Newsletter of the IEEE Robotics & Automation Society

ROBOTICS AND AUTOMATION

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In This Issue

THE INSTITUTE OF ELECTRICAL
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IEEE

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THE INSTITUTE OF ELECTRICAL
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IEEE

President's Message

Norman C. Caplan
National Science Foundation

The 1991 IEEE International Conference on Robotics and Automation, one of the cornerstones of the Society's yearly program, was a major success. Not enough can be said about the effort expended, and the success achieved, by Professor T.C. Hsia, the General Chairman, and Professor T.J. Tarn, the Program Chairman. They and their excellent committees worked hard and made the 1991 Conference a resounding success. Over 700 attendees enjoyed the high quality program and the social events. It was truly an international conference with representatives from many countries in attendance, presenting papers that reflect the healthy mix of experimental and theoretical programs that concern engineering science and generic technology, in addition to specific applications. The ultimate goal is to create devices and machines that serve a useful purpose, and we strive for that goal by promoting cooperation and exchanging technical information. Our annual conference is one of the activities that the Society promotes to achieve that end.

The Administrative Committee (AdCom) met in Sacramento to consider additional activities and approve the expenditures of funds to benefit the membership. The AdCom meets twice a year and subcommittees (the publications board, technical committees, etc.) meet at other times and places to minimize travel costs. These people volunteer their time to represent the membership and help to make the society a high quality technical organization.

We welcome your comments, suggestions, and advice to insure an open process. Frequently, letters from the members of the Society are brought to the attention of the AdCom or one of the standing committees. I can't encourage you enough to become active, get involved, and help make the Society an open forum for the exchange of ideas, above and beyond the technical information we are all so familiar with. Contact any member of the AdCom, or the Executive Committee, including your President. We will be happy to interact with you or provide more information. One of my goals as Society President is to broaden the Society's activities and membership participation. I also want to see more industry participation and more interaction with the product end of the research and development spectrum.

Let me share with you some of the decisions made by the AdCom, at their meeting in Sacramento, that will ultimately contribute to the society's goals. The budget for this newsletter was increased to permit expanded coverage of new items with a goal of expanding to a full news magazine. Incidently, this Newsletter is another excellent method of participation in areas of society interest. Send your contributions to the Editor at the address listed herein.

Another issue, involving sponsorship of a new journal devoted to technical characteristics and research associated with Micro Electro Mechanical Systems was approved. The MEMS Journal is a joint project publication of ASME and IEEE with financial support from our society and other participating societies. The MEMS area is one of the newest and most exciting fields of robotics, with applications ranging from space to robot surgery.

Space limitations prevent me from going into more details of the AdCom meeting, except to report on the future conference locations. As you know, the 1992 Robotics and Automation Conference is going to be held in Nice, France. This is our first time out of the United States and we are looking forward to a unique experience. Details are given elsewhere in this letter. The 1993 Conference will be held in Atlanta, Georgia. The 1994 Conference site has not been agreed upon. Proposals from responsible individuals will be considered. The 1995 Conference has been voted on after receiving a proposal from Prof. Toshio Fukuda of Nagoya University to host the conference in Japan. The 1995 Conference will be held in Japan with Prof. Fukuda as General Chair. We encourage and welcome proposals for future conferences and want more participation from a broader segment of the membership.

This is your Society. Get involved.

From the Editor

Michael B. Leahy
Air Force Institute of Technology

Welcome to the summer issue of the Society newsletter. Spring is a busy time for the society and we have several articles to bring you up to date on the recent Adcom meeting and the activities at our recently completed annual international conference on roboties and automation. I enjoyed visiting with many of you at the conference on both a technical and personal level. The panel discussions I attended on the relationship between industry and academia and future directions in robotics education were well attended and informative. I think we can look forward to similar forums in the future. Another new conference staple is the video proceedings. If you haven't already purchased a copy use the ad in this issue to order one.

Are you ready for France in '92? If not, reading Dr. Menga's invitation letter will change your mind. A brief article on the 93 conference in Atlanta GA is also included in this issue along with instructions for submitting a bid to host the event in North America in 1994. The 1995 conference venue will be Japan.

Just skimming the abstracts in the conference proceedings highlights the diversity of the research in which we are engaged. The amount of breadth and depth, conference size, and paper quality for future conferences are points of discussion for the newly activated Technical Activities Board (TAB). As a member of the TAB board I strongly encourage you to inform me and the other board members of your opinion about the current and future technical direction of the Society. While passivity may be a hot topic for robot control we want you to become active members. Speak out and volunteer if you can.

During the Adcom meeting I received approval for a operating budget that allows the newsletter to expand to 32 pages an issue. While we don't plan on producing 32 pages for every issue next year, the increased size gives us the flexibility to better serve the membership. The goal of the newsletter staff is to provide you with the information necessary to be a more productive member of our society. How are we doing? What do you like about the current newsletter format? What new features would you like to see?

In the coming issues you will start to see more regular and special features. Our vice president for technical affairs, George Lee, talks about the formation of the TAB and its responsibilities and membership in the first of what will become a regular feature. A second new informational item will be a column on new book announcements. We will publish the title, author, publisher, and a concise synopsis of books recently published by society members. We are also investigating the idea of providing textbook reviews and will be increasing our collaboration with the Robotics Industries Association to keep you better informed about significant events in the industrial sector.

The added space also provides the opportunity to venture into more technical areas. The Newsletter will complement, not compete with the Transactions. We are not interested in becoming a secondary outlet for research papers. Our objective is to provide an outlet for describing applications and experimental facilities. We would like to become the place where new arrivals can learn about the history of robotics research and where new and old alike can develop a fundamental understanding of important discoveries through tutorial articles. The upcoming special issue on experimental facilities is an example of those efforts. If you have ideas for a special issue or want to share your perspective on the history of robotics research in your specialty area please contact Roz Snyder or myself.

Finally, don't forget to check out our regular columns. We have four laboratory reports, several new arrivals and people on the move, initial calls for papers for several IEEE conferences, and a large calender of events to peruse. Have a great summer, but remember to take time on a rainy day to keep those articles and suggestions flowing.

From Roz Snyder, Managing Editor

You can now send contributions to me on MacIntosh diskettes as well as via email (FrameMaker format preferred). I am moving in June with my computer, telephone, and fax machine (and family). Our new address is: 5630 Lakeside Drive, Pfafftown, North Carolina 27040; Tel or FAX: (919)922-1633; email: wes@mrips.bgsm.wfu.edu.

Adcom Notes

David E. Orin, The Ohio State University
R & A Society Secretary

The Administrative Committee met during the annual conference in Sacramento and conducted business of importance to the Society.

Professor T. J. Tarn, who has served as Vice President for Technical Affairs during the past two years, was elected to a second term as President of the Society and will take office for two years beginning January 1, 1992.

Congratulations go to *Professors T. C. (Steve) Hsia* and *T. J. Tarn* and their organizing committee for an excellent conference in Sacramento. Introduction of the Video Proceedings was one of the many highlights of the conference.

Philips Prize Finalists to receive Travel Grants to Nice

The AdCom voted to provide partial travel scholarships to attend the 1992 R&A Conference which will be held in Nice, France on May 10-15, 1992 to the finalists of the Best Student Paper Award. Students should plan now to submit a paper so that they can be candidates for this award and accompanying travel scholarship *(deadline -- September 20)*.

This will be the first time that our annual conference has been held in Europe. The General Chairman is *Professor Giuseppe Menga* and Program Chairman is *Dr. Georges Giralt.*

MEMS Transactions

A new *Transactions on Micro Electro Mechanical Systems (MEMS)* will appear in 1992. The Robotics & Automations Society is co-sponsoring the Transactions along with the IEEE Electron Devices Society and ASME.

George Lee elected Technical Affairs VP

The Society thanks *C. S. George Lee* who has served diligently as Secretary during the past three years. In his new job as Vice President for Technical Affairs, we will continue to receive his contributions within the Society.

