Springer Tracts in Advanced Robotics

Volume 17

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Editors: Bruno Siciliano · Oussama Khatib · Frans Groen

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# Algorithmic Foundations of Robotics VI

With 200 Figures and 15 Tables

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# Foreword

At the dawn of the new millennium, robotics is undergoing a major transformation in scope and dimension. From a largely dominant industrial focus, robotics is rapidly expanding into the challenges of unstructured environments. Interacting with, assisting, serving, and exploring with humans, the emerging robots will increasingly touch people and their lives.

The goal of the new series of Springer Tracts in Advanced Robotics (STAR) is to bring, in a timely fashion, the latest advances and developments in robotics on the basis of their significance and quality. It is our hope that the wider dissemination of research developments will stimulate more exchanges and collaborations among the research community and contribute to further advancement of this rapidly growing field.

The biennial Workshop on Algorithmic Foundations of Robotics (WAFR) has traditionally published archival volumes of high reference value. Since its latest edition, WAFR has found a more suitable home within STAR, together with other thematic symposia devoted to excellence in robotics research.

The Sixth edition of Algorithmic Foundations of Robotics edited by Michael Erdmann, David Hsu, Mark Overmars, and Frank van der Stappen offers a collection of a broad range of topics in advanced robotics. The contents of these contributions represent a cross-section of the current state of robotics research from one particular aspect: algorithms, and how they reflect on the theoretical basis of subsequent developments. Validation of algorithms, design concepts, or techniques is the common thread running through this focused collection.

Rich by topics and authoritative contributors, WAFR culminates with this unique reference on the current developments and new directions in the field of algorithmic foundations. A fine addition to the series!

Naples, Italy
March 2005

*Bruno Siciliano*
*STAR Editor*

# Preface

Algorithms play a crucial role in describing the computational processes that plan, control, or reason about motion, manipulation, and perception, both in the physical world and in simulated virtual environments. Such algorithms form a foundation for robotics, but also for processes in other application domains, ranging from structural molecular biology to computer games.

The biannual Workshop on the Algorithmic Foundations of Robotics focuses on such algorithmic issues. The Sixth incarnation of the workshop was held from July 11 till July 13 2004 in Zeist, the Netherlands, organized by Utrecht University. Approximately 50 international researchers participated. The program contained three invited talks, by Bruce Donald (Dartmouth College), Pieter Jonker (Delft University of Technology) and Ken Goldberg (University of California at Berkeley). There were twenty-seven additional papers presented, carefully selected by an international program committee. The papers study a large range of algorithmic issues, including significant new results in sampling-based path planning, online searching, location, tracking, coverage and grasping, to name just a few. Important applications in for example computing protein structures, finding camera motions and robot soccer were discussed. This volume collects all these contributions.

In addition to the editors of this volume, the program committee of WAFR 2004 included: Karl Böhringer, Greg Chirikjian, Yan-Bin Jia, Oussama Khatib, Rolf Klein, Steven LaValle, Ming Lin, Kevin Lynch, Mark Moll, Nancy Pollard, Elon Rimon, Thierry Siméon, Jack Snoeyink, and Michael Yu Wang.

As the co-chairs of WAFR 2004 we would like to thank the Dutch Organization for Scientific Research (N.W.O.) and Utrecht University for their financial support. Also we would like to thank Thomas Ditzinger of Springer Verlag for his assistance in publishing this volume. Finally, our thanks go to all the participants and authors for their enthusiasm in making WAFR 2004 such a wonderful research meeting.

Utrecht, The Netherlands
July 2004

*Michael Erdmann*
*David Hsu*
*Mark Overmars*
*Frank van der Stappen*

# Contents

## Invited Papers

**Algorithmic Challenges in Structural Molecular Biology and Proteomics**
*Bruce Donald* . . . . . 1

**Networked Robots: Ten Years of Experiments**
*Ken Goldberg* . . . . . 11

**Algorithmic Foundation of the Clockwork Orange Robot Soccer Team**
*Pieter Jonker, Bas Terwijn, Jev Kuznetsov, Bram van Driel* . . . . . 17

