 2970: F. Fernández Rivera, M. Bubak, A. Gómez Tato, R. Doallo (Eds.), Grid Computing. XI, 328 pages. 2004.

Vol. 2964: T. Okamoto (Ed.), Topics in Cryptology – CT-RSA 2004. XI, 387 pages. 2004.

Vol. 2963: R. Sharp, Higher Level Hardware Synthesis. XVI, 195 pages. 2004.

Vol. 2962: S. Bistarelli, Semirings for Soft Constraint Solving and Programming. XII, 279 pages. 2004.

Vol. 2961: P. Eklund (Ed.), Concept Lattices. IX, 411 pages. 2004. (Subseries LNAI).

Vol. 2960: P.D. Mosses (Ed.), CASL Reference Manual. XVII, 528 pages. 2004.

Vol. 2958: L. Rauchwerger (Ed.), Languages and Compilers for Parallel Computing. XI, 556 pages. 2004.

Vol. 2957: P. Langendoerfer, M. Liu, I. Matta, V. Tsaoussidis (Eds.), Wired/Wireless Internet Communications. XI, 307 pages. 2004.

Vol. 2954: F. Crestani, M. Dunlop, S. Mizzaro (Eds.), Mobile and Ubiquitous Information Access. X, 299 pages. 2004.

Vol. 2953: K. Konrad, Model Generation for Natural Language Interpretation and Analysis. XIII, 166 pages. 2004. (Subseries LNAI).

Vol. 2952: N. Guelfi, E. Astesiano, G. Reggio (Eds.), Scientific Engineering of Distributed Java Applications. X, 157 pages. 2004.

Vol. 2951: M. Naor (Ed.), Theory of Cryptography. XI, 523 pages. 2004.

Vol. 2949: R. De Nicola, G. Ferrari, G. Meredith (Eds.), Coordination Models and Languages. X, 323 pages. 2004.

Vol. 2948: G.L. Mullen, A. Poli, H. Stichtenoth (Eds.), Finite Fields and Applications. VIII, 263 pages. 2004.

Vol. 2947: F. Bao, R. Deng, J. Zhou (Eds.), Public Key Cryptography – PKC 2004. XI, 455 pages. 2004.

Vol. 2946: R. Focardi, R. Gorrieri (Eds.), Foundations of Security Analysis and Design II. VII, 267 pages. 2004.

Vol. 2943: J. Chen, J. Reif (Eds.), DNA Computing. X, 225 pages. 2004.

Vol. 2941: M. Wirsing, A. Knapp, S. Balsamo (Eds.), Radical Innovations of Software and Systems Engineering in the Future. X, 359 pages. 2004.

Vol. 2940: C. Lucena, A. Garcia, A. Romanovsky, J. Castro, P.S. Alencar (Eds.), Software Engineering for Multi-Agent Systems II. XII, 279 pages. 2004.

Vol. 2939: T. Kalker, I.J. Cox, Y.M. Ro (Eds.), Digital Watermarking. XII, 602 pages. 2004.

Vol. 2937: B. Steffen, G. Levi (Eds.), Verification, Model Checking, and Abstract Interpretation. XI, 325 pages. 2004.

Vol. 2936: P. Liardet, P. Collet, C. Fonlupt, E. Lutton, M. Schoenauer (Eds.), Artificial Evolution. XIV, 410 pages. 2004.

Vol. 2934: G. Lindemann, D. Moldt, M. Paolucci (Eds.), Regulated Agent-Based Social Systems. X, 301 pages. 2004. (Subseries LNAI).

Vol. 2930: F. Winkler (Ed.), Automated Deduction in Geometry. VII, 231 pages. 2004. (Subseries LNAI).

Vol. 2929: H. de Swart, E. Orlowska, G. Schmidt, M. Roubens (Eds.), Theory and Applications of Relational Structures as Knowledge Instruments. VII, 273 pages. 2003.

Vol. 2926: L. van Elst, V. Dignum, A. Abecker (Eds.), Agent-Mediated Knowledge Management. XI, 428 pages. 2004. (Subseries LNAI).

Vol. 2923: V. Lifschitz, I. Niemelä (Eds.), Logic Programming and Nonmonotonic Reasoning. IX, 365 pages. 2004. (Subseries LNAI).

