Newsletter of the IEEE Robotics & Automation Society

ROBOTICS AND AUTOMATION

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In This Issue

ADVANCE PROGRAM AND REGISTRATION
1992 IEEE International Conference on Robotics and Automation
"Advances in Informationa Technology for Robotics and Automation"
Nice France
May 10-15

THE INSTITUTE OF ELECTRICAL
AND ELECTRONICS ENGINEERS, INC
IEEE

1993 IEEE INTERNATIONAL CONFERENCE ON

ROBOTICS AND AUTOMATION

Sponsored by the IEEE Robotics and Automation Society

May 2-7, 1993
Atlanta Hilton and Towers
Atlanta, Georgia

General Chairperson:	**W.J. Book,** Georgia Institute of Technology
Program Chairperson:	**J.Y.S. Luh,** Clemson University
Program Vice-Chairperson:	**P.K. Khosla,** Carnegie Mellon University
	P.B. Luh, University of Connecticut
Treasurer and Coordinator:	**H. Hayman**

CALL FOR PAPERS

The theme of the 1993 Conference is **"Integration of Intelligent Robots with Automated Manufacturing Systems".** The aim of the Conference is to report and explore the technical advancement and achievement in the field of flexible automation including the coordination of intelligent robotics systems in automated manufacturing systems. The conference will provide a forum for the exchange of ideas and discussion of future directions in robotics and automation. Technical papers presented on Monday, Tuesday and Wednesday, May 3-4, will appear in the bound proceedings. The topics will include but are not limited to:

- Application of robotics and automation in industry, construction, agriculture, and medicine
- Application to nuclear, space, underwater and other hazardous environments
- Robot sensing, data integration, and sensor fusion
- Multisensory perception and workspace modelling
- Autonomous manipulation and mobility with sensing
- Robot group coordination
- Telerobotics and autonomous robots
- Modelling and performance evaluation of manufacturing and other discrete event systems
- Scheduling and control of manufacturing systems
- Analysis of manufacturing system dynamics
- Information engineering for CIM
- Concurrent design of products and automated manufacturing
- Micro-electro mechanical systems
- Control and dynamic analysis addressing unresolved robotic issues

PAPER SUBMISSION: Four copies of each paper should be sent by October 2, 1992 to:

John Y.S. Luh
Dept. of Electrical and Computer Engr.
Clemson University
Clemson, SC 29364, U.S.A.
Telephone: (714) 787-6416 (before June 15, 1992)
(803) 656-5926 (after June 15, 1992)
Electronic Mail: LUHJ@prism.clemson.edu1

Authors will be notified of acceptance and furnished with author's kit by January 3, 1993. Final papers will be due for the proceedings by February 3, 1993.

BEST CONFERENCE PAPER AWARD: $500 will be awarded to the best conference paper.

THE INSTITUTE OR ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
IEEE

INVITED SESSIONS: Proposals for invited sessions should be sent by October 2, 1992 to:

Peter B. Luh
Department of Electrical and Systems Engr.
University of Connecticut - Box U-157
Storrs, CT 06269-3157, U.S.A.
Telephone: (203) 486-4821
Electronic Mail: LUH@farside.ese.uconn.edu

Each session is limited to four papers. Each paper of the submitted session will be reviewed through the normal procedure. If an invited paper is rejected it will be filled by other relevant contributed paper.

Anton Philips Award for Best Student Paper

A $1000 prize will be awarded for the best student paper. The student must be an IEEE member and a student as of June 1992, who is the first author and primary developer of the ideas. Send four copies of the paper, a nominating letter from the advisor, and the student's IEEE membership number to the Anton Philips Award Committee c/o John Y.S. Luh, Dept. of Electrical & Computer Engr., Clemson University, Clemson, SC 29364. Travel assistance is provided for five nominees.

From the Editor's Desk

Michael B. Leahy
Air Force Logistics Command
Robotics and Automation Center of Excellence (RACE)

Greetings from deep in the heart of soggy Texas. Ever since I wrote my last column we have been experiencing record rains. Hopefully the dual of that effect will happen when this issue is published, otherwise I will have to start paying closer attention to articles on underwater robotics. I just hope the weather in Nice doesn't hold any surprises.

Speaking of Nice, this issue is packed with information about our annual conference's first visit to Europe. Like the conference, this will be my first visit to Europe. I look forward to experiencing the French culture and visiting with the European members of our society, especially those who like myself do not get frequent opportunities to travel abroad. Email addresses will finally get faces and *Transactions* pictures voices. Of course I also look forward to meeting many colleagues and special friends whom regularly attend the conference. With any luck, several of you will be on the same flight and we can get started early.

Along with seeing old friends and hearing about the latest research accomplishments, our annual gathering also is a time for administrative and technical committees to meet. The Adcom meeting will be the first for our new society president, Professor T.J. Tarn. Under T.J.'s leadership we will continue to refine the role and objectives of our society. You have a direct voice in that process during the annual election of six Adcom board members. Don't let those ballots from the IEEE languish at the bottom of your in-baskets.

Society involvement goes beyond making six pencil marks and licking an envelope. Administrative matters are important to any large organization, but their purpose is to support our technical growth. To help foster your technical and professional growth we published a listing of the Technical Activities Board (TAB) members in the last issue. Make a point to meet the chairperson of the technical committee which is most closely aligned with your research interests during the conference. Stop a TAB member in the hall between sessions and tell them what you think should be done to improve the technical health of the society. At the May TAB meeting we will be discussing the results of the membership survey on future conference directions.

Also at the conference we will be formally awarding the rank of IEEE Fellow to five members of our society. A brief biographical sketch of each new Fellow is included in this issue. Their technical accomplishments and history of service have earned them one of IEEE's highest honors. These five individuals do not represent all the new Fellows who are society members. We chose to highlight those members because they achieved the Fellow rank primarily on the strength of their direct contributions to the field of robotics and automation. All Fellows who contribute to our society are to be congratulated.

I would like to thank those members who responded to my request for information on painting and stripping aircraft. During the last several months I have learned a great deal about the processes that are under investigation in an effort to eliminate reliance on toxic chemicals. In fact, there is a yearly conference devoted to that subject. The meeting will take place in Orlando Florida this year. (Like us they know how to pick good locations.) Listening to people present the results of their stripping research has helped impress on me the importance of process knowledge to the practicing robotics and automation engineer. Process understanding is the key to developing a solution that will work in the production environment and not just become another monument to technology. If you want your research to have a more direct impact on industry become process literate. You might be pleasantly surprised to learn that your research has new and varied potential applications. We must find innovative ways to speed the transition from laboratory to shop floor. A better understanding of industrial processes is one place to start.

Another method for improving technology transfer is the creation of *regional testbeds*: places where people can go to apply their theories to real hardware and which provide standard environments where apples-to-apples comparisons can be achieved so that the merits and limitations of rival paradigms are accurately determined.

Robotics is moving away from the one robot one laboratory approach. The industrial robot marketplace is rapidly maturing. High speed vision is commonplace and the robot itself is becoming a commodity. The emerging challenge is how to combine those commodities into flexible automation systems. Those systems involve the complex interconnection of several robots, sensors, and material presentation components. Building and maintain-

ing those systems is expensive and manpower intensive. We need to break away from the mode of individual universities and research centers with unique individual systems. Many of us have experienced the frustration of spending 80% percent of our time to create the environment necessary to perform the *real* part of our research, while only a hundred miles away another person is laboring to develop essentially the same capability.

We must work to break that cycle. Development of regional testbeds with trained staff would enhance research productivity, allow the concepts to be demonstrated on realistic systems, and speed the introduction of new ideas into the marketplace. Remember that research is all overhead, the ability to afford that overhead comes from the increased productivity that application of previous research provides.

Time to climb down off my soapbox, as John Graham from the Advanced Robotics Research Institute in Arlington Texas, kept saying when we discussed his ideas for developing such a testbed during my ARRI visit last month. I am sure we are not the only members who have strong opinions on this subject. Volunteer your ideas by email or at the conference. If you put your comments in written form we will be happy to print them and maybe get a dialogue started. The newsletter can, and should be, a forum for discussing these and other ideas.

We need more of that volunteer spirit. You may have noticed that this issue is thin when it comes to membership input. The increased space devoted to paid advertising shows that many people believe that the newsletter is an excellent way to reach the robotics and automation community. Take advantage of that opportunity to tell us about your laboratory or a recent conference you attended. Send us the information on new arrivals and job transfers. Work with us to improve your newsletter. Start by giving me some feedback at the conference. See you in Nice.

Letter To the Editor

S.H. Durrani

The opinions expressed in Letters to the Editor are those of the author and do not necessarily reflect those of the IEEE Robotics and Automation Society, its officers, or the Newsletter editors. Letters are encouraged, but may be edited for brevity.

I have been a strong supporter --and initiator -- of professional activities in the IEEE since the early 1970s. These activities are now part of our constitutional charter, and they should remain so. Lately, however, I have come to believe that it is time for us to examine the way we support them through USAB.

USAB has an annual budget of about $3.5M, primarily funded through a $20/member mandatory Regional Assessment in all US regions. Non-US Regions also have such assessments, but only $1 or $2 per member are spent on professional activities.

By contrast, IEEE does not have a mandatory assessment to support Technical Activities -- although these are also in the charter and are our primary mission.

I strongly believe that we should apply the same criteria and principles to both types of activities. Thus, we should establish a number of Professional Activities Societies (on Pensions, Career Development, R&D Policy, etc.), carefully define their scope or field of interest, and place them under a Professional Activities Board. Membership in each Society should be entirely voluntary, and each Society should choose its own officers.