The next meeting of the AdCom will be November 9, 1991 in Atlanta.

Call for Volunteers

IEEE-USA's Precollege Education Committee is in the process of establishing a discipline-based Volunteer Student Guidance Network and is looking for volunteers who are willing to serve as resource persons. If you enjoy counseling high school students and would be willing to answer an occasional request for career information in your particular area of experience, we need your help. Please contact **A. Hartfiel, IEEE-USA, 1828 L Street NW, Suite 1202, Washington DC 20036, Tel 202/785-0017**

TAB News

C. S. George Lee, Purdue University
V-P for Technical Affairs

I would like to keep you informed of recent technical activities since I became Vice-President for Technical Affairs.

•Formation of Technical Activities Board (TAB)

According to the Bylaws of the RAS, all the technical activities of the Society must be coordinated by the TAB. The members of the TAB are: Editor of Transactions (Dr. Russ Taylor), Editor of Newsletter (Dr. Mike Leahy), Chairman of Meetings Committee (Prof. Steve Hsia), Chairpersons of Technical Committees, and five appointed members (Professors Alan Desrochers, Toshio Fukuda, Dick Klafter, Art Sanderson, and Harry Stephanou). The TAB will be chaired by the V-P for Technical Affairs and shall meet twice a year.

• Restructuring of Technical Committees.

(a) The *International Committee* has become one of the Standing Committees with its chairmen intact.

(b) The *Future Direction of Robotics and Automation Technical Committee* has been dissolved because the future technical direction of R&A shall be handled by the newly formed TAB. Both Chairmen will be assigned to other Technical Committees.

(c) Several technical committees have been proposed, and the appointment of Chairpersons shall be approved by President-Elect, Professor T. J. Tarn. These technical committees are:

- •Computer-Aided Production System Technical Committee, *Dr. Debby Hoiffet*
- •Parallel/Distributed Computing Systems, *Dr. Amir Fijany*
- •Sensor Integration and Fusion, *Professor Ren Luo*
- •Manipulation, *Professor Matthew T. Mason*
- •Flexible Manipulators, *Dr. Alessandro De Luca*

• Current Tasks.

As a result of discussions in the AdCom meeting about our future conference direction, the TAB has been assigned a two-part task:

- present a report to the AdCom in the next meeting on the study of pros and cons of having two separate conferences, one on robotics and the other on automation;
- study the issues relating to quantity versus quality on the acceptance of submitted (and invited) papers for our future annual conferences.

If you have any opinion or suggestions/comments on the above issues relating to our future conference

Continued on next page

Call for Nominations for Election to the R&A Society

The Robotics and Automation Society currently has an 18-member Administrative Committee (AdCom) rotating on three-year terms. Beginning next year, we need to fill six vacant AdCom positions by election in early February. Professor Arthur C. Sanderson, Chairman of the Nominating Committee, is working closely with Dr. Norman Caplan, President of the Society, to come up with a slate of candidates for the six vacant AdCom positions.

I strongly urge anyone who is interested in the affairs of the Society to volunteer himself/herself. There are two channels to be nominated for election to the AdCom. As stated in the Society Bylaws, anyone can be nominated with petitions signed by twenty-five (25) or more members of the R&A Society. These petitions must be received by Professor Sanderson (Address: Electrical, Computer and Systems Engineering Dept., Rensselaer Polytechnic Institute, Troy, NY 12180-3590) or me (Address: Dept. of Electrical Engineering, The Ohio State University, Columbus, OH 43210) by **October 15**. It is also possible to be nominated through the Nominating Committee. Just send Professor Sanderson your updated short bio, resume, and your areas of expertise. Although the Nominating Committee may not be able to nominate everyone who volunteers to the AdCom, the Society has many appointed positions that may be able to use your talent and service.

David E. Orin
The Ohio State University
R & A Society Secretary

Proposals for1994 R&A Conference

Proposals are being accepted for the 1994 Conference which will be held in North America. If you are interested in making a proposal to the AdCom at its fall meeting, please contact **Professor T. C. (Steve) Hsia**, the Chairman of the Meetings Committee, or **President Norman Caplan.**

The AdCom has announced the following plans for the Robotics and Automation Conference for the years 1992-1995:

- **1992: Nice, France,** May 10-15, 1992; General Chair: Prof. Giuseppe Menga, Politecnico di Torino, Italy; Program Chair: Dr. Georges Giralt, LAAS, Toulouse -France
- **1993: Atlanta, Georgia (USA).** In 1983, Atlanta was the site of site of the first R&A Conference. General Chair: Prof. Wayne Book, Georgia Institute of Technology; Prof. John Luh, Clemson University, Program Chair.
- **1994:** ***OPEN.***
- **1995: Nagoya, Japan**. General Chair, Prof. Toshio Fukuda, Nagoya University.

TAB News (cont.)

direction, please direct your comments to any TAB member or myself. You may call me at (317) 494-1384 (EST), write or fax me (fax: (317) 494-6440), or send me e-mail (csglee@ecn.purdue.edu). If you are interested in chairing a technical committee in a specific area, please mail me: your brief biography, a one-page description of the area, including objective, field of interest, and how this TC will benefit our society members. The members of the TAB will decide on the formation of the technical committees.

Position Available

Johnson Endowed Chair in Robotics

College of Engineering
University of California, Riverside

The College of Engineering at the University of California, Riverside is initiating a nationwide search to attract an outstanding scholar for the Johnson Endowed Chair in Engineering. The College is emphasizing robotics and manufacturing and we wish to select a prominent leader in engineering who will have a major impact on a wide range of disciplines in the College. The general engineering area is Intelligent Machines, particularly in the area of robotics engineering and may involve conceptual structure, modeling, design and control of intelligent mechanisms with sensory perception. A candidate who is a generalist and can provide innovative inspiration rather than a specialist is preferred. Both applications and nominations are solicited.

The candidate for the Chair should have qualifications commensurate with the academic rank of full professor, in particular:

1)**Research Ability,** demonstrated by distinct contributions in areas such as Mechanisms, Sensory Perception and Intelligence;
2)**Scholarly knowledge,** demonstrated by competence to interact effectively with other institutions;
3)**Professional standing** at the level of Fellowship (or equivalent) in a major professional society;
4)**Commitment to teaching,** demonstrated by interest and the ability to provide high-quality instruction.

Please submit a resume and names of at least three individuals willing to write letters of reference by October 31, 1991 to

Chair of the Search Committee
Johnson Endowed Chair
College of Engineering
University of California
Riverside CA 92521-0425

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Introducing... New R&A Transactions Editors

Dr. Russell Taylor, Editor of the *IEEE Transactions on Robotics and Automation* is pleased to announce the appointment of a new Associate Editor, Dr. A.J. Koivo of Purdue University, and eight new Technical Editors: Prof. Peter K. Allen, Columbia University; Dr. Mike Erdmann, Carnegie Mellon University; Prof. A. C. Kak, Purdue University; Prof. Pradeep K. Khosla, Carnegie Mellon University; Prof. Kenneth Kreutz-Delgado, University of California; Dr. Bruno Siciliano - Universita delgli Studie di Napoli; Dr. Chuck Thorpe, Carnegie Mellon University; and Dr. Jean-Claude Latome.

Dr. Antti J. Koivo received the Ph.D. at Cornell University and is Professor of Electrical Engineering at Purdue University. His research interest is focused on the control of robotic systems with sensor feedback including cooperating multiple robots, and non-rigid link manipulators. He has previously served as a Technical Editor of the *IEEE Transactions on Robotics and Automation* and as guest co-editor of Special Issues of IEEE publications. He has been a program chair and member of organizing program committees of several national and international conferences on robotics and automation; he was the Technical Program Chair for the 1990 IEEE International Conference on Robotics and Automation.

