



ROBOTICS AND AUTOMATION

Volume 4, Number 2 Spring 1990

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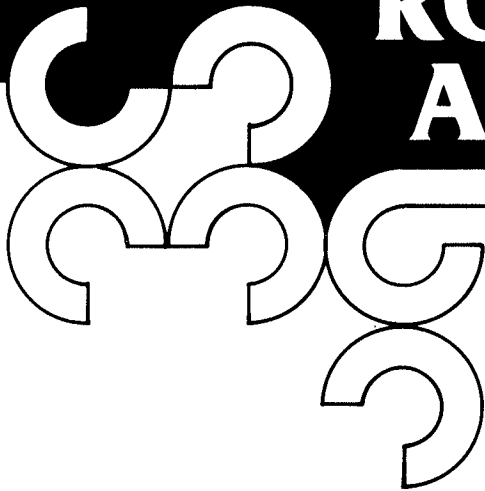
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ROBOTICS AND AUTOMATION



Sponsored by the IEEE Robotics and Automation Society

General Chairperson: **R. A. Volz**, Texas A&M University

Program Chairperson: **A.J. Kolvo**, Purdue University

Treasurer and
Coordinator:

Harry Hayman

Local Arrangements: **E.L. Hall**, University of Cincinnati

May 13-18, 1990

**The Hyatt Regency Cincinnati
Cincinnati, Ohio**

The theme of this conference is "Intelligent Automation and Robotics" with emphasis on information technology for sensor-based systems. Original basic and applied papers in all areas of automation and robotics are solicited. Special topics include but are not limited to the following:

- Automation systems: design, planning, modeling, evaluation, and optimization. Structural and geometric representation and reasoning.
- Flexible manufacturing systems: planning, scheduling, simulation and design for assembly.
- Artificial intelligence, knowledge management and expert systems for intelligent automation and robotics.
- Intelligent robot systems and their applications.
- Robot sensing: vision, touch, range, force. Information technology for sensors. Integration of multisensory information.
- Teleoperated and autonomous robots. Coordinated multiple robotic systems.
- Mobile robots: design, planning, navigation and applications.
- Micro electro-mechanical devices and systems.
- Applications of automation and robotics to industry, space, underwater, construction, medicine, hostile environment.

Reviews will be conducted by a program committee of established robotics researchers. Invited sessions will be entertained, but their papers will be reviewed by the normal process.

Authors will be notified of acceptance and furnished with an author's kit by January 15, 1990. Final papers received by the deadline will be included in the proceedings available at the conference.

The conference hosts workshops and tours on Sunday, May 13, and Friday, May 18, 1990, and tutorials on Monday, May 14. Conference sessions will be held on Tuesday, May 15 to Thursday, May 17, 1990.

Announcing the Anton Philips Award for Best Student Paper

A \$1000 prize will be awarded for the best paper offered by a graduate student. To be eligible, the student (1) must be first author and primary developer of the paper's ideas, (2) must have student status in June 1989 and (3) must be a member of the IEEE. Four copies of the paper, along with a nominating letter from the student's advisor and the student's IEEE membership number should be sent by October 16, 1989 to:

Anton Philips Award Committee
c/o A.J. Koivo, School of Electrical Engineering
Purdue University, West Lafayette, IN 47907



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IEEE

President's Message

Arthur C. Sanderson

I recently read that the AAAS, the publisher of *Science*, is planning to begin the publication of an all electronic journal. This new journal would "print" both reviewed articles and news items and disseminate them to subscribers through the major electronic computer networks. Their goal is to provide more current and more accessible information to a large population of the scientific community which increasingly relies upon electronic means of communication and information exchange.

Such trends which increase the rate at which information can be prepared and disseminated can be important to continue progress in rapidly changing technical fields. However, such trends also raise major challenges for us to manage and organize that information. The IEEE is currently reviewing their technical publishing activities and exploring ways to better serve the membership in this regard. Electronic publishing of journals is a high priority in this process, and an option for electronic submission of manuscripts for the *Robotics and Automation Transactions* may be possible as early as next year. With electronic publishing comes electronic storage of technical information, and enormous possibilities to provide more personalized access to technical information. Concepts for a personalized transactions or a customized conference proceedings are being investigated as a means to more efficiently meet users' needs.

The IEEE is evaluating alternative media for storage and presentation of technical information. In a current experiment, all the IEEE technical literature for 1989 is being placed on optical disks and disseminated to cooperating libraries. The move toward electronic storage, the incorporation of figures and graphics, and the extension to integrated video presentation of technical results, experiments, or lectures, opens up many new possibilities for effective communication.