Vol. 2919: E. Giunchiglia, A. Tacchella (Eds.), Theory and Applications of Satisfiability Testing. XI, 530 pages. 2004.

Vol. 2917: E. Quintarelli, Model-Checking Based Data Retrieval. XVI, 134 pages. 2004.

Vol. 2916: C. Palamidessi (Ed.), Logic Programming. XII, 520 pages. 2003.

Vol. 2915: A. Camurri, G. Volpe (Eds.), Gesture-Based Communication in Human-Computer Interaction. XIII, 558 pages. 2004. (Subseries LNAI).

Vol. 2914: P.K. Pandya, J. Radhakrishnan (Eds.), FST TCS 2003: Foundations of Software Technology and Theoretical Computer Science. XIII, 446 pages. 2003.

Vol. 2913: T.M. Pinkston, V.K. Prasanna (Eds.), High Performance Computing - HiPC 2003. XX, 512 pages. 2003. (Subseries LNAI).

Vol. 2911: T.M.T. Sembok, H.B. Zaman, H. Chen, S.R. Urs, S.H. Myaeng (Eds.), Digital Libraries: Technology and Management of Indigenous Knowledge for Global Access. XX, 703 pages. 2003.

Vol. 2910: M.E. Orlowska, S. Weerawarana, M.M.P. Papazoglou, J. Yang (Eds.), Service-Oriented Computing - ICSOC 2003. XIV, 576 pages. 2003.

Vol. 2909: R. Solis-Oba, K. Jansen (Eds.), Approximation and Online Algorithms. VIII, 269 pages. 2004.

Vol. 2908: K. Chae, M. Yung (Eds.), Information Security Applications. XII, 506 pages. 2004.

Vol. 2907: I. Lirkov, S. Margenov, J. Wasniewski, P. Yalamov (Eds.), Large-Scale Scientific Computing. XI, 490 pages. 2004.

Vol. 2906: T. Ibaraki, N. Katoh, H. Ono (Eds.), Algorithms and Computation. XVII, 748 pages. 2003.

Vol. 2905: A. Sanfeliu, J. Ruiz-Shulcloper (Eds.), Progress in Pattern Recognition, Speech and Image Analysis. XVII, 693 pages. 2003.

Vol. 2904: T. Johansson, S. Maitra (Eds.), Progress in Cryptology - INDOCRYPT 2003. XI, 431 pages. 2003.

Vol. 2903: T.D. Gedeon, L.C.C. Fung (Eds.), AI 2003: Advances in Artificial Intelligence. XVI, 1075 pages. 2003. (Subseries LNAI).

Vol. 2902: F.M. Pires, S.P. Abreu (Eds.), Progress in Artificial Intelligence. XV, 504 pages. 2003. (Subseries LNAI).

Vol. 2901: F. Bry, N. Henze, J. Ma luszyński (Eds.), Principles and Practice of Semantic Web Reasoning. X, 209 pages. 2003.

Vol. 2900: M. Bidoit, P.D. Mosses (Eds.), Casl User Manual. XIII, 240 pages. 2004.

Vol. 2899: G. Ventre, R. Canonico (Eds.), Interactive Multimedia on Next Generation Networks. XIV, 420 pages. 2003.

Vol. 2898: K.G. Paterson (Ed.), Cryptography and Coding. IX, 385 pages. 2003.

Vol. 2897: O. Balet, G. Subsol, P. Torguet (Eds.), Virtual Storytelling. XI, 240 pages. 2003.

Vol. 2896: V.A. Saraswat (Ed.), Advances in Computing Science – ASIAN 2003. VIII, 305 pages. 2003.

Vol. 2895: A. Ohori (Ed.), Programming Languages and Systems. XIII, 427 pages. 2003.

Vol. 2894: C.S. Laih (Ed.), Advances in Cryptology - ASIACRYPT 2003. XIII, 543 pages. 2003.

Vol. 2893: J.-B. Stefani, I. Demeure, D. Hagimont (Eds.), Distributed Applications and Interoperable Systems. XIII, 311 pages. 2003.