Dr. Peter K. Allen is an Associate Professor of Computer Science at Columbia University. He received the A.B. degree in Mathematics-Economics from Brown University, the M.S. in Computer Science from the University of Oregon and the Ph.D. in Computer Science from the University of Pennsylvania, where he was the recipient of the Rubinoff Award for innovative uses of computers. He has performed research in sensor fusion (integrating vision and touch sensing for object recognition), real-time computer vision, and model-based sensor planning. Professor Allen was named a National Science Foundation Presidential Young Investigator in 1987.

Dr. Kenneth Kreutz-Delgado received both the M.S. in Physics and the Ph.D. in Engineering Systems Science from U.C. San Diego (UCSD). Before joining the faculty of UCSD , he was a researcher at the NASA Jet Propulsion Laboratory, California Institute of Technology. Dr. Kreutz-Delgado is affiliated with both the California Space Institute and the UCSD Institute for Neural Computation, and is a member of the IEEE Robotics & Automation; Computer; Control; and Systems Man & Cybernetics Societies as well as the AAAS.

Dr. Bruno Siciliano was born in Naples, Italy on October 27, 1959. He received the Laurea and the Research Doctorate degrees in Electronic Engineering, both from the University of Naples in 1982 and 1987, respectively. He is currently a Research Associate there in the Department of Computer and Systems Science. His research interests include manipulator inverse kinematics techniques, modeling and control of lightweight flexible arms, redundant manipulator control, force/position robot control, and cooperative robot manipulation.

Dr. Avi Kak is a Professor in the School of Electrical Engineering at Purdue University where his research focus is on the sensory aspects of robotic intelligence. In recent years, he and his graduate students have made many contributions to model-based vision for driving manipulation, to high-precision robotic assembly using force/torque sensing, to various aspects of task-level planning, and in the application of calculi of uncertainty to task verification using vision. This year he is the Area Chair for the Robotics and Control Area on the Program Committee of the AAAI'91 Conference (the Ninth National Conference on Artificial Intelligence).

Dr. Pradeep Khosla received the PhD degree from Carnegie-Mellon University in 1986. He is currently an Associate Professor in the Department of Electrical and Computer Engineering at Carnegie-Mellon University. He is also a member of the The Robotics Institute and Director of Advanced Manipulators Laboratory. Prior to joining Carnegie-Mellon, he worked with Tata Consulting Engineers and Siemens in the area of real-time control. Professor Khosla's research interests are in the area of real-time sensor-based manipulation, architectures for real-time control, integrated design-assembly systems, and robotic applications in space, field, and manufacturing environments. His current projects include sensor-based control of CMU Direct-Drive Arm II, design, development and control of the Reconfigurable Modular Manipulator System, CHIMERA II: an architecture for real-time control, and research in developing designer's tools to verify the assemblability of a design. He is involved in Robotics education and was a member of the committee that formulated a curriculum for the Ph.D. program in Robotics at Carnegie Mellon. He is also the Chair of the Education Committee of the IEEE Robotics and Automation Society.

*We will introduce **Drs. Erdman, Thorpe** and **Latome** in the next issue of the newsletter.*

R&A Chapter Seminar Report

Medical Robotics:
A Step Toward Computer Integrated Medicine

Grigore Burdea, Rutgers University
Chairman, R&A Princeton Chapter

On February 18 the IEEE Robotics and Automation Chapter - Princeton Section, together with the CAIP Center at Rutgers University and the IEEE Computers In Medicine and Biology Society organized a joint seminar entitled "Medical Robotics: A Step Toward Computer Integrated Medicine".

The speaker was Dr. Russell H. Taylor, Manager of the Intelligent Robotics Research Division at IBM T.J.Watson Research Center and editor of the *IEEE Transactions on Robotics and Automation.*

Dr. Taylor explored the use of robots to augment a surgeon's ability to perform geometrically precise tasks planned from computed tomography (CT) or other image data. In many cases, the robot acts essentially as a replacement for a stereotactic frame. Other applications require active robot motion during surgery.

Researchers at IBM and the University of California at Davis have developed an image directed robotic system for orthopaedic bone machining applications, aimed initially at cementless total hip replacements. This system provides an order-of-magnitude improvement in implant fit and placement accuracy, compared to standard manual preparation techniques.

The talk exposed the "full-house" audience to further research issues and opportunities associated with the development of such systems, and illustrated important themes with examples drawn from IBM research on precise orthopaedic surgery, and from that of other researchers.

New Books in Print

Introduction to Robotics, by Phillip John McKerrow, Addison-Wesley Publishing Company.

This book is part of the Robotics and CIM series. It is designed as both an introductory text for students and a survey of the state of the art for professional practitioners.

Features include an approach which ties together the multidisciplinary components of robotics, rigorous mathematical treatment of mature topics combined with an algorithmic approach to newer areas of research, worked examples and a comprehensive bibliography.

In this issue we are beginning a new feature in which we will announce the publication of new books by members of the Society. Please send the name, publication information and a brief summary of books published in the last year for consideration in this column.

1991 Conference Report

T.C. Hsia, University of California, Davis
General Chair

The seventh IEEE International Conference on Robotics and Automation, was held in the Hyatt Regency Hotel in Sacramento April 7-12,1991. The three-day technical program covered recent advances in all aspects of robotics and manufacturing automation. In addition, there were four tutorials and six workshops offered during the week-long program. The weather in Sacramento was wonderful. We are happy to report that the 1991 conference was a huge success.

A record number of 785 papers were submitted. The Technical Program carefully selected 420 papers for presentation, of which 60 were invited papers. The presentation of this large number of papers required 9 parallel tracks with 16 papers per track on each day. Three panel discussion sessions were also organized to make up the grand total of 108 sessions for the three day conference program. In addition two plenary sessions were organized with international speakers to bring us a broad view of the issues in robotics and manufacturing in the 90's -- the main theme of the conference.

This was indeed the largest program ever in the seven year history of the conference. We also believe that the strong technical quality of the papers submitted by the authors has enabled us to maintain the conference's tradition of excellence.

The conference's technical program had a total of 709 registrants, plus about 50 student helpers. The conference had a broad geographical base, with 27 countries worldwide represented. Approximately a third of the registrants came from outside the United States. Thirteen exhibitors were also present at the conference.

Prof. T.J Tarn, Program Chair, and Prof. T.C. (Steve) Hsia, General Chair

Among the attendees, a large number of international high technology companies were represented. In particular, Intel Corporation made a generous contribution in hosting the conference reception, and its Executive Vice President, Dr. Craig Barrett, delivered the keynote address at the conference banquet.

Vendors' exhibits seemed to attract more interest this year than ever before. Professor Wayne Book, Georgia Tech, speaks with a Martin Marietta representative.

Vive Nice in '92!

1992 IEEE International Conference on Robotics and Automation

Giuseppe Menga, Polytechnico di Torino
General Chair

The 1992 Robotics and Automation Conference in Nice will be a special event for many reasons. First, this is the first time that the Conference will be held outside North America, so we will achieve one of the expectations of the founders, who specifically intended that this society become truly international, reflecting the fact that new technologies are without frontiers.

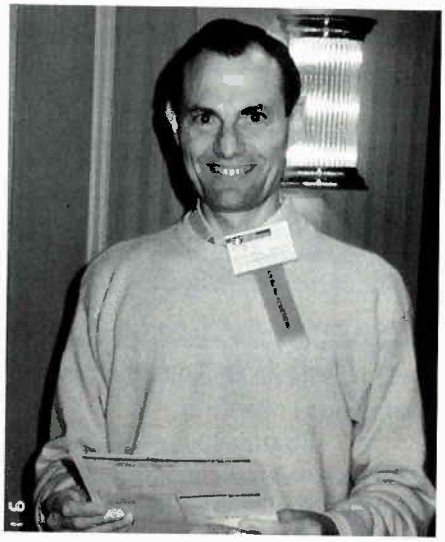
Next, 1992 will be an important year for Europe: the year of the European economic unification. Many things are moving forward in the Old World in innovative technologies, especially robotics and automation. Even now, as we are waiting for the unification, technological cooperation is spreading among western European industries and research centers, and in eastern Europe as well. The CEE ESPRIT program is one example, and it is not a coincidence that ESPRIT is cooperating to organize this conference.