The issue boils down to freedom of choice, and trust in the good judgment of members. Unfortunately, many USAB leaders believe that funds will dry up if dues are voluntary because (1) members do not know the benefits of USAB programs; (2) engineers usually are frugal (*i.e., cheap*) and will not join; and (3) employers do not support this type of professional activities. They also argue that (4) since everyone benefits from the works of USAB, everyone should pay to support it, just like taxes.

Each of these points can be refuted easily. (1) USAB has been around for about 15 years, plenty of time to publicize its programs. (2) Engineers are not cheap; they just demand good value for their money. They often pay to join two or more Technical Societies, and they will also join a Professional Society if it is worthwhile (3) Employers do not support many technical activities either; we just have to work hard (on conferences, publications, etc.) to raise funds. (4) Some taxes are essential for the common good, but others are like fees for extra services. The question is: which USAB programs are essential, and therefore should be covered by the basic dues and which are optional, for which a voluntary charge would be justified? The answer in a voluntary organization is properly left to members.

USAB's biggest success was in the area of pensions, where we lucked out because the big unions were pushing for similar legislation. However in spite of an excellent staff and a lot of dedicated volunteers, we have achieved very little in other areas. We certainly need to maintain our contacts with the US Congress, but we have too many programs in USAB which do not have much to show.

This is not to say that we should give up professional activities; indeed we should redouble the effort. But I firmly believe that we shall get meaningful results only when we establish Professional Activities Societies with voluntary membership, as proposed here. This conforms with the prevailing spirit of democracy and freemarket philosophy everywhere. By contrast, the current system imposes a continually growing Regional Assessment for activities over which members have no control, thus provoking Proposition 13-like protests against excessive taxation, and raising basic questions of what is a fair tax. I feel we need a change. What do your readers think?

Dr. Durrani has served as Chairman, Washington Section; President, Aerospace and Electronics Systems Society, and Director of the IEEE. He also served on SAB and many of its Committees, and was awarded its Citation of Honor in 1980. He has recently retired from NASA and may be reached at 17513 Lafayette Dr., Olney MD 20832.

News from the Society

AdCom Notes

The Administrative Committee met in Washington, D.C. on November 8, 1991 and conducted business of importance to the Society.

T. J. Tarn will serve as President of the Society for two years beginning January 1, 1992. The Society thanks Norman Caplan for his leadership and diligent service as President during the past year. He moves on to become Chairman of the Nominations Committee.

Richard D. Klafter, Harry E. Stephanou, and C. S. George Lee were re-elected to serve the Society as Vice Presidents for Finance, Member Activities, and Technical Affairs, respectively. The Society appreciates the continuing efforts of these members on its behalf.

George Saridis has ably served the Society as Chairman of the Awards Committee over the past few years. With his resignation, Arthur Sanderson, a past President of the Society, was appointed to this position effective January 1, 1992. A major responsibility of the Awards Committee is to consider nominations for Fellow of the IEEE, and we continue to be well served by these individuals.

Nominations were made to fill the six vacant positions in the AdCom for a 3-year term beginning in 1992. Election results will be received in March.

Preparations continue to be made for the 1992 Conference in Nice, France. The General Chairman, Giuseppe Menga, and Program Chairman, Georges Giralt, report that a record number of papers have been received with many coming from Europe. The AdCom voted to provide Conference Fellowships for Third World Attendees for this year and for 1993.

The 1993 Conference will be held in Atlanta from May 2-7 at the Atlanta Hilton and Towers. Wayne Book is the General Chairman and John Luh is the Program Chairman.

The AdCom voted at this meeting to hold the 1994 Conference in San Diego under the leadership of William Gruver as General Chairman and Harry Stephanou as Program Chairman.

The 1995 Conference will be held May 21-26, 1995 in Japan at the Nagoya Congress Center. Toshio Fukuda is the General Chairman.

The Technical Activities Board (TAB) of the Society has been very active under the leadership of C. S. George Lee, the Vice President for Technical Affairs. Surveys are being conducted on our Technical Interest Profile and Future Conference Directions. A number of new Technical Committees have been formed with chairpersons appointed.

Wesley E. Snyder and W. Thomas Miller, III were re-appointed as our Society's liaisons with the Neural Networks Council.

Robert Kelley will continue to serve on the Steering Committee of the *IEEE Transactions on Image Processing*.

The next meeting of the AdCom will be May 11, 1992 in Nice.

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

Mobile Robot TC

A new Robotics and Automation Society Technical Committee on Mobile Robot has recently been created and is chaired by Yuan Zheng of The Ohio State University. The scope of this committee includes the following aspects:

- Wheeled mobile robots.
- Legged walking robots
- Collision-free path planning for mobile robots
- Gait synthesis for legged walking robots
- Multi-sensor integration for mobile robot navigation,
- Mobile robot dynamics, kinematics and control, and
- Coordination of manipulation and mobility, etc.

People who are interested in becoming involved should contact Yuan at the following address:

Professor Yuan F. Zheng
Dept. of Electrical Engineering
The Ohio State University
Columbus, OH 43210-1272

Email Directory

Name	Affiliation	Email	FAX
Stefano Caselli	**University of Parma, Italy**	**caselli@prvxin.cineca.it**	**+39 (521) 580-723**
Francesco Zanichelli	**University of Parma, Italy**	**zanichelli@prvxin.cineca.it**	**+39 (521) 580-723 (ph. +39 (521) 580-724)**

Send Email Directory and Calendar items to Rosalyn Snyder, Managing Editor, roz@mrips.bgsm.wfu.edu, 5630 Lakeside Drive Pfafftown NC 270440, 919 922 1633

New Arrivals

•**Craig Hamilton,** North Carolina State University, *Thesis: "Analysis* and Improvements in Magnetic Resonance Phase Contrast Flow Imaging" *Advisors:* Sarah Rajala and Peter Santago.

•**Suresh B. Marapane,** University of Tennessee, Knoxville. *Thesis* "Computational Framework For Multi-Primitive Hierarchical Stereo Analysis" *Advisor:* Mohan M. Trivedi. *Currently:* Research Associate Computer Vision and Robotics Research Laboratory Department of Electrical and Computer Engineering The University of Tennessee Knoxville, TN 37996-2100

•**Chu-Xin Chen,** University of Tennessee, Knoxville. *Thesis* "Planning, Coordination and Execution of Perceptual and Motor Actions in Sensor-based Intelligent Robots" *Advisor:* Mohan M. Trivedi. Currently: Research Associate Computer Vision and Robotics Research Laboratory Department of Electrical and Computer Engineering The University of Tennessee Knoxville, TN 37996-2100

•**Clint Robert Padlock** University of Tennessee, Knoxville. *Thesis:* "A Robot Vision System for Object Identification, Localization, and Manipulation using 3D Geometric Models" *Advisor:* Mohan M. Trivedi *Currently:* Research Associate Artificial Intelligence Laboratory University of Michigan Ann Arbor, MI

•**Paolo Valigi,** Second University of Rome "Tor Vergata". October 1991. *Thesis:* Methods for Deterministic Control of Nonlinear Systems with Applications to Induction Motors and Industrial Robots (in Italian). *Advisors*: S. Nicosia and R. Marino. *Currently:* Dept. of Electronic Engineering, Second University of Rome, Via O. Raimondo, 00173 Rome, Italy.

DEADLINE FOR SUMMER ISSUE:

May 15, 1992!

...*from a different perspective*

Rosalyn Snyder

Axioms:

•*Extended exposure to CRT screens while trying to meet publication deadlines can result in remarkable revelations.*

•*Artificial Intelligence is no substitute for natural stupidity*

RA92 Special Technical Session: *The Sensuous Robot*

Even the most unsophisticated layman is aware of some of the great advances in robotics and automation technology over the past decade. Everyone is aware that many robots have acquired a degree of artificial intelligence. As is usually the case, the accounts in the popular press directed toward lay readers are far behind the state of the art.

Among the cognoscenti of the research community, robots have long been recognized to possess intelligence, vision, hearing, touch, and mobility. Moreover, as is evidenced by the substantial body of literature, many robots also exhibit emotional behavior and have the capacity for certain physical exercises which have been until recently universally construed to be dependent on biological characteristics not replicable in the laboratory. Not surprisingly, robots are experiencing the complex psychological problems and frustrations which inevitably accompany the development of complex of physical and emotional relationships.

For example, one frequently cited classic work deals with the obsession of certain computer vision systems with the production of pornography and presents techniques for channeling this energy in more socially acceptable behaviors.

However, at this conference, as in those previous, the papers dealing with these sensitive issues are scattered throughout the Advance Programme, presumably in order to avoid causing hysteria, panic and an invasion of voyeuristic reporters from the tabloid press.

After careful consideration and extended debate, the Program Committee has determined that this exciting yet disturbing area of research is of sufficient import and interest to establish a special session on **The Sensuous Robot.**

Papers will be presented on the following subjects:

•Singularities Avoidance *(Calls to the 900 number may not be charged to government grants)*

•Stripping Technology *(A 20FF and 2 drink minimum cover charge will apply for this presentation only)*

•Resolution of Redundancy Resolution

•On Shape-Preserving Boundary Conditions (*An exercise video will be available for purchase)*

•On-line Performance Enhancement *(The authors emphasise that their*

Continued on page 30

Advances in Information Technology for Robotics and Automation

Nice'92: Conference Preview

Giuseppe Menga, General Chair
Politecnico di Torino, Toulouse Italy

Georges Giralt, Program Chair
LAAS-CNRS - France

The 1992 IEEE International Conference on Robotics and Automation in Nice, the eighth sponsored by the society, will be a special event for many reasons.