In the field of robotics and automation, video presentation of experimental results and demonstrations is particularly effective and is increasingly used in our conference presentations and lectures. I am currently exploring a proposal to develop a video conference pro-

ceeding for our annual conference. The video conference proceedings would consist of a set of 3-5 minute video tapes of technical results, experiments, and demonstrations in the field of robotics and automation. Video-tapes would be submitted for consideration in parallel with submission of the papers for the conference. The tapes would be reviewed by a video program committee who would make recommendations for acceptance. Criteria for review of the tapes might include the technical quality of the results presented, the clarity and organization of the presentation, and the effective use of the video medium to demonstrate new technical results, new mechanisms and new experimental findings. The videos selected by the program committee would be packaged into a single tape and made available for conference attendees and for subsequent purchase from the IEEE. I feel that this video proceedings could become a valuable addition to the activities of our annual conference, and would provide a continuing video archive of major research results in the field of robotics and automation.

I would be happy to receive your comments regarding these new directions in IEEE publishing activities and the ways in which the Robotics and Automation Society can be helpful in providing information in a form which is more useful. I would also invite your thoughts on the video conference proceedings, and if there is sufficient interest, we will announce plans for a trial implementation of this concept for the 1991 conference.

Coming Soon in the R&A Newsletter...

Among the features we are planning for the next few issues are a survey of R&A Research in Italy, and Robotics and Automation in the Mining Industry. If you would like to see your institute featured in the Newsletter, send us your contribution.

The Deadline for items to be included in the Summer issue of the newsletter is June 1. Submissions by e-mail (wes@ecelet.ncsu.edu) are appreciated, but should be accompanied by a hard copy via regular mail.

Cincinnati Previews: The 1990 IEEE International Conference on Robotics and Automation

*Prof. Richard Volz, Texas A&M University, Conference Chairman
and Prof. Antti Koivo, Purdue University, Program Chairman*

The IEEE Robotics and Automation Society will hold the 1990 IEEE International Conference on Robotics and Automation in the Hyatt Regency Cincinnati, Cincinnati, Ohio, May 13-18, 1990. The theme for the conference is "Intelligent Automation and Robotics."

Technical Program

The selected technical papers will be presented on Tuesday, Wednesday, and Thursday, May 15, 16, 17, 1990. The technical program consists of seven parallel tracks, with four sessions per track each day. Each session will have four 25 minute presentations of the contributed papers. Speakers will have an opportunity to show VHS videotapes during their presentations. Each day of the contributed sessions, May 15-17, will begin with a plenary talk. The banquet is scheduled on Wednesday evening, featuring **Dr. Dana Yoerger** of Woods Hole Oceanographic Institute.

Tutorials and Workshops

Preceding the Technical Program, the conference offers tutorials and workshops on Sunday, May 13, and Monday, May 14. Additionally, one workshop and one tutorial are scheduled for the post conference day, Friday, May 18.

The tutorials are

- "Modeling and Control of Automated Manufacturing Systems", Dr. A. Desrochers, Rensselaer Polytechnic Institute
- "Networking for Computer-Integrated Manufacturing", Dr. A. Ray, The Univ. of Texas at Arlington
- "Sensor Based Planning" Dr. R. A. Brooks, Massachusetts Institute of Technology and Dr. V. J. Lumelsky, Yale University.

The workshops are:

- "Constraints in Obstacle Avoidance, Parts Mating and Assembly Verification", Dr. J. McCarthy, Univ. of California, Irvine
- "Micro Electro-Mechanical Systems", Prof. T. Fukuda, Nagoya Univ. and Dr. W. Trimmer, AT&T Bell Labs
- "Intelligent Sensory Processing", Dr. R. Carnes, Boeing Computer Services, Dr. R.J.P. deFigueredo, Rice Univ., Dr. R. Moore, Gensym Corp., Dr. N. Scogin, Texas A&M Univ. and Dr. J. Sztipanovits, Vanderbilt Univ.
- "Strategic Directions in Computations Robotics: Symbolic, Algorithmic and Neuromorphic", Dr. C.E. Weisbin, Dr. J. Barhen, Dr. S.T. Venkataraman, and Dr. S. Gulati, Jet Propulsion Lab., and Dr. S.S. Iyengar, Louisiana State Univ.
- "Introduction to Neural Networks for Intelligent Systems", Dr. B. Bavarian, University of California Irvine.

Information for registration to the tutorials and workshops appears on the conference announcement.

Plenary Sessions

On the days of the Technical Program, each morning begins with a plenary session. The "eye-opener" sessions (8:00-8:45 a.m.) are:

- **Tuesday, May 15** Dr. K. Kurokawa, Chief Research Engineer, Fujitsu Corporation will speak on Quality and Innovation;
- **Wednesday, May 16** Dr. J. Alic, U.S. Office of Technology Assessment and Harvard Business

School will discuss U.S. Manufacturing: An Agenda for Competitiveness

- **Thursday, May 17** Dr. J. White, Director of Engineering Programs, National Science Foundation will talk on U.S. Competitiveness: An Automation Report Card.

