

Shigeru Obayashi Kalyanmoy Deb
Carlo Poloni Tomoyuki Hiroyasu
Tadahiko Murata (Eds.)

LNCS 4403

Evolutionary Multi-Criterion Optimization

4th International Conference, EMO 2007
Matsushima, Japan, March 2007
Proceedings



Springer

0224-53
E54
2007
Shigeru Obayashi Kalyanmoy Deb
Carlo Poloni Tomoyuki Hiroyasu
Tadahiko Murata (Eds.)

Evolutionary Multi-Criterion Optimization

4th International Conference, EMO 2007
Matsushima, Japan, March 5-8, 2007
Proceedings



Springer



E2007003168

Volume Editors

Shigeru Obayashi
Tohoku University
Sendai 980-8577, Japan
E-mail: obayashi@ieee.org

Kalyanmoy Deb
Indian Institute of Technology
Kanpur, PIN 208 016, India
E-mail: deb@iitk.ac.in

Carlo Poloni
University of Trieste
34142 Trieste, Italy
E-mail: poloni@units.it

Tomoyuki Hiroyasu
Doshisha University
Kyoto 610-0321, Japan
E-mail: tomo@is.doshisha.ac.jp

Tadahiko Murata
Kansai University, Osaka 569-1095, Japan
E-mail: murata@res.kutc.kansai-u.ac.jp

Library of Congress Control Number: 2007921125

CR Subject Classification (1998): F.2, G.1.6, G.1.2, I.2.8

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN	0302-9743
ISBN-10	3-540-70927-4 Springer Berlin Heidelberg New York
ISBN-13	978-3-540-70927-5 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2007
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12021017 06/3142 5 4 3 2 1 0

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Moshe Y. Vardi

Rice University, Houston, TX, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Preface

Multicriterion optimization refers to problems with two or more objectives (normally in conflict with each other) which must be simultaneously satisfied. Evolutionary algorithms have been used for solving multicriterion optimization problems for over two decades, gaining an increasing attention from industry.

The 4th International Conference on Evolutionary Multi-criterion Optimization (EMO2007) was held during March 5–8, 2007, in Matsushima/Sendai, Japan. This was the fourth international conference dedicated entirely to this important topic, following the successful EMO 2001, EMO 2003 and EMO 2005 conferences, which were held in Zürich, Switzerland in March 2001, in Faro, Portugal in April 2003, and in Guanajuato, México in March 2005. EMO2007 was hosted by the Institute of Fluid Science, Tohoku University. EMO2007 was co-hosted by the Graduate School of Information Sciences, Tohoku University, the Japan Aerospace Exploration Agency (JAXA), and the Policy Grid Computing Laboratory, Kansai University.

The EMO2007 scientific program included four keynote speakers: Hirotaka Nakayama on aspiration level methods, Kay Chen Tan on large and computationally intensive real-world MO optimization problems, Carlos Fonseca on decision making, and Gary B. Lamont on design of large-scale network centric systems.

In response to the call for papers, 124 papers from 30 countries were submitted, each of which was independently reviewed by at least three members of the Program Committee. This volume contains the 65 papers that were accepted for presentation at the conference, together with contributions based on the invited talks. It is worth noting that the number of submissions to the EMO conference has steadily increased over the years. For EMO 2001, 87 papers were submitted (from which 45 were accepted). For EMO 2003, 100 papers were submitted (from which 56 were accepted). For EMO 2005, 115 papers were submitted (from which 59 were accepted). This is a clear indication of the growing interest in this research field.

We would like to express our appreciation to the keynote speakers for accepting our invitation. We thank all the authors who submitted their work to EMO 2007, and the members of the Program Committee for their thorough reviews. We wish to thank the Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development for their contribution to the success of this conference. The organizers are particularly thankful to industrial sponsors, CD-adapco JAPAN Co., Ltd., Engineous Japan, Inc. and Honda Research Institute Japan Co., Ltd. for Dinner Sponsorship, Itochu Techno-Solutions Corporation and Sumisho Computer Systems Corporation for Lunch Sponsorship, BestSystems Co., Ltd. Fujitsu Limited, Hitachi, Ltd., Mitsubishi Heavy Industries, Ltd., SGI Japan, Ltd., for Refreshment Sponsorship, and Honda Research Institute Europe GmbH., Platform Computing Inc. and Microsoft Co., Ltd. for Student Support Sponsorship.

We also thank Alfred Hofmann and Ronan Nugent of Springer for their continued support in publishing EMO proceedings.