For the first time, the Conference moves abroad and will fully accomplish, more than ever before, the aims of the founding officers who wanted this society to be international, meaning that new technologies are without frontiers.

This meaning will be fully captured by a truly European venue cast amidst a dramatic, continent-wide, evaluation from the EEC economic unification to the changes undergone by the Eastern countries.

We have a very timely theme for the Conference and much effort has been devoted to reach an ambitious objective: "*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*".

Many things are moving forward in the old world in innovative technologies, especially robotics and automation. Technological cooperation is spreading among western European industries and research centers and those in Eastern Europe as well.

To offer you a flavor of all this, we opened the conference to industrial participations, more than in the past. You haven't missed in the Call for Papers the presence of European companies and industrial associations in the field of robotics and automation.

With their help we are arranging alongside the conference a true exhibition area where industries and research centers will present the latest in robotics and automation. So you may also plan to come and bring with you your latest robot to show in this European environment.

What better choice; if you want to visit Europe, to start from one of its prettiest and most fashionable parts: the French Riviera, with Nice its capital and a fast spreading Hi-Tech center. However you may not know that it is at only two hours drive from Turin, the city of Fiat and the Italian center for automation, where we expect to spend a visit.

We would like to thank the public and private bodies which have supported the conference: first, the financial help of the two Chambers of Commerce of Nice and Turin, in a spirit of international cooperation, then the European Community throughout ESPRIT Program, finally a group of remarkable European industries: Asea Brown Bovery, Digital Electronic Automation, Electricite de France, Matra, Prima Industrie, Sagem, and Siemens.

We will be waiting for you: the success of this Conference remains in your hands

Plenary Speakers Named

The two keynote speakers for the Nice Conference are Professors *J. Blamont* of France and *Y. Furukawa* of Japan.

Prof. Blamont is Director of the French Space Agency and Scientific Advisor to many international bodies, including NASA, and is well known for his interest in robotics and automation. His lecture topic will be *Robotics and space: the challenge.*

Prof. Furukawa is one of the leading scientists in Japan involved in the Japanese-US-Europe IMS (Intelligent Manufacturing Systems). initiative. His lecture topic will be *Forecasting development process toward the 21st century from today's intelligent CIM*

Program Preview

A record number of 940 papers were submitted to the Program Committee for consideration, which selected 423 regular papers from 31 countries plus 9 posters, in a marathon two-days meeting December 16 and 17 in Toulouse, France. Our thanks to the hundreds of you who reviewed papers for the conference.

Much to our regret, many good papers could not be accepted. Two general rules guided the selection process: to achieve a good distribution over a wide range of subjects, e.g. automation, and to provide a fair representation of some new countries/geographical areas.

Worth mentioning is the following breakdown of the 423 accepted papers: North America: 225, Europe: 121, Japan: 49, rest of the World: 28.

We have an outstanding group of speakers and instructors for the workshops and tutorials which will be held preceding and following the conference. Descriptions of the workshops and tutorials are in the registration information provided in the newsletter.

Video Proceedings

Following the success of the last year's Video Proceedings, the 1992 IEEE Robotics and Automation Conference has issued the second ***Video Proceedings.***

The purpose of this video proceedings is to present new and significant experimental results in robotics and automation undertaken by this international community. The effort is intended to enhance and complement the theoretical results presented in technical sessions of the confer-

ence. A total of 47 entries were submitted, and 31 segments were selected, revised, and edited into this final one-hour video tape. Contributions came from ten countries including Belgium, Canada, France, Germany, Italy, Japan, Russia, Sweden, Switzerland, and United States.

This video will be presented at the conference in a video theater, available through conference registration before and during the conference, and also through IEEE after the conference. The price will be $55 for IEEE members and non-members, and will be valid till the end of May. After that, the regular Video Proceedings prices apply: $69.95 (plus $5 handling and local sales tax where applicable) for IEEE members and $109.95 (plus $8 handling and local sales tax where applicable) for non-members.

Receptions and Banquet

The welcoming and get-acquainted *Reception* will be on Tuesday, May 12, 1992, 7:00-9:00, at Hotel Plaza. The *Banquet* of the Conference will be on Wednesday, May 13, at 8:00 at Acropolis Convention Center. Banquet tickets are included in the registration package of non-student participants. Additional banquet tickets will be available at the Registration Desk until 12:30 on Wednesday. *Persons who are not planning to attend the banquet are asked to turn in their tickets at the Registration Desk for student attendees.*

Author's Breakfast

For the speakers and session chairpersons of the Technical Sessions, a breakfast will be served in the morning of their duties at 7:30 a.m. Each chairperson will host the authors of his/her session at a single table. This will facilitate the planning of the sessions and give the session chairperson the opportunity to explain how he/she will chair the session. Please provide him/her with your biographical sketch. If you are giving a talk on your paper at the conference, please plan to attend the breakfast on the day of your session.

F. Hotel Reservations

A block of rooms has been reserved in the hotels near the Acropolis Convention Center, as detailed in the Hotel Reservation Form at the end of this Advance Program. The rates for these rooms are valid from the beginning of the weekend before the conference until the end of the weekend after the conference. The deadline for the hotel reservation is March 31. After that date, the participants will be accommodated in the rooms still available and they will pay the full rate. If you wish to guarantee your room for arrival after 6:00 p.m., you must pay the first night's room rate plus 10% tax either by advance deposit or credit card. Reserva-

1992 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION

GENERAL CHAIRPERSON

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  A.C. Sanderson

- **PROGRAM VICE-CHAIRPERSONS**
  Hirochika Inoue
  Stanley B. Gershwin

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VIDEO PROCEEDINGS COMMITTEE

Peter B. Luh, Chairperson
Georges Giralt
Vincent Hayward
Oussama Khatib
Giuseppe Menga
Marc H. Raibert

tions may be cancelled at no charge up to 24 hours before intended arrival.

Transportation

Travel Arrangements The Conference has arranged for North American Attendees to make additional airline and hotel reservations at a substantial savings through:

Cerel's Travels
19 Main Street
Natick, MA 01760
Tel (800) 231-2264
(508) 653-2400
Fax (508) 653-5158

Ground Transportation For transportation from Nice Airport to the center of the City, there is a regular bus service every 20 minutes (working days) and 30 minutes (sundays and holidays) from Terminal 2 (Paris) and 1 (International) - Price is 20,- FF. These buses go directly to the regional coach station in Nice, which is about 5 minutes walk from Acropolis and near the main hotels offered by the conference. Taxi fare is around 150,- LFF for a 15 minutes ride.

Local Arrangements

For information on local arrangements, contact the local arrangements chairman:

Professor Pierre Bernhard
INRIA Sophia Antipolis
2004 Route des Lucioles
06565 Valbonne France
Phone +33/93/657878
Fax +33/93/657766

- **Conference Special Meeting Room**

A special room has been arranged for committee and other small group meetings during the conference. A coordinator will be located in the registration area during the conference to assist with scheduling.

Local Attractions

The Mediterranean remains a very busy cross road of ideas, culture and business. Nice is one of the most important welcoming lands of the Mediterranean. With magnificent surroundings and delightful climate, Nice has kept its charm, its authenticity, its tradition. Discover the "Promenade des Anglais", stroll along the seafront and through the quaint old town. Relax and savour the local scents and colours, the flower market and the red and ochre facades of historic Nice. Nice has plenty to offer for a fabulous night out: gastronomic restaurants, theatres, casinos, opera and discotheques. Villages perched on rocky peaks, bays shimmering in the sun, little harbours. This is the heart of the French Riviera.

- **Climate and Attire**

The climate in Nice in May is generally pleasant and Springtime attire is comfortable with temperature ranging in the mid 20's (Celsius).

Excursions:

- **MONACO:** one day including transport, guide and visit of Monaco and Monte Carlo, starting at 195,- FF
- **MONTE CARLO BY NIGHT:** including transport, guide, sightseeing tour by night, casino, starting at 210,- FF
- **CORSICA**: 2 days/one night, including air and ground travel, 3 stars hotel, full board, guide and sightseeing (half day Ajaccio and Iles Sanguinaires, half-day Porto), starting 1480,-FF (double occupancy)
- **FLORENCE** (Tuscany-Italy): 2 days/one night including ground transport, 4 stars hotel in half board, guide, half day sight seeing tour, starting 695,-
- **VENICE** (Italy): 2 days/2 nights, including night train, 3 stars hotel (one night in half board), guide, sight-seeing tour with admission to St Mark Basilica and Doge's Palace, starting 1530,- FF (double occupancy).
- **PARIS:** 2 days/one night, including air travel, hotel in half board, sight-seeing, guide, starting: 2030,- FF (3 stars hotel, double occupancy) 1920,- FF (2 stars hotel, double occupancy)
- **COLOURFUL PROVENCE:** one day, including transport, lunch, guide and visit of St. Remy de Provence and Les Baux de Provence (old Provencal villages), Fontvieille, and Daudet's windmill. For detailed information and booking, please call

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Technical Tours & Exhibits

Technical tours to local industries and university laboratories are being arranged and will be made available during the conference. Sign up for the technical tours at the Conference Desk.