Social Program

The Conference Committee is arranging a full schedule of social activities and social and professional tours in Cincinnati and the surrounding area. The current (and still subject to change) plans include the following:

Social Events and Sightseeing

- **Sunday:** Trip to Air Force Museum at Dayton
- **Monday evening:** No host cocktails - opening reception
- **Tuesday Evening:** Dinner, cruise and entertainment aboard a river boat. Cost: \$30.00. Be sure to make reservations in advance with Conference registration.
- **Wednesday evening:** Conference Banquet
- **Thursday evening:** Baseball game, Cincinnati Reds vs. St. Louis Cardinals

Professional Tours: Monday, May 14

- The Center for Robotics and Manufacturing at the University of Kentucky
- MAZAK Manufacturing and the Manufacturing Laboratory at Northern Kentucky University
- Cincinnati Milacron, Institute for Advanced Manufacturing Sciences and the Center for Robotics Research at the University of Cincinnati.

There will be a Conference Hospitality Desk where people may sign up for both sightseeing and professional tours and obtain information about other tours and local activities.

Transportation

Delta Air Lines, Inc., is offering special rates which afford a 5% discount off Delta's published special round-trip fares within the United States and San Juan, providing all rules and conditions are met. If special fares

do not coincide with your travel dates, a 40% discount off Delta's unrestricted round-trip coach fares will be offered.

Jetport Express will operate shuttle busses every 30 minutes from 5:30 a.m. until 11:30 p.m.. The one-way rate is \$8.00; however, a special \$10.00 roundtrip rate is available if you identify yourself as being with the Conference.

The Selection Process

Antti Koivo

722 papers were contributed from 31 different countries. Of these, 336 were accepted, about a 15% increase over the number of papers presented in last year's conference. This represents about a 46% acceptance rate. These papers were selected by the Technical Program Committee (TPC) at a meeting held January 6-7 in Indianapolis.

Prior to the TPC meeting, at least two outside reviews were obtained on each paper. TPC members were encouraged to cover the authors' names and affiliations so as to minimize a possible bias in the review process. At the TPC meeting, 2-4 persons discussed each paper, and made the decision whether or not to include the paper in the technical program.

The members of the TPC, themselves, submitted approximately 80 papers. The acceptance or rejection of these papers was decided by the general chairperson and the technical program chairperson with the help of the honorary referees, who were chosen from the past chairpersons of previous conferences.

'92 Conference Set for France

The 1992 IEEE International Conference on Robotics and Automation will be held the week of May 13, 1992 in Nice, France. This will be the first R&A Conference to take place in Europe.

General Chair will be Professor Giuseppe Menga, of the Technical University of Torino (Italy). Dr. George Giralt, Toulouse, France has agreed to be Program Chair. Dr. Giralt is Director of (LAAS), Laboratory for Automation and Analysis of Systems. More details will be published in the next newsletter.

From the IEEE Technical Activities Board

The IEEE Technical Activities Board is placing increased emphasis on international participation in IEEE activities. It is moving to hold more meetings outside of the U.S. with travel costs shared between TAB and the societies.

In this regard, TAB has approved the organization of a Region 9 (Central and South America) Colloquium to be held in September 1990. The arrangements are similar to the colloquium in Region 10 (Asia) in Fall 1989 where Art Sanderson and T.J. Tarn represented the R&A Society. It will combine TAB-related activities and technical presentations to local IEEE groups.

In the case of Robotics and Automation, the Region 9 organizers have requested lectures in industrial automation and manufacturing, both research and applications.

TAB has proposed a 1991 Colloquium to be held in Region 7 (Europe) and is interested in suggestions for the program and locations. A current proposal is to hold that meeting in Eastern Europe.

IEEE Society Presidents now have more power due to new TAB bylaw revisions which include the presidents in decision making positions.

Under the new structure, which went into effect in January, TAB consists of five Councils (Publication Products, Periodicals, Liaison, Technical Meetings, and

Administration). The TAB Administration Council is a new version of TAB OpCom, with five Society Presidents (elected by the Presidents' Forum) added as voting members, replacing the first year Division Directors, who are now non-voting members.

Two standing committees report directly to TAB: the Strategic Planning and Review Committee (SPRC), consisting of three past Directors and three past Society Presidents, and the Nomination and Appointments Committee (N&A), consisting of six Society Presidents elected by the Presidents' forum and six Division Directors elected by the Directors' Forum.

A plan to establish an IEEE e-mail node at Princeton University was approved by the IEEE Board of Directors in November 1989. When the node becomes operational in early 1990, it will receive and relay messages from IEEE volunteers and staff via several communications networks.

Jane Cullum, president of the Control Systems Society, chaired the task force which developed the plan.

Last year, Martha Sloan, the 1990 IEEE Executive Vice President, led an Institute-wide effort to create the first comprehensive member-opinion survey for all IEEE members. The survey was approved in November 1989 and has been mailed to the membership. The survey results should be available by July 1990.

