Newsletter of the IEEE Council on

ROBOTICS AND AUTOMATION

Volume 2, Number 1
Spring 1988

Editor: **Dr. Wesley Snyder**
Dept. Electrical & Computer Eng.
North Carolina State Univ.
Raleigh NC 27695-7914
(919)737-2336 or
wes @ece-csc.ncsu.edu

Managing Editor: **Rosalyn Snyder**
P.O. Box 37694
Raleigh NC 27606

From the Editor:

Wesley E. Snyder
North Carolina State University

We are back in sunny North Carolina after an interesting and enjoyable six months in Germany. A lot has happened during that six months. Probably the biggest news is under the headline *Coming Soon: The Robotics and Automation Society.* Yes, we are about to become an IEEE society.

During the year of transition from a council to a full fledged society we also have been considering expanding the R&A newsletter, so that it can better serve the membership as an informal forum for information and ideas in the field of robotics and automation. This expansion will have several aspects, including a larger staff and more types of features.

We are assembling a staff of associate editors to help us collect information on "what's happening" in different areas. We are grateful to John Jarvis of Bell Labs, Tom Henderson of the University of Utah, and Avi Kak of Purdue who have already agreed to assist us.

Rosalyn Snyder has taken on the duties of managing editor of this newletter. That will give me more time to concentrate on the technical content.

In this edition, you will see a regular feature, descriptions of robotics laboratories. We will welcome brief (~2 typed pages) descriptions of ongoing activities at other universities and research institutes, large and small. Good work is going on everywhere, a fact that is underscored by the news that the winner of the Philips Prize for the best student R&A paper did his Ph.D. work not at one of the "Big Three" universities, but at Tennesee Technological Institute.

In addition, I am pleased to announce that in future issues we will be able to accept advertisements; at very modest rates, too!

Forthcoming in the next newsletter: a special issue on Robotics in Germany.

It's good to be back.

****

News from the Council

Coming Soon: The Robotics and Automation Society!

The Technical Advisory Board (TAB) of the IEEE has endorsed the conversion of the Robotics and Automation Council to the newest Society of the IEEE, effective January 1, 1989. The Field of Interest of the new Society, which must be approved by the IEEE Executive Committee, is similar to that of the current Council.

The approximately 7000 IEEE members who currently subscribe to the Council's *Journal on Robotics and Automation* will become charter members of the new Society at no additional charge.

According to Council President Y.C. Ho, the Robotics and Automation Society will assume all the functions of the current R&A Council, including publication of the Journal.

"We also plan to sponsor many joint meetings with the Computer Society and other IEEE societies," said Prof. Ho.

R&A Officers Elected

The new president of the Robotics and Automation Council is **Prof. Y.C. Ho** , of Harvard University. He is excited about the changes and challenges he sees ahead in the coming year.

"Among the major duties of this year's Council will be to work out a plan to establish a society and to elect a board of governors to run the Robotics and Automation Society," he said.

Other officers to serve on the 1988 Robotics Council include:

Past President:
Dr. A.K. Bejczy, Jet Propulsion Laboratory

Founding President:
Prof. G.N. Saridis, Rensselaer Polytechnic Institute

Vice President:
Prof. Arthur C. Sanderson , Rensselaer Polytechnic Institute

Secretary:
Prof. George Lee, Purdue University

Treasurer:
Prof. R.D. Klafter, Temple University

Editor of Journal:
Prof. G.A. Bekey, University of Southern California

Chairman, Publications Committee:
Prof. R.B. Kelley, Rennselaer Polytechnic Institute

Chairman, Meetings Committee:
Prof. Roger W. Brockett, Harvard Univ.

Chairman, Standards Committee:
Dr. L.S. Haynes

Chairman, Education Committee:
Prof. A.A. Desrochers, Rensselaer Polytechnic Institute

1988 Conference:
Dr. T. Pavlidis, State Univ. of New York at Stony Brook, General Chairman and
Prof. R.B. Kelley, Rensselaer Polytechnic Institute, Program Chairman

1989 Conference:
Prof. G.A. Bekey, University of Southern California, Gen. Chairman, and
Prof. John M. Hollerbach, Massachusetts Institute of Technology, Program Chairman.