An exhibition of industrial and academic researches will be held during the conference at the Acropolis Convention Center. For exhibiting at the conference please contact:

Amedeo Carcassi
Di.Effe Srl
Viale Monterosa 67
20149 Milano - Italy
Tel +39/2/48009430
Fax +39/2/4980138

POSTER SESSIONS

- *A Modular Software System for Distributed Telerobotics* S. Graves, Texas A&M University, L. Ciscon, and J. D. Wise, Rice University - Houston, USA
- *Multi-Agent Interface Architecture for Human-Robot Cooperation* Y. Nakauchi, T. Okada, N. Yamasaki, and Y. Anzai, Keio University, Japan
- *Command and Control Structure and Perception System of the German MoD Experimental Program "ROBOTICS on the Battlefield"* A. Zapp, ESG Elektronik-System-GmbH, Germany
- *A Remote Manipulator for Forestry Operations* A.A. Goldenberg, J. Wiercienski, P. Kuzan, Szymczyk, R. G. Fenton, and B. Shaver, University

of Toronto, Canada

- *Automatic Detection of Three-Dimensional Solder Defects Using a Brightness-Based Approach* L. Berard, P. Cohen, Ecole Polytechnique, and N. Begnoche, IBM Canada Ltd, Canada
- *Ground-Based Control of Space Station Freedom-Based Robots* S. Kalaycioglu and S. Seifu, Thomson-CSF Systems Canada Inc., Canada
- *HERA: A Reliable and Safe Space Robot* C. J. M. Heemskerk and R. A. Bosman, Fokker Space & Systems B.V., The Netherlands
- *The Robot Vision System VIRO for Flexible Part Recognition and Loading of Processing Machines with High Precision* R. Koy-Oberthur, Bildverarbeitungs- systeme GmbH, Germany

Please check the Final Program which you will obtain at registration for possible changes or corrections to this program.

Technical Program

Notations:
TuA I, TuA II - Tuesday morning sessions
TuP I, TuP II - Tuesday afternoon sessions
WA I, WA II - Wednesday morning sessions
WP I, WP II - Wednesday afternoon sessions
ThA I, ThA II - Thursday morning sessions
ThP I, ThP II - Thursday afternoon sessions

TUESDAY, MAY 12, 1992
Plenary Session I: 8:00-8:45 a.m.
Room: Auditorium Hermes
Prof. Jacques Blamont
CNES, France
ROBOTICS AND SPACE: THE CHALLENGE

TECHNICAL SESSIONS: 9:00-10:40 a.m.

- TuA I-1 **Man-machine Interaction** Chairperson: R. P. Paul, University of Pennsylvania
- TuA I-2 **Dynamic Simulation**, Chairperson: Y. Nakamura, Univ. of California, Santa Barbara,
- TuA I-3 **Medical Robotics**, Chairperson: J. Troccaz, University Joseph Fourier,
- TuA I-4 **Cell Controllers**, Chairpersons J.F. Couturier University of Nancy, France
- TuA I-5 **Compliant Motion**, Chairpersons M. V. Vukobratovic, Mihajlo Pupin Institute
- TuA I-6 **Camera Calibration**, Chairpersons G. Sandini, University of Genova,
- TuA I-7 **Actuators**, Chairperson: J. M. Hollerbach, McGill Univ., Canada
- TuA I-8 **Assembly Planning And Geometric Constraints**, Chairperson: T. Lozano-Perez, MIT AI Lab.
- TuA I-9 **Distance Computation**, Chairperson: J. D. Boissonnat, INRIA, Sophia Antipolis

COFFEE BREAK: 10:40 - 11:00 a.m.

TECHNICAL SESSIONS: 11:00 a.m. - 12:40 p.m.

- TuA II-1 **Map Generation For Navigation** I Chairperson: N. Ayache
- TuA II-2 **Kinematics Analysis** I Chairpersons, B. Roth, Stanford University and P. Wenger, Ecole Centrale de Nantes
- TuA II-3 **Mining Applications** (INVITED) III Chairperson L. Daneshmend, McGill University
  - *Perception for a Road Header in Automatic Selective Cutting Operation,* J. J. Orteu, LAAS-CNRS, France; J. C. Catalina, AIT-EMIN, Spain, and M. Devy, LAAS-CNRS, France
  - *A Robotic System for Underground Coal Mining* G. Shaffer and A. Stentz, Carnegie Mellon University, USA
  - *Optical Guidance System for Underground Mine Vehicles* R. Hurteau, Campus de l'Université de Montreal; M. St. Amand, CCARM Montreal, Y. Laperrihre, and G. Chevrette, Noranda Technology Center, Pointe Claire, Canada
  - *Force Analysis for Automation of the Loading Operation in an LHD-Loader* A. Hemami, Ecole Polytechnique de Montreal, and L. Daneshmend, Mc Gill University, Montreal, Canada 1
- TuA II-4 **CIM** Chairperson: G. L. Kovacs, Hungarian Academy of Sciences
- TuA II-5 **Constrained Motion Control** Chairperson A. Castano, University of Illinois
- TuA II-6 **Vision And Systems** Chairperson TBA
- TuA II-7 **Adaptive Control** Chairperson R. Ortega, McGill University,
- TuA II-8 **Coordination Of Multiple Manipulator Systems** Chairperson V. Kumar, Univ. of Pennsylvania
- TuA II-9 **Non-holonomic Motion Planning** Chairperson S. Sastry, University of California

LUNCH: 12:40 p.m. - 14:20 p.m.

TECHNICAL SESSIONS: 14:20 - 16:00 p.m.

- TuP I-1 **Teleoperated Mobile Robots For Emergency Rescue** I Chairperson J. Pot, EDF
- TuP I-2 **Kinematic And Dynamic Calibration** Chairperson A. Rovetta, Politecnico di Milano
- TuP I-3 **Mechanical Design Of Robots**, Chairperson A. Rovetta, Politecnico di Milano
- TuP I-4 **Manufacturing And Sensing**, Chairperson L. G. Feinstein, Allegro Micro Systems
- TuP I-5 **Contact Sensing**, Chairperson R. Bajcsy, Univ. of Pennsylvania,
- TuP I-6 **Segmentation And Object Recognition**, Chairpersons TBA

•TuP I-7 **Adaptive Neural Networks**, Chairperson S. Arimoto, University of Tokyo

•TuP I-8 **Coordination Of Multiple Manipulator Systems,** Chairperson: B. Siciliano, University of Napoli

•TuP I-9 **Perception Based Mobile Robot Navigation,** Chairperson: R. Chatila, LAAS-CNRS,

COFFEE BREAK: 16:00 - 16:20 p.m.

TECHNICAL SESSIONS: 16:20 - 18:00 p.m.

•TuP II-1II **Mobile Robot Design**, Chairperson: D.E. Okhotsimsky, Keldish Institute of Applied Mathematics

•TuP II-2 **Kinematics Analysis,** Chairpersons: J. P. Merlet, INRIA and J. Angeles, McGill University

•TuP II-3 **Micro-robot Design**, Chairperson: W. S. Newman, Case Western Reserve Univ.

•TuP II-4 **Performance Analysis,** Chairperson: M. Silva, University of Zaragoza

•TuPII-5 **Proximity And Contact Sensing**, Chairpersons: TBA

•TuP II-6 **Image Motion Analysis**, Chairperson: C. Braccini, University of Genova

•TuP II-7 **Control Applications**, Chairperson: S. Dubowski, MIT

• TuP II-8 **Fine Manipulation**, Chairpersons: K. Goldberg, University of Southern California, and R. H. Taylor IBM T.J. Watson Research Center

•TuP II-9 **Mobile Robot Localization**, Chairpersons L. Kleeman, Monash University and J. L. Crowley, LIFIA-IMAG

TUESDAY, MAY 12, 1992
RECEPTION: 19:00 - 21:00
HOTEL PLAZA CONCORDE, NICE

WEDNESDAY, MAY 13, 1992

TECHNICAL SESSIONS: 9:00 - 10:40 a.m.

•WA I-1 **Mobile Robots**, Chairpersons: P. Lemarque and W.A. Gruver, University of Kentucky

•WA I-2 **Kinematics Analysis Of Redundant Robots:** Chairperson: A.A. Maciejewski, Purdue Univ.

•WA I-3 **Flexible Joint Robots**: Chairperson: S. Nicosia, II Università di Roma, and J. Baillieul, Boston University

•WA I-4 **PETRI NETS** I: Chairpersons: A.A. Desrochers, Rensselaer Polytechnic Institute

• WA I-5 **Force Control** I: Chairpersons: O. Khatib, Stanford University, and G. Hirzinger, DLR

•WA I-6 **Sensor Based Manipulation**, Chairpersons: K. Tanie, Tsukuba Science City and S. E. Salcudean, University of British Columbia

• WA I-7 **Control Of Mechanical Systems**, Chairperson: B. Bona, Politecnico di Torino

•WA I-8 **Grasp Planning**: Chairperson: M. Cutkosky, Stanford University,

•WA I-9 **Neural Networks For Walking Machines**: Chairperson: R. Zoppoli, University of Genova,

COFFEE BREAK: 10:40 - 11:00 a.m.

TECHNICAL SESSIONS: 11:00 a.m. - 12:40 p.m.

•WA II-1 **Walking Machines,** Chairperson: S. Hirose, Tokyo Institute of Technology

•WA II-2 **Kinematics Singularities,** Chairpersons: W. Khalil, Lab. d'Informatique de Nantes and J. W. Burdick, California Institute of Technology

•WA II-3 **Multiple Flexible Link Robots**: Chairperson: H. Van Brussel, Catholic University of Leuven

•WA II-4 **PETRI Nets** II, Chairperson: H. E. Stephanou, Rensselaer Polytechnic Institute

• WA II-5 **Force Control** II, Chairperson: H. Van Brussels, Catholic University of Leuven

•WA II-6 **Sensor Data Fusion,** Chairperson: TBA

• WA II-7 **Non-linear Control,** Chairperson TBA

• WA II-8 **Geometric Motion Planning,** Chairpersons: T. Hasegawa, Electro-Technical Laboratory, Japan

• WA II-9 **Position Estimation For Mobile Robots** IX Chairperson TBA

LUNCH: 12:40 - 14:20 p.m.