March 2007

Shigeru Obayashi
Carlo Poloni
Kalyanmoy Deb
Tomoyuki Hiroyasu
Tadahiko Murata

Organization

EMO2007 was co-hosted by the Graduate School of Information Sciences, Tohoku University, the Japan Aerospace Exploration Agency (JAXA), and the Policy Grid Computing Laboratory, Kansai University.

General Chairs

Shigeru Obayashi	IFS, Tohoku University, Japan
Carlo Poloni	University of Trieste, Italy
Kalyanmoy Deb	IIT Kanpur, India

International Program Committee

Chair

Tadahiko Murata	Kansai University, Japan
-----------------	--------------------------

Co-chairs

Hernan Aguirre	Shinshu University, Japan
Hisao Ishibuchi	Osaka Prefecture University, Japan
Tatsuya Okabe	Honda Research Institute, ATR, Japan

Members

Hussein Abbass	University of New South Wales, Australia
Hernan Eduardo Aguirre Duran	Shinshu University, Japan
Robert T. F. Ah King	University of Mauritius, Mauritius
Enrique Alba	University of Malaga, Spain
Shapour Azarm	University of Maryland, College Park, USA
Luigi Barone	The University of Western Australia, Australia
Matthieu Basseur	University of Sciences and Technologies of Lille, France
Stefan Bleuler	ETH Zurich, Switzerland
Juergen Branke	University of Karlsruhe, Germany
Carlos Alberto Brizuela	CICESE, Mexico
Dirk Bueche	University of Applied Sciences Northwestern Switzerland, Switzerland
Carlos A. Coello Coello	CINVESTAV-IPN, Mexico
David W. Corne	Heriot-Watt University, UK
Lino Costa	University of Minho, Portugal
Kalyanmoy Deb	Indian Inst. of Technology Kanpur, India
Rolf Drechsler	University of Bremen, Germany

Matthias Ehrgott	The University of Auckland, New Zealand
Daryl Essam	Australian Defence Force Academy, Australia
Richard Everson	University of Exeter, UK
Jonathan Fieldsend	University of Exeter, UK
Carlos M. Fonseca	Universidade do Algarve, Portugal
Xavier Gandibleux	University of Nantes, France
António Gaspar-Cunha	IPC-University of Minho, Portugal
Christian Grimme	Robotics Research Institute Dortmund, Germany
Thomas Hanne	Fraunhofer Institute for Industrial Mathematics (ITWM), Germany
Martina Hasenjaeger	Honda Research Institute Europe, Germany
Christian Haubelt	University of Erlangen-Nuremberg, Germany
Arturo Hernandez-Aguirre	Centre for Research in Mathematics (CIMAT), Mexico
Malcolm I. Heywood	Dalhousie University, Canada
Philip Hingston	Edith Cowan University, Australia
Tomoyuki Hiroyasu	Doshisha University, Japan
Evan J Hughes	Cranfield University, UK
Christian Igel	Ruhr University Bochum, Germany
Hisao Ishibuchi	Osaka Prefecture University, Japan
Andrzej Jaszkiwicz	Poznan University of Technology, Poland
Shinkyu Jeong	Tohoku University, Japan
Yaochu Jin	Honda Research Institute Europe, Germany
Hajime Kita	Academic Center for Computing and Media Studies, Kyoto University, Japan
Joshua Knowles	MIB, University of Manchester, UK
Rajeev Kumar	Indian Institute of Technology Kharagpur, India
Mary E. Kurz	Clemson University, USA
Gary B. Lamon	Air Force Institute of Technology, USA
Dario Landa Silva	University of Nottingham, UK
Marco Laumanns	ETH Zurich, Switzerland
Xiaodong Li	RMIT University, Australia
José Antonio Lozano	University of the Basque Country, Spain
Carlos Mariano	Mexican Institute for Water Technology, Mexico
Efren Mezura-Montes	National Laboratory of Advanced Informatics (LANIA), Mexico
Sanaz Mostaghim	University of Karlsruhe, Germany
Tadahiko Murata	Kansai University, Japan
Kaname Narukawa	Honda R&D, Japan
Antonio J. Nebro	University of Malaga, Spain

Yusuke Nojima
Shigeru Obayashi
Tatsuya Okabe

Johan Olvander
Isao Ono
Andrzej Osyczka

Akira Oyama
Luis Paquete
Geofferey Parks
Valentino Pediroda

Silvia Poles
Robin Purshouse
Ranji S. Ranjithan
Patrick Reed
Margarita Reyes-Sierra
Peter Rockett
Katya Rodríguez-Vázquez
Jun Sakuma
Dragan Savic
Mark Savill