To offer you a taste of all this, we have opened the conference to greater industrial participation than in the past. You haven't missed in the Call for Papers the presence of major European companies and industrial associations in the field of robotics and automation. We expect, with the help of these organizations, to prepare for you at the conference a number of tutorials and workshops devoted to industrial projects, to the economic aspects behind the introduction of innovation in industry, to the opening of international markets to innovative products, and specifically to international cooperative projects.

Moreover we are arranging aside of the conference a true exhibition area where industries and research centers are expected to present the latest in robotics and automation. You may also plan to come and bring with you your latest robot to show in this European environment.

Finally, if you have to come to Europe, what better choice to start than from one of its prettiest and most fashionable regions: the French Riviera, and Nice, its capital?

However, you may not know that Nice is only two hours' drive from Turin, the city of Fiat and the Italian center for automation, where we expect to arrange a technical tour. We want to acknowledge, the support of the Chambers of Commerce of both Nice and Turin. In a spirit of international cooperation, the two Chambers have been fundamental in making this conference possible. The weather will be warm at the time of the conference, and you can also plan



a weekend in Paris or on one of the Mediterranean islands, so pack your wife (or husband) and your robot and plan to come to Nice! I will be waiting for you.

-- Giuseppe Menga

AF - The Automated Factory Show

AF Srl, which will coordinate the exhibition at the 1992 Robotics and Automation Conference, was founded in 1989 by the Italian associations of industries operating in the field of computer integrated manufacturing: *ANIE, ANASIN, ASSINFORM, UCIMU and ANIMA*.

The scope of this organization is to promote advanced tools, systems and software for factory automation. This is achieved through the **AF Exhibition of Automation and Computer Integration,** held in Genoa every other year. Along with the exhibition, AF Srl offers an international monitoring service and computer data base on factory automation, which includes f statistical data and information regarding trends in the market of products in the field of integration.

In 1992 the AF Exhibition will be held in the Genoa International Fair Ground, from February 17th to 21st, and will host MAST: the demonstration of Manufacturing Advanced System Technology. MAST includes a reproduction of an automated factory, emphasizing logistics and total quality.

For more information about the AF Exhibition and exhibits at the Robotics and Automation Conference contact: *AF - THE AUTOMATED FACTORY SHOW S.r.l. V.le Fulvio Testi 128 - 20092, Cinisello Balsamo - Milano - Italy Telephone 39/2/24971 Fax 39/2/2497349.*

Reports from Research Institutes

CIMLab: University of Toronto

B. Benhabib and K.C. Smith

The Computer Integrated Manufacturing Laboratory (CIMLab), in the Department of Mechanical Engineering, at the University of Toronto, was founded in 1987. The research activities of the CIM Lab can be classified into the following areas: Kinematics and dynamics of robots, robot calibration, design and analysis of modular robots, performance planning of robotic workcells, supervisory control of robotic workcells, development of robotic sensors, robotic vision, sensor fusion, design of intelligent fixtures, and computer-aided engineering design. Some example research activities are listed below:

Modular Robotics

Modular robots introduce a new dimension to hardware for flexible automation, when compared to conventional industrial robots, in terms of yielding individual globally optimal arm geometries for each of the tasks at hand. The objective of our ongoing research in the area of "mechanical design of modular robots" is to develop an inventory of basic modular units. The individual modular-robot units that are presently under development include: one degree-of-freedom main and end-effector joints, connectors (base, in-plane, and out-of-plane), and links. A second research direction addresses the issue of kinematic modeling of modular robots. The generalized method developed can be used to derive individual kinematic models of all the mechanical clements - modular units - independent of their geometry and sequence of assembly into a robot. A general procedure is also developed to derive a global kinematic model of any open-loop-chain robot configured using these modular units.

Robot Calibration

To improve the accuracy of a robot, one would like to determine the values of the robot's true geometric parameters as precisely as possible. One way to estimate these values is by measuring the manipulator's Cartesian errors at several points in the workplace, and then deducing from these measurements the required corrections for the geometric parameters. One direction of our research is the application of sensitivity-analysis methods to the kinematic analysis of robotic manipulators. An "inverse" calibration procedure based on the use of sensitivity coefficients has been developed. A second research direction is the development of a generalized solution to the optimization problem of the robot calibration process, to minimize cost or time subject to accuracy constraints.

An Active Vision System for Robotic Workcells

Flexibility of robotic workcells can be significantly increased through the integration of visual sensors for 3D-object recognition, reducing the need for special and often complex tooling. The 3D-object-recognition system under development is based on two basic concepts: a pre-marking scheme (using circular markers) and active visual sensing, as a result of which the matching process is performed in 2D space.

Some of the basic problems under study and/or implementation are as follows: determination of optimal object models; optimal configuration of a multi-camera marker-detection environment; 3D-location estimation of circular features; accurate estimation of the five basic parameters of an elliptical shape based on its edge-point data; and, 2D matching based on statistical and structural pattern recognition.

Design and Analysis of Electro-Optical Robotic Sensors

The "multi-purpose robotic sensor" research project currently pursued, involves two phases: development of efficient and compatible single- purpose sensors for tactile force, distance, and orientation measurement, and their integration. The proximity sensor under development utilizes optical transducers based on the amplitude-modulation of light. The combination of output voltages from multiple optical-fiber-based receivers is related to the inclination angle of an object and its distance. We have also been developing a wrist-mounted robotic force/torque sensor which makes use of the electromagnetic interference immunity and electrical-isolation properties of electro-optical transducers, and at the same time attempts to achieve efficient mechanical force/torque decoupling.

Development of a Modular Fixturing System

The objective of this research is to develop a modular programmable fixturing system (MPFS) for robotic assembly. The features of this system include: modularity, automatic reconfigurability, sensory feedback controllability, and programmability. The current MPFS-fixture-component designs include: a horizontal locator, an adjustable-height vertical locator, an adjustable-width V-block, a universal clamp, and a hole-type baseplate.

Continued on page 20

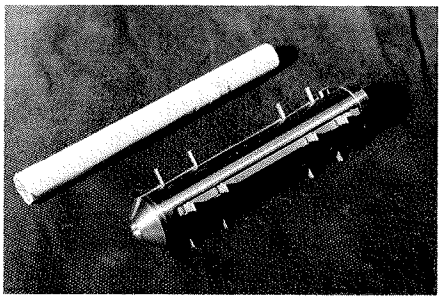


Fig. 3: A Mobile Robot in a small pipe

national Symposium on Micromachine and Human Science is organized by our laboratory regularly every year with the support from the city of Nagoya and other organizations.

Self-Organizing End-Effector System:

The goal of this project is to develop a multi- purpose end-effector system based on the concept of CEBOT. The end-effector can be built by the manipulators, after planning the configuration and the function of the system. The major issues of this project are how to design and control the end-effector cells and how to reconfigure them for a task. The experimental system has been developed for the versions 1.0 and 1.5.

Manipulator/Vehicle System:

A manipulator on a vehicle is not fixed on the ground and has control issues different from the one on the ground. Space robotics is one of them. The control of manipulator/ vehicle system on the water is one of the current research topics related to this system.

Man-Robot Cooperation Type of Manipulator System

The system is maneuvered directly by an operator. The cooperation control of the manipulator and the operator with interaction under its working environment has been proposed and applied to an experimental system. This system is to be applied for the robot in construction.