ADCOM Representatives

Representatives of the eight constituent societies of the Robotics Council and the three liaison societies make up the Advisory Committee (ADCOM). The

current members are:

Control Systems: **Prof. John Baillieul**, Boston University and **Prof. A.J. Koivo**, Purdue University

Industrial Electronics: **Dr. Abe Abramovich**, American Cimflex, and **Dr. Hiro Haneda**, Kobe University

Industrial Applications: **Dr. A.W. Scheide**, Cincinnati Milacron, and **Mr. Steven Collier**, C.H. Guernsey & Co.

Systems, Man, and Cybernetics: **Prof. G.V.S. Raju**, Ohio University

Engineering in Medicine and Biology (Nonvoting Liaison): **Prof. J.C. Lin**, Univ. of Illinois/Chicago Circle

Aerospace Electronics: **Dr. Paul Rosenberg**, Paul Rosenberg Associates, and **Prof. R.D. Klafter**, Temple University

Circuits and Systems: **Prof. Pradeep Khosla**, Carnegie Mellon University, and **Prof. Rui J.P. de Figueiredo**, Rice University

Components, Hybrids & Manufacturing Technology:
Mr. Michael Kutcher
IBM Corporation, and **Dr. Walter A. Trybula**, General Electric Company

Computer: **Dr. Wesley E. Snyder**, North Carolina State University, and **Prof. W.E.L. Grimson**, Massachusetts Institute of Technology

Engineering Management (Nonvoting Liaison): **Dr. Martin Izaak**, Power Authority, State of New York

Reliability (Nonvoting Liaison): **D.G. Raheja**, Technology Management, Inc.

****

ADCOM Announces R&A Technical Committees

At its February meeting the Robotics and Automation Council Advisory Committee authorized the establishment of five new technical committees. The committees and their chairmen are:

Robot Motion & Path Planning
Prof. Vladimir J. Lumelsky
Department of Electrical Engineering
Yale University
New Haven CT 06520

Robot Dynamics & Control
Prof. T.J. Tarn
Systems Science & Mathematics Dept.
Box 1040, Washington Univ.
St. Louis MO 63130

Computer Vision
Dr. Roger Tsai
Thomas J. Watson Research Center
Room 5-151, IBM
Yorktown Heights, NY 10598
(914-945-1437) rtsai@ibm.com.bitnet

Manufacturing Automation
Dr. Walter Trybula
Electronics Manufacturing Applications Center
General Electric Company
P.O. Box 8106
Charlottesville VA 22906
(804) 978-6456,
and **Dr. Stanley B. Gershwin**
Massachusetts Institute of Technology

Cambridge, MA 02139, (617) 253-2149

International Committee
Prof. Toshio Fukuda
The Science University of Tokyo
1-3 Kugura-Zaka
Shimjuku, Tokyo 162 JAPAN
and **Prof. Giuseppe Menga**
Dept. Automatica & Informatica
Politecnico di Torino
C. Duca degli Abruzzi 24
10129 Torino, ITALY

In the next issue of the newsletter the committee chairmen will provide reports on their activities and future plans. If you are interested in participating in technical committees, please contact the chairman for meeting times and other information.

****

R&A Conference Program

The calibre of papers presented at the **5th IEEE International Conference on Robotics and Automation** should be higher than ever before, according to Program Chairman **Dr. Robert Kelley**. Less than 50 percent of approximately 600 submissions were accepted for presentation during the six daily tracks of presentation sessions.

Dr. Kelley said that 12-13 shorter papers will be presented at each of three poster sessions. Attendees can view videotapes provided by speakers at a separate video theatre (VHS format only).

A new feature of this year's conference is the **Philips Prize**, which was instituted by the North American Philips Laboratories to encourage conference participation by graduate students and new Ph.D's. Dr. Kelley said that approximately 30 papers were submitted for the competition, which was limited to single-authored papers.