J. David Schaffer
Hartmut Schmeck
Detlef Seese
Bernhard Sendhoff
Patrick Siarry
Thomas Stützle
El-Ghazali Talbi
Kay Chen Tan
Kiyoshi Tanaka
Jürgen Teich

Jose Antonio Tenreiro Machado

Lothar Thiele
Dirk Thierens
Ashutosh Tiwari
Andrea Toffolo
Holger Ulmer
Godfrey Walters
Shinya Watanabe

Osaka Prefecture University, Japan
Tohoku University, Japan
Honda Research Institute Japan and
Advanced Telecommunications Research
Institute International, Japan
Linköping University, Sweden
Tokyo Institute of Technology, Japan
AGH University of Science and Technology,
Poland
Japan Aerospace Exploration Agency, Japan
University of Algarve, Portugal
University of Cambridge, UK
Department of Mechanical Engineering,
University of Trieste, Italy
Esteco, Italy
PA Consulting Group, UK
North Carolina State University, USA
The Pennsylvania State University, USA
CINVESTAV-IPN, México
University of Sheffield, UK
IIMAS-UNAM, México
Tokyo Institute of Technology, Japan
University of Exeter, UK
Cranfield University and Girtoom College,
Cambridge, UK
Philips Research, USA
Universitaet Karlsruhe, Germany
Universitaet Karlsruhe, Germany
Honda Research Institute Europe, Germany
University Paris 12 (LiSSI), France
Université Libre de Bruxelles, Belgium
University of Lille, France
National University of Singapore, Singapore
Shinshu University, Japan
University of Erlangen-Nuremberg,
Germany
Instituto Superior de Engenharia do Porto,
Portugal
ETH Zürich, Switzerland
Utrecht University, The Netherlands
North Carolina State University, USA
University of Padova, Italy
Robert Bosch GmbH, Germany
University of Exeter, UK
Ritsumeikan University, Japan

Lyndon While	The University of Western Australia, Australia
Gary G. Yen	Oklahoma State University, USA
Yeboon Yun	Kagawa University, Japan
Andreas Zell	University of Tuebingen, Germany
Eckart Zitzler	ETH Zurich, Switzerland

Local Organizing Committee

Chair	
Shigeru Obayashi	IFS, Tohoku University, Japan

Secretariat	
Tomoyuki Hiroyasu	Doshisha University, Japan

Members	
Hernán Aguirre	Shinshu University, Japan
Tetsushi Higashimura	Cd Adapco Japan, Japan
Hisao Ishibuchi	Osaka Prefecture University, Japan
Shinkyu Jeong	IFS, Tohoku University, Japan
Keiji Kudo	Engineous Japan, Japan
Tadahiko Murata	Kansai University, Japan
Kaname Narukawa	Honda R&D, Japan
Tatsuya Okabe	HRI-JP, ATR, Japan
Akira Oyama	JAXA-ISAS, Japan
Jun Sakuma	Tokyo Institute of Technology, Japan
Koji Shimoyama	IFS, Tohoku University, Japan
Tetsuya Uchimoto	IFS, Tohoku University, Japan
Shinya Watanabe	Ritsumeikan University, Japan
Kazuomi Yamamoto	JAXA-ISTA, Japan

EMO Steering Committee

David Corne	Heriot-Watt University, UK
Kalyanmoy Deb	IIT Kanpur, India
Peter J. Fleming	University of Sheffield, UK
Carlos Fonseca	Universidade do Algarve, Portugal
J. David Schaffer	Philips Research, USA
Lothar Thiele	ETH Zürich, Switzerland
Eckart Zitzler	ETH Zürich, Switzerland

Acknowledgements

Keynote Speakers

We thank the keynote speakers for their talks given at the conference.

Hiroataka Nakayama

Konan University, Japan

Kay Chen Tan

National University of Singapore, Singapore

Carlos Fonseca

Universidade do Algarve, Portugal

Gary B. Lamont

Air Force Institute of Technology, USA

Local Sponsors

Support by the following organizations and companies is gratefully acknowledged.

Sponsors

Institute of Fluid Science, Tohoku University

Graduate School of Information Sciences, Tohoku University

Japan Aerospace Exploration Agency (JAXA)

Policy Grid Computing Laboratory, Kansai University

Co-sponsors

Air Force Office of Scientific Research, Asian Office of Aerospace Research and
Development (AFOSR/AOARD)⁺

Inoue Foundation for Science

The Kajima Foundation

Cooperation Companies

BESTSYSTEMS Co., Ltd.