Robot Applied under Hazardous Environment:

The main purpose of this project is to develop a robotic system for maintenance applications under unstructured environments. The wall-climbing robot, the flying manipulator, the brachiation type of mobile robot, the pipe inspection robot, etc. have been proposed.

Neuromorphic Control:

ATDNN (Active Time Delay Neural Network) has been proposed by our laboratory as a new Neural Network . structure with the combination of the fuzzy logic used for the acceleration of the convergence. The development of an intelligent control system using N.N. is the goal of this project. IJCNN'93 (International Joint Conference on Neural Networks) will be held in Nagoya in October 1993, chaired by Prof. Toshio Fukuda.

Skill-Based Control of Manipulator:

The goal of this program is to transfer human skills to robot controller. How to model a task, extract human skills from the operator's motion and apply it to robot control is the main issue of this research. A method for an assembling task of two parts has been proposed.

Manipulator Control with Collision Phenomena:

The control of collision phenomena is an important issue for the practical application of enabling a manipulator to have interaction with its environment. A new learning control algorithm using audio feedback has been proposed.

Single-Master Multi-Slave Manipulator System:

The goal of this project is to develop a semi-autonomous telerobotic system based on the concept of task-oriented control. How to control slave arms in cooperation using a master arm is the problem of this research. A task-oriented control of a single-master dual-slave manipulator system has been proposed.

Image Processing for BioEngineering Technology:

The development of an image processing system for microrobots is the goal of this project which applies AI, fuzzy and neural network technologies. The recognition of animal cells on a micro carrier and the recognition of protoplasts for bio-engineering applications are the current topics.

Sensor Integration System:

A new sensor integration technique using neural network and fuzzy inference is under development. The goal of this project is to develop a sensor integration system for robotic application in the aerospace industry.

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*e-mail:*d43131a@nucc.ccnagoyau.ac.jp

IEEE Robotics and Automation Society Newsletter EDITORIAL POLICIES

We publish news items, letters, and reports on work in progress. Normally, technical contributions will not be reviewed. However the editor reserves the right to solicit technical reviews and to reject any contribution which is inappropriate for this newsletter.

Announcements for non-commercial scholarly conferences, workshops, etc. will be published gratis in our Calendar as space is available with priority given to events sponsored by the IEEE Robotics and Automation Society. For-profit short courses and seminars may be advertised at our standard classified or display rates.

For more information about advertising in the newsletter please contact the Managing Editor.

The Control/Robotics Research Laboratory: Polytechnic University, Brooklyn, New York

Farshad Khorrami

A research laboratory facility has been developed at Polytechnic University to study various control problems in robotics and flexible mechanical structures.

The Control/Robotics Research Laboratory (CRRL), which was initiated within the Electrical Engineering Department about two years ago, is an example of the interdisciplinary, collaborative research efforts among the departments to which robotics and control areas are particularly amenable. The Department of Mechanical Engineering has also been making contributions to this effort.

The emphasis of the experimental research in CRRL is on control of flexible mechanical structures and control of robotic systems. Control objectives for these experiments range from *nonlinear controllers for robotic manipulators, coordination, force control, active vibration suppression* to *slewing and pointing*, and combinations thereof. *System and parameter identification for control* is another primary objective in the development and utilization of these experiments. To this end, we have developed and are developing a number of experimental setups to study flexible multi-body systems at CRRL. A description of the existing setups is given next.

Several robot manipulators (such as GE P50, Mitsubishi, and IBM robots) are in this laboratory. Furthermore, a three-link articulated rigid robot arm has been designed in-house for testing of different control algorithms. All the machining and hardware integration were performed in-house. At this point, a two-link (with a possible extension to three link) planar flexible arm has been developed. Several other experimental setups on flexible structures including truss type structures are being established

The Flexible-link Manipulator

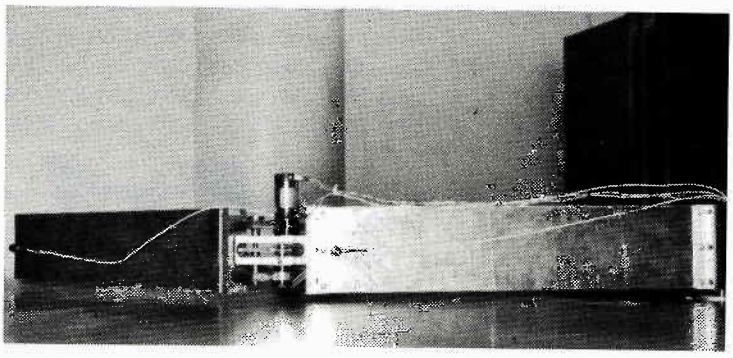
The two-link robot arm can accommodate replaceable links. Different configurations (i.e., rigidity) can be studied by varying the lengths and the thickness of the arms. The actuator at the base is a low inertia and high torque direct drive motor.

The advantages of the direct drive motors are the reduced friction and omission of backlash such as that due to drive gears. The second link is actuated by a geared DC motor through anti-backlash gears. The reason for a geared motor at the second joint was to reduce the joint weight as much as possible. However, a low gear ratio has been chosen. Air cushion supports are also provided to support joints with minimum friction above the granite table that supports the mechanism. The angular positions and velocities of the arms are measured by optical encoders and DC tachometers respectively. Each arm is also instrumented with a piezoelectric type accelerometer at the tip. We are instrumenting the links with several strain gauges. Signal conditioning and anti-aliasing filters have been developed in-house for our experimental setups.

To evaluate the performance of the system, a CCD camera is being installed to monitor the end-effector of the manipulator. Different control algorithms with different measurements of the flexural effects have been designed and are being implemented on this test bed. The two-link planar arm mechanism is designed to study vibrations in one direction. However, experience has shown that two dimensional vibrations and torsion will occur. Although these effects will complicate the dynamics and make the control design much more challenging, they are expected in real life structures.

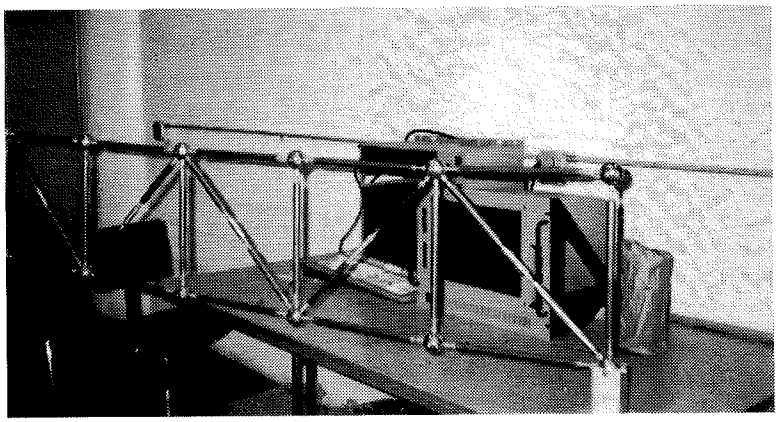
Slewing Flexible Truss Structure

The second experimental test bed recently being developed at CRRL is a slewing flexible truss structure. The struts and the nodes for the structure are the same as the ones used in NASA's and JPL's setups. One of the nodes is attached to a direct drive motor through a hub assembly. An active member is being installed in the truss setup by replacing one of the struts by a piezo type linear actuator. This will provide an active member for vibration suppression along the truss. We are also instrumenting the truss by accelerometers and strain gauges. Further-



A two-link flexible manipulator

A slewing truss structure



more, a specialized gripper has been designed to insert into the nodes. This gripper may be utilized to assemble the truss structure by a robot.

The real-time control algorithms are implemented by DSP boards (TMS320C30 based) having ratings of 33 MFlops. The DSP boards will provide an excellent basis for real-time control applications. Further enhancements of our computational power for real-time control applications are anticipated.