## Contributed Papers

**Uniform Coverage of Simple Surfaces Embedded in $R^3$ for Auto-Body Painting**
*Prasad N. Atkar, David C. Conner, Aaron Greenfield, Howie Choset, Alfred A. Rizzi* . . . . . 27

**Stealth Tracking of an Unpredictable Target among Obstacles**
*Tirthankar Bandyopadhyay, Yuanping Li, Marcelo Ang, David Hsu* . . . . . 43

**Multi-Step Motion Planning for Free-Climbing Robots**
*Tim Bretl, Sanjay Lall, Jean-Claude Latombe, Stephen Rock* . . . . . 59

**Sampling-Based Motion Planning under Kinematic Loop-Closure Constraints**
*Juan Cortés, Thierry Siméon* . . . . . 75

**Composing Navigation Functions on Cartesian Products of Manifolds with Boundary**
*Noah Cowan* ..... 91

**Adaptive RRTs for Validating Hybrid Robotic Control Systems**
*Joel Esposito, Jongwoo Kim, Vijay Kumar* ..... 107

**Collision Free Motion Planning on Graphs**
*Michael Farber* ..... 123

**Online Searching with an Autonomous Robot**
*Sandor P. Fekete, Rolf Klein, Andreas Nüchter* ..... 139

**Competitive Complexity of Mobile Robot On Line Motion Planing Problems**
*Yoav Gabriely, Elon Rimon* ..... 155

**Pareto Optimal Coordination on Roadmaps**
*Robert Ghrist, Jason O'Kane, Steven LaValle* ..... 171

**Automatic Generation of Camera Motion to Track a Moving Guide**
*Onno Goemans, Mark Overmars* ..... 187

**Computing Deform Closure Grasps**
*K. Gopal Gopalakrishnan, Ken Goldberg* ..... 203

**Coordinating Multiple Droplets in Planar Array Digital Microfluidics Systems**
*Eric Griffith, Srinivas Akella* ..... 219

**Topological Mapping with Sensing-Limited Robots**
*Wesley Huang, Kristopher Beevers* ..... 235

**Locating and Capturing an Evader in a Polygonal Environment**
*Volkan Isler, Sampath Kannan, Sanjeev Khanna* ..... 251

**Semi-Differential Invariants for Recognition of Algebraic Curves**
*Yan-Bin Jia, Rinat Ibrayev* ..... 267

**Modeling Macromolecular Machines Using Rigid-Cluster Networks**
*Moon Kim, Gregory Chirikjian* ..... 283

**Fast Tree-Based Exploration of State Space for Robots with Dynamics**
*Andrew Ladd, Lydia Kavraki* . . . . . 297

**Incremental Grid Sampling Strategies in Robotics**
*Stephen Lindemann, Anna Yershova, Steven LaValle* . . . . . 313

**Toward Complete Path Planning for Planar 3R-Manipulators among Point Obstacles**
*Guanfeng Liu, J. C. Trinkle, R. James Milgram* . . . . . 329

**Computing Protein Structures from Electron Density Maps: The Missing Fragment Problem**
*Itay Lotan, Henry van den Bedem, Ashley Deacon, Jean-Claude Latombe* 345

**A Machine Learning Approach for Feature-Sensitive Motion Planning**
*Marco Morales, Lydia Tapia, Roger Pearce, Sam Rodriguez, Nancy Amato* . . . . . 361

**Probik: Protein Backbone Motion by Inverse Kinematics**
*Kimberley Noonan, David O'Brien, Jack Snoeyink* . . . . . 377

**Randomized Algorithms for Minimum Distance Localization**
*Malvika Rao, Gregory Dudek, Sue Whitesides* . . . . . 393

**Multi-Point Contact Models for Dynamic Self-Righting of a Hexapod**
*Uluc Saranli, Alfred Rizzi, Daniel Koditschek* . . . . . 409

**Gap Navigation Trees: A Minimal Representation for Visibility-based Tasks**
*Benjamin Tovar, Luis Guilamo, Steven LaValle* . . . . . 425

**A Simple Algorithm for Complete Motion Planning of Translating Polyhedral Robots**
*Gokul Varadhan, Shankar Krishnan, T.V.N. Sriram, Dinesh Manocha* . . 441