Cd-Adapco Japan Co., Ltd.

Cray Japan Inc.

Engineous Japan, Inc.

Fujitsu Limited

Hitachi, Ltd.

Honda Research Institute Japan Co., Ltd.

Honda Research Institute Europe GmbH.

ITOCHU Techno-Solutions Corporation

Microsoft Co., Ltd.

⁺ AFOSR/AOARD support is not intended to express or imply endorsement by the U.S. Federal Government.

Mitsubishi Heavy Industries, Ltd.
Platform Computing Inc.
SGI Japan, Ltd.
Sumisho Computer Systems Corporation

Keynote Speakers	
We thank the keynote speakers for their contribution to the conference.	
Hiroaki Nakayama	Kay Ched Tan
Carlton Fothergill	Gary B. Lamont
Local Sponsors	
Support by the following organisations and companies is gratefully acknowledged.	
Sponsors	
Institute of Fluid Science, Tohoku University	
Graham School of Information Sciences, Tohoku University	
Japan Aerospace Exploration Agency (JAXA)	
Policy Grid Computing Laboratory, Kansai University	
Co-sponsors	
Air Force Office of Scientific Research, Active Research, AFOSR/ONR	
Development (AFOSR/OASD)	
Inoue Foundation for Science	
The Kajima Foundation	
Cooperation Companies	
BEST/STEMS Co., Ltd.	
Cy-Adapt Japan Co., Ltd.	
Cray Japan Inc.	
Engineers Japan, Inc.	
Fujitsu Limited	
Hitachi Ltd.	
Honda Research Institute Japan Co., Ltd.	
Honda Research Institute Europe GmbH	
ITOCHI Techno-Solution Corporation	
Microsoft Co., Ltd.	

