Proceedings
of the
1997 IEEE/RSJ International Conference
on Intelligent Robot and Systems

Innovative Robotics for
Real-World Applications

September 7-11, 1997
World Trade Center Atria,
Grenoble, France

IROS'97

Volume 1

Organized by
INRIA Rhône-Alpes

Sponsored by
IEEE Industrial Electronics Society
IEEE Robotics and Automation Society
Robotics Society of Japan
Society of Instrumentation and Control Engineers
New Technology Foundation
The IEEE/RSJ International Conference on Intelligent Robots and Systems celebrates its 10th anniversary in 1997, and for the first time, takes place in France. The main theme of this year's conference (IROS'97) is "Innovative Robotics for Real-World Applications". Indeed, bringing robots out of carefully engineered environments is both a fascinating challenge and a socio-economic necessity for the next century. This probably will have a large impact on various application domains like health care and medical robotics, space and undersea exploration, intervention in dangerous or contaminated environments, agriculture and mining, amusement and entertainment or transportation systems. IROS'97 will examine component theories as well as real integrated systems for intelligent robots and systems through 277 technical presentations and keynote lectures.

We have received a total of 396 papers submissions: 68 papers from America, 157 papers from Europe/Africa, and 171 papers from Asia/Oceania regions. Each paper was reviewed by at least three reviewers (two regional PC members and one other region PC member). Finally, the Program Committee, chaired by Georges Giralt and co-chaired by Toshio Fukuda and Martial Hebert, accepted 274 papers, and built up the IROS'97 program with six parallel traks in three-day technical sessions. In addition to this conference program, IROS'97 offers 10 Tutorials and Workshops on Sunday September 7, and Thursday September 11. The associated exhibition provide opportunities for private companies or organizations to present their latest studies and results in the field of Intelligent Robots and Systems.

As chairman of IROS'97, I would like to thank you for your support and participation. I would also like to express my appreciation to the Program Committee and the Organizing Committee members who have worked extremely hard to ensure the success of the conference. Lastly, I would like to thank all the public and private agencies who have supported this conference.

Christian Laugier
General Chair of IROS'97.
Conference Organization

ADVISORY COUNCIL

Honorary Chair:
Fumio HARASHIMA (Tokyo Univ., Japan)

Chair:
Toshio FUKUDA (Nagoya Univ., Japan)

Vice Chair:
Shin'ichi YUTA (Tsukuba Univ., Japan)

ORGANIZING COMMITTEE

General Chair:
Christian LAUGIER (INRIA Rhône-Alpes, France)

Local Arrangements chair:
Radu HORAUD (IMAG-CNRS & INRIA Rhône-Alpes, France)
Assisted by:
Gérard BAILLE (INRIA Rhône-Alpes, France)
Bruno MILLON FREMILLON (INRIA Rhône-Alpes, France)

Tutorials/Workshops co-chairs:
Raja CHATILA (LAAS-CNRS, France)
Joris de SCHUTTER (KU Leuven, Belgium)

Video Proceedings chair:
Jean-Pierre MERLET (INRIA, France)

Exhibits chair:
Emmanuel MAZER (IMAG-CNRS, France)

Publication/Publicity chair:
James L. CROWLEY (IMAG-INPG, France)

Finance chair:
Jocelyne TROCCAZ (IMAG-CNRS, France)

Secretariat:
Danièle HERZOG & Thierry FRAICHARD
(INRIA Rhône-Alpes, France)
Program Committee

Co-Chairs:
Georges Giralt (LAAS/CNRS, France)
Toshio Fukuda (Nagoya Univ., Japan)
Martial Hebert (CMU, USA)

Europe/Africa
Rachid Alami       LAAS-CNRS, France
Josep Amat        Universitat Politecnica de
Helder Araujo     Universidade de Coimbra, Catalunya, Spain
Portugal
Antonio Bicchi    Universita di Pisa, Italy
Raja Chatila      LAAS-CNRS, France
James Crowley     GRAVIR, France
Paolo Dario       Scuola Superiore
S. Anna, Italy
Pierre Dauchez    LIRMM, France
Joris de Schutter  Katholieke Universiteit
Leuven, Belgium
Rüdiger Dillmann  Fakultät für Informatik,
Germany
Gordon Dodds      The Queen’s University of
Belfast, UK
Jan-Olof Eklundh  RIT (KTH), Sweden
Thierry Fraichard INRIA Rhône-Alpes,
France
Eddie Grant       University of Amsterdam,
The Netherlands
Frans Groen       DLR, Germany
Dominique Meizel  Université de Compiègne,
France
Aníbal Ollerio   Universidad de Sevilla,
Spain
Patrick Rives    INRIA-Sophia, France
Giulio Sandini    University of Genoa, Italy
Günther Schmidt  TU München, Germany
Bruno Siciliano  Universita Degli Studi di
Napoli Frederico II, Italy
Sergey Sokolov    KIAM, Russia

USA
Peter Allen       Columbia University
Ron Arkin         Georgia Tech.
Bob Bolles       SRI
Joel Burdick     Caltech
Howie Choset     CMU
Ingemar Cox      NEC
Steven Dubowsky  MIT
Kamal Gupta       Simon Fraser University

Tom Henderson    Utah
Michael Jenkin   York University
Avi Kak          Purdue
Lydia Kavraki    Rice University
Oussama Khatib   Stanford
Roman Kuc        Yale
Larry Matthies   JPL
Evangelos Papadopoulos
Jean Ponce       McGill
Art Sanderson    University of Illinois
Shankar Sastry   RPI
George Stockman
Russ Taylor      Berkeley
Yangsheng Xu     Michigan State University

Asia/Oceania
Fumihito Arai    Nagoya University
Minoru Asada     Osaka University
Hajime Asama     The Inst. of Physical and
Chemical Research (RIKEN)
Hyung Suck Cho   Korea Advanced Inst.
of Sc. and Technology
Li-Chen Fu       National Taiwan University
Hideki Hashimoto
Roberto Horowitz
Katsuhi Ikeuchi
R.A. Jarvis      The University of Tokyo
Makoto Kaneko    Berkeley
Hisato Kobayashi
Kazuhiro Koguse
Kazuhiko Koashi
Bum-Hee Lee     The University of Tokyo
Chong-Won Lee    Kobe University
Ren C. Luo       National Chung
Cheng University
Masaharu Matsuishi
Mignon Park      The University of Tokyo
Toshi Takamori  Yonsei University
Kazuo Tanie     Kobe University
Kazuo Yamauchi  Mechanical Eng. Lab.,
MIT
University of Electro-
Communications
Yasuyoshi Yokokoji
Shi’ichi Yuta    Kyoto University
University of Tsukuba
Table of contents

Preface .......................................................................................................................................................... i
Conference Organization .......................................................................................................................... ii
Program Committee ..................................................................................................................................... iii
Table of Contents ........................................................................................................................................ v
Technical Session ......................................................................................................................................... Vol. 1, 2, 3
Visual Session ............................................................................................................................................. Vol. 3, V-1
Panel Session ............................................................................................................................................... Vol. 3, PS-1
Authors Index ............................................................................................................................................... Vol. 1, 2, 3AI-1

TECHNICAL SESSIONS

Multiple Manipulators I

- Cooperative Control of a Two-Manipulator System Handling a General Flexible Object
  D. Sun, Y. Liu and J. K. Mills, Dept. of Mechanical and Industrial Engineering, University of Toronto, Canada - Dept. of mechanical and automation Engineering, The Chinese University of Hong Kong, Hong Kong ................................................................. Vol. 1, p. 5

- An Extension of Passive Velocity Field Control to Cooperative Multiple Manipulator Systems
  M. Yamakita, K. Suzuki, X. Z. Zheng, M. Katayama and K. Ito, Tokyo Institute of Technology, Japan - Tohoku University of Technology, Japan - Bio-Mimetic Control Research Center, RIKEN, Japan ................................................................. Vol. 1, p. 11

