Preface

With its fourth edition, the ANTS series of workshops\(^1\) has changed its name. The original “ANTS – From Ant Colonies to Artificial Ants: International Workshop on Ant Algorithms” has become “ANTS – International Workshop on Ant Colony Optimization and Swarm Intelligence”. This change is mainly due to the following reasons.

First, the term “ant algorithms” was slower in spreading in the research community than the term “swarm intelligence”, while at the same time research in so-called swarm robotics was the subject of increasing activity: it was therefore an obvious choice to substitute the term ant algorithms with the more accepted and used term swarm intelligence.

Second, although swarm intelligence research has undoubtedly produced a number of interesting and promising research directions\(^2\), we think it is fair to say that its most successful strand is the one known as “ant colony optimization”. Ant colony optimization, first introduced in the early 1990s as a novel tool for the approximate solution of discrete optimization problems, has recently seen an explosion in the number of its applications, both to academic and real-world problems, and is currently being extended to the realm of continuous optimization (a few papers on this subject being published in these proceedings). It is therefore a reasonable choice to have the term ant colony optimization as part of the workshop name.

As mentioned above, this is the fourth edition of the ANTS workshops. The series started in 1998 with the organization of ANTS’98. On that occasion more than 50 researchers from around the world joined for the first time in Brussels, Belgium to discuss swarm intelligence related research, and a selection of the best papers presented at the workshop was published as a special issue of the Future Generation Computer Systems journal (Vol. 16, No. 8, 2000). Two years later the experience was repeated with the organization of ANTS 2000, which attracted more than 70 participants. The 41 extended abstracts presented as talks or posters at the workshop were collected in a booklet distributed to participants, and a selection of the best papers was published as a special section of the IEEE Transactions on Evolutionary Computation (Vol. 6, No. 4, 2002). After these first two successful editions, it was decided to make of ANTS a series of biannual events. Accordingly, the third edition was organized in September 2002, in Brussels, Belgium. The success of the workshop and the quality of the papers presented in the second edition had also made it clear that it was the right time to have an official workshop proceedings: the ANTS 2002 proceedings was

\(\text{\small \textsuperscript{1} http://iridia.ulb.ac.be/\textasciitilde ants/}\)

\(\text{\small \textsuperscript{2} Think, for example, in addition to the already mentioned swarm robotics, of algorithms for clustering and data mining inspired by the ants’ cemetery building behavior, of dynamic task allocation algorithms inspired by the behavior of wasp colonies, of particle swarm optimization, and so on.}\)
published by Springer as Volume 2463 of LNCS, and contained 36 contributions: 17 full papers, 11 short papers, and 8 extended abstracts, selected out of a total of 52 submissions.

The Ant Colony Optimization and Swarm Intelligence field is still growing, as testified, for example, by the success of the 1st IEEE Swarm Intelligence Symposium, held in 2003 in Indianapolis, Indiana, US; or by the steady increase we are observing in the number of submissions to ANTS workshops, which resulted in the 79 papers submitted to ANTS 2004. This relatively high number of submissions allowed us to set the acceptance threshold for full and short papers at approximately 50%, which guaranteed a fairly high quality of the proceedings, and, at the same time, a reasonably dense workshop program. We are sure that the readers of these proceedings will enjoy the quality of the papers collected in this volume, quality that somehow reflects the growing maturity of the swarm intelligence field.

We wish to conclude by saying that we are very grateful to the authors who submitted their works; to the members of the international program committee and to the additional referees for their detailed reviews; to the IRIDIA people for their enthusiasm in helping with organization matters; to the Université Libre de Bruxelles for providing rooms and logistic support; and, more generally, to all those contributing to the organization of the workshop. Finally, we would like to thank our sponsors, the company AntOptima and the Metaheuristics Network, who financially supported the workshop.

June 2004

Marco Dorigo
Mauro Birattari
Christian Blum
Luca M. Gambardella
Francesco Mondada
Thomas Stützle

---

3 In addition to the accepted papers, a small number of posters were selected for presentation: these are works that, although in a rather preliminary phase, show high potential and are therefore worth discussing at the workshop.

4 More information available at www.antoptima.com

5 A Marie Curie Research Training Network funded by the European Commission. More information available at www.metaheuristics.org
ANTS 2004 was organized by IRIDIA, Université Libre de Bruxelles, Belgium.