The speaker at the Wednesday night banquet will be **Mr. Dick Lundin**, Senior Scientist, New York Institute of Technology. Mr. Lundin and his colleagues are applying techniques from mechanical engineering and robotics to move animated characters and vehicles and to model clothing in computer generated animation graphics. He plans to present a tape on some of his current work.

There will also be a reception Tuesday evening, but no plenary speakers. "We tried to keep the group events light," said Dr. Kelley. "We thought the sessions would be heavy enough."

****

****

Philips Prize Recipient Named

Mark E. Pittelkau will receive the **Philips Prize**, a $1000 cash award given by the North American Philips Laboratories for the best single authored paper presented at the 1988 Robotics and Automation Conference by a graduate student or by a new Ph.D. based on his thesis work. Dr. Pittelkau completed his doctoral work at Tennessee Technological University in February 1988 while on leave from the Naval Surface Warfare Center. He is currently a research engineer with the FMC Corp. Defense Systems Division, Dahlgran, Va.

The prize winning paper, *Adaptive*

Load-Sharing Force Control for Two-Arm Manipulators, deals with simultaneous interactive position and force control for interacting manipulators. The position control is independent of the load and the control algorithm apportions the load between the two manipulators.

Dr. Pittelkau performed his doctoral research under the direction of **Dr. Joe Anderson**, a member of the Electrical Engineering faculty and the Center for Manufacturing Research at Tennesee Tech.

Dr. Ernie Kent of the Philips Laboratories Robotics and Flexible Automation Department will present the award at the conference banquet.

****

****

Robotics Education: A view from Japan

"We may be at the entrance into the time of nightmare: the expectations [for] industrial robots become lower and the enthusiasm for intelligent robots has vanished. Now is the time when we need elaborate and systematic robotics education."

In 1987 a committee of the Robotics Society of Japan conducted a survey of robotics education programs in Japan, the United States, and Europe. The committee, led by **T. Arai**, Univ. of Tokyo and **Y. Hasegawa**, presented their findings to the society along with proposals for an educational policy in robotics in a report which was also sent to those who participated in the survey. Here we present excerpts from their report, slightly edited for brevity and clarity.

Robotics in Japan has developed as a process of designing a piece of mechanism in automatic machines. Robotics is often recognized as an example of electronic mechanics, which is called **mechatronics,** rather than as a component of manufacturing systems. As a result, hardware-oriented studies such as mechatronics and micro-electronics are highly advanced in Japan, while software-oriented studies such as systems engineering and computer science are behind.

Current educational systems, both in the universities and the technical institutes, generally emphasize conventional and fundamental theories rather than advanced and practical applications. Japanese industries require engineers capable of advanced technologies including robotics. However, educational institutions in Japan lack the budgets and materials to satisfy these demands.

Robotics in Europe is generally regarded as a component of comprehensive automation engineering, even though the definitions of robotics varies in different countries. Some higher educational institutes are well-equipped and offer good opportunities in robotics education for workers.

It is necessary to aggressively promote cooperation between educational organizations and industries and to improve the level of technological skills of general laborers.

Robotics in the USA emphasizes education in systems engineering, such as **flexible manufacturing systems (FMS)**, while hardware design of robots and mechatronics are inactive.

It is widely pointed out in the USA that two different engineering fields, systems engineering and production engineering, must be combined.

Robotics Education in Japan

Technical High Schools

At least one course in robotics has been introduced in nearly half of the technical high schools which responded to the survey. In the technical high schools, which offer a three-year course to students 16-18 years old, experiments and exercises play a greater role than lectures. To keep up with the rapid progress of technology in industry and to inspire students to study willingly, teaching staffs frequently change the curricula. In addition they try to abolish the old framework of their engineering courses to make the education more interdisciplinary.

Budgetary restrictions in the technical high schools require teachers to introduce new subjects in the form of extra-curricula activities such as micromouse clubs and microcomputer clubs.

There is a need to spread systems engineering in education in the technical high schools.