TECHNICAL SESSIONS: 14:20 -16:00 p.m.

•WP I-1 **Robotics Vehicles In Space** Chairperson: E. Krotkov, Carnegie Mellon University and D. Moura Small Marsokhod

•WP I-2 **Multiple Robots** Chairperson: B. Zhang, Tsinghua University

•WP I-3 **Robot Skills** Chairperson: D. E. Kodtischek, Yale University, and H. Kazerooni, University of California

•WP I-4 **Robot Programming And Scheduling** IV Chairperson: Y. Takenchi, The University of Electro-Communications

•WP I-5 **Force Control III** Chairpersons: V. Hayward, McGill University and B. Bona, Politecnico di Torino

•WP I-6 **Shape And Surface Representation** Chairpersons TBA

•WP I-7 **Intelligent Sensing And Control** Chairperson: G. Buttazzo, Scuola Superiore S. Anna

•WP I-8 **Motion Planning** Chairperson: B. Faverjon INRIA

•WP I-9 **PANEL:** ***Large Scale R&DProjects. National And International Policies:*** Chairperson: P. McConnaill, EEC, Bruxelles

• *NASA Telerobotics Research Program* R. Weisbin, Jet Propulsion Laboratory, M.D. Montemerlo, NASA Headquarters
•*Technical Progress during the first year of Implementation of the TELEMAN Program*, Robertson, Commission of the European Communities, Belgium
• *Results of the Advanced Robotics Technology, MITI Project*

Sato, University of Tokyo, Japan;
•*Computer Integrated Manufacturing in ESPRIT III*: TBA

COFFEE BREAK: 16:00 - 16:20 p.m.

TECHNICAL SESSIONS: 16:20 - 18:00 p.m.

•WP II-1 **PANEL:** ***Educational Issues,*** Chairpersons: P. Khosla, Carnegie Mellon University, and T.C. Hsia, Univ. of California Davis

•WP II-2 **Kinematic Redundancy In Robot Manipulators,** Chairperson: B. Siciliano, University of Napoli

•WP II-3 **Single Flexible Link Robot,** Chairpersons: W. Book, Georgia Inst. of Tech. and K. S. Rattan, Wright University

•WP II-4 **Robots And Manufacturing** Chairperson: L. Nielsen, Lund Institute of Technology

•WP II-5 **Force Reflecting Teleoperation,** Chairpersons A.K. Bejczy, CalTech

•WP II-6 **SONAR Sensing,** Chairperson G. Carbonato, Prima Industrie S.p.A.,

•WP II-7 **Neural Networks** I, Chairperson R. Bajcsy, University of Pennsylvania,

• WP II-8 **Motion Planning For Assembly I,** (INVITED) Chairpersons: L. S. Homem de Mello, Jet Propulsion Laboratory, and S. Lee, University of Southern California

•*AMP-CAD: An Assembly Motion Planning System,* S. N. Gottschlich, Rensselaer Polytechnic Institute, and A. C. Kak, Purdue University, USA
•*The Robustness of an Admittance Control Law Designed for Force Guided Assembly to the Disturbance of Contact Friction,* J. M. Schimmels, Marquette University, and M. A. Peshkin, Northwestern University
•*USA Mating Constraint Languages for Assembly Sequence Planning,* J. Wolter, S. Chakrabarty, and J. Tsao, Texas A&M University, USA
• *From Symmetry Groups to Stiffness Matrices,* Y. Liu and R. Popplestone, University of Massachusetts at Amherst, USA

WEDNESDAY, MAY 13, 1992
CONFERENCE BANQUET AT 20:00 p.m.
at ACROPOLIS

THURSDAY, MAY 14, 1992

Plenary Session II 8:00 - 8:45 a.m.
Room: Auditorium Hermes
Paradigm Shift In Manufacturing Systems: Forecasting Development Process Toward 21st Century From Today's Intelligent CIM
Prof. Yuji Furukawa
Tokyo Metropolitan University
Department Of Computer Controlled Precision Engineering

TECHNICAL SESSIONS: 9:00 - 10:40 a.m.

•ThA I-1 **Mobile Robots II** Chairpersons G. N. Saridis, Rensselaer Polytechnic Institute, and U. Rembold, University of Karlsruhe

•ThA I-2 **Redundancy Resolution** Chairpersons A. De Luca, University of Rome,

•ThA I-3 **Swarm Robotics And Distributed Intelligence** Chairpersons S. Hackwood, University of California and T. Fukuda, Nagoya University

•ThA I-4 **Scheduling I** Chairpersons R. Akella, Carnegie Mellon University, and F. Nicolò, University of Rome

•ThA I-5 **Friction Modelling** Chairpersons M. Gautier, E.C.N., France,

•ThA I-6 **Stereo Vision** Chairpersons R. A. Jarvis, Monash University,

• ThA I-7 **Neural Networks II** Chairpersons M. V. Vukobratovic, Mihajlo Pupin Institute, and W. Khalil, Laboratoire d'Informatique de Nantes

•ThA I-8 **Motion Planning For Assembly II** (INVITED) Chairpersons S. Lee, University of Southern California, and L. S. Homem de Mello, Jet Propulsion Laboratory

• *Backward Assembly Planning with DFA Analysis S.* Lee, University of Southern California, USA
•*Assembling Polyhedra with Single Translations* R. H. Wilson and A. Schweikard, Stanford University, USA
• *A Multihierarchical Representation of Tetrahedral Truss Structures for Assembly Sequence Planning* L. S. Homem de Mello, Jet Propulsion Laboratory, USA
•*KBAP: An Industrial Prototype of Knowledge-Based Assembly Planner* A. Delchambre, CRIF/WTCM

•ThA 1-9 **Task-level Planning For Autonomous Robots** Chairpersons TBA

COFFEE BREAK: 10:40 - 11:00 a.m.

TECHNICAL SESSIONS: 11:00 a.m. - 12:40 p.m.

•ThA II-1 **Mobile Robots III** Chairperson: J. Borenstein, University of Michigan

• ThA II-2 **Robot Control I** Chairperson: D. Simon, INRIA,

•ThA II-3 **Teleoperation** Chairperson: G. Hirzinger, DLR

• ThA II-4 **Scheduling II** Chairperson: F. Nicolò, University of Roma,

• ThA II-5 **Neural Networks For Force Control** Chairperson: TBA

• ThA II-6 **Perception And Uncertainty** Chairperson TBA

•ThA II-7 **Optimal Control** Chairpersons: P. Dorato, University of New Mexico, and A.J. Koivo, Purdue University

•ThA II-8 **Motion Planning For Assembly III** (INVITED) I Chairpersons: L. S. Homem de Mello, Jet Propulsion Laboratory S. Lee, University of Southern California

•*Conceptual Graph Based Synthesis of Robotic Assembly Operations,* A. Kapitanovsky and O. Maimon, Tel-Aviv University
• Israel
•*Feedback Evaluation of Assembly Plans,* W. Hsu, C. S. G. Lee, and S. F. Su, Purdue University, USA
•*An Assembly Sequence Generation Algorithm using Case-based Search Techniques,* P. Pu, University of Connecticut, USA
• *A Semi-Automatic Assembly Sequence Planner,* J. J. Waarts,

Boneschanscher, and W. F. Bronsvoort, Delft University of Technology, The Netherlands

•ThA II-9 **Control Architectures For Mobile Robots** Chairperson R. Lumia, NIST

LUNCH: 12:40 - 14:20 p.m.

TECHNICAL SESSIONS: 14:20 - 16:00 p.m.

•ThP I-1 **Collision Avoidance** Chairpersons W. S. Newman, Case Western Reserve University, and O. Khatib, Stanford University

•ThP I-2 **Robot Dynamics**, Chairpersons D. E. Orin, Ohio State University, and R. E. Ellis, Queen's University

•ThP I-3 **Space Robotics**, Chairperson: J. L. Lacombe

•ThP I-4 **Scheduling III** Chairperson S.B. Gershwin, M.I.T.

•ThP I-5 **On-line Motion Planning** Chairpersons V. J. Lumelsky, University of Wisconsin

•ThP I-6 **Vision Sensors** Chairpersons TBA

• ThP I-7 **Sliding Mode Control** Chairpersons TBA

•ThP I-8 **Motion Planning With Uncertainties** Chairpersons: B. Donald, Cornell University and R. Sharma, University of Maryland

•ThP I-9 **Control Architectures and Robot Programming** Chairpersons D. M. Lyons, Philips Laboratories, G. Saridis, Rensselaer Polytechnic Institute

COFFEE BREAK: 16:00 - 16:20 p.m.

TECHNICAL SESSIONS: 16:30 - 18:00 p.m.

•ThP II-1 **Mobile Robots** Chairperson TBA

•ThP II-2 **Sensors For Robots** Chairperson P. Dario, Scuola Superiore S.Anna

•ThP II-3 **Space Robots Dynamics** Chairperson: S. Dubowsky, M.I.T.

•ThP II-4 **Scheduling** Chairpersons F. Di Cesare, RPI

•ThP II-5 **Constrained Motion Planning** Chairpersons A.A. Goldenberg, University of Toronto, and G. Lee, Purdue Univ.