**Workshop Chair**

Marco Dorigo  
IRIDIA, ULB, Brussels, Belgium

**Technical Program Chairs**

Luca M. Gambardella  
IDSIA, USI-SUPSI, Manno-Lugano, Switzerland  
Francesco Mondada  
ASL, EPFL, Lausanne, Switzerland  
Thomas Stützle  
Intellektik, TUD, Darmstadt, Germany

**Publication Chairs**

Mauro Birattari  
IRIDIA, ULB, Brussels, Belgium  
Christian Blum  
IRIDIA, ULB, Brussels, Belgium

**Program Committee**

Tucker Balch  
Georgia Tech, Atlanta, GA, USA  
Christian Blum  
IRIDIA, ULB, Brussels, Belgium  
Eric Bonabeau  
Icosystem, Boston, MA, USA  
Oscar Cordón  
Universidad de Granada, Spain  
David Corne  
University of Reading, UK  
Jean-Louis Deneubourg  
CENOLI, ULB, Brussels, Belgium  
Gianni di Caro  
IDSIA, Manno-Lugano, Switzerland  
Dario Floreano  
ASL, EPFL, Lausanne, Switzerland  
Michel Gendreau  
Université de Montréal, Canada  
Deborah Gordon  
Stanford University, CA, USA  
Walter Gutjahr  
Universität Wien, Austria  
Richard Hartl  
Universität Wien, Austria  
Owen Holland  
University of Essex, Colchester, UK  
Holger Hoos  
University of British Columbia, Vancouver, Canada  
Paul B. Kantor  
Rutgers University, New Brunswick, NJ, USA  
Joshua Knowles  
MIB, UMIST, Manchester, UK  
Sven Koenig  
Georgia Tech, Atlanta, GA, USA
Vittorio Maniezzo  
Università di Bologna, Italy
Alcherio Martinoli  
EPFL, Lausanne, Switzerland
Chris Melluish  
University of the West of England, Bristol, UK
Ronaldo Menezes  
Florida Tech, Melbourne, FL, USA
Daniel Merkle  
Universität Karlsruhe, Germany
Peter Merz  
Universität Tübingen, Germany
Martin Middendorf  
Universität Leipzig, Germany
Stefano Nolfi  
CNR, Rome, Italy
Ben Paechter  
Napier University, Edinburgh, UK
Van Parunak  
Altarum Institute, Ann Arbor, MI, USA
Andrea Roli  
Università degli Studi G. D’Annunzio, Chieti, Italy
Erol Şahin  
Middle East Technical University, Ankara, Turkey
Michael Sampels  
IRIDIA, ULB, Brussels, Belgium
Guy Theraulaz  
Université Paul Sabatier, Toulouse, France
Franco Zambonelli  
Università di Modena, Italy
Mark Zlochin  
Weizmann Institute, Rehovot, Israel

Publicity Chair
Andrea Roli  
Università degli Studi G. D’Annunzio, Chieti, Italy

Local Arrangements
Max Manfrin  
IRIDIA, ULB, Brussels, Belgium
Carlotta Piscopo  
IRIDIA, ULB, Brussels, Belgium

Additional Referees
Ashraf Abdelbar  
Julia Handl  
Rubén Ruiz García
Christian Almeder  
Stephane Magrenat  
Jürgen Schmidhuber
Erkin Bahceci  
Marco Manei  
Alena Shmygelska
Levent Bayindir  
Roberto Montemanni  
Kevin Smyth
Leonora Bianchi  
Alberto Montresor  
Krzysztof Socha
Gilles Caprari  
Luís Paquete  
Onur Soysal
Karle Doerner  
Yves Piguet  
Christine Strauss
Alberto V. Donati  
Andrea Emilio Rizzoli  
Emre Uğur
Frederick Ducatelle  
Daniel Roggen  
Markus Waibel
Michael Guntsch  
Martin Romauch

Sponsoring Institutions
AntOptima (www.antoptima.com), Lugano, Switzerland
Metaheuristics Network (www.metaheuristics.org), a Marie Curie Research Training Network of the Improving Human Potential Programme funded by the European Commission
Ant Colony Optimization and Swarm Intelligence
4th International Workshop, ANTS 2004, Brussels, Belgium, September 5-8, 2004, Proceeding
Dorigo, M.; Birattari, M.; Blum, C.; Gambardella, L.M.; Mondada, F.; Stützle, Th. (Eds.)
2004, XIV, 438 p., Softcover
ISBN: 978-3-540-22672-7