The resources of Polytechnic University and in particular those of the Departments of Electrical and Mechanical Engineering will be available to this research facility. The main computing facility for these Departments include a Convex C120, a number of Sun servers and workstations (e.g., Sun 3/260, 3/180, 3/110, and Sparc Stations), and IBM servers. These computing facilities are available for the simulation and control analysis studies related to this research. Numerous simulation and control packages are available on our system.

For more information, contact Dr. Farshad Khorrami, School of Electrical Engineering & Computer Science, Polytechnic University, 333 Jay Street, Brooklyn, New York 11201.

Calendar

•**July 1 "Automation for Productivity"** Sydney, Australia. ***Sponsor:*** Australian Robot Association, in conj. w/ the "Automate Australia" show of robotics and automation technology. ***Contact:*** Michael Kassler, Australian Robot Association Inc., G.P.O. Box 1527, Sydney NSW 2001, Australia. Ph.+61 2 959 3239, fax +61 2 959 4632, e-mail: michael@extro.ucc.su.OZ.AU.

•**July 1-3 IASTED Int. Conf. on Artificial Intelligence Applications and Neural Networks**. ***Contact:*** AINN'91, A. Kopp, PO Box 354, CH-8053, Zurich Switzerland FAX: 980-2413

•**July 8-12 International Joint Conference of Neural Networks.** Seattle WA. ***Sponsors:*** International Neural Networks Society and IEEE Neural Networks Council. ***Contact:*** Sarah Eck, University of Washington Conference Management , IJ CNN-91 Seattle Tel (206)543-0888 or Fax (206)685- 9359.

•**July 26. "Challenges Facing Industry in the 1990's"** Pittsburgh PA. ***Sponsor:*** CMU Center for Integrated Manufacturing Decision Systems. ***Contact:*** Betsy Herk, (412)268-3078.

•**July 29. First International Aerial Robotics Competition.** Atlanta, GA. Sponsor: Association for Unmanned Vehicle Systems Contact: Robert Michelson, Georgia Tech Research Institute, Aerospace Science & Technology Laboratory, Atlanta, Ga 30332

•**August 1-3. IEEE International Conference on Systems Engineering, Special Session on Reconfigurable and Reusable Real-Time Systems.**Wright State University, Dayton, Ohio. ***Contact:*** David B. Stewart, CMU. (412)-268-7120; stewart@faraday.ece.cmu.edu or Thomas Wheatley, NIST, (301)-975-3449, wheatley@cme.nist.gov.

•**August 5-6. International Conference on Integrated Manufacturing Systems and Processes.** Varanasi, India ***Contact*** Dr. Suren N. Dwivedi, Dept. of Mechanical Engineering, 333 ESB West Virginia University, PO Box 6101, Morgantown WV 26506, USA

•.**August 9-14 Indo-US Workshop on CAD/CAM and Robotics.** Indian Institute of Technology, New Delhi INDIA ***Contact*** Dr. Suren N. Dwivedi (see above)

•**August 13-15. IEEE International Symposium on Intelligent Control** Arlington Virginia ***Sponsor:*** IEEE Control Systems Society. ***Contact:*** Prof. Alexander Levis, Dept. of ECE, George Mason Univ., Fairfax VA 22030-4444. Tel 703-764-6282.

•**August 13-15. AUVS-91: Unmanned Systems: Innovative Solutions for a Changing World.** ***Sponsor:*** Association for Unmanned Vehicle Systems. ***Contact:*** Maria Cevallos (202) 371-1170 or Richard Wagaman, 703-248-3500, McDonnell-Douglas, Arlington, 1000 Wilson Blvd. 22209.

•**August 16-18 International Conference on Simultaneous Engineering.** University of Roorkee, Roorkee, INDIA ***Contact*** Dr. Suren N. Dwivedi, *(See above)* .

•**August 15-17,** Neural Networks for Ocean Engineering. Washington, D.C. ***Sponsor:*** IEEE Ocean Engineering Society in Cooperation with IEEE Neural Networks Council. ***Contact:*** CNNOE, 5665 Oberlin Drive, Suite 110, San Diego CA 92121.

•**August 17-19**. Fourth World Conference on Robotics Research. Pittsburgh PA. ***Sponsor:*** Robotics International of the Society of Manufacturing Engineers. ***Contact:*** Karen Kammerer, Conference Dept., SME, One SME Dr., PO Box 930, Dearborn MI 48121-9030. Tel. 313/ 271-1500, ext. 542.

•**August 19-22. 6th International Conference on CAD/CAM: Robotics and Factories of the Future. London UK.** ***Sponsor:*** International Society for Productivity Enhancement (ISPE). ***Contact:*** Dr. Michael Sobelewski, Concurent Engineering Research Center, West Virginia University, Drawer 2000, Morgantown WV 26506, E-Mail: sobol@cerc.wvu.wvnet.edu; Tel: (304)293-6961, ext. 115; FAX: (304)293-6888.

• **August 24-30. 12th International Joint Conference on Artificial Intelligence.** Sydney, Australia, ***Sponsor:*** IJCIA, Inc.; ***Cosponsor***: National Committee on Artificial Intelligence and Expert Systems of the Australian Computer Society. ***Information***: Prof John Mylopoulos or Prof. Ray Reiter, Dept. of Computer Science, University of Toronto,Toronto Ont. M5S 1A4 CANADA, Fax (+1 416 978-1455 email: ijcai@cs.Toronto, Toronto.edu.

• **Sept 10-12 2nd Gov't Neural Network Applications Workshop**, Huntsville ALA,. ***Sponsor***: U.S. Dept. Defense Triservice Neural Network Working Group. ***Contact:*** AMSMI-RD-WS-PO (Dr. John L. Johnson) Huntsville ALA 35898-5248 FAX 304-293-6689

• **September 17-19, 4th World Conf. on Robotics Research,** Pittsburgh PA. ***Sponsor***: Robotics International of the Society of Manufacturing Engineers Contact: Karen E. Kammerer, SME, RI/SME, One SME Drive, PO 930, Dearborn MI 48121-0930.

•**September 30-October 2. ICDAR '91 First International Conference on Document Analysis and Recognition**. Saint-Malo, France Sponsors: CNRS, IAPR, IGS, INRIA, IEEE Section francaise Contact: Veronique

Dearborn MI. *(See Call for Papers)*

- **November 9-13 ISRAM '92: International Symposium on Robotics and Manufacturing.** Santa Fe, New Mexico. *(See Call for Papers)*
- **November 16-18, 1992. ISMCR'92: Second International Symposium on Measurement and Control in Robotics**. Tsukuba Science City, Japan. *(See Call for Papers).*