- Decentralized Control of Multiple Manipulators Handling an Object in Coordination
  Based on Impedance Control of Each Arm
  K. Kosuge, T. Oosumi and H. Seki, Department of Machine Intelligence and Systems Engineering, Tohoku University, Japan ................................................................. Vol. 1, p. 17

- Optimal Redundancy Resolution for Cooperative Industrial Robots
  B. Cao, G. I. Dodds and G. Irwin, The Queen's Univ. of Belfast, UK ............................................................ Vol. 1, p. 23

- Efficient Multi-Arm Closed Chain Dynamics Computation for Visualisation
  F. Isnard, G. Dodds and C. Vallée, Control Group, Queen’s University, UK ........................................................... Vol. 1, p. 30

Visual Servoing

- Self-organizing Reaching Operation in A Simulated Robot via Interaction of Binocular and Arm Movements
  J. M. Chung and N. Ohnishi, The institute of Physical and Chemical Research (RIKEN), Japan ................................................................. Vol. 1, p. 37

- Positioning a Camera Parallel to a Plane Using Dynamic Visual Servoing
  A. Crétaux and F. Chaumette, Institut de Recherche en Informatique et Systèmes Algétoires, France ................................................................. Vol. 1, p. 43

- Visually Servoed Gripping of a Used Car Battery
  M. Tonko, J. Schurmann, K. Schaffter and H. H. Nagel, Fraunhofer Institut für Informations- und Datenverarbeitung, Germany - Institut für Algorithmen und Kognitive Systeme, Karlsruhe Universität, Germany ................................................................. Vol. 1, p. 49

- Speed Command of a Robotic System by Monocular Pose Estimate

- Underwater Pipe Inspection Task Using Visual Servoing Techniques
  P. Rives and J. J. Borely, INRIA, France ................................................................. Vol. 1, p. 63
Robot Design I

- **Optimal Upper Bound Conditioning for Manipulator Kinematic Design Optimization**
  R. V. Mayorga and E. Dias de León, USA .......................... Vol. 1, p. 70

- **Experimental Research of a Torque-unit Manipulator**
  K. Yoshida, K. Osuka, T. Nakano and T. Ono, Department of System Engineering, Osaka Prefectural University, Japan .......................... Vol. 1, p. 76

- **Active and Passive Strategies in Dynamic Contact Point Sensing by a Flexible Beam**
  M. M. Svinin, M. Kaneko and N. Ueno, Industrial and System Engineering Department, Faculty of Engineering, Hiroshima University, Japan .......................... Vol. 1, p. 84

- **Self-excited Dynamic Active Antenna**
  N. Ueno and M. Kaneko, Kyushu National Industrial Research Institute, Japan - Hiroshima University, Japan .......................... Vol. 1, p. 91

Grasping

- **In-hand Manipulation: Geometry and Algorithms**
  A. Sudsang and J. Ponce, Beckman Institute, University of Illinois, USA .......................... Vol. 1, p. 98

- **On Planning Immobilizing Grasps for a Reconfigurable Gripper**
  A. Sudsang, N. Srinivasa and J. Ponce, Beckman Institute, University of Illinois, USA .......................... Vol. 1, p. 106

- **Solving Contact and Grasp Uncertainties**

- **Fast Planning of Precision Grasps for 3D Objects**
  M. Fischer and G. Hirzinger, DLR, Germany .......................... Vol. 1, p. 120

Human Machine Interaction/Interface

- **Haptic Interaction in Virtual Environment**
  D. Ruspini, K. Kolarov and O. Khatib, Stanford University, USA - Interval Research Corporation, Palo Alto, USA .......................... Vol. 1, p. 128

- **Human Computer Competition in Game Situation: Motion Planning for Boxing**

- **Contrasting Potential Fields and Constraints in a Shared Control Task**
  P. Aigner and B. J. McCarragher, faculty of Engineering and Information Technology, The Australian National University, Canberra, Australia .......................... Vol. 1, p. 140

- **A Simple Driving Device for a Vehicle -Implementation and Evaluation-**
  T. Sekimoto, T. Tsubouchi and S. Yuta, University of Tsukuba, Japan .......................... Vol. 1, p. 147

- **Optimal 3D Viewing with Adaptive Stereo Displays: A Case of Tilted Camera Configuration**
  S. Lee, USA .......................... Vol. 1, p. 155

Dynamic Control

- **Model-Matching Solution for Optimal Positive Joint Torque Feedback**
  F. Aghili, M. Buelher and J. M. Hollerbach, McGill University, Canada - University of Utah, USA .......................... Vol. 1, p. 157

- **Force Control of Robot Floating on the Water Utilizing Vehicle Restoring Force**
  H. Kajita and K. Kosuge, Department of Machine Intelligence and Systems Engineering, Tohoku university, Japan .......................... Vol. 1, p. 162
• A Study of Casting Manipulation (Swing Motion Control and Planning of Throwing Motion)
  H. Arisumi, T. Kotoku and K. Komoriya, AIST, MITI, Japan .......................................................... Vol. 1, p. 168

• An Efficient Method for Analysis of Practical Stability of Robots Interacting with Dynamic Environment
  D. Stokic and M. Vukobratovic, ATB Institute for Applied System Technology, Germany ........ Vol. 1, p. 175

• Control Strategies for a Defective, Wire-Based, Haptic Interface
  C. Melchiorri, M. Montanari and G. Vassura, University of Bologna, Italy ........................................ Vol. 1, p. 181

Multiple Manipulators II

• Two-arm manipulation tasks with friction assisted grasping
  J. P. Desai, M. Zefran and V. Kumar, General Robotics and Active Sensory Perception (GRASP) Laboratory, University of Pennsylvania, USA .......................................................... Vol. 1, p. 189

• Dynamic Analysis of Rodlike Objects Deformation towards Their Dynamic Manipulation
  H. Wakamatsu, T. Matsumura, E. Arai and S. Hirai, Osaka University, Japan - Ritsumeikan University, Japan .......................................................... Vol. 1, p. 196

• Hybrid Position/Force Coordination for Dual-Arm Manipulation of Flexible Materials
  W. J. Kraus and B. J. McCarragher, Department of Engineering - FEIT, Australian National University, Canberra, Australia .................................................. Vol. 1, p. 202

• Coordinated Motion Control of Multiple Robots Manipulating a Large Object
  K. Kosuge, S. Hashimoto and K. Takeo, Department of Mechanical Engineering, Tohoku University, Japan .......................................................... Vol. 1, p. 208

Perception for Vehicle Control

• Minimum Throughput Adaptive Perception for High Speed Mobility
  A. Kelly and A. Stentz, Field Robotics Center, Carnegie Mellon University, USA .................................. Vol. 1, p. 215

• Reactive Task Execution by Combining Action Maps
  J. Riekki and J. Röning, University of Oulu, Finland .......................................................... Vol. 1, p. 224

• Dynamic Speed Planning for Safe Navigation
  A. Mandow, V. F. Muñoz, R. Fernandez and A. García-Cerezo, Universidad de Malaga, Spain ........ Vol. 1, p. 231

• A Reactive Sensor-Based System for Solving Navigation Problems of an Autonomous Robot
  G. Vercelli, M. Piaggio and R. Zaccaria, University of Genova, Italy - University of Trieste, Italy ........ Vol. 1, p. 238

Legged Locomotion I

• Walking of a Biped Robot with Compliant Ankle Joints
  K. Y. Yi, Kwangwoon University, Korea .................................................. Vol. 1, p. 245

• Design of Biped Walking Robots Having Antagonistic Driven Joints Using Nonlinear Spring Mechanism
  J. Yamaguchi and A. Takanishi, Humanoid Research Laboratory, Advanced Research Institute for Science and Engineering, Waseda University, Japan - Department of Mechanical Engineering School of Science and Engineering, Waseda University, Japan ........................ Vol. 1, p. 251