R&A e-mail Addresses

Name	Institution	e-mail	FAX
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Carnegie-Mellon University: The Robotics Institute

The Robotics Institute of Carnegie Mellon University is entering its second decade of research and education. The Institute was founded in 1980 to conduct research in robotic technologies relevant to industrial problems and to facilitate the adoption of the results of the research by industry. It now has an annual budget of \$12 million, which is provided by a combination of governmental and industrial sponsorship. **Dr. Raj Reddy** and **Dr. Takao Kanade** are co-directors of the Institute.

Research Centers

Three program "Centers" coordinate related research activities within the Institute. A fourth center's mission is to facilitate interaction with industry and technology transfer of the research results of the other centers.

- *The Center for Integrated Manufacturing Decision Systems*, Dr. Mark Fox, Director. Ongoing activities include research in intelligent decision systems for engineering and manufacturing problem solving. Research domains include sensor-based robots, flexible manufacturing, and knowledge-based systems. Laboratories within the Center include:
 - Design Laboratory
 - Production Planner Laboratory
 - Rapid Manufacturing Laboratory
 - Automated Factory Scheduling Laboratory
 - Manufacturing Logistics Laboratory
 - Automated Monitoring Laboratory
 - Integrated Manufacturing System Architecture Laboratory
- *The Vision and Autonomous System Center (VASC)*, Dr. Takao Kanade, Director. VASC includes laboratories and projects in computer vision, manipulation, mobile robots and other intelligent robot systems. Researchers are working to develop new robotics technology and to demonstrate it in integrated robot systems such as the Autonomous

Land Vehicle and Planetary Rover. Laboratories include:

- Advanced Manipulators Laboratory
- Calibrated Imaging Laboratory
- Intelligent Modeling Laboratory
- *The Field Robotics Center (FRC)*, Dr. William "Red" Whittaker, Director. In the FRC mobile, perceptive robots are developed for duty in unpredictable and sometimes hazardous or remote environments. Applications areas for field robots include nuclear maintenance and damage recovery, mining, excavation, undersea exploration, construction, hazardous waste reclamation, and the military.

Programs within the FRC are designed to meet the challenges of developing robots which can perform tasks in unpredictable and sometimes hazardous environments.

The broad research areas are *Mechatronics*, *Machine Intelligence*, and *Robot Synthesis*.

FRC accomplishments include the remote work systems that explored and remediated the basement of the crippled Three Mile Island reactor containment basement and the development, in conjunction with VASC, of the extraterrestrial explorer robot AMBLER, the world's largest land-based robot. A current project, under the direction of Dr. Pradeep Khosla, is the RMMS, (Reconfigurable Modular Manipulator System).

- *Manufacturing Engineering Technology Applications Center, (MITAC)* Dr. Halil Kulluk, director. MITAC was established in 1988 to transfer appropriate levels of computer-integrated manufacturing, robotics and expert system technologies to small and moderately-sized manufacturing industries. MITAC also focuses identifying work that is

at or near the prototype stage and effectively transferring it to industrial settings.

Several other laboratories operate within the Institute independently or jointly under two or more centers. These laboratories, and a contact person for each, are:

- *Intelligent Sensors Laboratory*, Mel Siegel
- *Inspection Laboratory*, Bob Thibadeau
- *Learning Robots Laboratory*, Tom Mitchell
- *Manipulation Laboratory*, Matthew Mason
- *Planetary Rover Project*, Chuck Thorpe
- *Mobile Robot Laboratory*, Hans Moravec
- *NavLab Project*, Chuck Thorpe
- *Robotic Welding Laboratory*, Fritz Prinz
- *Shape Deposition Laboratory*, Lee Weiss

A crucial part of the Robotics Institute is the **Industrial Affiliates Program** which permits affiliated companies access to research results and to maintain liaison with projects of interest to them. Levels of corporate sponsorship range from as little as \$5000 to multimillion dollar projects. For more information about the Robotics Institute and Industrial Affiliates program, contact Mr. Chris Locke, Director of Industrial Relations, (412)268-3826.

The Ph.D in Robotics

Carnegie-Mellon has established a graduate program leading to a Ph.D in Robotics. In the robotics program, faculty members in the CMU Robotics Institute have combined with faculty from across the University to define a curriculum. The Robotics Program is an interdisciplinary effort involving faculty from:

- The Robotics Institute
- Computer Science
- Electrical and Computer Engineering
- Mechanical Engineering
- Civil Engineering
- The Graduate School of Industrial Administration.

Students in the program complete a core qualifying course in Robotics and three other qualifiers in basic science. Beginning in the first semester of study, each student participates in a guided two-year research qualifier in one of the 15 laboratories in the Robotics Institute. The program culminates with the original research, written dissertation and public defense of a doctoral thesis.

Japanese MITI Plans \$Billion Multinational R&D Initiative

The Japanese Ministry of International Trade and Industry (MITI) has announced a 10-year, 150 million yen (\$1 billion) international research and development program aimed at revitalizing manufacturing industries in western nations and stemming the loss of talented workers to service industries.