Polytechnic Schools All of the polytechnic schools (a five year course with students aged 16-20 years old) which responded have some courses in robotics. The educational policy in polytechnics is to emphasize specialized technologies for applications, especially technical measurement, control theory, microcomputers, mechanics and electronic circuits.

The polytechnics seem to succeed in educating students to understand mechatronics but students lack a deep understanding of the fundamental theories of robotics. Future educational plans must include sound foundations in both basic theory and specialized applications.

Universities

Few Japanese universities and institutes have tailor-made courses in robotics. Therefore most teach robotics as a part of existing courses such as measurement, kinematics, and automatic control. Robotics has been considered not as an object of education but rather a field of research in universities. When rapid developments in industrial robots required more educational courses, the universities could not immediately respond. Robot suppliers and the Japan Industrial Robot Association set up several courses in robotics. Afterwards universities began to construct curricula suitable for advanced technologies.

The existing sectionalism is a large obstacle to the realization of robotics as an integrated engineering subject. Courses and research programs must be formed under the cooperation of different departments.

Proposals

- **Robotics must be dealt with as a new paradigm.**

Robotics in Japan is considered too much as a part of hardware-oriented technologies. We need more experts to

discuss robots in the social sciences and general arts, because robots should be accepted as a kind of daily machinery such as automobiles and microcomputers.

•*Let robotics be a science instead of a manufacturing technology.*

•*Let computer sciences be strengthened.*

• **Education in advanced technologies must be supported.**

Elaborate equipment is indispensable to furthering practical studies, but it is often too expensive and involves a risk of rapidly becoming obsolete as technologies rapidly change. This makes it difficult to invest aggressively in equipment.

•*Encourage robot suppliers to allow students to experiment on robots.*

•*Encourage cooperation between educational institutions and industries and cooperation among existing departments.*

****

****

Reports from Research Centers:

Computer Vision and Robotics Control at the University of Utah

Thomas C. Henderson
Dept. of Computer Science
University of Utah

The computer vision and robotics research program at the University of Utah is directed toward solving both practical and theoretical problems in robotics, vision and sensory control. The design and development of integrated robotic systems is of central concern, as well as individual components of such systems. In particular, we are studying high level control of a multi-fingered robot hand, contact sensors for the hand, together with the image processing and pattern recognition aspects of the problem, multisensor integration systems, 3-D sensing systems, representations and modelling of objects, grasping, computation of salient features, and manipulation strategies for industrial tasks.

Another major area of work is Computer-Aided Geometric Design (CAGD)- based computer vision for recognition and manipulation of 3-D objects. Work on segmentation, classification and contextual cueing algorithms and evaluation of various image processing and pattern recognition algorithms and expert systems is also in progress, as well as the development of special purpose architectures for the execution of such systems.

The long-range goals of our research are to contribute to the understanding of human intelligence and to participate in the development of machine vision systems. Thus, artificial intelligence is of central concern to us, and in particular, all aspects of image analysis and pattern recognition. Areas of special interest include robotics, both in the artificial intelligence sense of planning and in the hand-eye coordination genre, 2-D and 3-D shape analysis, 3-D digital geometry, and parallel processing.

As for the short range goals of the next year or so, several projects have been started or planned.

1. The major short term goal is the development of a multisensor integration and data acquisition

systems. Such a system will be useful for a wide range of activities, including situation assessment, distributed sensory systems, and in our particular application, for the integration of data from diverse sensors at a robot workstation (e.g., cameras, tactile sensors, sonar, etc.). Currently we are working on developing the notion of logical sensor specifications, an approach which should provide most of the benefits of data abstraction to the user of the multisensor system.

2. Another ongoing project is the development of dextrous hand control systems. This work is being done in conjunction with Steve Jacobsen of the Mechanical Engineering Department. Several levels of hand control are being investigated, and our area of interest includes the integration of touch information from tactile sensors, object characterization, and object reorientation. Expert systems dealing with physics and geometry are under development.

3. The use of Computer Aided Geometric Models (CAGD) in driving vision algorithms and systems is another area of study. Visual recognition is accomplished by the use of multiple, perhaps hierarchical, representations of an object to obtain orientation and position information.

