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Proceedings

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Welcome Note from the Conference Chairman

I would like to extend a warm welcome to all participants in this year's International Conference on Robotics and Automation, ICRA99. This conference carries the distinction of being held in Detroit, the heart of the automotive industry in America. It ascertains the strong bond between R&D in academia and research laboratories, and the practice of robotics in industry.

More than any time in the history of this technology, this is an era for effective exchange of information and ideas between the two entities. ICRA99 provides a unique chance for industry engineers to meet with and exploit the minds of some of the most prominent researchers in the world. Reciprocally, this is an unequaled opportunity for researchers to pick the brains of industry practitioners seeking ideas for problems to solve through research, and avenues for industry support.

Only at ICRA conferences is there such a gathering of prominent robotics researchers in one place. This is particularly obvious this year; look up the names, affiliations, and topics of the presentations and you will recognize the wealth of information that will be presented at the conference. The panel sessions explore the frontiers of robotics research while the Banquet speaker Dr. Gustaf Olling of DaimlerChrysler symbolizes the renaissance of the American automotive industry through robotic and information technologies.

Detroit is experiencing a spectacular revival. After decades of relative dormancy, Greater Detroit is now bustling with activity, social, cultural, professional and economic. You are invited to participate in the many cultural and industrial tours available through the conference to see the new Detroit. Across the Detroit River, in Windsor, there is another country and a different culture.

This is a conference organized and managed by volunteers who deserve special thanks. Much hard work and sleepless nights have gone into making this conference a reality. Please let them know that we all appreciate their efforts.

Welcome and please enjoy this great conference.

Hadi Akeel
General Chairman

Foreword

The 1999 IEEE International Conference on Robotics and Automation (ICRA99) has two unique features. First, the conference is held in the final year of the 20th century which has witnessed the dramatic growth of information technology in recent years. The conference therefore emphasizes the robotics and automation technologies for the next century with integration of information. This leads to the theme of the conference as **Mega-Information Integration for Robotics and Automation in the 21st Century.** Secondly, the conference is held in Detroit, Michigan, the international center for automobile manufacturing which has a constant need of new robotics and automation technologies and enables the conference to attract many industry practitioners, while traditionally most ICRA participants are academicians. In addition, ICRA99 overlaps the annual Robotics Industries Association (RIA) Robot Show and Conference which is held in Cobo Hall, a walking distance from the conference hotel. This overlap further symbolizes the cooperation between academia and industry.

Eight-hundred thirty-five papers covering a wide scope of robotics and automation were submitted to the conference. The Program Committee had a very difficult time to select 521 papers for inclusion in the conference proceedings. While selecting the papers, the Program Committee focused on quality, and broad coverage of the areas as stressed by the conference theme. We regret that many good papers were not selected by the Program Committee because of the limited space. The conference program also includes 5 tutorials and 9 workshops, 3 video sessions, 2 plenary sessions, and a banquet speech. These supplementary programs further enhance the theme of the conference.

I am grateful for the assistance of Peggy Gerds of the Department of Electrical Engineering at The Ohio State University in handling the submitted papers and responses with the authors, and in sending thousands of email messages and letters. I also like to extend my sincere thanks to the General Chair Hadi Akeel, and other members of the Organizing Committee: Michael Bridges, Nikolaos Papanikolopoulos, T.J. Tarn, Rajiv Dubey, Daniel Koditschek, Elsayed Orady, Gary Rutledge, Guy Potok, Jianming Tao, Jason Tsai, Bruno Siciliano and Shin'ichi Yuta as well as the Program Committee members, Local Arrangements Committee members, and Video Proceedings Committee members. Special thanks should go to C.S. George Lee for assisting the publication of the Advance and Final Programs.

Finally we should thank all the authors and participants of the conference. Without them, there will not be a successful ICRA99.

Yuan F. Zheng
Program Chair

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1999 IEEE International Conference on Robotics and Automation
Technical Sessions Schedule

May 12, 1999

8:15-8:30	OPENING CEREMONY												
WAI 8:30-10:10	PLENARY SESSION: Intelligent Transportation												
	1	2	3	4	5	6	7	8	9	10	11	12	13
WAII 10:35-12:15	Mobile Robot Maneuvering	Navigation in Unknown Environment	Biped Robot I	Underwater Vehicles	Robot Planni. & Program. for Assembly	Discrete Even. Control of Manu. Syst.	Motion Planning I	Robot Control I	Actuator	Teleop. I Force & Pos. Control	Contact and Grasping Control	Visual Servo Control I	Tactile Sensing
WPI 1:30-3:10	Mobile Robots and Applications	Sensor Based Navigation	Biped Robot II	Underwater Robotics: Sensing, etc.	Flexible Manipulator I	Task Scheduling	Motion Planning II	Robot Control II	Actuators and Joint Actuation	Teleop. II Sensor Based Teleopera.	Contact Geometry	Visual Servo Control II	Sonar Based Sensing
WPII 3:35-5:15	Mobile Robot Environment Interaction	Mobile Robot Motion Planning I	Biology-Inspired Methods	Service and Underwater Robots	Flexible Manipulator II	Manufactur. Planning and Scheduling	Constraint & Nonholono. Systems	Robot Control III	Fault Tolerant Robot	Parallel Manipulators	Dexterous Manipulation	Computer Vision in Manufactu.	Contact Sensing

May 13, 1999

TAI 8:30-10:10	PLENARY SESSION: Robot Art												
	1	2	3	4	5	6	7	8	9	10	11	12	13
TAII 10:35-12:15	Mobile Robot Field Applications	Mobile Robot Motion Planning II	Humanoid and Walk. Robots	New Robotic Technol. & Applications	Flexible Robots	Manufactu. Process Control	Control Architectures	Fuzzy Control I	Study of Robot Kinematics	Multiple Manipulator	Grasping Analysis	New Geometry Method in Comp. Vision.	Robotic Sensing & Its Applications
TPI 1:30-3:10	Mobile Robot Localization I	Mobile Robot Motion Planning III	Legged Locomotion I	Space Robots	Calibrat. and Tolerances	Production Planning and Control	Force Control	Fuzzy Control II	Kinematics	Cooperative Robots	Fixture Desi. and Manipu. Planning	Calibration-Free Visual Servo	Sensing and Sensor Design
TPII 3:35-5:15	Mobile Robot Localization II	Mobile Robot Motion Planning IV	Legged Locomotion II	Medical Robotics I	Calibrat. and Friction Modeling	Process Planning and Manufactu.	Impedance Control	Robot Control IV	Distance and Contact Calculations	Teleop. III Experiments and Control	Grasping Computation	Real-Time Computer Vision	Sensor Fusion I
6:30	Conference Banquet - Banquet Speech - Dr. Gustav Olling, Daimler Chrysler Corp. "CAD/CAM/CAE Applications"												

Note: There are three video sessions on May 13, 1999: TAII-VS 10:35-12:15: Video Session I; TPI-VS 1:30-3:10: Video Session II; TPII-VS 3:35-5:15: Video Session III.

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WPI-11
CONTACT GEOMETRY

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