University and other research organizations in Europe and the United States have been invited to submit proposals for participation in the initial phase of the **Intelligent Manufacturing Systems (IMS)** program. The initial deadline was February 28, but some late proposals may be considered.

According to a published report from the Comline News Service, Japan plans to provide 90 billion yen for the R&D budget (30 billion yen from the private sector and 60 billion by the government). MITI will ask the United States and European countries to provide the balance,

Plans for the ambitious program include setting up a major R&D center employing more than 50 researchers where much of the joint research would take place. The R&D Center would be located outside Japan, according to Mr. Kenzo Inagaki, deputy director of MITI's Machinery and Information Industries, in order to create a really international research environment and to avoid criticism that Japan was profiting unduly from the research.

The IMS program will concentrate on next-generation manufacturing technology, including production system architecture, information and communication technology, production control and processing equipment and technology, new materials application technology, and human factors.

Among the companies involved in the IMS initial planning stage are Fuji Electric, Kawasaki Heavy Industries, Mitsubishi Electric, Toyota Motor, and IBM-Japan.

For more information, contact: Mr. Tadao Tamura, International Robotics and Factory Automation Center (IROFA), 9th Fl., Daiichi Nakano Bldg., 2-6-10 Iwamoto-cho, Chiyoda-ku, Tokyo 101, Tel. 03-861-5601, FAX 03-861-5635.

Rehabilitation Robotics at Tufts-New England Medical Center

David M. Horowitz and Jeffrey M. Hausdorff

Robotics research in the Department of Rehabilitation Medicine at the Tufts-New England Medical Center has focused on applying robotic technology to assist individuals with severe disabilities in overcoming barriers to employment. The program has concentrated on four areas of research: (1) The development of a user-intuitive robot control language and user-interface; (2) Pre-vocational and educational applications of robotics; (3) Clinical evaluation and human performance studies on prescribing robotic manipulators for severely disabled individuals; and (4) A collaborative vocational placement model with the Massachusetts Project with Industry.

Robot Control Language and User Interface

Work on a real-time, object oriented, task level, robot control language and user interface was completed in order to provide individuals with quadriplegia with an appropriate set of tools to enhance their vocational competitiveness. A voice-controlled vocational robotic workstation was designed to suit the vocational needs of individuals who lack motor ability. Since the utility of the workstation depends, in part, on its ability to meet the changing needs of the user, modifications can easily be achieved under user command.

Several constraints have governed the research and development of the workstation: (1) Users should not be required to learn a complex robot programming language; (2) Users should be able to execute pre-defined tasks; (3) Users should be able to easily teach the robotic manipulator new tasks without relying upon engineering support; (4) The cost of the system must be reasonably contained; and (5) The system should manage the user's dialogue without the need of a natural language processing system.

The work station incorporates a Kurzweil voice recognition system (1,000 or 5,000 words), a Universal Machine Intelligence RTX robotic manipulator and an IBM compatible personal computer. An expert system was

implemented to manage the user's dialogue with the programmable robotic manipulator and speech recognizer. It decreases the burden associated with teaching new tasks and assists the user with developing a structured, object oriented vocabulary.

Pre-vocational and Educational Application of Robotics

Small, low cost robotic arms (Esched Scorbot ER-III) have been utilized in two long-term educational/clinical environments for evaluation. The physical limitations of a person can be partially overcome through the use of a mechanical arm that is under the person's control. The mechanical arm is flexible and can be accommodated to a number of different tasks. The two selected educational/clinical sites include the Campus School of Boston College in Chestnut Hill and the Massachusetts Hospital School in Canton. The students range in age from 5 to 23 years. Both schools provide comprehensive educational and vocational services. To date, the arm has been used for recreational activities as well as pre-vocational training. Students have learned to manipulate objects in their environment. Technological barriers and a lack of appropriate vocational and social training have prevented successful vocational placement.

Clinical Evaluation and Human Performance Studies

As part of the overall program to provide supported employment services to severely physically disabled individuals with a robotic workstation, there was a need to develop more reliable protocols for client evaluation and better quantitative techniques for the assessment of human productivity with the aid of a robotic manipulator.

Using a multi-disciplinary team approach, referred individuals are evaluated with respect to medical, physical, psychological and vocational status. Individuals enroll in a preliminary training process in which they obtain limited experience in using the voice-controlled

Call for Papers

Special Section on New Actuators for Robotics and Automation

The *IEEE Transactions on Robotics and Automation* plans to publish a "Special Section", consisting of 6-8 papers, on New Actuators for Robotics and Automation in mid-1991. The Special Section may include papers covering both theoretical and experimental studies on novel actuators and actuation techniques.

Actuation is increasingly recognized as a significant limitation for robot and automation design. For example, the deficiencies of current actuators have retarded the development of high performance robot arms. Similarly, the development of dexterous end-effectors has been even more significantly affected by the lack of compact, lightweight and easily controllable actuators. New direct-drive actuators for articulated end effectors would alleviate the problems of friction, backlash and other nonlinear effects associated with power transmission through gearings or tendons.