Lecture Notes in Computer Science

For information about Vols. 1–4300

please contact your bookseller or Springer

- Vol. 4429: C. Ullrich, J.H. Siekmann, R. Lu (Eds.), *Cognitive Systems*. X, 162 pages. 2007. (Sublibrary LNAI).
- Vol. 4405: L. Padgham, F. Zambonelli (Eds.), *Agent-Oriented Software Engineering VII*. XII, 225 pages. 2007.
- Vol. 4403: S. Obayashi, K. Deb, C. Poloni, T. Hiroyasu, T. Murata (Eds.), *Evolutionary Multi-Criterion Optimization*. XIX, 954 pages. 2007.
- Vol. 4397: C. Stephanidis, M. Pieper (Eds.), *Universal Access in Ambient Intelligence Environments*. XV, 467 pages. 2007.
- Vol. 4396: J. García-Vidal, L. Cerdà-Alabern (Eds.), *Wireless Systems and Mobility in Next Generation Internet*. IX, 271 pages. 2007.
- Vol. 4394: A. Gelbukh (Ed.), *Computational Linguistics and Intelligent Text Processing*. XVI, 648 pages. 2007.
- Vol. 4393: W. Thomas, P. Weil (Eds.), *STACS 2007*. XVIII, 708 pages. 2007.
- Vol. 4392: S.P. Vadhan (Ed.), *Theory of Cryptography*. XI, 595 pages. 2007.
- Vol. 4390: S.O. Kuznetsov, S. Schmidt (Eds.), *Formal Concept Analysis*. X, 329 pages. 2007. (Sublibrary LNAI).
- Vol. 4385: K. Coninx, K. Luyten, K.A. Schneider (Eds.), *Task Models and Diagrams for Users Interface Design*. XI, 355 pages. 2007.
- Vol. 4384: T. Washio, K. Satoh, H. Takeda, A. Inokuchi (Eds.), *New Frontiers in Artificial Intelligence*. IX, 401 pages. 2007. (Sublibrary LNAI).
- Vol. 4383: E. Bin, A. Ziv, S. Ur (Eds.), *Hardware and Software, Verification and Testing*. XII, 235 pages. 2007.
- Vol. 4381: J. Akiyama, W.Y.C. Chen, M. Kano, X. Li, Q. Yu (Eds.), *Discrete Geometry, Combinatorics and Graph Theory*. XI, 289 pages. 2007.
- Vol. 4380: S. Spaccapietra, P. Atzeni, F. Fages, M.-S. Hacid, M. Kifer, J. Mylopoulos, B. Pernici, P. Shvaiko, J. Trujillo, I. Zaihrayeu (Eds.), *Journal on Data Semantics VII*. XV, 219 pages. 2007.
- Vol. 4378: I. Virbitskaite, A. Voronkov (Eds.), *Perspectives of Systems Informatics*. XIV, 496 pages. 2007.
- Vol. 4377: M. Abe (Ed.), *Topics in Cryptology – CT-RSA 2007*. XI, 403 pages. 2006.
- Vol. 4376: E. Frachtenberg, U. Schwiegelshohn (Eds.), *Job Scheduling Strategies for Parallel Processing*. VII, 257 pages. 2007.
- Vol. 4373: K. Langendoen, T. Voigt (Eds.), *Wireless Sensor Networks*. XIII, 358 pages. 2007.
- Vol. 4372: M. Kaufmann, D. Wagner (Eds.), *Graph Drawing*. XIV, 454 pages. 2007.
- Vol. 4371: K. Inoue, K. Satoh, F. Toni (Eds.), *Computational Logic in Multi-Agent Systems*. X, 315 pages. 2007. (Sublibrary LNAI).
- Vol. 4370: P.P. Lévy, B. Le Grand, F. Poulet, M. Soto, L. Darago, L. Toubiana, J.-F. Vibert (Eds.), *Pixelization Paradigm*. XV, 279 pages. 2007.
- Vol. 4369: M. Umeda, A. Wolf, O. Bartenstein, U. Geske, D. Seipel, O. Takata (Eds.), *Declarative Programming for Knowledge Management*. X, 229 pages. 2006. (Sublibrary LNAI).
- Vol. 4368: T. Erlebach, C. Kaklamani (Eds.), *Approximation and Online Algorithms*. X, 345 pages. 2007.
- Vol. 4367: K. De Bosschere, D. Kaeli, P. Stenström, D. Whalley, T. Ungerer (Eds.), *High Performance Embedded Architectures and Compilers*. XI, 307 pages. 2007.
- Vol. 4366: K. Tuyls, R. Westra, Y. Saeys, A. Nowé (Eds.), *Knowledge Discovery and Emergent Complexity in Bioinformatics*. IX, 183 pages. 2007. (Sublibrary LNBI).
- Vol. 4364: T. Kühne (Ed.), *Models in Software Engineering*. XI, 332 pages. 2007.
- Vol. 4362: J. van Leeuwen, G.F. Italiano, W. van der Hoek, C. Meinel, H. Sack, F. Plášil (Eds.), *SOFSEM 2007: Theory and Practice of Computer Science*. XXI, 937 pages. 2007.
- Vol. 4361: H.J. Hoogeboom, G. Păun, G. Rozenberg, A. Salomaa (Eds.), *Membrane Computing*. IX, 555 pages. 2006.
- Vol. 4360: W. Dubitzky, A. Schuster, P.M.A. Slood, M. Schroeder, M. Romberg (Eds.), *Distributed, High-Performance and Grid Computing in Computational Biology*. X, 192 pages. 2007. (Sublibrary LNBI).
- Vol. 4358: R. Vidal, A. Heyden, Y. Ma (Eds.), *Dynamical Vision*. IX, 329 pages. 2007.
- Vol. 4357: L. Buttyán, V. Gligor, D. Westhoff (Eds.), *Security and Privacy in Ad-Hoc and Sensor Networks*. X, 193 pages. 2006.
- Vol. 4355: J. Julliand, O. Kouchnarenko (Eds.), *B 2007: Formal Specification and Development in B*. XIII, 293 pages. 2006.
- Vol. 4354: M. Hanus (Ed.), *Practical Aspects of Declarative Languages*. X, 335 pages. 2006.
- Vol. 4353: T. Schwentick, D. Suciu (Eds.), *Database Theory – ICDT 2007*. XI, 419 pages. 2006.
- Vol. 4352: T.-J. Cham, J. Cai, C. Dorai, D. Rajan, T.-S. Chua, L.-T. Chia (Eds.), *Advances in Multimedia Modeling, Part II*. XVIII, 743 pages. 2006.
- Vol. 4351: T.-J. Cham, J. Cai, C. Dorai, D. Rajan, T.-S. Chua, L.-T. Chia (Eds.), *Advances in Multimedia Modeling, Part I*. XIX, 797 pages. 2006.