• Human-Operated Walking Control of a Quadruped by Event-Driven Method

• Kinematic Aspects of Robotic Biped Locomotion Systems
  F. M. Silva and J. A. T. Machado, Department of Control and Automation, Modern University, Portugal .................................................. Vol. 1, p. 266
Dexterous Manipulation

- Controlled Slip: An Approach Within Planning Dexterous Manipulation in Three-Fingered Grasp
  S. Payandeh, Experimental Robotics Laboratory, School of Engineering Science, Simon Fraser University, Canada................................................................. Vol. 1, p. 273

- Development of a Redundant Macro-micro Manipulator and Contour Tasks Utilizing its Compliant Motion
  K. Nagai, Y. Nakagawa, S. Iwasa and K. Ohno, Motion, Japan ................................................ Vol. 1, p. 279

- Reorientation Planning for a Multifingered Hand based on Orientation States Network Using Regrasp Primitives
  T. Omata and M. A. Farooqi, Tokyo Institute of Technology, Japan ........................................... Vol. 1, p. 285

- Practical Motion Planning for Dextrous Re-Oriention of Polyhedra
  M. Cherif and K. K. Gupta, INRIA Rhône Alpes & GRAVIR-CNRS, France - School of Engineering Science Simon Fraser University, Canada .......... Vol. 1, p. 291

Human-Robot Interaction

- Human-Robot Interaction with a Minimal Spanning Natural Language Template for Autonomous & Tele-operated Control
  J. S. Zelek, Department of Computer Science and Engineering, Wright State University, USA ................................................................. Vol. 1, p. 299

- Behavioral Expression by an Expressive Mobile Robot - Expressing Vividness, Mental distance and Attention -
  H. Mizoguchi, K. Takagi, Y. Hatamura, M. Nakao and T. Sato, Research Center for Advanced Science and Technology, The University of Tokyo, Japan - Graduate School of Engineering, The University of Tokyo, Japan ................................................ Vol. 1, p. 306

- Contact Interaction Robot (Communication between Robot and Human through Contact Behavior)
  T. Sato, T. Harada and T. Mori, The University of Tokyo 4-6-1 Komaba, Meguro-ku, Japan .......... Vol. 1, p. 312

- Biological Interaction between a Man and a Machine
  Y. Kuno, T. Yagi and Y. Uchikawa, Nagoya University, Japan - RIKEN, Japan ......................... Vol. 1, p. 318

Identification and Modelling

- Structural Identification
  R. Balaniuk and E. Mazer, University of Brasilia and Gravir-Inria Rhône-Alpes ........................................ Vol. 1, p. 325

- Modelling, Identification and Experimental Validation of a Hydraulic Manipulator Joint for Control
  G. Bilodeau and E. Papadopoulos, Department of Mechanical Engineering & Centre for Intelligent Machines, McGill University, Canada ........................................ Vol. 1, p. 331

- Constraint-based Identification of a Dynamic Model
  A. Joukhadar, F. Garat and C. Laugier, INRIA Rhône Alpes & GRAVIR, France ......................... Vol. 1, p. 337

- Modeling a Robot with Flexible Joints and Decoupling its Equations of Motion
  A. Meghdari, Sharif University of Technology, Iran ................................................ Vol. 1, p. 343

Service Robotics

- Localization and Obstacle Detection for a Robot for Carrying Food Trays

- An Autonomous Heavy Duty Outdoor Robotic Tracked Vehicle
  R. Jarvis, Intelligent Robotics Research Centre, Monash University, Australia ......................... Vol. 1, p. 352
Perception for a Transport Robot in Public Environments
F. Sandt and L. H. Pampagnin, ITMI Aptor (Cap Gemini group), France ........................................ Vol. 1, p. 360

A Mobile Robot for Service Use: Behaviour Simulation System and Intelligent Control

Vision-Based Mobile Robot Navigation I

- Visually-Guided Obstacle Avoidance in Unstructured Environments
  L. M. Lorigo, R. A. Brooks and W. E. L. Grimson, MIT Artificial Intelligence Laboratory, USA .... Vol. 1, p. 373

- Color Impression Factor: an Image understanding Method for Outdoor Mobile Robot

- Fusion of Fuzzy Agents for the Reactive Navigation of a Mobile Robot
  M. Benreguieg, H. Maaref and C. Barret, University of Evry, France ........................................... Vol. 1, p. 388

- Autonomous Navigation in ill-Structured Outdoor Environments
  J. Fernandez and A. Casals, Universitat Politècnica de Catalunya, Spain ........................................ Vol. 1, p. 395

Legged Locomotion II

- Centipede Type Walking Robot (CWR-2)
  A. Torige, S. Yagi, H. Makino, T. Yagami and N. Ishizawa, Seikei University and Nikon Corp - Japan .................................................................................................................. Vol. 1, p. 402

- Gait Study for Hexapod Walking with Disabled Leg
  K. Inagaki, Department of Control Engineering, Tokai University, Japan ........................................ Vol. 1, p. 408

- A Design Method for Practically Used Walking Machine
  T. Takahama and K. Inagaki, Reliance Electric Limited, Japan - Department of Control Engineering, Tokai University, Japan .......................................................... Vol. 1, p. 414

Object Manipulation

- Analysis of Part Motion on a Longitudinally Vibrating Plate
  D. Reznik, J. Canny and K. Goldberg, University of California, Berkeley, USA ................................... Vol. 1, p. 421

- On Motion Behavior of the Object Manipulated by Active Fence (AF)
  A. Salvainov and S. Payandeh, Experimental Robotics Laboratory, School of Engineering Science, Simon Fraser University, USA .............................................................. Vol. 1, p. 428

- Task allocation and distributed cooperation strategies in a group of object transferring robots
  M. N. Ahmadabadi and N. Eiji, Advanced Robotics Lab., The Graduate School of Information Sciences, Tohoku University, Japan ................................................................. Vol. 1, p. 435

- Qualitative Transitions in Object Reorienting Behaviour, Part 2: The Effects of Varying the Centre of Mass
  G. E. Deacon, M. Wright and C. Malcolm, Department of Artificial Intelligence, University of Edinburgh, UK .......................................................... Vol. 1, p. 441

Human Skills Modelling

- Modeling of the Peg-in-Hole Task Based on Impedance Parameters and HMM

- On Force Control in Human Physical Skill
  Y. Tsumaki, H. Naruse, D. N. Nenchev and M. Uchiyama, Department of Aeronautics and Space Engineering, Tohoku University, Japan ........................................ Vol. 1, p. 458
• **Stiffness-based Understanding and Modeling of Contact Tasks by Human Demonstration**
P. Sikka and B. J. McCarragher, Department of Engineering, FEIT, The Australian National University, Australia ................................................................. Vol. 1, p. 464

• **Programming and Learning in Real-World Manipulation Tasks**
E. Cervera and A. P. Del Pobil, Jaume I University, Spain ......................................................... Vol. 1, p. 471

**Robust Control**

• **Robustness of NPD Control**
B. Armstrong, UW Milwaukee, USA ...................................................................................... Vol. 1, p. 478

• **Learning and Adaptive Controls for Coordination of Multiple Manipulators Holding a Geometrically Constrained Object**
T. Naniwa, S. Arimoto and K. Wada, Faculty of Engineering, University of Tokyo, Yamaguchi University, Japan .......................................................... Vol. 1, p. 484

• **Robust Adaptive Control of Underactuated Robot Manipulators in Cartesian Space**
J. H. Shin and J. J. Lee, Department of Electrical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Korea .................................................. Vol. 1, p. 491

• **Model Matching 2-DOF Control System with H∞ Stabilizing Filter -Robot Control of a 6-Link Hydraulic Manipulator-**

**Mobile Robot Navigation**

• **On the sensor-based navigation by changing a direction to follow an encountered obstacle**

• **ROMAN: A Mobile Robotic Assistant for Indoor Service Applications**

• **Real-Time Robot Navigation in Unstructured Environments Using a 3D Laser Rangefinder**

