

Intelligent Autonomous Systems 8

IAS-8



IOS
Press

Editors: Frans Groen
Nancy Amato
Andrea Bonarini
Eiichi Yoshida
Ben Kröse

Intelligent Autonomous Systems 8

Edited by

Frans Groen

University of Amsterdam, The Netherlands

Nancy Amato

Texas A&M University, USA

Andrea Bonarini

Politecnico di Milano, Italy

Eiichi Yoshida

AIST, Japan

and

Ben Kröse

University of Amsterdam, The Netherlands

IOS
Press

Amsterdam • Berlin • Oxford • Tokyo • Washington, DC



© 2004, The authors mentioned in the table of contents

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without prior written permission from the publisher.

ISBN 1 58603 414 6

Library of Congress Control Number: 2004101287

Publisher

IOS Press

Nieuwe Hemweg 6B

1013 BG Amsterdam

The Netherlands

fax: +31 20 620 3419

e-mail: order@iospress.nl

Distributor in the UK and Ireland

IOS Press/Lavis Marketing

73 Lime Walk

Headington

Oxford OX3 7AD

England

fax: +44 1865 75 0079

Distributor in the USA and Canada

IOS Press, Inc.

5795-G Burke Centre Parkway

Burke, VA 22015

USA

fax: +1 703 323 3668

e-mail: iosbooks@iospress.com

LEGAL NOTICE

The publisher is not responsible for the use which might be made of the following information.

PRINTED IN THE NETHERLANDS

INTELLIGENT AUTONOMOUS SYSTEMS 8

Preface

IAS-8 brings the Intelligent Autonomous Systems Conference back to Amsterdam, the city which also hosted the first two IAS conferences. The annual **Euron Meeting** of the European Network of Excellence in Robotics is co-located with and immediately follows the IAS-8 conference. Since 1986, the IAS conferences have been meeting places for researchers on intelligent systems that can directly sense and act in their own environment without demanding detailed supervision from humans. These systems are beginning to enter our daily life in ambient intelligence applications. Many new challenges are emerging to create systems that can operate and interact in human inhabited environments. The goal of the IAS-8 Conference is to exchange and stimulate research ideas about how to bring active, intelligent systems into our daily lives.

The conference will take place at The Grand Hotel in the centre of Amsterdam. Successively a convent in the 15th century, the formal residence of royal guests in the 16th century, headquarters of the Dutch Admiralty in the Golden Age, then City Hall until 1988, it provides all the facilities for exhibitions and conferences close to the cultural activities in the centre of the city.

A total of 155 technical papers were submitted by authors from 33 countries. All the submissions were rigorously reviewed by the Program Committee. Of those submissions 104 were accepted as full papers and 30 as posters. The overall outcome of the revision process is an excellent selection of papers that shows the research of autonomous systems today. We have 3 invited guest speakers at IAS-8: Rolf Pfeiffer from the University of Zurich who will address Designing autonomous agents, Takanori Shibata from AIST, Tsukuba on Artificial Emotional Creatures and Manuela Veloso from Carnegie Mellon University on Multi-Robot Coordination in Highly Dynamic Environments

We would like to take this opportunity to thank everyone involved with the organization of IAS-8. First, we would like to thank the members of the Program Committee who did a thorough and conscientious job in reviewing a large number of papers. Ben Kröse coordinated the local arrangements assisted by Wannes van der Mark and Roel Segerink from the conference office of the University of Amsterdam. Bas Terwijn managed the Website and the electronic submission and reviewing process. The members of the Steering Committee provided invaluable help and support through the process of organizing the conference. It has been with the support of all these people and several others not mentioned here that the conference came into existence. We sincerely appreciate all the hard work they put in to make this conference a success.

Finally, we would like to thank our sponsors TNO-FEL, DECIS and the University of Amsterdam. Their financial support of this conference would not have been possible.

We warmly welcome all to join us in Amsterdam in March 2004!