- Vol. 4349: B. Cook, A. Podelski (Eds.), Verification, Model Checking, and Abstract Interpretation. XI, 395 pages. 2007.
- Vol. 4348: S.T. Taft, R.A. Duff, R.L. Brukardt, E. Ploederer, P. Leroy (Eds.), Ada 2005 Reference Manual. XXII, 765 pages. 2006.
- Vol. 4347: J. Lopez (Ed.), Critical Information Infrastructures Security. X, 286 pages. 2006.
- Vol. 4346: L. Brim, B. Haverkort, M. Leucker, J. van de Pol (Eds.), Formal Methods: Applications and Technology. X, 363 pages. 2007.
- Vol. 4345: N. Maglaveras, I. Chouvarda, V. Koutkias, R. Brause (Eds.), Biological and Medical Data Analysis. XIII, 496 pages. 2006. (Sublibrary LNBI).
- Vol. 4344: V. Gruhn, F. Oquendo (Eds.), Software Architecture. X, 245 pages. 2006.
- Vol. 4342: H. de Swart, E. Orłowska, G. Schmidt, M. Roubens (Eds.), Theory and Applications of Relational Structures as Knowledge Instruments II. X, 373 pages. 2006. (Sublibrary LNAI).
- Vol. 4341: P.Q. Nguyen (Ed.), Progress in Cryptology - VIETCRYPT 2006. XI, 385 pages. 2006.
- Vol. 4340: R. Prodan, T. Fahringer, Grid Computing. XXIII, 317 pages. 2007.
- Vol. 4339: E. Ayguadé, G. Baumgartner, J. Ramanujam, P. Sadayappan (Eds.), Languages and Compilers for Parallel Computing. XI, 476 pages. 2006.
- Vol. 4338: P. Kalra, S. Peleg (Eds.), Computer Vision, Graphics and Image Processing. XV, 965 pages. 2006.
- Vol. 4337: S. Arun-Kumar, N. Garg (Eds.), FSTTCS 2006: Foundations of Software Technology and Theoretical Computer Science. XIII, 430 pages. 2006.
- Vol. 4335: S.A. Brueckner, S. Hassas, M. Jelasity, D. Yamins (Eds.), Engineering Self-Organising Systems. XII, 212 pages. 2007. (Sublibrary LNAI).
- Vol. 4334: B. Beckert, R. Hähnle, P.H. Schmitt (Eds.), Verification of Object-Oriented Software. XXIX, 658 pages. 2007. (Sublibrary LNAI).
- Vol. 4333: U. Reimer, D. Karagiannis (Eds.), Practical Aspects of Knowledge Management. XII, 338 pages. 2006. (Sublibrary LNAI).
- Vol. 4332: A. Bagchi, V. Atluri (Eds.), Information Systems Security. XV, 382 pages. 2006.
- Vol. 4331: G. Min, B. Di Martino, L.T. Yang, M. Guo, G. Ruenger (Eds.), Frontiers of High Performance Computing and Networking - ISPA 2006 Workshops. XXXVII, 1141 pages. 2006.
- Vol. 4330: M. Guo, L.T. Yang, B. Di Martino, H.P. Zima, J. Dongarra, F. Tang (Eds.), Parallel and Distributed Processing and Applications. XVIII, 953 pages. 2006.
- Vol. 4329: R. Barua, T. Lange (Eds.), Progress in Cryptology - INDOCRYPT 2006. X, 454 pages. 2006.
- Vol. 4328: D. Penkler, M. Reitenspiess, F. Tam (Eds.), Service Availability. X, 289 pages. 2006.
- Vol. 4327: M. Baldoni, U. Endriss (Eds.), Declarative Agent Languages and Technologies IV. VIII, 257 pages. 2006. (Sublibrary LNAI).
- Vol. 4326: S. Göbel, R. Malkewitz, I. Iurgel (Eds.), Technologies for Interactive Digital Storytelling and Entertainment. X, 384 pages. 2006.
- Vol. 4325: J. Cao, I. Stojmenovic, X. Jia, S.K. Das (Eds.), Mobile Ad-hoc and Sensor Networks. XIX, 887 pages. 2006.
- Vol. 4323: G. Doherty, A. Blandford (Eds.), Interactive Systems. XI, 269 pages. 2007.
- Vol. 4320: R. Gotzhein, R. Reed (Eds.), System Analysis and Modeling: Language Profiles. X, 229 pages. 2006.
- Vol. 4319: L.-W. Chang, W.-N. Lie (Eds.), Advances in Image and Video Technology. XXVI, 1347 pages. 2006.
- Vol. 4318: H. Lipmaa, M. Yung, D. Lin (Eds.), Information Security and Cryptology. XI, 305 pages. 2006.
- Vol. 4317: S.K. Madria, K.T. Claypool, R. Kannan, P. Uppuluri, M.M. Gore (Eds.), Distributed Computing and Internet Technology. XIX, 466 pages. 2006.
- Vol. 4316: M.M. Dalkilic, S. Kim, J. Yang (Eds.), Data Mining and Bioinformatics. VIII, 197 pages. 2006. (Sublibrary LNBI).
- Vol. 4314: C. Freksa, M. Kohlhase, K. Schill (Eds.), KI 2006: Advances in Artificial Intelligence. XII, 458 pages. 2007. (Sublibrary LNAI).
- Vol. 4313: T. Margaria, B. Steffen (Eds.), Leveraging Applications of Formal Methods. IX, 197 pages. 2006.
- Vol. 4312: S. Sugimoto, J. Hunter, A. Rauber, A. Morishima (Eds.), Digital Libraries: Achievements, Challenges and Opportunities. XVIII, 571 pages. 2006.
- Vol. 4311: K. Cho, P. Jacquet (Eds.), Technologies for Advanced Heterogeneous Networks II. XI, 253 pages. 2006.
- Vol. 4310: T. Boyanov, S. Dimova, K. Georgiev, G. Nikolov (Eds.), Numerical Methods and Applications. XIII, 715 pages. 2007.
- Vol. 4309: P. Inverardi, M. Jazayeri (Eds.), Software Engineering Education in the Modern Age. VIII, 207 pages. 2006.
- Vol. 4308: S. Chaudhuri, S.R. Das, H.S. Paul, S. Tirthapura (Eds.), Distributed Computing and Networking. XIX, 608 pages. 2006.
- Vol. 4307: P. Ning, S. Qing, N. Li (Eds.), Information and Communications Security. XIV, 558 pages. 2006.
- Vol. 4306: Y. Avrithis, Y. Kompatsiaris, S. Staab, N.E. O'Connor (Eds.), Semantic Multimedia. XII, 241 pages. 2006.
- Vol. 4305: A.A. Shvartsman (Ed.), Principles of Distributed Systems. XIII, 441 pages. 2006.
- Vol. 4304: A. Sattar, B.-H. Kang (Eds.), AI 2006: Advances in Artificial Intelligence. XXVII, 1303 pages. 2006. (Sublibrary LNAI).
- Vol. 4303: A. Hoffmann, B.-H. Kang, D. Richards, S. Tsumoto (Eds.), Advances in Knowledge Acquisition and Management. XI, 259 pages. 2006. (Sublibrary LNAI).
- Vol. 4302: J. Domingo-Ferrer, L. Franconi (Eds.), Privacy in Statistical Databases. XI, 383 pages. 2006.
- Vol. 4301: D. Pointcheval, Y. Mu, K. Chen (Eds.), Cryptology and Network Security. XIII, 381 pages. 2006.