• **Mobile Robot Navigation Using Egomotion Estimates**
A. Branca, E. Stella and A. Distante, CNR-IESI, Italy ................................................................. Vol. 2, p. 533

**Vision-Based Mobile Robot Navigation II**

• **Sensor-Based Learning of Environment Model and Path Planning with a Nomad 200 Mobile Robot**

• **Visual Navigation in an Open Environment without Map**

• **Appearance Based Processes for Visual Navigation**

• **Navigation of a Mobile Robot on the Temporal Development of the Optic Flow**
A. Dev, B. Krüse and F. Groen, University of Amsterdam, The Netherlands ................................. Vol. 2, p. 558

**Emmisive Range Sensors**

• **Measuring Range and Bearing with a Binaural Ultrasonic Sensor**
B. Stanley and P. McKerrow, University of Wollongong, Australia ........................................... Vol. 2, p. 565
• Range Feature Extraction During Active Sensor Motion
  N. E. Pears, Cambridge University, UK .......................................................... Vol. 2, p. 572

• Characterization of a Radial Laser Scanner for Mobile Robot Navigation
  A. Reina and J. Gonzales, Universidad de Malaga, Spain ................................ Vol. 2, p. 579

On the Identification of Sonar Features
S. Lacroix and G. Dudek, LAAS / CNRS, France and McGill University, Canada.......... Vol. 2, p. 586

Learning I

• Speed up Reinforcement Learning between two Agents with Adaptive Mimetism
  T. Yamaguchi, Y. Tanaka and M. Yachida, Osaka University, Japan ..................... Vol. 2, p. 594

• Region-based Q-learning using Convex Clustering Approach

• Generation of Behavior Automaton on Neural Network
  T. Ogata, K. Hayashi, I. Kitagishi and S. Sugano, Waseda University, Japan ............ Vol. 2, p. 608

• Tuning Neural Networks With Stochastic Optimization
  A. Dubrawski, Institute of Fundamental Technological Research, Poland .............. Vol. 2, p. 614

Human Assistance Robots

• Adaptive Shared Control of a Smart Wheelchair Operated by Voice Control

• Walk Training System: Improvement of the Ability of Postural Control
  T. Tani, A. Sakai, T. Fujimoto and M. Fujie, Fujimoto Hospital, Japan ................... Vol. 2, p. 627

• Monitoring Patient Respiration and Posture Using Human Symposia System
  Y. Nishida, M. Takeda, T. Mori H. Mizoguchi and T. Sato, Faculty of Engineering, The University of Tokyo, Japan - College of Science and Engineering, Aoyama Gakuin University, Japan - RCAST, The University of Tokyo, Japan ........ Vol. 2, p. 632

• Development of Power Assist System with Individual Compensation Ratios for Gravity and Dynamic Load

Assembly Tasks I

• Assembly Cost Evaluation based on Necessary Adjustments due to Tolerances
  R. Suarez, C. Yi and S. Lee, Instituto de Ciberntica, Universidad Politecnica de Cataluna, Spain - Computer Science Department, University of Southern California, USA - Jet Propulsion Laboratory, California Institute of Technology, USA ................................................ Vol. 2, p. 648

• Combining Force and Position Measurements for the Monitoring of Robotic Assembly

• Assembly Automation using Perturbation/Correlation
  S. Lee and H. Asada, Korea Institute of Science and Technology, Korea - Massachusetts Institute of Technology, USA ...................................................... Vol. 2, p. 661

• Experiments in Force Controlled Assembly using a Discrete Event Framework
  D. Austin and B. J. McCarragher, Faculty of Engineering and Information Technology, The Australian National University, Canberra, Australia ................................ Vol. 2, p. 668
Mobile Robot Localization I

- Indoor Exploration Using a Sonar Sensor Array: A Dual Representation Strategy
  K. S. Chong and L. Kleeman, Monash University, Australia .................................................. Vol. 2, p. 676

- Mobile Robot and Sound Localization
  J. Huang, T. Supaongprapa, I. Terakura, N. Ohnishi and N. Sugie,
  Bio-Mimetic Control Research center, RIKEN, Japan -
  Department of Information Engineering, Graduate School of Engineering,
  Nagoya University, Japan - Faculty of Science and technology, Meijo University, Japan ........ Vol. 2, p. 683

- Position Estimation and Path Control of an Autonomous Land Vehicle
  N. Miyake, T. Aono, K. Fujii, Y. Matsuda and S. Hatsumoto ,
  Mechanical Engineering Research Laboratory, Japan - Hitachi Ltd, Japan .................. Vol. 2, p. 690

- Real-Time Self-Localization in Unknown Indoor Environments using a Panorama Laser Range Finder
  T. Einsele , Technische Universitat Munchen, Germany .................................................. Vol. 2, p. 697

Vision-Based Mobile Robot Navigation III

- Vision-Based Navigation of Mobile Robot with Obstacle Avoidance by Single Camera Vision and Ultrasonic Sensing
  A. Ohya, A. Kosaka and A. Kak, University of Tsukuba - Japan, Purdue University - USA .......... Vol. 2, p. 704

- Acquisition of Statistical Motion Patterns in Dynamic Environments and their Application to Mobile Robot Motion Planning

- A Navigation System Based on an Omnidirectional Vision Sensor
  L. Delahoche, C. Pégard, B. Marhic and P. Vasseur, Université de Picardie J.Vernes,
  Laboratoire des Systèmes Automatiques, France .......................................................... Vol. 2, p. 718

- Autonomous Mobile Robot Motion Control in Non-Structured Environments
  Based on Real-Time Video Processing
  J. Ferruz and A. Ollero, Universidad de Sevilla, Spain .................................................. Vol. 2, p. 725

3D Sensing

- Experiments on Depth from Magnification and Blurring
  S. Chul Ahn, S. Lee, A. Meyyappan and P. Schenker, USA ........................................ Vol. 2, p. 733

- Motion and Structure from Perspectively Projected Optical Flow by Solving Linear Simultaneous Equations
  T. Mukai and N. Ohnishi , The Institute of Physical and Chemical Research (RIKEN),
  Nagoya, Japan - Department of Information Engineering, Faculty of Engineering,
  Nagoya University, Japan ................................................................................................. Vol. 2, p. 740

- Practical Stereo Vision and Multi-Laser Scanning in Object Face Detection and Orientation Determination
  A. Zatari and G. Dodds, Department of Electrical Engineering,
  Queen’s University of Belfast, UK .................................................................................. Vol. 2, p. 746

- Output Methods for an Associative Operation of Programmable Artificial Retinas
  T. M. Bernard and F. Paillet, ETCA/CTME/GIP, France ................................................ Vol. 2, p. 752

Learning II

- An Iterative Learning Control Scheme for Manipulators
  J. H. Moon, T. Y. Doh and M. J. Chung, Department of Electrical Engineering,
  Korea Advanced Institute of Science and Technology, Korea ........................................ Vol. 2, p. 759
- **Interacting Fuzzy Multimodel Intelligent Tracking System for Swift Target Maneuvers**
  L. Gökkus, A. M. Erkmen and O. Tekinalp, Aeronautical Engineering Department, Electrical and Electronic Engineering Department, Middle East Technical University, Turkey. Vol. 2, p. 766

- **Learning of Membership Functions of Fuzzy Behaviours for a Mobile Robot Control System**
  J. Qiu and M. Walters, University of Luton, UK. Vol. 2, p. 772

- **Adaptive Visual Servoing for Legged Robots - Vision-Cued Swaying of Legged Robots in Unknown Environments**

- **A Modular Reinforcement-Based Neural Controller for a Three-Link Manipulator**

**Humanoid Robots**

- **A Functionally Distributed Responsive Micro Controller for Distributed Real-time Processing**

- **Development of an Anthropomorphic Head-Eye Robot with Two Eyes - Coordinated Head-Eye Motion and Pursuing Motion in the Depth Direction**