4. An algorithm and sensor performance evaluation system is another area of interest which allows the characterization of physical sensors, the specification of algorithms and the evaluation of algorithm/sensor combinations.

Specific areas of research include: CAGD-based vision analysis, low-level representations of sensor data, logical sensor specification and multisensor integration, representation and models of 2-D and 3-D objects, constraint-based analysis, evaluation of pattern recognition and image analysis algorithms, contextual cueing, expert systems, robot hand grasping and manipulation strategies, and distributed problem solving.

In addition to a VAX/750 and graphics facilities, the machine vision and robotics group has a Rhino XR-1 six degree of freedom robot arm, a Unimate PUMA 560 six degree of freedom arm, a VICOM image processing system, and a laser range-finder (White scanner). In addition, we have an HP 9000 Model 237 AI Development Workstation. The graphics facilities provide a suitable environment for simulations, and the mechanical engineering department's Center for Biomedical Design offers a strong complement to the research of the group by allowing first-hand experience with the latest in robotics technology such as the Utah/MIT dextrous hand.

****

****

New Products:

A Solution to the Textile Gripping Problem?

ARATO Engineering, Buochs, Switzerland, has announced the development of a unique gripper for handling textiles ranging from nylon stockings to rugs.

The ARATO G-28 gripper uses 28 of the finest steel needles which are hardened, tempered, ground and polished. In each stab movement, 14 needles stab in the same direction, under about a 45 degree angle, into the work piece, whereby two thirds of the needles cross each other. During the movement, the needles retain their direction of stabbing, and they are concentrated on a 7x7 cm square, with a spacing of 4 needles per square cm. Thanks to this close spacing, thin materials (e.g. 0.07 mm thick) can be picked up.

The manufacturer states that the fine needles cause no damage to the work piece, due to the fact that, for instance in leather, they leave pore type indentations and, in fiber materials, the fibers make way for them because of their small diameter and polished surface.

The depth of the gripping can be reproducibly adjusted between 0 and about 4 mm. Compressed air at 2.5 bar is used to operate the gripper, which has a frequency of gripping movement, at full gripping depth, of more than 2 Hz. The low weight (130 g) permits very fast movement (about 2 m/s)

As of June 1987 about 100 SOFT GRIPPERS were reported in use for applications ranging from movement of irregular stacks of shirt collars to the transport of heavy carpeting.

Self-Tuning Control Technique Compensates for Variable Load Inertias

WIC, Inc. of Mountain View, California, has announced the development of a new compensating feedback technique for the design of direct self-tuning controllers that achieves essentially constant regulation for load inertia variations as great as 100 to 1. The technique adds a single new secondary feedback circuit which is capable of reduction to integrated circuit form.

The new self-tuning technique, on which WIC, Inc. has patents pending, uses a secondary feedback loop to vary a "zero" term in the forward path of the primary controller and thus precisely

cancels the deregulating effect of variations in the inertia pole.

William L. Wise, president of WIC and the inventor of the new technique and its implementations, calls this behavior "pole-tracking". This secondary feedback loop, which embodies the essence of Mr. Wise's invention, adjusts a resistance in the primary feedback regulator to vary the inertia-cancelling zero.

****

****

Positions Available

Division of Information, Robotics and Intelligent Systems (IRIS)*

The National Science Foundation's Division of Information, Robotics, and Intelligent Systems (IRIS) is seeking qualified applicants for the positions of Program Director. Persons appointed to these positions will administer grant programs in support of research in Robotics, Machine Intelligence, Knowledge Systems, and Database Theory. The positions are in the excepted service and will be filled on a permanent basis or on a one- or two-year rotational or temporary basis. Alternatively, faculty members can receive mobility assignments under the Intergovernmental Personnel Act. The per annum salaries range from $50,000 to $72,500 for rotational appointments and from $45,673 to $71,555 for permanent or temporary appointments.