¥1033.00元

Table of Contents

Invited Talks

Aspiration Level Methods in Interactive Multi-objective Programming and Their Engineering Applications	1
<i>Hiroataka Nakayama</i>	
Improving the Efficacy of Multi-objective Evolutionary Algorithms for Real-World Applications	2
<i>Kay Chen Tan</i>	
Decision Making in Evolutionary Optimization	3
<i>Carlos M. Fonseca</i>	
MOEAs in the Design of Network Centric Systems	4
<i>Gary B. Lamont</i>	

Algorithm Design

Controlling Dominance Area of Solutions and Its Impact on the Performance of MOEAs	5
<i>Hiroyuki Sato, Hernán E. Aguirre, and Kiyoshi Tanaka</i>	
Designing Multi-objective Variation Operators Using a Predator-Prey Approach	21
<i>Christian Grimme and Joachim Lepping</i>	
Capabilities of EMOA to Detect and Preserve Equivalent Pareto Subsets	36
<i>Günter Rudolph, Boris Naujoks, and Mike Preuss</i>	
Optimization of Scalarizing Functions Through Evolutionary Multiobjective Optimization	51
<i>Hisao Ishibuchi and Yusuke Nojima</i>	
Reliability-Based Multi-objective Optimization Using Evolutionary Algorithms	66
<i>Kalyanmoy Deb, Dhanesh Padmanabhan, Sulabh Gupta, and Abhishek Kumar Mall</i>	
Multiobjective Evolutionary Algorithms on Complex Networks	81
<i>Michael Kirley and Robert Stewart</i>	
On Gradient Based Local Search Methods in Unconstrained Evolutionary Multi-objective Optimization	96
<i>Pradyumn Kumar Shukla</i>	