- **Development of a Humanoid Robot Saika**
  A. Konno, K. Nagashima, K. Nishiwaki, T. Noda, M. Inaba and H. Inoue, Department of Mechano-Informatics, University of Tokyo, Japan. Vol. 2, p. 805

- **Humanoid As a Research Vehicle Into Flexible Complex Interaction**
  Y. Kuniyoshi and A. Nagakubo, Electrotechnical Laboratory, Japan. Vol. 2, p. 811

**Robot Control Architectures**

- **Describing a Modular Motion System based on a Real Time Process Network Model**
  T. Oka, M. Inaba and H. Inoue, University of Electro-Communications and University of Tokyo, Japan. Vol. 2, p. 821

- **Design and Implementation of Brain Real-Time Part for Remote-Brained Robot Approach**

- **The Maestro Language and its Environment : Specification Validation and Control of Robotic Missions**

- **GenoM: A tool for the specification and the implementation of operating modules in a distributed robot architecture**
  S. Fleury, M. Herrb and R. Chatila, LAAS-CNRS, France. Vol. 2, p. 842

**Mobile Robot Localization II**

- **Robot Localization - Theory and Practice**
  O. Karch and H. Nolte-meier, University of Würzburg, Germany. Vol. 2, p. 850

- **Learning to build visual categories from Perception-Action Associations**

- **Positioning of a Mobile Robot with Landmark-Based Method**
Visual Tracking

- **Robust Real-Time Tracking on an Active Vision Head**

- **Vehicle Segmentation Using Evidential Reasoning**

- **Model-Based Object Tracking in Cluttered Scenes with Occlusions**
  F. Jurie, LASMEA, CNRS UMR 6602, France ................................................................. Vol. 2, p. 886

- **Visual Tracking of An End-Effector by Adaptive Kinematic Prediction**

Mobile Robot Design

- **Development of a Semi Self-Contained Wall Climbing Robot with Scanning Type Suction Cups**
  T. Yano, T. Suwa, M. Murakami and T. Yamamoto , Mechanical Engineering Laboratory, AIST, MITI, Japan - Research and Development Center, Nippon Koei Corporation, Japan ................. Vol. 2, p. 900

- **A Development of a New Mechanism of an Autonomous Unicycle**
  R. Nakajima, T. Tsubouchi, S. Yuta and E. Koyanagi, University of Tsukuba, Japan - Yokosuka Technical Highschool, Japan ................................................................. Vol. 2, p. 906

- **Rollmobs, A New Omniforme Robot**
  L. Ferriere, B. Raucent and J. C. Samin, Université Catholique de Louvain, Belgium .................. Vol. 2, p. 913

- **Specification of a Small Electric Vehicle : Modular and Distributed Hardware Approach**
  L. Lisowski and G. Baille, INRIA Rhône Alpes, France ................................................. Vol. 2, p. 919

Assembly Tasks II

- **Integrated Task Scheduling and Action Planning/Control for Robotic Systems Based on a Max-Plus Algebra Model**
  N. Xi and T. I. Tarn, Department of Systems Science and Mathematics, Washington University, USA ................................................................. Vol. 2, p. 926

- **An Effective Algorithm for a Surface Mounting Machine in Printed Circuit Board Assembly**

- **Assembly Motion Teaching System using Position/Force Simulator -Generating Control Program-**

- **Determining Compliant Motions for Planar Assembly Tasks in the Presence of Friction**

Gesture Recognition

- **Cue-Circles: Image Feature for Measuring 3-D Motion of Articulated Objects**
  J. M. Chung and N. Ohnishi , The Institute of Physical and Chemical Research (RIKEN), Japan ................................................................................................. Vol. 2, p. 953

- **Gesture Recognition based on Subspace Method and Hidden Markov Model**
  Y. Iwai, T. Hata and M. Yachida , Department of Systems and Human Science, Osaka University, Japan ........................................................................ Vol. 2, p. 960

- **Spotting recognition of gestures performed by people from a single time-varying image**
  T. Nishimura, T. Mukai and R. Oka , Tsukuba Research Center, Real World Computing Partnership, Japan ................................................................. Vol. 2, p. 967
Non Holonomic Motion Planning and Control

- **Adaptive Stabilization of Uncertain Nonholonomic Mechanical Systems**
  R. Colbaugh, E. Barany and K. Glass, Departments of Mechanical Engineering and Mathematical Sciences, New Mexico States University, USA ........................................ Vol. 2, p. 981

- **A Practical Path and Motion Planner for a Tractor-Trailer Robot**
  M. Viale, T. Tsubochi and S. Yuta, University of Tsukuba, Japan ........................................ Vol. 2, p. 989

- **Continuous-Curvature Path Planning for Car-Like Vehicles**
  A. Scheuer and Th. Fraichard, INRIA Rhône-Alpes & GRAVIR, France .................................. Vol. 2, p. 997

- **Computing Good Holonomic Collision-Free Paths to Steer Nonholonomic Mobile Robots**
  T. Siméon, S. Leroix and J. P. Laumond, LAAS-CNRS, France ........................................ Vol. 2, p. 1004

Mobile Robot Localization III

- **Mixed Traffic and Automated Highways**
  C. Thorpe, Carnegie Mellon University-USA ................................................................. Vol. 2, p. 1011

- **Active Navigation Vision Based on Eigenspace Analysis**
  S. Maeda, Y. Kuno and Y. Shirai, «Dept; Computer-Controlled Mechanical Systems, Osaka University, Japan» ........................................ Vol. 2, p. 1018

- **Map Generation for Multiple Image Sensing Sensor MISS Under Unknown Robot Egomotion**
  Y. Yagi, K. Egami and M. Yachida, Graduate School of Engineering Science, Osaka University, Japan ......................................... Vol. 2, p. 1024

- **Obstacle Detection and Self-Localization without Camera Calibration Using Projective Invariants**

- **Visual Landmark Extraction and Recognition for Autonomous Robot Navigation**
  P. E. Trathanias, S. Velissaris and T. Garavelos, Institute of Computer Science, Greece - University of Crete, Heraklion, Greece ......................................... Vol. 2, p. 1036

Visual Guided Manipulation

- **Visual Learning and Object Verification with Illumination Invariance**
  K. Obba, Y. Sato and K. Ikeuchi, Mechanical Engineering Laboratory, MITI, Japan - The University of Tokyo, Japan ................................................ Vol. 2, p. 1044

- **Development of Vision System for Two-Fingered Micro Manipulation**
  T. Tanikawa, T. Arai and Y. Hashimoto, Department of Robotics Mechanical engineering Laboratory AIST, MITI, Japan - Graduate School of Engineering Science, Osaka University, Japan - Nihon University, Japan ................................................ Vol. 2, p. 1051

- **Hand-Eye Calibration**

- **Trajectory Generation by Visual Servoing**
  F. Berry, P. Martinet and J. Gallice, LASMEA-CNRS UMR 6602, France ........................................ Vol. 2, p. 1066

- **Vision System for Automatic Capturing a Moving Object by the Robot Manipulator**
Robot Design II

- **Task-reconfigurable Robots: Navigators and Manipulators**
  K. D. Kotay and D. L. Rus, Department of Computer Science, Dartmouth College, Hanover ........ Vol. 2, p. 1081

- **Distributed Formation Control for a Modular Mechanical System**

- **Synthesis of Actively Adjustable Frequency Modulators Via Redundant Actuation: The Case for a Five-bar Finger Mechanism**

- **Micro Positioning System with 3 dof for a Dynamic Compensation of Standard Robots**

- **Evolutionary Algorithms in Kinematic Design of Robotic Systems**
  O. Chocron and P. Bidaud, Laboratoire de Robotique de Paris, France ........................................ Vol. 2, p. 1111

Robot System Control

- **Parametrized Scripts for Motion Planning**
  P. Rowe and A. Stentz, Robotics Institute, Carnegie Mellon University, USA ................................................ Vol. 2, p. 1119