A solution to the problem of developing new actuators could derive from current research on innovative electric, pneumatic and hydraulic actuators, as well as on a number of more exotic transducing materials. Other important fields of investigation are mechanical design and control techniques aimed at optimal use of new actuator properties. An attractive approach is also represented by "mechatronics", i.e. the integration of actuator and control in the same structure.

Possible topics for papers submitted for the Special Section include, but are not limited to:

- Innovative Electric, Pneumatic and Hydraulic Actuators;
- Direct Drive DC Motors;
- Ultrasonic Motors;
- Shape Memory Alloy Actuators;
- Electrostatic Motors;
- Piezoelectric Motors;
- Mechanochemical Motors;
- Metal Hydrides Motors;
- Mechatronic Devices;
- Design and Control of Novel Mechanisms for Optimal Use of New Actuators;
- Control Techniques for New Actuators.

The Guest Editors for the Special Section are:

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Six copies of papers submitted for possible inclusion in the Special Section should be sent to the Editor of the *Transactions* by 1 June 1990, and should be clearly marked as being intended for possible inclusion in the Special Section. They will be assigned an appropriate log number and forwarded to the Guest Editors for review. In accord with our usual policy, final decisions on acceptance or rejection of papers and selection of papers for the Special Section will be made by the *Transactions* Associate Editors and Editor, in consultation with the Guest Editors. Papers accepted for publication in the *Transactions* but not selected for the Special Section will be treated as regularly submitted items; i.e., they will be scheduled for publication as soon as the "packages" for them are complete.

Calendar

- **April 16-20** Applications of Artificial Intelligence VIII. Orlando FL. Sponsors: SPIE in cooperation with IEEE Computer and Systems Man & Cybernetics Societies.
- **May 7-9** 40th IEEE Vehicular Technology Conference. Orlando, Florida. *Contact:* IEEE VTC '90, Winter Park PL 32790-1317, (407)-629-5712.
- **May 13-18** IEEE International Conference on Robotics & Automation. Cincinnati, Ohio. Sponsor: IEEE Robotics & Automation Society *See Announcement*.
- **May 21-23** International Conference on Computer Integrated Manufacturing. Troy NY. Sponsor: Rensselaer Polytechnic Inst..
- **May 29-31** IEEE International Workshop on Advanced Motion Control. Yokohama Japan. *Contact:* Prof. Kouhei Ohnishi, Dept. Electrical Engineering, Keio University, 3-14-1 Hiyoshi, Kohoku, Yokohama, 223 Japan, Tel: 81-44-63-1141, FAX 81-44-63-3421.
- **June 3-6** 3rd Annual IEEE Symposium on Computer-Based Medical Systems. Chapel Hill, NC. *Contact:* Division of Continuing Education, CB#3420 Abernethy Hall, Univ. of North Carolina, Chapel Hill, Chapel Hill NC 27599-3420. Registration: Betty Kompst, (919)962-1106, Program: James Brown, (919)541-6994, Exhibits: Jill Hallenbeck, (919)541-7413.
- **June 3-6** 3rd National Conference on Robotics. Melbourne AUSTRALIA. Australian Robot Association,
- **June 14-15** 1990 Int. Conf. on Rehabilitation Robotics, Alfred I. duPont Inst. of the Nemours Foundation, *Contact:* Michael L. Gilbert, Dept. of Medical Education, Alfred I. duPont Inst., PO Box 269, Wilmington DE 19899 (302)651-6752.
- **June 21-22** IEEE International Workshop on Intelligent Robots and Systems. Tsuchiura JAPAN. *Contact:* Dr. Tatsuo Gotoh, Mechanical Engineering Research Laboratory, Hitachi Ltd., 502

Kandatsu-machi, Tsuchiura-shi, Ibaraki-ken, 300 JAPAN.

- **June 25-27, 1990** Remotely Operated Vehicle Conference, ROV '90. Vancouver (CANADA) Trade and Convention Centre. *Contact:* J. S. Collins, Dept. of Electrical and Computer Engineering, University of Victoria, Victoria, B.C., Canada, (604)721-8684 or Fax: (604)721-8676
- **July 4-6** 1st International Conference on Automation Technology. Taipei Taiwan ROC. Sponsor: China Society of Industrial Automation & Automated Industries *Contact* Yung-Chun Wu, Control Engineering Dept., National Chiao Tung University, Hsinchu, Taiwan, ROC, Tel (035)712121 ext 2301, FAX (035)715544.
- **July 9-11** Japan-USA Symposium on Flexible Automation. Kyoto JAPAN. Sponsor: Instit. of Systems, Control, and Information Engineers and American Society of Mechanical Engineers, *Contact:* ISCE, Yoshida-Kawaharacho 14, Sakyo-ku, Kyoto 606 JAPAN, FAX 075-751-6037 or ASME, 345 47th St., New York, NY 10017.