Frans Groen, Nancy Amato, Eiichi Yoshida and Andrea Bonarini



IAS-8 Conference Organization

General Chair

Frans Groen, University of Amsterdam, the Netherlands

Steering Committee

Tamio Arai, The University of Tokyo, Japan

Ruediger Dillmann, The University of Karlsruhe, Germany

Maria Gini, Univ. of Minnesota, USA

Enrico Pagello, The University of Padua and Ladseb-CNR, Italy

Anthony Stentz, Carnegie Mellon University, USA

Program Committee Co-Chairs

In America: Nancy Amato, Texas A&M University, USA

In Europe/Africa: Andrea Bonarini, Politecnico di Milano, Italy

In Asia/Oceania: Eiichi Yoshida, AIST, Japan

Local Organization

Ben Kröse, University of Amsterdam, the Netherlands

Program Committee

Peter Allen, University of Columbia, USA

Marcelo H. Ang, National University of Singapore, Singapore

Ron Arkin, Georgia Tech, USA

Minoru Asada, Osaka University, Japan

David Bonyuet, Delta Search Labs Cambridge, USA

Osman Burchan Bayazit, Washington University St. Louis, USA

Alicia Casals, University Pol. de Catalunya, Spain

Riccardo Cassinis, University of Brescia, Italy

Enric Celaya, IRI (CSIC-UPC), Spain

Raja Chatila, LAAS, France

Hyung Suck Cho, KAIST, Korea

Henrik Christensen, Royal Institute of Technology, Sweden

Jim Crowley, INRIA Rhone-Alpes, France

Antonio D'Angelo, University of Udine, Italy

Kerstin Dautenhahn, University of Hertfordshire, UK

Ernst Dickmanns, Univ. der Bundeswehr, Munich, Germany

Dario Floreano, EPFL, Switzerland

Dariu Gavrilă, DaimlerChrysler, Germany, and University of Amsterdam, The Netherlands

John Hallam, University of Edinburgh, UK

Koji Ito, Tokyo Institute of Technology, Japan

Ray Jarvis, Monash University, Australia

Gal Kaminka, Bar-Ilan University, ISRAEL

Alonzo Kelly, Carnegie Mellon University, USA

Hiroaki Kitano, Sony, Japan

Sven Koenig, Georgia Tech., USA

Kurt Konolige, SRI International, USA

Gerhard Kraetzschmar, University of Ulm, Germany
Ben Kröse, University of Amsterdam, The Netherlands
Jean-Claude Latombe, Stanford University, USA
Christian Laugier, INRIA Rhones-Alpes, France
Steve LaValle, University of Illinois at Urbana-Champaign, , USA
Paul Levi, University of Stuttgart, Germany
Pedro U. Lima, IST, Lisbon, Portugal
James J. Little, University of British Columbia, Canada
Ramon Lopez de Manteras, IIIA, Barcelona, Spain
Vladimir Lumelsky, University of Wisconsin, USA
Zhi-Wei Luo, RIKEN, Japan
Rezia Molfino, University of Genova, Italy
Satoshi Murata, Tokyo Institute of Technology, Japan
Ulrich Nehmzow, University of Manchester, UK
Anibal Ollero, University of Sevilla, Spain
Jun Ota, University of Tokyo, Japan
Isabel Ribeiro, IST Lisbon, Portugal
Alan Schultz, Navy Research Lab, USA
Wei-Min Shen, University of Southern California, USA
Roland Siegwart, EPFL, Switzerland
Carmen Torras, University Politècnica de Catalunya
R.Lai.Tummala, San Diego State University, USA
Hendrik Van Brussel, Catholic University of Leuven, Belgium
Peter Will, ISI/University of Southern California, USA
Mark Yim, Xerox Park, USA
Hiroshi Yokoi, Hokkaido University, Japan

Invited Guest Speakers

Designing Autonomous Agents: The Interaction of Morphology, Materials, Control and Environment

Prof. Rolf Pfeifer, Director, Artificial Intelligence Laboratory, University of Zurich

Human Interactive Robot for Psychological Enrichment and Robot Therapy

Dr. Takanori Shibata, Intelligent Systems Institute, AIST, Japan

Multi-Robot Coordination in Highly Dynamic Environments

Prof. Manuela M. Veloso, Computer Science Department, Carnegie Mellon University
USA

Designing Autonomous Agents: The Interaction of Morphology, Materials, Brain and Environment

Rolf Pfeifer, Prof., Dr. sc. techn.
Director, Artificial Intelligence Laboratory
Department of Information Technology
University of Zurich

Abstract

The last two decades in the field of artificial intelligence have clearly shown that true intelligence always requires the interaction of an agent with a real physical and social environment. The concept of embodiment that has been introduced to designate the modern approach to designing autonomous agents has far-reaching implications. Rather than studying computation alone, we must consider the interplay between morphology, materials, brain (control), and the environment.