Applicants must have a Ph.D. or equivalent professional experience and training in information or computer science/engineering or a related field and substantial scientific research experience beyond the Ph.D. A broad general knowledge of information and computer research and some administrative experience are also required. For information about these positions, contact Dr. Y.T. Chien, Room 310, IRIS Division, National Science Foundation, Washington, D.C. 20550 (Telephone: 202/357-9572, or by net mail to YTCHIEN@NOTE.NSF.GOV)

*IRIS is in the Directorate for Computer and Information Science and Engineering (CISE)

****

Calendar

March 28-30, 1988
BPRA 4th International Conference on Pattern Recognition, Queens College, Cambridge, England. For information contact Dr. J. Kittler, Dept. Electronic and Electrical Engineering, University of Surrey, Guildford GU2 5XH, England.

April 4-8, 1988
IEEE/SPIE Applications of Artificial Intelligence, Peabody Orlando Hotel, Orlando, Florida. Contact M. Trivedi, U of Tenn, 615/974-5450.

April 24-29, 1988
IEEE Int. Conf. on Robotics & Automation, Franklin Plaza Hotel, Philadelphia, Pa.

June 5-9, 1988
IEEE Computer Society Conf. on Computer Vision & Pattern Recognition, Univ. of Michigan, Ann Arbor, Mich. Contact Ramesh Jain, Dept. EECS, 3215 EECS Bldg, Univ of Michigan, Ann Arbor, MI 48109-2122

June 6-10, 1988
Int. Conf. on Vector & Parallel Computing Issues in Applied Research &

Development,, Tromso, Norway

June 8-16, 1988
ACM/IEEE Design Automation Conference, Anaheim Convention Center Contact Design Automation Conference, MP Associates, 7366 Old Mill Trail Boulder, CO 80301, (303) 530-4333

Aug 8-11, 1988
3rd Int. Conf. on Applications of Artificial Intelligence in Engineering, spons. by the Computional Mechanics Institute, Stanford CA. Contact Computational Mechanics Institute, 25 Bridge Street, Billerica, MA 01821.

Aug 14-17, 1988
3rd Int. Conf. on CAD/CAM: Robotics & Factories of the Future, Southfield Hilton, Southfield, Mich. Sponsored by International Society for Productivity Enhancement. Contact Kelyan Ghosh, Industrial Engineering Department, Ecole Polytechnique, PO Box 6079, Postal Station A, Montreal, Quebec H3C 3A7

Aug 29-31, 1988
IEEE Workshop on Languages for Automation, Univ. of Maryland, College Park. Md. Contact P.A. Ligomenides, EE Dept, U of Maryland, College Park, 20742

Sept 5-8, 1988
1st Int. Conf. on Visual Search, University of Durham. UK

Sept 19-21, 1988
1st UK informal seminar on COMADEM: Condition Monitoring & Diagnostic Engineering Management, City of Birmingham Polytechnic (UK) in assoc. with the Institution of Diagnostic Engineers. Contact Dr. Raj B.K.N. Rao, Dept. Mechanical & Production Eng., City of Birmingham Polytechnic, Perry Barr, Birmingham, B42 2SAU, United Kingdom.

Oct 12-14, 1988
IAPR Workshop on Computer Vision - Special Hardware & Industrial Applications, Nihon Dalgaku Kalkan, Tokyo, Japan Contact Mikio Takagi, Institute of Industrial Science, University of Tokyo, 7-22-1, Roppongi, Minato-ku, Tokyo 106, Japan.

Oct 17-20, 1988
IAPR 9th International Conference on Pattern Recognition. Beijing, China. For information contact 9ICPR Secretariat, Chinese Association of Automation, P.O. Box 2728, Beijing, China.

Nov 7-10, 1988
IEEE International Conference on Computer Aided Design (ICCAD) Contact ICCAD, 1730 Massachusetts Ave NW, Washington, DC, 20036-1903

Dec 5-8, 1988
2nd Int. Conf. on Computer Vision (ICCV). Tarpon Springs, Fla. See call for papers.