The Calendar concludes on back cover

LETTERS

An Open Apology

It has been pointed out to me that in the call for papers for the IEEE International Workshop on Intelligent Motion Control, to be held in Istanbul Aug. 20-22, 1990, no technical chairperson has been allocated to more than 30% of the world, including Australia, Central and South America, New Zealand etc. I, on behalf of everybody in the organization committee, hereby apologize to everybody concerned, especially to Dr. C.G. Macnish of Cambridge University, U.K., for not explicitly stating these parts of the world. It was intended that prospective authors from countries not specifically mentioned should apply to the General Chairman, i.e., myself. However, this was not at all clear. I therefore apologize for the slip-up, thank Dr. Macnish for pointing it out to me, and assure everybody that there was no "prejudice" intended.

*Okay Kaynak
Chairman of the Workshop*



CALL FOR PAPERS

Thirteenth IASTED International Symposium

ROBOTICS AND MANUFACTURING

November 13-15, 1990
Santa Barbara, California, U.S.A

SPONSORED BY

The International Association of Science and Technology for Development - IASTED
Technical Committee on Robotics
Technical Committee on Control

LOCATION

Sheraton Santa Barbara, California, U.S.A.

The Sheraton Santa Barbara overlooks the beautiful Pacific Ocean and the palm-lined beaches of the California coast. Santa Barbara has a year-round mild climate.

SCOPE

This conference is intended as a forum for presenting new results and developments in the areas of robotics and manufacturing. Topics to be covered include:

- Systems
- Modelling
- Simulation
- Dynamics
- Stability
- Design
- Control
- Algorithms
- Multilevel control
- Computer-aided design
- Robot-computer interface
- Software
- Programming languages
- Knowledge-based systems
- Supervision
- Industrial robots
- Arms
- Wrists
- Hands
- Vision
- Hand/eye coordination
- Remote-controlled robots
- Mobile robots
- Economic systems
- Safety
- Reliability
- Human factors
- Management
- Artificial intelligence
- Bionics and robots
- Multi-robot systems
- Image processing
- Pattern recognition
- Object recognition
- Scene analysis
- Speech analysis and synthesis
- Controllers
- Actuators
- Teleoperators
- Sensors
- Visual
- Tactile
- Sonar
- Others
- Trends
- Social implications
- Flexible manufacturing
- Computer-integrated manufacturing
- Intelligent manufacturing
- Production scheduling
- Expert systems
- Knowledge-based systems
- CAD/CAM/CAT
- Neural networks
- Applications, all fields
 - Welding
 - Painting
 - Assembly
 - Material handling
 - Feeding mechanisms
 - Automatic inspection
 - Mining
 - Exploration
 - Security
 - Manufacturing
 - Biomedical
 - Others

SUBMISSION OF PAPERS

Three copies of the papers (maximum 12 double-spaced pages including figures) should be received by **June 1, 1990** for review by the International Program Committee. Please indicate the area of the paper. Authors are also expected to assist with the review process by reviewing a maximum of two papers. Notification of acceptance and the author's kit will be mailed by **August 1, 1990**. The final manuscripts are to be received at the conference for publication in the proceedings. Papers to be considered for review in the **IASTED International Journal of Robotics and Automation** are to be sent separately to the Editor, Professor T.C. Hsia, Department of Electrical Engineering and Computer Science, University of California, Davis, CA 95616 U.S.A.

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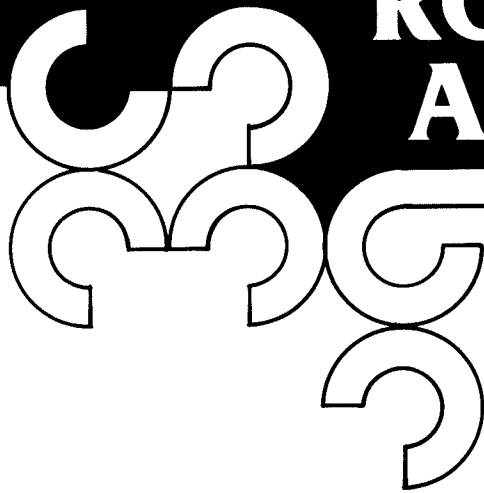
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ADDRESS

For submission of papers write to: The Secretary, Robotics and Manufacturing, P.O.Box 25, Station G, Calgary, Alberta, Canada T3A 2G1. Telephone (403) 270-3616. Fax (403) 270-8855.