A number of case studies are presented, and it is demonstrated how artificial evolution and morphogenesis can be used to systematically investigate this interplay. Taking these ideas into account requires entirely novel ways of thinking, and often leads to surprising results.

Human Interactive Robot for Psychological Enrichment and Robot Therapy

Dr. Takanori Shibata

Intelligent Systems Institute, AIST, Japan

shibata-takanori@aist.go.jp

Abstract

We have been developing mental commit robots that provide psychological, physiological, and social effects to human beings through physical interaction. The appearances of these robots look like real animals such as dog, cat, and seal. The dog and cat robots were developed as familiar animals to human, and a seal robot as a non-familiar animal. By results of experiments of subjective evaluation of these robots by public, we found the seal robot was the most acceptable by them, because, in the case of familiar animals, most people compared robots with real animals and became very severe in their evaluation. The experiments of subjective evaluation of the seal robot were conducted in U.K., Sweden, Italy, and Korea, as well as Japan. The results were all good and almost the same. Therefore, there were almost no difference in the results based on countries and cultures. The seal robot has been improved its functions and structure especially for "robot therapy." We have been applied seal robots to assisting therapy of children at pediatric wards, and to assisting activity of elderly people at elderly institutions. In order to investigate the effects of the seal robots to people, we evaluated the people's moods by face scales (which express person's moods by illustration of person's faces). In the case of elderly people, questionnaires and urinary tests were conducted additionally. Moreover, stress of nursing staff was investigated. We evaluated their mental poverty by "Burnout Scale." As the results, feelings of people were improved by interaction with the seal robots. Then, urinary tests of elderly people showed that their restoration abilities to the stress were also improved. Moreover, the nursing staff's mental poverty decreased because the elderly people are motivated and spent their time by themselves with the seal robots. Consequently, the seal robots were useful at pediatric wards and at elderly institutions. The Guinness World Records certified the seal robot as the most therapeutic robot in 2002.

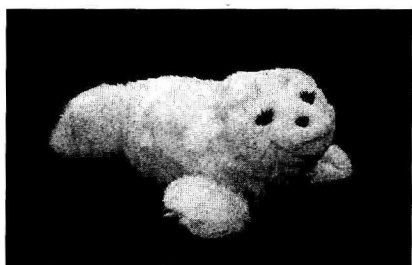


Fig. 1 Seal Robot, Paro



Fig. 2 Robot Therapy at
Karolinska Hospital, Sweden

Multi-Robot Coordination in Highly Dynamic Environments

Manuela M. Veloso
Computer Science Department
School of Computer Science
Carnegie Mellon University

Abstract

In recent years, many researchers have invested significant effort on investigating multi-robot systems. Robot soccer, as a pioneering multi-robot task, has offered a challenging research testbed. In robot soccer, a team of multiple robots faces an uncertain and dynamic environment created by an opponent team of robots.

We have researched in robot soccer developing single-robot and multi-robot perception, cognition, and action algorithms. To form an effective team of robots, individual robots need to be skilled. We have developed effective object recognition, localization, and behavior-based algorithms. In addition, to achieve a reliable team of robots, we research on team coordination strategies, team response to a dynamic world, behavior recognition, opponent modeling, and multiagent learning.

In this talk, I will present our contributions to multi-robot coordination for our robot soccer teams, in particular a team of small wheeled robots and a team of communicating four-legged Sony AIBO robots. I will also present our skills-tactics-plays architecture for adaptation of team plays to different opponent teams. I will conclude setting my research goals in perspective and discussing some of the fascinating open questions to be addressed towards creating teams of truly autonomous robots.