19th International Symposium and Exposition on Robots. 1988. Sydney, Australia. The symposium will be held as part of Australia's bicentennial celebration. Papers presented will discuss the complex applications and implications of robot technology in modern society. The exposition will display robots at work in industry, the home, and educational institutions. Contact Dr. Michael Kassler, The Australian Robot Association, 9 Queens Ave., McMahons Pt., Sydney 2060, Australia. Tel: (02) 922-5026.

Feb, 1989
Robotics International of SME Conf. on Robotics in Aerospace, Anaheim CA, Contact Lori Navalta, Society of Manufacturing Engineers One SME Drive, PO Box 930, Dearborn, MI 48121.

Mar 13-16, 1989
Robotics & Remote Systems, The Omni Hotel, Charleston SC.

Mar 20-22, 1989
IEEE Workshop on Visual Motion, Irvine CA, See call for papers.

May 27-31 International Conf on Pattern Recognition, Atlantic City, NJ Contact Herbert Freeman, Rutgers University, Hill Center, New Brunswick, NJ 08903, (201) 932-4208

****

Call for Papers

August 14-17,1988
Third International Conference on CAD/CAM, Robotics, and Factories of the Future This conference, sponsored by the International Society for Productivity Enhancement, has areas of interest in: CAED, CIM, Design/Build Automation, Knowledge Automation, Robotics, and Factories of the Future. The theme is to be "C4 (CAD/CAM/CAE/CIM) Integration, Robotics, and Factory Automation for improved productivity and cost containment". Proceedings will be published by Springer-Verlag. Three copies of the abstract should be sent to
CARS & FOF Conference
Dr. Brian Prasad
Technical System Development
Electronic Data Systems
1400 North Woodward Ave
Bloomfield Hills, MI 48013
(313) 645-4714

Abstracts are requested by March 15. Camera-ready manuscripts due May 30. 1988.

Aug 29-31, 1988
IEEE Workshop on Languages for Automation, , Univ. of Maryland, College Park, Md.
Sponsored by IEEE Computer Society, in cooperation with IEEE SMC Society, IEEE TC on Robotics, IEEE TC on PR, IP,&CV, Univ. of Maryland, Univ. of Pittsburgh, G. Mason Univ., Univ. Polit. de Madrid, E-SYSTEMS Corp.

The theme of next year's LFA Workshop is "Symbiotic & Intelligent Robotics". We wish to investigate the Languages and Automation aspects in the development of Submit 4 copies of complete ms. to

P.A. Ligomenides, (Americas)
Univ. of Maryland, Dept. of Electrical. Engr.
College Park, MD 20742 USA

J. Gutierrez Rios (Europe & Asia)
Universitad Polit. de Madrid, Facultad de Informatica
Km 7, Carretera de Valecia
Madrid 31, Spain

IAPR Workshop on Computer Vision - Special Hardware & Industrial Applications, October 12-14, 1988, Nihon Daigaku Kaikan, Tokyo, Japan. Submit 400 word English summary of paper or research tool by May 15 to:

Mikio Takagi
Inst. of Industrial Science
Univ. of Tokyo
7-22-1, Roppongi, Minato-ku, Tokyo 106
JAPAN Tel.: +81-3-479-0289; Fax.:+81-3-423-2834; Telex.: 0242-3216 IISTYOJ

2nd Int. Conf. on Computer Vision (ICCV), Dec. 5-8, 1988, Tarpon Springs, Fla. Sponsored by the Computer Society of the IEEE. Submit 4 copies of completed paper by May 15, 1988 to

Ruzena Bajcsy
Univ. of Pennsylvania
Dept. Computer & Information Science
200 S, 33rd St.
Philadelphia PA 19104-6389

Feb 1989
Robotics in Aerospace
Continuing to provide robotic technology information for application in the Aerospace Manufacturing Industry, the Aerospace Division of Robotics International of SME presents this conference with the theme "Aerospace Robotics: From Introduction to Integration". Topics of interest cover the entire spectrum of Aerospace robotics, including CAD/CAM, Fabrication, Government plans for robots, Maintenance, and Applications.
Title and 100 word abstract should be sent by March, 1988 to Lori Navalta, SME, One SME Drive, PO Box 930, Dearborn, MI, 48121.