Algorithm Improvements

Symbolic Archive Representation for a Fast Nondominance Test 111
Martin Lukasiewicz, Michael Glaß, Christian Haubelt, and Jürgen Teich

Design Issues in a Multiobjective Cellular Genetic Algorithm 126
Antonio J. Nebro, Juan J. Durillo, Francisco Luna, Bernabé Dorronsoro, and Enrique Alba

FastPGA: A Dynamic Population Sizing Approach for Solving Expensive Multiobjective Optimization Problems 141
Hamidreza Eskandari, Christopher D. Geiger, and Gary B. Lamont

Constraint-Handling Method for Multi-objective Function Optimization: Pareto Descent Repair Operator 156
Ken Harada, Jun Sakuma, Isao Ono, and Shigenobu Kobayashi

Steady-State Selection and Efficient Covariance Matrix Update in the Multi-objective CMA-ES 171
Christian Igel, Thorsten Suttorp, and Nikolaus Hansen

A Multi-tiered Memetic Multiobjective Evolutionary Algorithm for the Design of Quantum Cascade Lasers 186
Mark P. Kleeman, Gary B. Lamont, Adam Cooney, and Thomas R. Nelson

Local Search in Two-Fold EMO Algorithm to Enhance Solution Similarity for Multi-objective Vehicle Routing Problems 201
Tadahiko Murata and Ryota Itai

Mechanism of Multi-Objective Genetic Algorithm for Maintaining the Solution Diversity Using Neural Network 216
Kenji Kobayashi, Tomoyuki Hiroyasu, and Mitsunori Miki

Alternative Methods

Pareto Evolution and Co-evolution in Cognitive Game AI Synthesis 227
Yi Jack Yau, Jason Teo, and Patricia Anthony

The Development of a Multi-threaded Multi-objective Tabu Search Algorithm..... 242
Peter Dawson, Geoff Parks, Daniel Jaeggi, Arturo Molina-Cristobal, and P. John Clarkson

Differential Evolution Versus Genetic Algorithms in Multiobjective Optimization 257
Tea Tušar and Bogdan Filipič

EMOPSO: A Multi-Objective Particle Swarm Optimizer with Emphasis on Efficiency	272
<i>Gregorio Toscano-Pulido, Carlos A. Coello Coello, and Luis Vicente Santana-Quintero</i>	
A Novel Differential Evolution Algorithm Based on ϵ -Domination and Orthogonal Design Method for Multiobjective Optimization	286
<i>Zhihua Cai, Wenyin Gong, and Yongqin Huang</i>	
Molecular Dynamics Optimizer	302
<i>Swee Chiang Chiam, Kay Chen Tan, and Abdullah Al Mamun</i>	

Applications

Sequential Approximation Method in Multi-objective Optimization Using Aspiration Level Approach	317
<i>Yeboon Yun, Hirotaka Nakayama, and Min Yoon</i>	
Multi-objective Optimisation of a Hybrid Electric Vehicle: Drive Train and Driving Strategy	330
<i>Robert Cook, Arturo Molina-Cristobal, Geoff Parks, Cuiclahuac Osornio Correa, and P. John Clarkson</i>	
Multiobjective Evolutionary Neural Networks for Time Series Forecasting.....	346
<i>Swee Chiang Chiam, Kay Chen Tan, and Abdullah Al Mamun</i>	
Heatmap Visualization of Population Based Multi Objective Algorithms	361
<i>Andy Pryke, Sanaz Mostaghim, and Alireza Nazemi</i>	
Multiplex PCR Assay Design by Hybrid Multiobjective Evolutionary Algorithm.....	376
<i>In-Hee Lee, Soo-Yong Shin, and Byoung-Tak Zhang</i>	
ParadisEO-MOEO: A Framework for Evolutionary Multi-objective Optimization	386
<i>Arnaud Liefvooghe, Matthieu Basseur, Laetitia Jourdan, and El-Ghazali Talbi</i>	
Multi-objective Evolutionary Algorithms for Resource Allocation Problems	401
<i>Dilip Datta, Kalyanmoy Deb, and Carlos M. Fonseca</i>	
Multi-objective Pole Placement with Evolutionary Algorithms	417
<i>Gustavo Sánchez, Minaya Villasana, and Miguel Streffeza</i>	
A Multi-objective Evolutionary Approach for Phylogenetic Inference ...	428
<i>Waldo Cancino and Alexandre C.B. Delbem</i>	