- **Optimal Velocity Based Control of a Parallel Manipulator with Fixed Linear Actuators**
  P. Huynh, T. Arai, N. Koyachi and T. Sendai, Autonomous Machinery Division, Mechanical Engineering Laboratory, AIST, MITI, Japan - Osaka University, Graduate School of Engineering Science, Japan - Nitta Industries Corporation, Japan ........................................ Vol. 2, p. 1125

- **Fast Passing over Steps with Unknown Height by a Variable structure Type Four-wheeled Robot**
  O. Matsumoto, S. Kajita and K. Tani, Mechanical Engineering Laboratory, MITI, Kumamoto Prefecture Industrial Research Institute, Japan ................................................ Vol. 2, p. 1131

- **A Scheduling Approach for Decentralized Mobile Robot Control System**

- **Predictive Sensor Guided Robotic Manipulators in Automated Welding Cells**
  A. Bauchspies and S. C. Absi Alfaro, Faculty of Technology, Brasilia, Brazil ........................................ Vol. 2, p. 1144

Teleoperation/Telerobotics

- **An Examination of the STRIPE Vehicle Teleoperation System**

- **Reference Adaptive Impedance Control and Its Application to Obstacle Avoidance Trajectory planning**
  S. Lee, S. Y. Yi, J. O. Park and C. W. Lee, University of Southern California, USA - Jet Propulsion Laboratory, California Institute of Technology, USA - Korea Institute of Science and Technology, Korea ................................................ Vol. 2, p. 1158

- **Remote Supervisory Control of A Sensor Based Mobile Robot Via Internet**
  R. C. Luo and T. M. Chen, Intelligent Automation Laboratory, National Chung Cheng University, Taiwan ................................................ Vol. 2, p. 1163

- **Supervised Autonomy: A Paradigm for Teleoperating Mobile Robots**
  G. Cheng and A. Zelinsky, The Australian National University, Australia ................................................ Vol. 2, p. 1169
Supervision and Teleoperation System for an Autonomous Mobile Robot
P. Skrzypczynski, Technical University of Poznan, Poland ........................................................... Vol. 2, p. 1177

Motion Planning

- A Quasi-Linear Method for Computing and Projecting onto C-Surface: General Case

- A Probability-Based Approach To Model-Based Path Planning
  I. Mantegh, M. R. M. Jenkin and A. A. Goldenberg, University of Toronto, Canada -
  York University, Canada ........................................................................................................ Vol. 2, p. 1189

- Motion Planning in R3 for Multiple Tethered Robots
  S. Hert and V. Lumelsky, Computer Sciences Department, University of Wisconsin,
  USA - Robotics Laboratory, University of Wisconsin, USA .................................................. Vol. 2, p. 1196

- Planning of Vision-Based Navigation for a Mobile Robot under Uncertainty

- Robot Motion Planning by a Hierarchical Search on a Modified Discretized Configuration Space
  A. Autere and J. Lehtinen, Department of Computer Science, Helsinki University of Technology, Finland ................................................................. Vol. 2, p. 1208

Path Planning and Obstacle Avoidance

- Mobile Robot Navigation: Implementing the GVG in the Presence of Sharp Corners
  I. Konukseven and H. Choset, Carnegie Mellon University, USA ........................................ Vol. 3, p. 1218

- Robot Path Planning Using Kohonen Maps
  E. Ralli and G. Hirzinger, German Aerospace Research Establishment (DLR), Germany ........ Vol. 3, p. 1224

- Distance Computing Between General Shape Preprocessed obstacles and
  General Segments-Based Robot
  O. Habert, H. Bullier and A. Pruski, Laboratoire d'Automatique des
  Systemes Coopératifs (L.A.S.C.), France ............................................................................. Vol. 3, p. 1230

- Avoiding Obstacles Using a Connectionist Network
  A. Silva, P. Menezes and J. Dias, Instituto de Sistemas e Robotica, Coimbra, Portugal ........ Vol. 3, p. 1236

Sensing for Navigation

- Active Sensor Fusion for Collision Avoidance
  T. C. H. Heng, Y. Kuno and Y. Shirai, Dept. of Computer-Controlled Mechanical Systems,
  Osaka University, Japan ........................................................................................................ Vol. 3, p. 1244

- Understanding Man-made Environments Using Nonstructured Lighting -
  3D World Modeling for Indoor Mobile Robots -
  T. Tsukiyama, Electrotechnical Laboratory, Tsukuba, Japan ............................................... Vol. 3, p. 1250

- An Original Correlation and Data Fusion Based Approach to Detect a Reap
  Limit into a Gray Level Image
  T. Chateau, M. Berducat and P. Bonton, Cemagref, France -
  Lasmea, Ura 1793 du CNRS, France ................................................................................. Vol. 3, p. 1258

- An Overview of the Advantages and Constraints of Coded Pattern Projection Techniques
  for Autonomous Navigation.
  J. Salvi, E. Mouaddib and J. Batlle, Computer Vision and Robotics Group,
  Universitat de Girona, Spain - Laboratoire des Systemes Automatiques,
  Universite de picardie, France .............................................................................................. Vol. 3, p. 1264
Mobile Manipulators

- **On-Line Automatic Tipover Prevention for Mobile Manipulators**
  D. A. Rey and E. G. Papadopoulos, Center for Intelligent Machines, McGill University, USA .......... Vol. 3, p. 1273

- **Observer-Based Control for Manipulators with Moving Bases**
  K. A. Tahboub, College of Engineering and Technology, Hebron, Palestine. ..................................... Vol. 3, p. 1279

- **Stability Compensation of a Mobile Manipulator by Manipulator Motion: Feasibility and Planning**
  Q. Huang, S. Sugano and K. Tanie, Mechanical Engineering Laboratory, Japan .................................... Vol. 3, p. 1285

- **Towards the Use of Dual Quaternions for Motion Generation of Non-Holonomic Mobile Manipulators**
  C. Perrier, P. Dauchez and F. Pierrot, LIRMM - UMR 5506, Montpellier, France ............................. Vol. 3, p. 1293

Microrobotics

- **Bio-Micro-Manipulation (New Direction for Operation Improvement)**
  F. Arai, K. Morishima, T. Kasugai and T. Fukuda, Nagoya University, Japan ................................. Vol. 3, p. 1300

- **Micro-Conveying Station for Assembly of Micro-Components**
  P. Hélín, M. Calin, V. Sadaune, N. Chaillot, C. Druan and A. Bourjault, Institut d'Electronique et de Microélectronique du Nord, France - Laboratoire d'Automatique de Besançon, UMR CNRS 6596, France ........................................ Vol. 3, p. 1306

- **Design of Cooperative Microrobots with Impedance Optimization**
  M. Calin, N. Chaillot, J. Agnus and A. Bourjault, Laboratoire d’Automatique de Besançon, URA CNRS 6596, France ............................. Vol. 3, p. 1312

- **A One Cubic Centimeter Mobile Microrobot with a Steering Control**
  S. D’Attanasio, R. Lazzarini, C. Stefanini, M. C. Carrozza and P. Dario, Scuola Superiore Sant’Anna, Pisa, Italy .......................................................... Vol. 3, p. 1318

Detection and Tracking of People

- **Building Topological Maps by Looking at People: An Example of Cooperation between Intelligent Spaces and Robots**
  G. Appenzeller, J. H. Lee and H. Hashimoto, Institute of Industrial Science, University of Tokyo, Japan .......................... Vol. 3, p. 1326

- **Action Recognition System Based on Human Finder and Human Tracker**
  T. Mori, Y. Kamiisawa, H. Mizoguchi and T. Sato, The University of Tokyo, Japan .......................... Vol. 3, p. 1334

- **Robust Visual Tracking by an Active Observer**
  A. Arsenio and J. Santos Victor, Instituto Superior Tecnico, Lisboa, Portugal ................................. Vol. 3, p. 1342