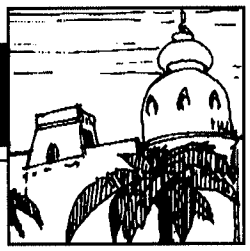
• ThP II-6 **Visual Servoing** Chairpersons H. Inoue, University of Tokyo, and S. Stansfield, Sandia National Labs.

•ThP II-7 **Tracking Control** Chairperson C. Canudas De Wit, Laboratoire d'Automatique de Grenoble

•ThP II-8 **Geometric Motion Planning** Chairpersons B.H. Lee, Seoul National University, and J. D. Boissonnat, INRIA Sophia Antipolis

•ThP II-9 **Multi-finger Manipulation And Grasping** Chairpersons: V. Kumar, University of Pennsylvania and H. E. Stephanou, Rensselaer Polytechnic Inst.

1992 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION



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

Sponsored by the IEEE Robotics and Automation Society

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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.

Workshops and Tutorials

•Workshop S1 (Sunday, May 10, 1992 - 9:00 AM to 5:00 PM:
Assembly Planning: Theory and Implementation *(Room Risso 6)*

The objective of this Workshop is to provide an informal forum for researchers in industries, universities and government labs to get together to discuss recent progress and future research directions in assembly planning.
Topics of interest include: assembly modeling, assembly plan representation, evaluation of assembly plans, algorithmic and knowledge-based approaches to assembly planning, and implementation issues.
Each of the speakers will deliver a 25-minutes presentation, and the attendees will participate in an hour long discussion at the end of the presentations.
The outcome of the Workshop hopefully will be a concerted research effort among the researchers to advance the science and engineering in assembly planning.
Organizers: C.S. George Lee, Purdue University
Sukhan Lee, University of Southern California
A.C. Sanderson, Rensselaer Polytechnic Institute
Speakers:
C.S. George Lee, Purdue University
Jean-Michel Henrioud, Alain Bourjault, Laboratoire d'Informatique de Besancon
Thomas L. De Fazio, Daniel E. Whitney, Charles Stark Draper Laboratory
A.C. Sanderson, L.S. Homem de Mello, Rensselaer Polytechnic Institute
Sukhan Lee, Jet Propulsion Laboratory and University of Southern California
Jan Wolter, Texas A&M University
David Strip, Sandia National Laboratories

•**Workshop S2 (Sunday, May 10, 1992 - 9:00 AM to 5:00 PM): Architectures for Intelligent Control Systems** *(Room Mobile 10)*

The purpose of this Workshop is to bring together researchers working on the design of software robot control, to present and discuss their approaches, to try to find some common grounds in order to formalize better the problem of control, to classify and characterize the adequate architectures, their advantages and drawbacks, and to look for some validation means. The Workshop will be open to people interested in these issues that are central to the design of an integrated robotic system.
The first such Workshop was held in association with the 1991 IEEE Conference on Intelligent Control (Arlington, Virginia) in August 1991, and was organized by Scott Harmon and Alexander Meystel.
Organizers:
Raja Chatila, LAAS-CNRS
Scott Y. Harmon, Hughes Research Laboratories
Speakers: R. Arkin, Georgia Institute of Technology
Scott Y. Harmon, Hughes Research Laboratory
Ronald Lumia, NIST, National Institute of Standards & Technology
Alexander Meystel, Drexel University
Rodney Brooks, MIT
Rachid Alami, Raja Chatila, LAAS-CNRS
James Crowley, LIFIA
Helene Chochon, AAR
Ulrich Rembold, University of Karlsruhe
Mike Brady, Hugh Durrant-Whyte, University of Oxford

•**Tutorial M1 (Monday, May 11, 1992 - 9:00 AM to 1:00 PM): Redundancy: Performance Indices, Singularities Avoidance, and Algorithmic Implementations** *(Room Risso 6)*

It is the purpose of this Tutorial to present some of the most relevant topics concerning robot mechanisms (manipulator) redundancy. The first section is devoted to the study of the kinematic criteria that serve as performance indices for the design analysis/optimization of redundant mechanisms. Next, their impact on the important subject of kinematic control and singularities/obstacle avoidance is treated. The last section deals with some of the most successful algorithmic implementations for redundancy resolution
Organizers: Rene V. Mayorga, University of Waterloo
J. Angeles, McGill University
Speakers: J. Angeles, McGill University
Olaf Egeland, University of Trondheim
V. Kumar, University of Pennsylvania
A.A. Maciejewsky, Purdue University
Rene V. Mayorga, University of Waterloo
B. Siciliano, University of Naples

•**Tutorial M2 (Monday, May 11, 1992 - 9:00 AM to 1:00 PM) Application of Machine Learning Methodologies in Robotics** *(Room Mobile 10)*

The purpose of this tutorial is to give an overview and to discuss subsymbolic and symbolic learning strategies which are useful to enhance robot performance and reliability as well as to support the acquisition of behavior and skills. For this purpose various learning methodologies and their application to some real world robot domains e.g. for connecting sensing with action or reaction, will be presented.
The tutorial consists of 4 parts starting with an introduction into basic machine learning system architectures. In the following, symbolic learning methodologies (e.g. based on induction or deductive reasoning) and subsymbolic learning schemes (e.g. based on neural net architectures) as well as "hybrid" approaches are presented and discussed in detail. The last part of the Tutorial is related to the presentation of some existing systems, the discussion of its performance and an outlook to future development. Books, journals, events and the leading research groups will be reviewed.
Organizer: R. Dillmann, University of Karlsruhe
Speaker: R. Dillmann, University of Karlsruhe

•**Tutorial M3 (Monday, May 11, 1992 - 9:00 AM to 5:00 P.M.): Concurrent Product/Production System Design and Petri Nets in Automated Manufacturing Systems** *(Room Mobile 11)*

After a short introduction of Advanced (Flexible, Intelligent, Integrated) Manufacturing Cells and Systems, the Concurrent Engineering (CE) approach to product and manufacturing system design will be discussed using modeling and knowledge processing techniques. A rapid prototype of a manufacturing cell design system will be presented, which uses blackboard architecture and cooperating expert subsystems to realize the CE approach.
Research and development over the last two decades has provided new theory and graphical tools based on Petri nets and related concepts. The purpose of the second part of this tutorial is to present the theory, its implementation and examples of applications to the modeling, discrete event control and performance analysis of manufacturing systems. Currently available software tools based on the Petri net approach will be reviewed and assessed.
Organizers: Manuel Silva, University of Zaragoza
George L. Kovacs, Hungarian Academy of Sciences
Speakers: Alan Desrochers, Rensselaer Polytechnic Institute
Frank DiCesare, Rensselaer Polytechnic Institute
Manuel Silva, University of Zaragoza
George L. Kovacs, Hungarian Academy of Sciences
Istvan Mezgar, Hungarian Academy of Sciences

•**Tutorial M4 (Monday, May 11, 1992 - 9:00 AM to 5:00 PM): High-Precision Sensors/Actuators and Systems** *(Room Risso 7)*

Research and development of high-precision systems, micro electromechanical systems, distributed sensors/actuators, smart structural systems, high precision controls, etc. have drawn much attention in the recent years. These new devices and systems could bring a new technological revolution in modern industries and further impact future human life. This Tutorial is concerned with the most updated new technologies in this general area, such as silicon-based sensors/actuators and control, piezoelectric micro sensors/actuators, micro actuation and control, micro sensors applications in robot control, etc.
An overview of optical fiber sensors for robotics includes sensing phenomena, sensor design and application case studies.
There are four essential subjects emphasized in this tutorial: (1) surveying the state-of-the-art research and development, (2) tutoring fundamental theories and tools, (3) demonstrating practical applications, and (4) discussing future research and development
Organizers: H.S. Tzou, University of Kentucky and Institute of Space and Astronautical Science
Toshio Fukuda, Nagoya University
Janusz Marszalec, Technical Research Center of Finland
Speakers: Toshio Fukuda, Nagoya University
R.S. Fearing, University of California, Berkeley
S. Middelhoek, Delft University of Technology
Paolo Dario, University of Pisa
D.L. Polla, University of Minnesota
S. Aoshina, NTT
H.S. Tzou, University of Kentucky and Institute of Space and Astronautical Science
Janusz Marszalec, Technical Research Center of Finland

•**Tutorial M5 (Monday, May 11, 1992 - 2:00 PM to 6:00 PM) Active Computer Vision: Robot Heads, Visual Control, and Applications** *(Room: Risso 6)*

The field of active computer vision has been the subject of increasingly intensive research and development. The efforts have yielded a new generation of hardware in the form of multi-camera robot heads, and new vision techniques that make some ill-posed problems easier to solve. This tutorial will survey the field, presenting a comprehensive review of currently available hardware, discussing selected problems in gaze control and control of multiple sensors and degrees of freedom, and identifying promising and less promising applications of active computer vision.

Organizer: Eric Krotkov, Carnegie Mellon University
Speakers: Eric Krotkov, Carnegie Mellon University
Chris Brown, University of Rochester
James Crowley, LIFIA

- **Tutorial M6 (Monday, May 11, 1992 - 2:00 PM to 6:00 PM): Model Based Specification and Execution of Compliant Motion** *(Room: Mobile 9)*

The purpose of this tutorial is to present a theoretical framework for specification and intelligent execution of compliant motion tasks, which is much more powerful than the traditional task frame or compliance frame approach. A general, invariant description of motion constraints (natural constraints) is presented based on twist and wrench spaces.
The description of a combination of simultaneous motion constraints are modelled by means of contact features. The specification of a compliant motion task is a description of the behaviour of the contact features.
Based on the measured velocities and contact forces the task execution can be monitored, and errors in the nominal geometric constraint model can be identified. This is a generalization of the tracking problem. All steps are illustrated with examples.
Numerical algorithms for each step are provided, and attention is paid to non-invariance problems.