Contents

Preface	v
Conference Organization	vii
Abstracts Invited Guest Speakers	ix

Part 1. Biologically Inspired and Social Systems

AirInsect – A New Innovative Biological Inspired Six-Legged Walking Machine Driven by Fluidic Muscles, <i>T. Kerscher, J. Albiez, J.M. Zoellner and R. Dillmann</i>	3
Locomotion Velocity Parameters of Biologically Inspired Hexapod Robot, <i>Goran S. Dorđević, Milan Rašić and Reza Shadmehr</i>	11
Dynamic Integration for Scene Recognition Using Complex Attentional Sequences, <i>Gökhan Çakaroğlu and Işıl Bozma</i>	21
Hole Avoidance: Experiments in Coordinated Motion on Rough Terrain, <i>Vito Trianni, Stefano Nolfi and Marco Dorigo</i>	29
Blind Area Measurement with Mobile Robots, <i>Sertan Girgin and Erol Şahin</i>	37
Using an Ant Clustering Algorithm to Create Partitions for a Territorial Robotic System, <i>Toby J. Richer and Dan R. Corbett</i>	45
Physical Connections and Cooperation in Swarm Robotics, <i>Francesco Mondada, Michael Bonani, Stéphane Magnenat, André Guignard and Dario Floreano</i>	53
Detecting and Analysing Children's Play Styles with Autonomous Mobile Robots: A Case Study Comparing Observational Data with Sensor Readings, <i>Tamie Salter, René te Boekhorst and Kerstin Dautenhahn</i>	61
Impact of Imitation on the Dynamics of Animat Populations in a Spatial Cognition Task, <i>Ph. Laroque, N. Cuperlier and Ph. Gaussier</i>	71
Human-Robot Collaboration and Cognition with an Autonomous Mobile Robot, <i>Donald Sofge, J. Gregory Trafton, Nicholas Cassimatis, Dennis Perzanowski, Magdalena Bugajska, William Adams and Alan Schultz</i>	80
A Prototype of Peristaltic Robot Using Pneumatic Artificial Muscle, <i>Norihiko Saga and Taro Nakamura</i>	88
Corpus-Based Robotics: A Route Instruction Example, <i>Guido Bugmann, Ewan Klein, Stanislao Lauria and Theocharis Kyriacou</i>	96
Cooperative Embodied Behaviors for Interactive Humanoid Robots, <i>Takayuki Kanda, Daisuke Sakamoto, Tetsuo Ono, Masayuki Kamasima, Michita Imai and Hiroshi Ishiguro</i>	104
Automatic Business Process Generation in the Autonomous Web Services Environment, <i>Makoto Oya and Yukinori Kakazu</i>	112
I, Robot Being, <i>Brian R. Duffy and Gina Joue</i>	120
Energetically Autonomous Robots, <i>Ioannis Ieropoulos, Chris Melhuish and John Greenman</i>	128
Rapid Prototyping for Interactive Robots, <i>Christoph Bartneck and Jun Hu</i>	136

Part 2. Cooperative Robotics

A Simulation Analysis of Formations for Flying Multirobot Systems, <i>Francesco Amigoni, Mauro Stefano Giani and Sergio Napolitano</i>	149
Searching and Tracking for Multi-Robot Observation of Moving Targets, <i>Zheng Liu, Marcelo H. Ang Jr. and Winston Khoo Guan Seah</i>	157
Trajectory Planning in Coordinated Object Transfer by Multiple Wheeled Mobile Robots, <i>Yoshio Yamamoto, Yoshihisa Hiyama and Akira Fujita</i>	165
Adaptive Control System for SMA-Net Robot with Chaotic Neural Networks, <i>Ikuo Suzuki, Masaru Fujii, Keitaro Naruse, Hiroshi Yokoi and Yukinori Kakazu</i>	173
Negotiated Formations, <i>David J. Naffin and Gaurav S. Sukhatme</i>	181
Vision-Based Robot Formations with Bézier Trajectories, <i>Siou Y. Chiem and Enric Cervera</i>	191
A Novel Model to Rule Behavior Interaction, <i>Andrea Bonarini, Matteo Matteucci and Marcello Restelli</i>	199
On Utilizing Geometric Formations for Minimizing Uncertainty in 3 Robot Teams, <i>Lars A.A. Andersson and Jonas Nygård</i>	207
Towards a Comprehensive Framework for Teamwork in Behavior-Based Robots, <i>Gal A. Kaminka, Yehuda Elmaliach, Inna Frenkel, Ruti Glick, Meir Kalech and Tom Shpigelman</i>	217
Coordinating and Analyzing UAV Swarms, <i>Patrick Vincent and Izhak Rubin</i>	227
Event-Driven Modelling and Control of a Mobile Robot Population, <i>F.A. Melo, P. Lima and M.I. Ribeiro</i>	237
Amoeba-Like Multi-Cell Robot Control System – Obstacle Avoidance Using Distributed Pattern Generator, <i>Nobuyuki Takahashi, Wenwei Yu, Hiroshi Yokoi and Yukinori Kakazu</i>	245
Designing Enzymes in a Multi-Agent System Based on a Genetic Algorithm, <i>Geoff Poulton, Ying Guo, Phil Valencia, Geoff James, Mikhail Prokopenko and Peter Wang</i>	253
Functionally-Oriented PKMs for Robot Cooperation, <i>Massimo Callegari and Alessandra Suardi</i>	263
Delegating Responsibility in an Autonomous Multiagent System, <i>John Debenham</i>	271