- **Real-Time Vergence and Binocular Gaze Control**

Integrated Systems

- **Multisensor Controlled Robotic Tracking and Automatic Pick and Place**
  I. Konukseven, B. Kaftanoglu and T. Balkan, USA ........................................................................ Vol. 3, p. 1356

  G. T. McKee and B. G. Brooks, Department of Computer Science, University of Reading, UK .......... Vol. 3, p. 1363

- **A Modular Re-configurable Approach to the Creation of Flexible Manufacturing Cells for Educational Purposes**
  S. Owen, M. C. Bonney and A. Denford, Denford Ltd, UK - Department of Manufacturing Engineering and Operations Management, University of Nottingham, UK .................................. Vol. 3, p. 1369
• Perception-Net Based Geometric Data Fusion for State Estimation and System Self-Calibration
  S. Lee, S. Ro and P. Schenker, University of Southern California, Los Angeles, USA - JPL, Pasadena, USA ......................................................... Vol. 3, p. 1375

Control of Wheeled Robots

• Initial Results from Vision-based Control of the Ames Marsokhod Rover
  D. Wettergreen, H. Thomas and M. Bualat, NASA Ames Research Center, USA ................... Vol. 3, p. 1377

• Joystick Velocity Control of the «High Performance Econo» Vehicle
  W. Lerouquais, Y. Fupe, B. D’Andréa-Novel and T. Oomichi,
  Ecoles des Mines de Paris, France - Mitsubishi Heavy Industries, Japan ......................... Vol. 3, p. 1383

• Robust Path Following Control for Wheeled Robots via Sliding Mode Techniques
  L. Aguilar, T. Hamel and P. Souères, LAAS-CNRS, France - UTC Heudiasyc, France .......... Vol. 3, p. 1389

• Steering behaviour and control of fast wheeled robots
  F. BenAmar, Laboratoire de Robotique de Paris, France ................................................ Vol. 3, p. 1396

Sensor Fusion

• Sensor-Guided Manipulation in a Manufacturing Workcell

• A Decentralized Approach to Sensory Data Integration
  A. C. S. Chung, H. C. Shen and O. B. Basir, The Hong Kong University of Science & Technology, Hong Kong - School of Engineering, University of Guelph, Canada .................. Vol. 3, p. 1409

• Proposal of a Probabilistic Believes Fusion Framework Application to Range Data Fusion
  E. Piat and D. Meizel, HEUDIASYC UTC URA CNRS 6599, France ................................. Vol. 3, p. 1415

Multi-Robot System

• Reducing Communication Load on Contract Net by Case-Based Reasoning - Eavesdropping for Utilizing Message Leakage-
  T. Ohko, K. Hiraki and Y. Anzai, Anzai Laboratory, Keio University and PRESTO Electrotechnical laboratory, MITI, Japan ................................................. Vol. 3, p. 1430

• IRoN: An Inter Robot Network and Three Examples on Multiple Mobile Robots Motion Coordination
  M. Rude, R. Rupp, K. Matsumoto, S. Sutedjo and S. Yuta, University of Tsukuba, Japan - University of Wollongong, Australia ......................................................... Vol. 3, p. 1437

• Performance of Emotional Group Robotic System using Mass Psychology
  H. Ishihara and T. Fukuda, Nagoya University, Japan ..................................................... Vol. 3, p. 1445

Manipulability

• A Study of the Manipulability Measures for Robot Manipulators
  J. Lee, Chung-nam University, Korea .............................................................................. Vol. 3, p. 1458

• Singularity Analysis of a 6-DOF Parallel Manipulator with Local Structurization Method
  D. Kim, W. Chung and Y. Youm, Pohang Univ. of Science & Technology, Korea .............. Vol. 3, p. 1466
• Dynamic Manipulability Analysis of Compliant Motion
  R. Koeppe and T. Yoshikawa, German Aerospace Research Establishment (DLR), Germany -
  Department of Mechanical Engineering, Kyoto University, Japan .................................................. Vol. 3, p. 1472

• Force and Dynamic Manipulability for Cooperating Robot Systems
  A. Bicchi, D. Prattichizzo and C. Melchiorri, Universita di Pisa, Italy -
  Universita di Bologna, Italy ................................................................. Vol. 3, p. 1479

Space Robots

• A Prototype Manipulation System for Mars Rover Science Operations
  R. Volpe, T. Ohm, R. Petras, R. Welch, J. Balaram and R. Ivlev, Jet Propulsion Laboratory,
  California Institute of Technology, USA ......................................................... Vol. 3, p. 1486

• Dynamically Equivalent Manipulator for Space Manipulator System: Part2
  B. Liang, Y. Xu, M. Bergeveerk and G. Li, Carnegie Mellon University USA -
  Beijing Institute of control Engineering, China ................................................... Vol. 3, p. 1493

• Control of Space Free-Flyers Using the Modified Transpose Jacobian Algorithm
  S. A. A. Moosavian and E. Papadopoulos, Department of Mechanical Engineering &
  Centre for Intelligent Machines, McGill University, USA .................................................. Vol. 3, p. 1500

• Mobility Evaluation of a Wheeled Microrover using a Dynamic Model
  G. Sukhatme, S. Brizius and G. A. Bekey, Department of Computer Science,
  Institute for Robotics and Intelligent Systems, University of Southern California, USA ......... Vol. 3, p. 1506

Biological and Medical Systems

• Locomotion Control of a Bio-Robotic System via Electric Stimulation
  R. Holzer and I. Shimoyama, University of Tokyo, Japan .................................................. Vol. 3, p. 1514

• A Design of Motion-Support Robots for Human Arms using Hexahedron Rubber Actuator

• Development of a Mastication Robot Using Nonlinear Viscoelastic Mechanism

• An Integrated Robotics and Medical Control Device to Quantify
  Atheromatous Plaques: Experiments on the Arteries of a Patient
  S. Boudet, J. Gariépy and S. Mansour, Electricité de France (E.D.F.), France -
  Hôpital Broussais, France - I6dP, France .................................................. Vol. 3, p. 1533

Trajectory Generation and Control

• Sub-Optimal Trajectory Planning of Flexible Manipulator along Specified Path
  P. K. Sarkar, M. Yamamoto and A. Mohri, Kyushu University, Japan ..................................... Vol. 3, p. 1540

• Preshaped Trajectory Command for Fast Repetative PTP Motion of PD-
  Controlled Flexible Joint Manipulators
  Research Institute, Seoul National University, Korea .................................................. Vol. 3, p. 1546

• A Global Optimization Approach to Trajectory Planning for Industrial Robots
  A. Piazza and A. Visioli, Dipartimento di Ingegneria, University of Parma, Italy -
  Dipartimento di Ellettronica per l’Automazione, University of Brescia, Italy ......................... Vol. 3, p. 1553

3D Reconstruction

• Shape Measurement Method integrating Stereo Vision and Shape-from-Shading
  with Evolutionary Programming
  P. Kobayashi, T. Fukuda, K. Shimozima and T. Takusagawa, Nagoya University, Japan -
  Agency of Industrial Science and Technology, Japan - Japan Airlines, Japan ........................ Vol. 3, p. 1561
A Novel Method for Extracting Roof Edges of Specular Polyhedra
W. S. Park and H. S. Cho, Korea Advanced Institute of Science and Technology, Korea Vol. 3, p. 1567

Euclidean Reconstruction and Affine Camera Calibration Using Controlled Robot Motions
R. Horneud, S. Christy and R. Mohr, GRAVIR-IMAG & INRIA Rhône Alpes, France Vol. 3, p. 1575

Camera Calibration from Multiple Views of a 2D Object using a Global Non Linear Minimization Method
M. Devy, V. Garric and J. J. Orteu, LAAS / CNRS, France - Ecole des Mines d'Albi, France Vol. 3, p. 1583

Cooperative Multiple Robot Systems

Cooperative Motion Control for Multi-Target Observation
L.E. Parker, Oak Ridge National Laboratory, USA Vol. 3, p. 1591