Vol. 2892: F. Dau, The Logic System of Concept Graphs with Negation. XI, 213 pages. 2003. (Subseries LNAI).

Preface

This book is based on the papers presented at the 6th Conference *Evolution Artificielle*, EA 2003, held in Marseilles. Previous EA meetings took place in Toulouse (1994), Brest (1995), Nîmes (1997), Dunkerque (1999), and Le Creusot (2001), while the best presented papers were published in Springer's LNCS, volumes 1063, 1363, 1829, and 2310.
This year again, authors were invited to present original works, relevant to simulated evolution, including but not limited to evolutionary optimization and learning, theory of evolutionary computation, artificial life, population dynamics, and implementation and real-world applications of evolutionary paradigms. EA 2003 turned out to be very international, and the proposed papers were selected through a rigorous process, each of them being examined by at least three referees from the international program committee. We are greatly indebted to each of them for the hard work and time they spent to ensure a high quality of editing in this volume. We also would like to thank all the participants of the conference and the numerous authors who chose to submit their manuscripts.

We are particularly grateful to Prof. Hans-Paul Schwelfel for his invited lecture on *Genesis and Future of Evolutionary Computation* which presented a wide survey of the art with a deep analysis, promising many further interesting applications.

Contributions in this book were organized into nine parts according to their main topics, and these are briefly presented below.

1. **Theoretical Issues:** Variable-length representations in evolutionary algorithms are investigated by M. Defoin Platel et al. using parametrical models in between the royal road landscapes and the NK landscapes according to Kauffman. M. Nicolau, A. Auger and C. Ryan explore the mathematical formalization of an encoding process using grammatical evolution and give asymptotics estimates and experimental results. A basic but general method to maximize many fitness functions is to choose – at random – an initial point and apply random perturbations (following a given or updated random process) to it in order to improve the fitness. The response to the increase in the number of variables for such perturbations is studied by L. Grosset, R. Le Riche, and R.T. Haftka, both for random stochastic hill climber and univariate marginal distribution algorithms, while S. Aupetit, P. Liardet and M. Slimane applied such a method to produce binary sequences with low out-of-phase aperiodic autocorrelations.
Asymptotic distribution laws of upper-order statistics were used by S. Puechmorel and D. Delahaye for improving the efficiency of selection and crossover operators. The last theoretical contribution, by M. Drugan and D. Thierens, was a survey on evolutionary Markov Chain Monte Carlo algorithms

related to evolutionary schemes; they proposed a new algorithm relying on elitist coupled acceptance rules.

2. **Algorithmic Issues:** Constraint satisfaction problems are considered by V. Barichard et al. in a general evolutionary framework based on the collaboration between constraint propagation techniques and local search methods. R. Baños et al. proposed a new parallel evolutionary algorithm for graph partitioning that mixed simulated annealing, tabu search and selection mechanisms. F. Lardeux, F. Saubion and J.-K. Hao investigated hybrid evolutionary algorithms involving recombination operators specially designed for SAT problems. This part ended with the presentation of B. Sareni, J. Regnier and X. Roboam on the efficiency of some crossover operators associated with self-adaptive procedures in the case of real-encoded multiobjective genetic algorithms.
3. **Applications:** The difficult technological problem of optical fiber alignment was efficiently solved using new genetic algorithms by M. Murakawa, H. Nosato and T. Higuchi. They incorporated a local-learning method to accelerate the alignment. K. Deb and A.R. Reddy dealt with a very large-sized scheduling problem often encountered in automated foundries: find an optimal sequence for casting a number of molds. A method for creating image classification is described by J. Korczak and A. Quirin. They used evolutionary operators applied to remote sensing data and derived well-adapted classification rules to recognize large objects on the image as well as the smaller ones. M. Segond et al. adapted an ant algorithm to detect vortex structures in coastal waters, using data from hydrodynamical simulations of the stream circulation. In order to speed up the selection of the flight aircraft by the controllers, D. Delahaye and S. Puechmorel presented a virtual keyboard whose optimal efficiency is related to an NP-hard assignment problem. They applied it to real instances. A.B. Garmendia-Doval, S.D. Morley and S. Juhos proposed and applied cartesian genetic programming to evolve postdocking filters automatically for removing false positives from virtual hit sets.
4. **Implementation Issues:** A number of various evolutionary algorithms are encountered in the literature. The graphic user interface (GUIDE) of P. Collet and M. Schoenauer unified all kinds of such algorithms and gave us facilities to create quite new combinations. ParaDisEO is a framework that uses evolving objects in parallel and distributed computing which is efficiently applied for large combinatorial problems. S. Cahon et al. made use of this approach in three evolutionary models involving asynchronous migration and parallel or distributed evaluation, experimenting on two real-word problems. Y. Yang, J. Vincent and G. Littlefair proposed a new model of coarse-grained parallel genetic algorithm managing clustered groupings. They tested their approach on multimodal optimization problems.
5. **Genetic Programming:** Maintaining a structural diversity and controlling the code size are the main challenges in genetic programming, a promising variant of evolutionary programming which produces solutions to problems in the form of computer programs. A measure of genotypic and phenoty-