Part 3. Distributed Decision Making

Distributed Reinforcement Learning using Bi-Directional Decision Making for Multi-Criteria Control of Multi-Stage Flow Systems, <i>Kei Aoki, Hajime Kimura and Shigenobu Kobayashi</i>	281
Distributed Cluster Walk for the ATRON Self-Reconfigurable Robot, <i>Esben H. Ostergaard and Henrik H. Lund</i>	291
Using Sensor Uncertainty Models to Optimize the Robot Positioning Actions, <i>Piotr Skrzypczyński</i>	299
Logic Based Hybrid Decision System for a Multi-Robot Team, <i>Vasco Pires and Miguel Arroz and Luis Custódio</i>	309
Multiagent Q-Learning by Context-Specific Coordination Graphs, <i>Jelle R. Kok and Nikos Vlassis</i>	317
A Versatile Implementation of the <i>TraderBots</i> Approach for Multirobot Coordination, <i>M. Bernardine Dias, Robert Zlot, Marc Zinck, Juan P. Gonzalez and Anthony (Tony) Stentz</i>	325

A Surveillance System Based on Audio and Video Sensory Agents Cooperating with a Mobile Robot, <i>Emanuele Menegatti, Enzo Mumolo, Massimiliano Noliche and Enrico Pagello</i>	335
A Distributed Autonomous Architecture for Chinese Railway-GIS Data Management, <i>Aimin Liang, Limin Jia, Xiaoping Liu and Jian Sun</i>	344

Part 4. Learning and Adaptive Systems

Acquisition of the Intermediate Goals for an Agent Executing Multiple Tasks, <i>Yusuke Fukazawa, Chomchana Trevai, Jun Ota and Tamio Arai</i>	353
Sharing Memories: An Experimental Investigation with Multiple Autonomous Autobiographic Agents, <i>Wan Ching Ho, Kerstin Dautenhahn, Chrystopher L. Nehaniv and René te Boekhorst</i>	361
Self Tuning Torque Control of Switched Reluctance Motor Considering Nonlinear Analysis, <i>F. Ismael, M. Khater, H. El Khashab and A. Oshiba</i>	371
Unoriented Parallel Genetic Algorithm with a Novel Mutation Operator, <i>Qiwen Yang, Xiangyong Xu and Xinnan Fan</i>	378
Policy Learning by GA using Importance Sampling, <i>Chikao Tsuchiya, Hajime Kimura and Shigenobu Kobayashi</i>	385
Evolution-Inspired Incremental Development of Complex Autonomous Intelligence, <i>Torbjorn S. Dahl and Christophe Giraud-Carrier</i>	395
A Genetic Regulatory Network-Inspired Real-Time Controller for a Group of Underwater Robots, <i>Tim Taylor</i>	403
Reinforcement Learning by Policy Improvement Making Use of Experiences of the Other Tasks, <i>Hajime Kimura and Shigenobu Kobayashi</i>	413
Comparison Between Q-Learning and ZCS Learning Classifier System: From Aspect of Function Approximation, <i>Atsushi Wada, Keiki Takadama, Katsunori Shimohara and Osamu Katai</i>	422
Comparing Three Critic Models of Reinforcement Learning in the Basal Ganglia Connected to a Detailed Actor in a S-R Task, <i>Mehdi Khamassi, Benoît Girard, Alain Berthoz and Agnès Guillot</i>	430
Hierarchical Reinforcement Learning Based on Subgoal Discovery and Subpolicy Specialization, <i>Bram Bakker and Jürgen Schmidhuber</i>	438
Learning in Complex Environments with Feature-Based Categorization, <i>Alejandro Agostini and Enric Celaya</i>	446
An Autonomous Adaptive Interface Including Ambiguous Evaluated Signals Using Reinforcement Learning, <i>Yuko Ishiwaka, Takamasa Sato and Yukinori Kakazu</i>	456
Experimental Validation of the Fuzzy Reactive Behaviours Evolved in Simulation, <i>Piotr Skrzypczyński</i>	464
Improving Learning and Adaptation Capability of Agents, <i>Yohannes Kassahun and Gerald Sommer</i>	472