ROBOTICS AND AUTOMATION



April 7-12, 1991
Hyatt Regency Sacramento
Sacramento, California

Sponsored by the IEEE Robotics and Automation Society

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CALL FOR PAPERS

The theme of this conference is "Automation and Manufacturing in the 90's" with emphasis on information technology for sensor-based systems. Original basic and applied papers in all areas of automation and robotics are solicited. Special topics include but are not limited to the following:

- Automation systems: design, planning, modeling, evaluation, and optimization. Structural and geometric representation and reasoning.
- Flexible manufacturing systems: planning, scheduling, simulation and design for assembly.
- Artificial intelligence, knowledge management and expert systems for intelligent automation and robotics.
- Intelligent robot systems and their applications.
- Robot sensing: vision, touch, range, force. Information technology for sensors. Integration of multisensory information.
- Teleoperated and autonomous robots. Coordinated multiple robotic systems.
- Mobile robots: design, planning, navigation and applications.
- Micro electro-mechanical devices and systems.
- Applications of automation and robotics to industry, space, underwater, construction, medicine, hostile environment.

Submission of non-commercial papers from representatives of industry, universities, research institutions, and government is encouraged.

PER SUBMISSION: Four copies of papers should be sent by September 16, 1990 to:

T.J. Tam, Systems Science and Mathematics
 Campus Box 1040, Washington University,
 St. Louis, MO 63130

Reviews will be conducted by a program committee of established researchers. The program committee is also soliciting proposals for invited sessions. The program committee particularly encourages cohesive sessions focusing on new emerging areas and sessions created around theme problems. Such sessions proposals will have priority over those of a classical or mainstream flavor. Proposals should be submitted by September 16, 1990, to the program chairperson, Professor T.J. Tam.

Authors will be notified of acceptance and furnished with an author's kit by January 3, 1991. Final papers received by the deadline will be included in the proceedings available at the conference.

The conference hosts workshops and tours on Sunday, April 7, and Friday, April 12, 1991, and tutorials on Monday, April 8. Conference sessions will be held on Tuesday, April 9 to Thursday, April 11, 1991. Prior to September 1, 1990 those with proposals for tutorials or workshops should contact: Dr. H. Stephanou, Department of Electrical & Computer Engineering, George Mason University, Fairfax, VA 22030.

Announcing the Anton Philips Award for Best Student Paper

A \$1000 prize will be awarded for the best paper offered by a graduate student. To be eligible, the student (1) must be first author and primary developer of the paper's ideas, (2) must have student status in June 1990 and (3) must be a member of the IEEE. Four copies of the paper, along with a nominating letter from the student's advisor and the student's IEEE membership number should be sent by September 16, 1990 to:

Anton Philips Award Committee
 c/o **T.J. Tam**, Systems Science and Mathematics
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IEEE

Calendar

Continued from p. 11

- **July 18-20** 3rd International Symposium on Robotics & Manufacturing. Vancouver BC CANADA. Sponsor: Simon Fraser University, Burnaby BC CANADA *Contact:* Prof. AA Goldenberg, Dept. Mechanical Engineering, Robotics & Automation Laboratory, University of Toronto, Toronto CANADA.
- **August 9-11** IEEE International Conference on Systems Engineering. Pittsburgh, PA, USA. Sponsors: IEEE, Wright State University, & Carnegie Mellon University. *Contact:* Belle Shenoi (813 873 3527) or Pradeep Khosla (412 268 5090).
- **August 15-17** 6th IASTED Int. Conf. on Expert Systems & Neural Networks. Honolulu, Hawaii. Sponsor: International Assoc. of Science & Technology for Development. *Contact:* ESNN, IASTED Secretariat, PO Box 25, Stn. G, Calgary, Alberta, CANADA, T3A 2G1. Tel:(403)270-3616. Fax:(403)270-8855.
- **August 20-22** IEEE International Conference on Intelligent Motion Control. Istanbul TURKEY. *Contact* Prof. M. Okyay Kaynak, Dept. Electronic and Electrical Engineering. *See Calls for papers*
- **Sept. 5-7** 5th IEEE Symposium on Intelligent Control. Philadelphia PA. Sponsor: IEEE Control Systems Society. *See Calls for Papers.*
- **Sept 18-21** International Conference on Automation, Robotics, and Computer Vision. Singapore. Sponsor: Nanyang Technological Institute. *See Calls for Papers.*
- **October 10-12** IASTED Int. Conf. on Adaptive Control and Signal Processing, New York NY. Sponsor: International Assoc. of Science & Technology for Development - IASTED. *Contact:* ACSP'90, PO Box 25, Stn. G, Calgary, Alberta CA T3A 2G1. Fax:(403) 270-8855. Tel (403)270-3616.
- **November 13-15** 13th IASTED Int. Symposium on Robotics and Manufacturing. Santa Barbara, CA. Sponsor: International Assoc. of Science & Technology for Development. *See Announcement.*
- **April 7-12 1991** IEEE International Conference on Robotics and Automation. Sacramento CA. Sponsor: IEEE Robotics and Automation Society. *See Announcement.*
- **June 24-28, 1991** INCANN-91 Int. Conf. on Neural Networks. Helsinki Finland. *See Calls for Papers*

IEEE Robotics & Automation Society



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