Organizers: Joris De Schutter, Catholic University of Leuven
Hermann Bruyninckx, Catholic University of Leuven
Speakers: Joris De Schutter, Catholic University of Leuven
Hermann Bruyninckx, Catholic University of Leuven

- **Workshop F1 (Friday, May 15, 1992 - 9:00 AM to 1:00 PM): Sensor Based Robot Navigation** *(Room: Mobile 10)*

The focus of the Workshop is on the interaction between sensing and spatial planning and reasoning in mobile robot navigation. More precisely, different ways of using spatial reasoning to compensate for imperfect sensing and vice versa are explored, both in known and unknown environments. Closely related is the problem of map building. What is the nature of a map? Can fully metric mapping be attained? If not, what should be the elements of a cognitive map, that allows navigation, if coupled with sensing? What types of spatial reasoning architectures are required, in order to fully account for the uncertainty inherent in sensory and odometric data?

Organizers: James Crowley, INPG, Institut National Polytechnique de Grenoble
Evangelos E. Milios, York University
Speakers: Ronald Arkin, Georgia Institute of Technology
Rodney Brooks, MIT
Ernst Dickmanns, University of Bundeswehr
Gregory Dudek, McGill University
Michael Jenkin, York University
Avi Kak, Purdue University
Benjamin Kuipers, University of Texas at Austin
Vladimir Lumelsky, University of Wisconsin
Edward Riseman, University of Massachusetts at Amherst
Charles Thorpe, Carnegie Mellon University

- **Workshop F2 (Friday, May 15, 1992 - 9:00 AM to 1:00 PM): Approaching and Grasping Strategies for Unknown Objects** *(Room: Mobile 11)*

When a robot works in unstructured environments, such as space, underwater, underground, and so on, it will often meet a task to treat unknown objects. The objects shape, position, and orientation may be roughly given but not exactly under those environments.
This Workshop focuses on "How to approach an unknown object and how to grasp it stably?" Several key technologies for eventually achieving a stable grasp are discussed in the following steps: (1) contact-point-detection between finger link and unknown objects, (2) object-shape-sensing using finger tip tactile sensors, (3) compliant, sensor-based grasping strategies, and (4) haptic system architecture for a task in unstructured environments.

Organizers: Makoto Kaneko, Kyushu Institute of Technology
Kazuo Tanie, Mechanical Engineering Lab., Tsukuba Science City
Speakers: Makoto Kaneko, Kyushu Institute of Technology
Kazuo Tanie, Mechanical Engineering Lab., Tsukuba Science City
Mark Cutkosky, Stanford University
Ruzena Bajcsy, University of Pennsylvania

- **Workshop F3 (Friday, May 15, 1992 - 9:00 AM to 5:00 PM) Remotely Controlled Robots - Telerobotic Concepts and Orbital Robotics** *(Room: Risso 6)*

The first part of the Workshop covers teleoperational and telerobotic techniques with emphasis on man-machine interfaces including e.g. force-reflecting control, "shared" autonomy, time-delay-compensating techniques and robot-vehicle interaction.
The second part examines applications of robotics to orbital spaceflight-systems from a technical and programmatic viewpoint. It will address the need for robotics in orbit and steps being taken around the world to respond to this need. Primary emphasis will be on describing applications in use or under development. Secondary emphasis will be on information management aspects. This part of the Workshop will include a panel discussion.

Organizers: Jean-Jacques Slotine, MIT
Byron Purves, The Boeing Company
Speakers: Tom Sheridan, MIT
Gerhard Hirzinger, DLR
Dana Yoerger, Woods Hole Oceanographic Institute
Jean-Jacques Slotine, MIT
Bejczy, Jet Propulsion Laboratory
Katsuhisa Furuta, Tokyo Institute of Technology
Byron Purves, The Boeing Company
Mitsushige Oda, NASDA
Giulio Varsi, Jet Propulsion Laboratory
Michel Maurette, CNES
Peter Putz, Dornier GmbH
Davis Hunter, CSA

- **Workshop F4 (Friday, May 15, 1992 - 2:00 PM to 6:00 PM): Control Issues to Promote Robotic Machine Intelligence** *Room: Mobile 10*

The purpose of this workshop is to review the state-of-the-art in intelligent control of robot manipulators via task driven non-linear feedback. The presentation will be divided into three parts:
(1) Task Driven Feedback Control of Robot Manipulators
(2) Control of Robots with Elastic Joints and Flexible Links
(3) Cooperative Machine and Human Intelligence in Robotic Systems

Organizers:
Howard Moraff, National Science Foundation
Tzyh-Jong Tarn, Washington University in St. Louis
Speakers: Antal Bejczy, Jet Propulsion Laboratory
Alessandro De Luca, University of Rome
Howard Moraff, National Science Foundation
Tzyh-Jong Tarn, Washington University in St. Louis

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

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Please register me as follows (Circle appropriate fee).

	Member	Non-Member	Student
Conference	$225	$275	$100
Conference (plus Video)	$280	$330	$155
Workshop S1 (full day)	$125	$150	$125
Workshop S2 (full day)	$125	$150	$125
Tutorial M1 (half day)	$100	$125	$100
Tutorial M2 (half day)	$100	$125	$100
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Tutorial M6 (half day)	$100	$125	$100
Workshop F1 (half day)	$100	$125	$100
Workshop F2 (half day)	$100	$125	$100
Workshop F3 (full day)	$125	$150	$125
Workshop F4 (half day)	$100	$125	$100
TOTAL	$~~~	$~~~	$~~~

Please circle applicable fees for those sessions you desire to attend, then add together to determine total fee which should be included with your registration For registration after April 20, add $50 late fee ($20 for Students). Payment may made by Check in U.S. Dollars on U.S. Bank, VISA or Master Card Only

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Signature.....

The tutorials and workshops include coffee breaks and notes. Conference registration includes the proceedings, coffee breaks and social functions. Student registration for the conference only (does not include social functions, but includes coffee breaks and proceedings). 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
Registration fees may be refunded in full if a written request is received before April 15. A 50% penalty charge will be levied to those who request a refund after that date and before April 30. After April 30 there WILL BE NO REFUNDS). Late registration will be accepted beginning Sunday May 10, 1992 at the Acropolis Convention Center. Note: The conference plus video includes a copy of the video presentations which will be presented at the conference in a video theatre.

EXHIBITS

A limited number of exhibit booths will be available at the Acropolis Convention Center. For further information regarding exhibiting at the conference contact:
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The Conference has arranged for North American attendees to make additional AIRLINE and HOTEL reservations at a substantial savings through:
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PLAZA (1)	850	850	80 FF/pers
SOFITEL CENTRE	780	780	70 FF/pers
Category 3*			
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APOGIA	420	470	49 FF/pers
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MERCURE BAIE (2)	415	500	50 FF/pers
NOVOTEL CENTRE	510	560	48 FF/pers
PULLMAN	530	630	30 FF/pers
VENDOME	510	590	40 FF/pers

HOTELS	Single	Double	Breakfast
Category 2*			
ARCADE	370	400	45 FF/person
HARVEY	270	330	20 FF/person
IMPERIAL	265	350	20 FF/person
MADRID	310	320	20 FF/person
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Supplement club floor: 200 FF
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1992 IEEE Fellows

Congratulations to the following members of the Robotics and Automation Society who have recently been named Fellows of the IEEE. The status of Fellow is awarded through an arduous evaluation process to members who have demonstrated outstanding contributions to the field and are nominated by other Fellows. Only about 250 of the quarter million members of the IEEE are named as Fellows each year.

Professor Antti J. Koivo
Purdue University

For contributions to the modeling and adaptive control robotic manipulator systems with sensory feedback.

Dr. Koivo received the Diploma in Electrical Engineering at Finland Institute of Technology, Finland, M.S. at Indiana University, and Ph.D. at Cornell University, Ithaca, NY. His current research is concentrated in sensory feedback control, coordinated multiple robot systems, construction robots, and intelligent manufacturing. He has published over one hundred technical archival and conference papers, and is the author of a dual-level text on robotics.

He has been a program chairperson and member of organizing program committees of several national and international conferences of robotics and automation. He was the Technical Program Chairperson for the 1990 IEEE International Conference on Robotics and Automation (ICRA), and a General Vice-Chairperson for the 1992 IEEE ICRA. He has been a lecturer and consultant to the International Programs of United Nations Educational, Scientific and Cultural Organization (UNESCO) and NATO. He was a liaison representative of the IEEE Control System Society in the Robotics and Automation Council, 1986-1988, and is a member of the AdCom of the IEEE Robotics and Automation Society, 1989-1990 and 1991-1993. He was a member of the AdCom, 1987-1989 and the Chairman of the Technical Committee on Robotics 1986-1991 for the IEEE Systems, Man and Cybernetics Society. He has been guest co-editor of Special Issues for the *IEEE Transactions*. He was a Technical Editor of the *IEEE Transactions on Robotics and Automation*, 1988-1991, and is currently an Associate Editor of the same *Transactions*. He received the 1979 D. Ewing Award for Excellence in Teaching in the School of Electrical Engineering at Purdue University.