Part 5. Mobile Robot Navigation

Multi-Agent Repairer of Damaged Process Plans in Manufacturing Environment, <i>S. Kornienko, O. Kornienko and P. Levi</i>	485
Mobile Robot Scheduling Using a Genetic Algorithm Enhanced with a Credit Gain Mechanism, <i>Silvana Badaloni and Marco Falda</i>	495
Robot Staffetta in Its Natural Environment, <i>Antonio Sgorbissa and Renato Zaccaria</i>	504

Fingerprinting Agent-Environment Interaction via Information Theory, <i>Danesh Tarapore, Max Lungarella and Gabriel Gómez</i>	512
Tracking Control and Adaptive Local Navigation for Nonholonomic Mobile Robots, <i>Alexander Mojaev and Andreas Zell</i>	521
Mission-Level Path Planning for Rover Exploration, <i>Paul Tompkins, Anthony Stentz and William Whittaker</i>	529
Field Experiments in Mission-Level Path Execution and Re-Planning, <i>Paul Tompkins, Anthony Stentz and William Whittaker</i>	538
Some Notes on the Use of Hybrid Maps for Mobile Robots, <i>Pär Buschka and Alessandro Saffiotti</i>	547

Part 6. Path and Motion Planning

Robots Find a Better Way: A Learning Method for Mobile Robot Navigation in Partially Unknown Environments, <i>Kristo Heero, Jan Willemsen, Alvo Aabloo and Maarja Kruusmaa</i>	559
Planning and Adaption of Flexible Paths in Dynamic Environments, <i>Marcus Walther, Peter Steinhaus and Rüdiger Dillmann</i>	567
A Sensor Based Motion Planning Algorithm with Potential Fields for Mobile Robots: A Completeness Analysis, <i>Diego Alvarez, Juan C. Alvarez and Rafael C. González</i>	576
Path-Planning for Generic-Shaped Non-Holonomic Mobile Robots with MCA, <i>Fabio M. Marchese</i>	584
PRMs Based on Obstacles' Geometry, <i>Antonio Benitez, Daniel Vallejo and M. Auxilio Medida</i>	592
Sampling Techniques for Probabilistic Roadmap Planners, <i>Roland Geraerts and Mark Overmars</i>	600
Centralized Multi-Robot Motion Planning: A Random Walks Based Approach, <i>Stefano Carpin and Gianluigi Pillonetto</i>	610
Motion Control of 3-D Hopping Apparatus, <i>Vladimir B. Larin and Vladimir M. Matiyasevich</i>	618
Autonomous Tracking of Unmanned Electric Bicycle, <i>Seounghoon Kim and Woonchul Ham</i>	626
On-Line Modification of Biped Walk, <i>Miomir Vukobratović, Dejan Andrić and Branislav Borovac</i>	634
"Cheap" Rapid Locomotion of a Quadruped Robot: Self-Stabilization of Bounding Gait, <i>Fumiya Iida and Rolf Pfeifer</i>	642
A System for Hierarchical Planning in Service Mobile Robotics, <i>Fulvio Mastrogiovanni, Antonio Sgorbissa and Renato Zaccaria</i>	650
Bias-Optimal Incremental Learning of Control Sequences for Virtual Robots, <i>Jürgen Schmidhuber, Viktor Zhumatiy and Matteo Gagliolo</i>	658
Subsymbolic Action Planning for Robots: Generalised Representations of Experience, <i>John Pisokas and Ulrich Nehmzow</i>	666
An Agent Based Framework for Sequencing Autonomous Robots Skills, <i>D.M. Rivero, R. Barber, F.J. Rodriguez and M.A. Salichs</i>	674