pic diversity, based on the notions of entropy and variance, was applied by M. Tomassini et al. to three standard test problems, related to even parity, symbolic regression and artificial ants, while B. Wyns, S. Sette and L. Boullart introduced a self-improvement operator to reduce the effects of code growth.

Discrepancies, constantly encountered in genetic programming when the learning result issuing from training data is specialized over the entire distribution of instances, lead to the so-called overfitting that G. Paris, D. Robilliard and C. Fonlupt explored on two benchmarks, and they proposed guidelines to reduce its effect.

6. **Coevolution and Agent Systems:** Evolutionary processes may be issued from various paradigms. In auction theory A.J. Bagnall and I. Toft gave an adaptive agent model using a basic learning mechanism for optimal strategies in common auction scenarios. The multipopulation approach was used by F. Streichert et al. to extract global and local optima in multimodal search spaces: they proposed a niching-like method associated with cluster analysis for identifying species from an initially undifferentiated population. In their contribution R. Groß and M. Dorigo showed how to obtain an efficient cooperative transport of a pray using two simple autonomous mobile robots without any intercommunication facility and using very limited computing resources.
7. **Artificial Life:** The plant model considered by C. Lattaud is based on multiagent systems, each agent being a plant organ and each plant being composed either of a unique organ or of three organs. This approach allowed us to define interactions between plants through a diffusion process of chemical substances (allellopathy model) and to simulate evolution of artificial plant communities. M. Annunziato et al. proposed an on-line adaptive control and optimization of complex processes, based on artificial environments.
8. **Cellular Automata:** The analysis presented by M. Giacobini, M. Tomassini and A. Tettamanzi concerned the takeover time for selection mechanisms applied on a spatially structured population, involving circular cellular automata with synchronous or asynchronous propagation. Their theoretical approaches are corroborated by empirical results. A class of 2-D cellular automata are studied by E. Sapin, O. Bailleux and J.-J. Chabier to search transition rules leading to automata that can be used to simulate the logic AND and NOT gates.
9. **Machine Learning:** Methods for learning integrate evolutionary strategy and cover a large range of applications. M.C. Codrea et al. proposed a feature-learning algorithm which does an automatic identification of plant species from their fluorescence induction curves. Receiver operating characteristics (ROC) curves figure out the dependency of the true positive rate with respect to the false positive one in test interpretations, and the area under the curve (AUC) is a popular learning criterion in medical data analysis. M. Sebag, J. Azé and N. Lucas presented the ROGER algorithm, implementing an evolution strategy based on optimization of the AUC criterion. Its per-

formances were compared to those issuing from a support vector machine, namely SVMTorch. The last contribution, by D. Kazakov and M. Bartlett, dealt with a model that simulated the evolution of language on the basis of learning communication systems.

We take this opportunity to thank the different partners whose financial and material support contributed to the success of the conference: the *Université de Provence*, the *Institut National de Recherche en Informatique et en Automatique* (INRIA), and the *Centre National de la Recherche Scientifique* (CNRS), with the LATP (*Laboratoire d'Analyse, Topologie et Probabilité*) and the CNRS *Groupe de Recherche ALP* (Algorithmique Langage et Programmation), the *Association Française d'Intelligence Artificielle*, and the Association *Évolution Artificielle*.