Calls for Papers

- **CAMP '91 Computer Architecture for Machine Perception**. December 16-18, 1991. Paris. ***Sponsors:*** Délégation Générale Pour l'Armement, Ministère de l'Education Nationale, Ministère des Affaires Etrangères. Focus: New architectures, oth hardware and software, associated programming environments and algorithms designed for research and industrial applications of Artificial Intelligence, Vision, and more generally Machine Perception. ***Submissions***: 4 copies of an extended (1500 words) by July 1, 1991 to: L. Wendel, Ecole National Supèriure de Physique de Strasbourg (LSIT), 7 rue de l'Université, 67000 Strasbourg, FRANCE. Fax: 33 88 35 31 76, Email: zavido@etca.fr.
- **International Conference on Intelligent Control and Instrumentation (SICICI '92)** Singapore. February 18-21 1992. ***Sponsor:*** IEEE Singapore Section Control Chapter. ***Submissions:*** Professor C. C. Hang, Technical Programme Chairman, SICICI '92. IEEE Singapore Section, 200 Jalan Sultan *11-03 Textile Centre, Singapore 0719. email: fenghcc@nus3090.bitnet
- **2nd International Workshop on Advanced Motion Control**, March 16-18.1992 Nagoya Japan. ***Sponsor***: IEEE/IES. ***Submissions*:** Prof. Shigeru Okuma, Nagoya Univ. Japan, Tel: 81 52 781 5111, ext. 6753; FAX 81 52 781 9263.
- **ECCV2 European Conference on Computer Vision.** May 18-22, 1992. Santa Margherita Ligure Italy. ***Submissions*:** Send long (~6000 words) or short (~2000 words) by **October 15 1991** to Prof. Giulio Sandini, DIST Univ. of Genova, via Opera Pia 11 A, 16145 Genova, FAX 39 10 603 801, e-mail: eecv92@dist.unige.it. Topics of interest are Color, Texture, Stereo, Motion, Image Features, Stereo Motion Cooperation, Active Vision, Shape, Vision-based Control, Hardware Architectures, Applications.
- **Rensselaer's 3rd Int. Conf. on Computer Integrated Manufacturing.** May 20-22, 1992. Troy New York. ***Sponsors:*** Rensselaer Polytechnic Institute and New York State Center for Advanced Technology in Automation and Robotics. **Submissions:** Send 4 copies of complete papers to:Prof. Alan Desrochers, Rensselaer Polytechnic Institute, CII 8015, Dept. of Electrical, Computer, & Systems Eng., Troy NY 12180-3590, Ph:(518)-276-6718 FAX: (518)276-8715
- **1992 Japan-USA Symposium on Flexible Automation** July 13-15, 1992, San Francisco. ***Sponsors:*** ASME and Institute of Systems, Control and Information Engineers of Japan. ***Submissions*:** Send four copies of long and short (600-1000 word summary of research) papers from all countries except Japan by November 15, 1991 to the Program Chairman, Professor Ming C. Leu, Dept. of Mechanical and Industrial Engineering, Rm. 311, MEC, New Jersey Institute of Technology, University Heights, Newark NJ 07152.
- **IAPR: 11th International Conference on Pattern Recognition.** August 30-Sept.3, 1992. ***Sponsor:*** International Association for Pattern Recogniton. Four simultaneous conferences: *Computer Vision and Applications* (Ch. H. Niemann); *Pattern Recogniton Methodology and Systems* (Ch. J. Kittler); *Image, Speech and Signal Analysis,* (Ch. I.T. Young); *Architectures for Vision and Pattern Recognition,* (Ch. V. Cantoni). ***Submissions:*** 4 copies of extended (2000-2500 word extended abstract via *ordinary mail* by ***October 31 1991*** to: 11th ICPR Secretariat, Delft University of Technology, Department of Electrical Engineering, PO Box 5031, 2600 GA Delft, the Netherlands. Tel: 31 15 78 60 52; FAX: 31 15 62 20 00; email: ICPR@ET.TUDELFT.NL.
- **International Workshop on Intelligent Manufacturing Systems. October 1-2, 1992.** Dearborn MI. ***Sponsor:*** International Federation of Automatic

FIRST CALL FOR PAPERS

IEEE INTERNATIONAL CONFERENCE ON FUZZY SYSTEMS
March 8-12, 1992
San Diego, California

Sponsored by the IEEE Neural Networks Council
in cooperation with the IEEE Lasers and Electro-Optics, Communications, and
Industrial Electronics Societies and IFSA, NAFIPS, and SOFT

Conference Chairs: Lotfi Zadeh and James Bezdek

The IEEE Neural Networks Council is sponsoring a conference dedicated to the use of fuzzy models in scientific applications and engineering systems. Members of the fuzzy systems community are cordially invited to submit papers to this exciting conference. Only accepted papers will be published in the FUZZ-IEEE Proceedings, expected to be available at the conference for distribution to all conference registrants. The program will include technical sessions on: Basic Concepts and Tools, Artificial Intelligence, Fuzzy Neurocomputing, Control Systems, Decision Analysis and Optimization, Fuzzy Hardware, and Engineering Applications. For further conference information or call for papers instructions contact:

Nomi Feldman, Conference Coordinator
FUZZ-IEEE SYSTEMS CONFERENCE
5665 Oberlin Drive, Suite 110
San Diego, CA 92121 USA
Tel (619)453-6222, FAX (619)535-3880

IEEE Transactions on Neural Networks Special Issue

The *IEEE Transactions on Neural Networks* will devote a special issue to fuzzy control systems, neurocomputing, hardware, and engineering applications. Interested authors should submit one original and five copies of articles directly to the guest editor:

James Bezdek
Division of Computer Science
University of West Florida
Pensacola FL 32514 USA
Tel (904)474-2784, FAX (904)474-3023
e-mail: jbezdek@uwf.bitnet

Authors of accepted papers will be automatically placed in the appropriate FUZZ-IEEE technical session. Contributions accepted for the special issue will NOT appear in the Conference Proceedings.

DEADLINE DATE FOR ALL SUBMISSIONS: SEPTEMBER 15, 1991

Control. CoSponsors: ASME, IEEE Control Systems Soc., SCS, SME. ***Submissions***: 5 copies of 800-1000 word abstract by October 15, 1991 to Dr. Naim A. Kheir, IFAC Workshop IPC Chairman, Department of Electrical & Systems Engineering, Oakland University, Rochester, MI 48309-4401 USA.

- **ISRAM '92:4th International Symposium and Exhibition on Robotics and Manufacturing.** November 11-13 1992. Sante Fe New Mexico. ***Submissions*:** Send 3 copies of full-length regular papers or extended abstracts of short papers by October 1, 1991 to Dr. Ron Lumia (Robotics), Intelligent Controls Group, Robot Systems Division, National Institute of Standards and Technology, Gaithersburg MD 20899 USA, Tel: 301-975-3452; FAX 301-990-9688, email: lumia@cme.nist.gov or Prof. Joe H. Mullins (Manufacturing), Manufacturing Engineering Program, Farris Engineering Center, College of Engineering, University of New Mexico, Albuquerque, NM 87131 NM 87131 USA. Tel: 505-277-0558; FAX: 505-277-0813.
- **ISMCR'92: Second International Symposium on Measurement and Control in Robotics.** November 16-18, 1992.Tsukuba Science City, Japan. *Sponsor:* IMEKO. The conference is organized to focus on the international development of robotics. Suggested topics include robotics overviews of national or R&D projects; human factors in robotics; technology; and applications. Submissions: The deadline for abstracts is January 10, 1992. Contact: Prof. S. Tachi, RACST, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153 JAPAN. Tel: 81 3 3481 4467 FAX: 81 3481-4469.

Call for Papers

IROS '92

1992 IEEE/RSJ International Conference on Intelligent Robots and Systems

--Sensor-Based Robotics and Opportunities for Its Industrial Applications---

July 7-10, 1992, The Radisson Plaza Hotel, Raleigh, North Carolina, USA

Sponsored by: IEEE Industrial Electronics Society
IEEE Robotics and Automation Society
Robotics Society of Japan (RSJ)
Society of Instrumentation and Control Engineers (SICE)
New Technology Foundation

This is the 5th such technical meeting. IROS meetings have evolved in Japan and for the first time this meeting will be held in the US. The theme of IROS '92 is **Sensor-Based Robotics and Opportunities for Its Industrial Application**

TOPICS:
Papers with new research results are encouraged for submission. Topics of interest include but are not limited to:

- New sensors, new actuators
- Multisensor fusion/integration
- INformation technology for sensors
- Teleoperated and autonomous robots
- Mobile robots: design, planning, navigation, and applications
- Distributed multiple robotic systems
- Cellular robotics
- Micro electro-mechanical devices, systems and robotics
- Application of automation and robotics
- Bio-robotics
- Intelligent motion control
- Learning control, fuzzy control
- AI techniques for intelligent robots and systems
- Neural networks
- Hand-eye systems
- Automation systems: design, planning, modeling, evaluation and optimization
- Man-machine interfaces
- Task and motion planning
- Other related topics on intelligence for robots and systems

Workshops and tutorials will be held on Tuesday, **July 7, 1992**. A technical tour of the Research Triangle Park in North Carolina will also be arranged. The program committee is soliciting proposals for workshops, tutorials, and invited special sessions.