Generation of Conflict Resolution Maneuvers for Air Traffic Management
J. Kosecki, C. Tomlins, G. Pappas and S. Sastry, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, USA Vol. 3, p. 1598

Distributed Decision Making of Dynamically Reconfigurable Robotic System
T. Fukuda and T. Kaga, Nagoya University, Japan Vol. 3, p. 1604

How to Solve Deadlock Situations within the Plan-Merging Paradigm for Multi-robot Cooperation
S. Qutub, R. Alami and F. Ingrand, LAAS-CNRS, France Vol. 3, p. 1610

Parallel Manipulators

Kinematic Feature Analysis of a 6-Degree-of-Freedom In Parallel Manipulator for Micro-Positioning

High Speed and High Precision Parallel Mechanism
T. Arai, H. Funahashi, Y. Nakamura, Y. Takeda and Y. Koseki, Osaka University, Japan - Tokyo Institute of Technology, Japan - University of Tokyo, Japan - Mechanical Engineering Laboratory, Japan Vol. 3, p. 1624

DEMONCRAT : A DESIGN Methodology for the Conception of Robot with parallel Architecture
J. P. Merlet, INRIA Sophia Antipolis, France Vol. 3, p. 1630

Design of a 3-dof Parallel Translating Manipulator with U-P-U Joints Kinematic Chains
S. Leguay-Durand and C. Reboulet, ONERA - CERT - SUPAERO, Département d' Automatique, France Vol. 3, p. 1637

Space Robotics and Teleoperation

Teleoperation System of ETS-VII Robot Experiment Satellite
M. Oda and T. Doi, National Space Development Agency of Japan (NASDA), Japan - Toshiba Corporation, Japan Vol. 3, p. 1644

A General Formulation for Under-Actuated Manipulators
K. Yoshida, Department of Aeronautics and Space Engineering, Tohoku University, Japan Vol. 3, p. 1651

Local World Modeling for Teleoperation in a Nuclear Environment Using a Bayesian Multiple Hypothesis Tree

Teleoperation Experiment of Truss Structure on ETS-7 — Development of Flight Model and Ground Station—
K. Matsumoto and S. Wakabayashi, National Aerospace Laboratory, Japan Vol. 3, p. 1664
Applications: Construction

- Sticky and Slippery Collision Avoidance for Tele-Excavation

- Micro In-Pipe Mobile Machines by Making Use of an Electro-Rheological Fluid
  Y. Kondoh and S. Yokota, Tokyo Institute of Technology, Japan ........................................ Vol. 3, p. 1672

- Construction Manipulators of Steel Towers for the Transmission of Electricity

- A Wheeled Multijoint Robot for Autonomous Sewer Inspection
  W. Ilg, K. Berns, S. Cordes, M. Eberl and R. Dillmann, Research Center for Computer Science at the University of Karlsruhe, Germany ........................................ Vol. 3, p. 1687

Obstacle Detection and Avoidance

- Real-Time Collision Avoidance for 7-DOF Arms
  H. Seraji, B. Bon and R. Steele, California Institute of Technology, Jet Propulsion Laboratory - USA ........................................ Vol. 3, p. 1694

- A Geometrical Bounded Method for the On-Line Obstacle Avoidance of Redundant Manipulators
  R. Mayorga, University of Waterloo, USA ........................................ Vol. 3, p. 1700

- Neuro-Fuzzy Expert System E_S_CO_V for the Obstacle Avoidance of Intelligent Autonomous Vehicles (IAV)

- Efficient Dynamic Collision Detection using Expanded Geometry Models
  B. Baginski, Fakultät für Informatik Technische, Universität München, Germany ........................................ Vol. 3, p. 1714

Environment Modelling

- Map Building with Radar and Motion Sensors for Automated highway Vehicle Navigation
  K. Kimoto and C. Thorpe, Kyoto University, Japan - Carnegie Mellon University, USA ........................................ Vol. 3, p. 1721

- Detecting Changes in a Dynamic Environment for Updating its Maps by Using a Mobile Robot
  H. Zha, K. Tanaka and T. Hasegawa, Kyushu University, Japan ........................................ Vol. 3, p. 1729

- A Sensor Failure Detection Framework for Autonomous Mobile Robots
  M. Soika, Siemens AG, Germany ........................................ Vol. 3, p. 1735

- Place Learning and Recognition using Hidden Markov Models
  O. Aycard, F. Charpillet, D. Fohr and J. F. Mari, CNRS-CNRS / INRIA-Lorraine ........................................ Vol. 3, p. 1741

Cooperative Motion Control of Multiple Mobile Robots

- Estimating the Center of Gravity of an Object Using Tilting by Multiple Mobile Robots

- Cooperative Transport System with Regrasping Car-like Mobile Robots
  N. Miyata, J. Ota, Y. Aiyama, J. Sasaki and T. Arai, Dept. of Precision Machinery Engineering, Graduate School of Engineering, The University of Tokyo, Japan ........................................ Vol. 3, p. 1754

- Adaptive Behavior Acquisition of Collision Avoidance among Multiple Autonomous Mobile Robots
  Y. Arai, T. Fujii, H. Asama, Y. Katoaka, H. Katsu, A. Matsumoto and I. Endo, Saitama University, Japan - The Institute of Physical and Chemical Research (RIKEN), Japan - Toyo University, Japan ........................................ Vol. 3, p. 1762
Information Sharing among Multiple Robots for Cooperation in Cellular Robotic System
A. Cai, T. Fukada and F. Arai, Nagoya University, Japan ................................................................. Vol. 3, p. 1768

Redundant Manipulators

• Real-Time Control for a Serpentine Manipulator
  K. Glass, R. Colbaugh and H. Seraji, Department of Mechanical Engineering, New Mexico State University, USA - Jet Propulsion Laboratory, California Institute of Technology, USA .............................................................. Vol. 3, p. 1775

• Disturbance Observer based Motion Control of Redundant Manipulators Using Weighted Decomposition

• Obstacle Avoidance for Kinematically Redundant Robots Using Distance Algorithm

• Design Concept and Ondulatory Motion Mode of a Modular Snake-Like Robot
  L. Jammes, Y. Kyodo, M. Hiraki and S. Ozono, Dept. of Precision Machinery Eng., Faculty of Engineering, The University of Tokyo, Japan - Tsukuba University, Japan ................................................................. Vol. 3, p. 1794

Telerobotics

• A Prototype of Standard Teleoperation Systems on an Enhanced VRML

• Semantics and Implementation of a Language for Telerobotics
  E. Le Rest, J. L. Fleureau and L. MarcC, Equipe LIMI Université de Bretagne Occidentale, France - Dpt. EIA, ENSIETA, Brest, France ................................................................. Vol. 3, p. 1807

• EVEREST: A Virtual Reality Interface to Program a Teleoperated Mission
  Y. Masson and R. Fournier, CENCEREM, Laboratoire de téléopération, France ................................ Vol. 3, p. 1813

• The Hidden Robot Concept: High Level Abstraction Teleoperation

Applications: Forestry and Agriculture

• A Computer-Based Training Environment for Forestry Telemanipulation

• On the Modeling and Control of an Experimental Harvester Machine Manipulator
  E. Papadopoulos, R. Frenette, B. Mu and Y. Gonthier, Department of Mechanical Engineering & Centre for Intelligent Machines, McGill University, Canada - Centre de Recherche Informatique de Montréal, Canada ................................................................. Vol. 3, p. 1832

• Vision-Based Perception for an Automated Harvester
  M. Ollis and A. Stentz, Robotic Institute, Carnegie Mellon University, USA ................................................................. Vol. 3, p. 1838

• Recent Results in the Grading of Vegetative Cuttings Using Computer Vision
  S. Singh and M. Montemerlo, Field Robotics Center, Robotics Institute, Carnegie Mellon University, USA ................................................................. Vol. 3, p. 1845