EA 2003 took place at the *Institut Universitaire de la Formation des Maîtres* (IUFM) nicely located on *La Canebière*. We are indebted to Mme Catherine Ponsin-Costa, administrative manager, and her team Mme Shirley Chemouny, Max Laffont and Xavier Campagna, for their particular kindness.

Finally, we wish to express our gratitude to Josy Liardet and Valérie Collet for their efficiency and enthusiasm in setting up the conference. LATP and INRIA linked their sponsorship to their efficient teams: Aline Blanc and Marie-Christine Tort from Marseilles; and Nathalie Gaudechoux, Dominique Potherat, Chantal Girodon and Marie-Jo Cardet from Rocquencourt. Many thanks to all of them as well as to Mario Giacobini from Lausanne for his general and efficient help.

January 2004

Pierre Liardet
Pierre Collet
Cyril Fonlupt
Evelyne Lutton
Marc Schoenauer

Evolution Artificielle 2003 – EA 2003

October 27–30, 2003

Université de Provence, Marseilles, France

6th International Conference on Artificial Evolution

Organizing Committee

Pierre Liardet (Université de Provence)
Pierre Collet (LIL Calais)
Cyril Fonlupt (LIL Calais)
Evelyne Lutton (INRIA Rocquencourt)
Marc Schoenauer (INRIA Rocquencourt)

Program Committee

J.-M. Alliot (ENAC, Toulouse) – O. Bailleux (Univ. Bourgogne)
P. Bessière (IMAG, Grenoble) – A. Blair (Univ. New South Wales)
B. Braunschweig (IFP, Rueil-Malmaison) – J.-J. Chabrier (LIRSIA, Dijon)
P. Collard (I3S, Nice) – P. Collet (LIL, Calais)
M. Corne (Univ. of Reading) – K. Deb (IIT Kanpur)
D. Delahaye (CENA, Toulouse) – C. Dhaenens (LIFL, Lille)
M. Dorigo (ULB, Bruxelles) – N. Durand (ENAC, Toulouse)
M. Ebner (Univ. Wuerzburg) – D. Fogel (Nat. Selection Inc., La Jolla)
C. Fonlupt (LIL, Calais) – O. François (Ensimag, Grenoble)
P. Galinier (Ecole Poly., Montréal) – J. Gottlieb (SAP AG, Walldorf)
G. Granger (ENAC, Toulouse) – W. Hart (Sandia Nat. Lab.)
M. Keijzer (Vrije Univ. Amsterdam) – N. Krasnogor (Univ. West of England)
J.-K. Hao (Univ. Angers) – J.-C. Heudin (Univ. L. de Vinci, La Défense)
C. Lattaud (Paris V) – R. Le Riche (École des Mines, St.-Étienne)
P. Liardet (Univ. Provence, Marseille) – B. Leblanc (Mat. Design, Le Mans)
J. Louchet (INRIA, Rocquencourt) – E. Lutton (INRIA, Rocquencourt)
S. Luke (G. Mason Univ., Virginia) – N. Monmarché (EPU, Univ. Tours)
N. Melab (LIFL, Lille) – P. Preux (LIL, Calais)
N. Radcliffe (Quadstone Ltd., Edinburgh) – E. Ramat (LIL, Calais)
D. Robilliard (LIL, Calais) – E. Ronald (CMAP & EPFL, Lausanne)
G. Rudolph (Parsytec AG, Aachen) – M. Schoenauer (INRIA, Rocquencourt)
M. Sebag (LMS Palaiseau & LRI Orsay) – M. Slimane (EPU, Univ. Tours)
E.-G. Talbi (LIFL, Lille) – S. Tsutsui (Hannan Univ.)
G. Venturini (EPU, Univ. Tours)

Sponsoring Institutions

Université de Provence
INRIA (Institut National de Recherche en Informatique et en Automatique)
CNRS (Centre National de la Recherche Scientifique)
AFIA (Association Française d'Intelligence Artificielle)

Table of Contents

Applications

Implementation Issues

Genetic Programming

Coevolution and Agent Systems

Artificial Life

Cellular Automata

Machine Learning

Theoretical Issues