PAPER SUBMISSION:

Two types of papers will be considered: 1) Long papers--limited to 25 double-spaced pages, and 2) Short papers--limited to 10 double-spaced pages

DEADLINES

Paper submission due: (**four copies** of complete manuscripts for peer review)	**December 1, 1991**
Acceptance notification:	**February 15, 1992**
Final camera ready paper due:	**April 1, 1992**

For those of you who received the first Call for Papers, please note these are revised deadlines.

Submit papers to either of the following Program Co-Chairs:

Avi Kak, Program Co-Chair
School of Electrical Engineering
Purdue University
West Lafayette, IN 47907, USA
Phone: (317) 494-3551
FAX:(317) 494-6440
E-mail:kak@ecn.purdue.edu

Kazuo Tanie, Program Co-Chair
Mechanical Engineering Laboratory, MITI
1-2 Namiki, Tsukuba-shi
Ibaraki-ken, 305, Japan
Phone: +81-298-54-2656
FAX: +81-298-54-2518
E-mail: M1750@MEL.GO.JP

Proposals for workshops, tutorials, and invited special sessions should be submitted by November 1, 1991* to either of the following

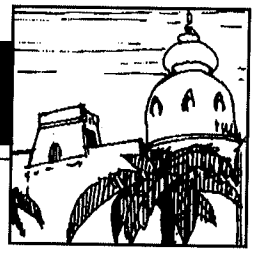
Ren C. Luo, General Co-Chair
Box 7911
Dept. of Electrical and Computer Engineering
North Carolina State University
Raleigh, NC 27696-7911, USA
Phone: (919) 737-5193; after July 27, '91, 515-5193
FAX: (919) 737-5523; after July 27, '91, 515-5523
E-mail: luo@eceris.ece.ncsu.edu

Ichiro Masaki, General Co-Chair
Computer Science Dept.
General Motors Research Laboratories
30500 Mound Rd.
Warren, MI 48090-9055, USA
Phone: (313) 986-1466
FAX:(313) 986-9356
E-mail: MASAKI@GMR.COM

The 1992 Japan-USA Symposium on Flexible Automation will be held after this conference (IROS '92) on July 13-15, 1992 at Parc55 Hotel, San Francisco, CA, USA.

1992 IEEE INTERNATIONAL CONFERENCE ON

ROBOTICS AND AUTOMATION



N I C E

Acropolis Convention Center
Nice, France
May 10 - 15, 1992

CALL FOR PAPERS

Sponsored by the IEEE Robotics and Automation Society

General Chairperson: **Giuseppe Menga**, Politecnico di Torino - Italy

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- D.E.A., Digital Electronic Automation - Moncalieri - Italy
- ABB Robotics - Västeras - Sweden
- Siemens - Münich - Germany

The beautiful "Cote d'Azur" will host the 1992 IEEE International Conference on Robotics and Automation, to be held in Europe for the first time. Presented in an international co-operative environment, the theme of the conference will be "Advances in Information Technology for Robotics and Automation" and it will aim to be a door opening on the new frontier of Machine and System Intelligence, from machine and shop-floor automation to the Integrated Factory, from sensors and mechanical devices to the high level functionalities of third generation robots.

Special topics include but are not limited to the following:

- Modelling, performance evaluation and simulation of discrete-event dynamic systems.
- Scheduling and control of manufacturing systems.
- Information technology for CIM: software environments for design and prototyping, distributed computer architectures, local area networks.
- Concurrent design of products and automated manufacturing.
- Micro electro-mechanical devices and systems.
- Temporal and logical reasoning systems.
- High level man/machine interfaces.
- Robot sensing : vision, touch, range, force; sensor integration.
- Multisensory perception and environment modelling.
- Design and advanced control software for robotic mechanisms.
- Task level planning, programming, reasoning and reactivity, skills acquisition, learning.
- Autonomous manipulation and mobility: geometric reasoning, navigation, motion generation, sensor-based execution, control.
- Multiple robot coordination and group robotics.
- Applications of automation and robotics in industry, construction, medicine, agriculture, etc.
- Teleoperation, telerobotics and autonomous robots for unstructured environments: underwater, space, hostile environments, etc.

A strong industrial participation through exhibits and presentation of projects is expected. Submissions of non-commercial papers describing applications of interest are encouraged from representatives of industry. A video proceedings presenting research results and applications will be prepared.

PAPER SUBMISSION

Four copies of papers should be sent by **September 20, 1991**, to:
Georges Giralt
Laboratoire d'Informatique et d'Analyse des Systemes
7, Avenue du Colonel Roche - 31077 Toulouse Cedex, France
Tel. 33/61/336200 - Fax 33/61/553577- e-mail: giralt@laas.fr
Authors will be notified of acceptance and furnished with an author's kit by January 15, 1992. Final papers received by the deadline will be included in the proceedings available at the conference.

EXHIBITION

An exhibition of industrial projects, academic research and international cooperative programs will be organized at the Acropolis Convention Center. For information regarding submission of proposed exhibits please contact:
A. F. - The Automated Factory Show S.r.l.
Viale Fulvio Testi, 128
20092 Cinisello Balsamo - Milano - Italy
Tel. 39/2/24971 - Telex 320212 CEU I - Fax 39/2/2497349

WORKSHOPS AND TUTORIALS

The conference will host workshops on Sunday, May 10, and workshops and tutorials on Monday, May 11, and Friday, May 15, 1992. Conference sessions will be held on Tuesday, May 12 to Thursday, May 14, 1992.
Prior to September 1, 1991, those with proposals for tutorials or workshops should contact:
Gerd Hirzinger
DLR, Institute for Flight Systems Dynamics, D-8031 Wessling, Germany (Telephone: 49/8153/28401 - Fax: 49/8153/281134 - e-mail: DF57@ DLRVM.BITNET).

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 1991 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 20, 1991, to:

Anton Philips Award Committee
c/o **Georges Giralt**, L.A.A.S.
7, Avenue du Colonel Roche
31077, Toulouse Cedex, France

Travel assistance to the conference will be provided to the student authors of the five papers nominated for the award.

IEEE
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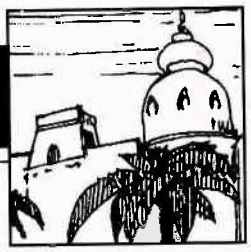
1992 IEEE INTERNATIONAL CONFERENCE ON

ROBOTICS AND AUTOMATION

Acropolis Convention Center
Nice, France
May 10 - 15, 1992



N I C E

CALL FOR VIDEOS

Following the success of the first Video Proceedings of the 1991 IEEE International Conference on Robotics and Automation, the 1992 Conference announces the Call for Videos. The purpose of the video proceedings is to present new and significant experimental work and demonstrations in robotics and automation undertaken by this international community. The effort is intended to enhance and complement theoretical results presented in the conference proceedings.

Suggestions for videos:

- Music and background noise generally interfere with presentation.
- Showing flow charts, block diagrams, circuit boards, computers, motors, or operators usually does not add much value.
- The purpose of the Proceedings is to disseminate technical information, not for promotion.
- **A good video should be dynamic, and contain information that cannot be easily conveyed in a paper.**

What to submit:
A 2 to 3 minute video segment (preferable formats: 3/4", Betacam, or super VHS) and a one-page information sheet (including title, author, affiliation, address, a 200-word abstract, 2 to 3 references, and a short acknowledgement if needed).

When to submit: October 1, 1991

The notification of acceptance will be mailed in late December.

Where to submit:
Professor Peter B. Luh
Electrical and Systems Engineering, University of Connecticut
Storrs, CT 06269-3157, U.S.A.
Phone: (203) 486-4821, Fax: (203) 486-3789

IEEE Robotics & Automation Society

ROBOTICS AND AUTOMATION

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