Mar 20-22, 1989
IEEE Workshop on Visual Motion, Irvine, CA
This workshop will bring together researchers from the areas of Computer Vision, Visual Perception, and Artificial Intelligence to discuss current work on the representation and analysis of motion in image sequences. Submit three copies of the paper by July 15, 1988 to Ellen Hildreth, Artificial Intelligence Laboratory, 545 Technology Square, Cambridge, MA 02139 or Ramesh Jain, Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, 48109-2122.

****

Editorial Policy

We accept news items, surveys, letters, positions available, calendar items, book reviews, 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 edit any contributions for style, clarity, and brevity, and to reject any contribution which is inappropriate for this newsletter.

Universities and government agencies may submit position available announcements, which will be published at no cost provided they do not exceed three column inches. We will also publish commercial advertisements. Pricing information can be obtained by calling 919-851-1433.

****

Registration Form

1988 IEEE INTERNATIONAL CONFERENCE ON
ROBOTICS AND AUTOMATION

April 24-29, 1988
Franklin Plaza Hotel
Philadelphia, PA

April 24-29, 1988

The Franklin Plaza Hotel
Philadelphia, Pennsylvania

Please complete and return this form (with your check made payable to "Robotics & Automation") to:

Robotics and Automation
P.O. Box 3216
Silver Spring, MD 20901
U.S.A.

Telephone Contact:
Harry Hayman
After 4/7/88
(301) 434-1990
Prior to 4/1/88
(305) 483-3037

Name

Company

Address

City/State/Zip

Country

Telephone No. (Where you can be reached during the day)

IEEE Membership Number

Please Register me as follows (Circle appropriate fee):

	Member	Non-Member	Student
Sunday Workshop	$80	$100	$80
Conference	$170	$215	$75
One Tutorial	$90	$110	$90
Two Tutorials	$170	$215	$170
Monday one-half day Workshop	$60	$75	$60
Friday Workshop	$90	$110	$90

Please circle applicable fees and add together to determine total fee which should be included with your registration.

If you are attending the tutorials please list the tutorial numbers on the line below.

For Registration after April 15, 1988 add $25 late fee.

The Tutorials and Workshop includes coffee breaks and notes.

Conference registration includes the proceedings, coffee breaks and social functions.

To qualify for student rate, students must be IEEE Members and must not be employed full time. Students will be required to show their IEEE membership card when picking up their registration. Student registration for the conference (does not include social functions, but includes coffee breaks and proceedings).

Late registration will be accepted beginning Sunday, April 24, 1988 at the Franklin Plaza Hotel at 8:00 AM.

Guest Room Registration Request

1988 IEEE INTERNATIONAL CONFERENCE ON
ROBOTICS AND AUTOMATION

April 24-29, 1988
Franklin Plaza Hotel
Philadelphia, PA

April 24-29, 1988

The Franklin Plaza Hotel
Philadelphia, Pennsylvania

Name

Company

Address

City/State/Zip

Country

Arrival Date and Time

Departure Date

A block of rooms for this conference is reserved until Monday, April 9, 1988. Reservations received after this date will be confirmed on an availability basis.

Note: Rooms will be held until 6PM on specified arrival date, unless otherwise noted. Should you wish to guarantee your accommodation for late arrival supply the following information.

American Express Visa/MasterCard Diners Club

Card No.

Exp. Date

Signature

Room Rate – Single $89
Double $99

Forward to: **The Franklin Plaza Hotel**
Two Franklin Plaza
Philadelphia, PA 19103
Tel: (215) 448-2000
Telex: 83-4572

Newsletter of the IEEE Council on

ROBOTICS AND AUTOMATION

Editor: Dr. Wesley Snyder
Dept. Electrical & Computer Eng.
North Carolina State Univ.
Raleigh NC 27695-7914

The INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS, Inc.
445 Hoes Lane · Piscataway, N.J. 08854