Part 7. Reconfigurable/Modular Robotics 683

Metamodule Control for the ATRON Self-Reconfigurable Robotic System, <i>David Johan Christensen, Esben Hallundbæk Østergaard and Henrik Hautop Lund</i>	685
--	-----

Controlling Self-Reconfiguration Using Cellular Automata and Gradients, <i>Kasper Støy</i>	693
Filling an Obstacle Pocket with Hexagonal Metamorphic Robots, <i>Jennifer E. Walter, Mary E. Brooks and Nancy M. Amato</i>	703
Co-Evolution of Configuration and Control for Homogenous Modular Robots, <i>Daniel Marbach and Auke Jan Ijspeert</i>	712
Steps Toward Self-Reconfigurable Robot Systems by Modelling Cellular Adhesion Mechanisms, <i>Peter Ottery and John Hallam</i>	720
An XML-Based Scripting Language for Chain-Type Modular Robotic Systems, <i>Ying Zhang, Alex Golovinsky, Mark Yim and Craig Eldershaw</i>	729
Concept of Automatic Assembly System for Large Modular Structure, <i>Yuzuru Terada, Haruhisa Kurokawa and Satoshi Murata</i>	739
Deformable Multi M-TRAN Structure Works as Walker Generator, <i>Haruhisa Kurokawa, Eiichi Yoshida, Kohji Tomita, Akiya Kamimura, Satoshi Murata and Shigeru Kokaji</i>	746
A New Modular Concept for a Multi-Joint, Autonomous Inspection Robot, <i>Clemens Birkenhofer, Kay-Ulrich Scholl, J. Marius Zöllner and Rüdiger Dillmann</i>	754

Part 8. Robotic and Autonomous Systems

Wave CPG Model for Autonomous Decentralized Multi-Legged Robot-Gait Generation and Walking Speed Control, <i>Shinkichi Inagaki, Hideo Yuasa, Takanori Suzuki and Tamio Arai</i>	765
Autonomous Decentralized Control of Traffic Signals with Cycle Length Control, <i>Masao Sugi, Hideo Yuasa, Jun Ota and Tamio Arai</i>	775
Who Likes Their Web-Surfing, Their Web-Surfing Likes Him, <i>Shinichiro Yoshii, Michihiro Sagae, Takashi Tsutsui and Yukinori Kakazu</i>	785
Steps Toward Detecting and Recovering from Perceptual Failures, <i>Mathias Broxvall, Lars Karlsson and Alessandro Saffiotti</i>	793
Scalable Robot Fault Detection and Identification, <i>Vandi Verma and Reid Simmons</i>	801
Plan Projection under the APPEAL Robot Control Architecture, <i>Thorsten Belker, Martin Hammel and Joachim Hertzberg</i>	809
Investigations on the Robustness of an Evolved Learning Mechanism for a Robot Arm, <i>Gabriel Gómez and Peter Eggenberger Hotz</i>	818
Toward Design of a Simple Multi-Agent System for Manipulating Objects, <i>Herbert F. Noriega, Shahram Payandeh and Kamal K. Gupta</i>	828
Design of a Holonomous Platform for a Humanoid Robot Using MCA2, <i>Joachim Schröder, Peter Steinhaus, Tilo Gockel and Rüdiger Dillmann</i>	836
Legged Adaptive Platform for Service Operations, <i>Ulrich Schmucker, Anatoli Schneider, Vadym Rusin and Yuriy Zavgorodniy</i>	844
A Multi-Segment Inspection Robot and its Physical Real-Time Simulation, <i>Jan A. Neuhofer, Bernhard Klaassen and Hermann Streich</i>	852

Part 9. Robot Vision 861

Affine Height Landscapes for Monocular Mobile Robot Obstacle Avoidance, <i>Bojian Liang, Nick Pears and Zezhi Chen</i>	863
Adaptive Robot Speed Control by Considering Map and Localization Uncertainty, <i>Yoshiro Negishi, Jun Miura and Yoshiaki Shirai</i>	873
Autonomous Robot Navigation Using Uncalibrated Images, <i>Tommaso Gramegna, Lea Venturino, Grazia Cicirelli, Giovanni Attolico and Arcangelo Distante</i>	881