Professor Takeo Kanade
Carnegie Mellon University

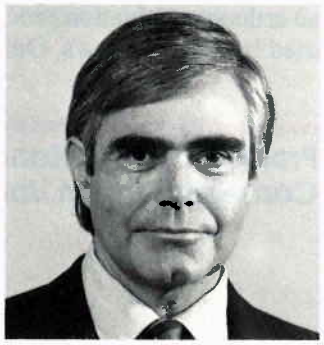
For contributions to vision, manipulators, autonomous mobile robots, and sensors

Dr. Kanade received his Doctoral degree in Electrical Engineering from Kyoto University, Japan, in 1974. After holding a faculty position at Department of Information Science, Kyoto University, he joined Carnegie Mellon University in 1980, where he is currently Professor of Computer Science and Co-Director of the Robotics Institute. He established the Robotics Ph.D. Program at CMU and is currently the Chairman of the program.

Dr. Kanade has made technical contributions in multiple areas of robotics: vision, manipulators, autonomous mobile robots, and sensors. His contributions in vision include: shape recovery from line drawings (known as Origami World theory and skew symmetry), stereo, color, and face recognition. Kanade is the co-developer of the concept of direct-drive manipulators and the world's first prototype (CMU DD Arm I). In the area of autonomous mobile robots, he has been a project leader and developer of vision systems for Carnegie Mellon's NavLab - DARPA's autonomous land vehicle project, and CMU's Ambler - NASA's planetary exploration robot project. Also, Kanade has developed a few unique 3D sensors for which he holds patents. He has written two books and more than fifty journal papers on these research topics.

Dr. Kanade is a Fellow of American Association of Artificial Intelligence, the founding editor of *International Journal of Computer Vision*, and an Administrative Committee member of IEEE Robotics and Automation Society. He has received several awards, including the Marr Prize Paper Award in 1990 and his paper was selected as one of the most influential papers that appeared in the Artificial Intelligence journal. He has served for many government, industry, and university advisory panels, including NASA Advanced Technology Advisory Committee and Canadian Institute for Advanced Research.

Professor Aristides A. G. Requicha
University of Southern California



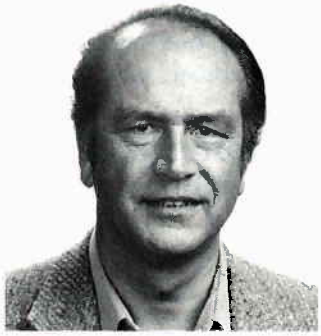
For contributions to the theory and practice of three-dimensional geometric modeling, and to its applications in programmable automation.

Professor Requicha was born in Monte Estoril, Portugal, in 1939. He received the Engenheiro Electrote'cnico degree from the Instituto Superior Te'cnico, Lisbon, Portugal, in 1962, and the Ph.D. degree in electrical engineering from the University of Rochester, Rochester, N.Y., in 1970. He was a high school and college Valedictorian in Portugal.

Requicha directs the Programmable Automation Laboratory, a research unit within USC's Institute for Robotics and Intelligent Systems (IRIS). He joined USC in late 1986, after 13 years at the University of Rochester, where most recently he was the director of the Production Automation Project. His work at Rochester was centered on geometric modeling of three-dimensional solid objects, and ranged from mathematical foundations to algorithm development and implementation in the PADL modeling systems. These are disseminated widely, and several enhanced versions of PADL-2 are commercially available from CAD/CAM vendors. Requicha was previously a lecturer in physics at the University of Lisbon, a lieutenant in the Portuguese Air Force, and a research scientist with NATO's SACLANTCEN in La Spezia, Italy.

Requicha is a member of AAAI, AAAS, ACM, SME, and Sigma Xi. He served as an editor for the *ACM Transactions on Graphics*, 1984 - 1990, and now edits the *IEEE Transactions on Robotics and Automation,* the Academic Press journal *CVGIP - Graphic Models and Image Processing*, Chapman and Hall's *Journal of Design and Manufacturing*, and the Springer Verlag book series on *Computer Graphics*. He chaired or participated in numerous conference program committees, and is the author of about 100 scientific papers, reports and book chapters. His current work is a blend of Artificial Intelligence and Computational Geometry, with an emphasis on spatial reasoning and its applications in intelligent systems for design and manufacturing. Specific topics include geometric uncertainty, automatic planning of manufacturing and inspection tasks, and conceptual design for mechatronic systems.

Professor Raymond A. Jarvis
Monash University, Australia



For leadership in and contributions to the fields of computer vision and intelligent robotics

Ray Jarvis completed the Ph.D. degree at the University of Western Australia in 1968. He spent 1969/70 at Purdue University working in the area of pattern recognition and returned to Australia to take up a senior lectureship in Computer Science and to establish teaching in this area at the Australian National University. Full departmental status was achieved in 1976 and Ray became the first chairman of the department. During his 14 years at the ANU, Ray established a Computer Vision and Robotics laboratory which was the most advanced in Australia. When he accepted a Chair in Electrical and Computer Systems Engineering at Monash University in Victoria he transferred his laboratory to that campus and formed an Intelligent Robotics Research Centre around Computer Systems Engineering staff. Some $1.8 million of research funds have been attracted by the Centre over the last four years for its research in Robot Vision, Tactile Sensing and Autonomous Mobile Robot Navigation. Ray has over 100 publications in the first and third of these areas. He has been involved in many conferences as chairman or on the program committees (e.g. IEEE Conference on Robotics and Automation, International Symposium and Exposition on Robots, National Conference on Robotics, International Conference on Automation, Robotics and Computer Vision (Singapore), IEEE Tencon 92 (Automation), IEEE/RSJ conference on Intelligent Robots and Systems.) He is on a number of Australian Government (Department of Industry, Technology and Commerce) Committees and is Chairman of Australia's Technical Committee for the Japanese-initiated project on International Collaboration in Advanced Automation and a member of the Australian Steering Group for the International Advanced Robotics Program. He has at various times been Public officer, National Secretary and President of the Australian Robot Association. He is a member of the editorial board of the *International Journal of Computer Vision* and is a sub editor for *Robotica*.

Despite all these activities at various levels, he is still dedicated to pursuing research in Robotic Vision and Navigation as a 'hands on' experimental activity and enjoys best his time hiding away from other duties in his well equipped laboratory.

Professor Ruzena Bajcsy
University of Pennsylvania

•For contributions to machine perception and robotics

Dr. Ruzena Bacjsy received her first Ph.D. in Electrical Engineering at the Slovak Technical University in Bratislava, Czechoslovakia in 1967 where she was the first woman in Slovakia granted a Ph.D. in Electrical Engineering. Her dissertation topic was studies of Stochastic Learning Automata. During her studies in Czechoslovakia, she received a fellowship to study Russian Computer Technologies in Penza, USSR, which she did for 3 months in 1963-64. In October 1967, she received a fellowship from Stanford University, Stanford, California to study Artificial Intelligence with Professor J. McCarthy. At Stanford she completed a Ph.D. in Computer Science and in 1972 accepted a faculty position in the Computer and Information Science Department at the University of Pennsylvania in Philadelphia. While at Stanford, with the encouragement of her advisor, Professor McCarthy she began to work in the area of Machine Perception, in particular recognition of visually textured (repetitive patterns) surfaces. Her thesis contained the first program that was able to describe a variety of different visual textured patterns.

At the University of Pennsylvania, she has continued working in the general area of Machine Perception, covering the whole spectrum of problems (segmentation, 3D shape recognition, multiresolution problems, etc.) that the field of Computer Vision involves, and extending it to other modalities, in particular to touch. She has built the GRASP laboratory which now enjoys a worldwide reputation.

Dr. Bajcsy was the chairman of the Computer and Information Science Department at Penn between December 1984 and June 1989. She has served on various panels, including one appointed by the Research Council of the National Academy, and also was the general chair (together with Shimon Ullman) of the 2nd International Conference on Computer Vision in Florida, December 1988.She is a member of the Computer Science and Telecommunication board of the National Research Council and is also a founding fellow of AAAI.

Congratulations also to the following members of the Robotics and Automation Society whose evaluations for Fellow status were submitted by other IEEE societies.

•**Dr. Leif Borno,** Taastrup, Denmark
For contributions to ultrasound technology. **(Ultra Sonics, FerroElectrics, and Frequency Control)**

•**Professor Ramalingam Chellappa**
University of Maryland
For contributions to statistical model based approaches for two- dimensional spectral analysis and image processing. (Signal Processing)

•**Professor Tatsuo Higuchi,**
Tohoku University, Japan
For contributions to the theory of multidimensional signal processing and the development of the beyond-binary VLSI signal processing technique (Circuits and Systems)

•**Professor Takamasa Hori,** Mie University, Japan
For contributions to the development of speed control systems for industrial alternating current motors. (Industrial Electronics)

• **Dr. Lawrence D. Jackel,** AT&T Bell Laboratories
For leadership in the applications of neural networks to pattern recognition and in the development of electronic systems implementing neural networks (Neural Networks Council)

•**Professor Ramesh C. Jain,** University of Michigan
For contributions to computer vision in the estimation of structure and motion from images. (Computer Society)

•**Professor Alojz R. Kralj**
University of Ljubljana, Yugoslavia
For contributions to the development and clinical application of electrical stimulation to individuals paralyzed by stroke or spinal cord injury (Engineering in Medicine and Biology)

•**Professor Ren-Chyuan Luo**
North Carolina State University
For contributions to intelligent sensors and robotics (Industrial Electronics)

•**Professor Rajnikant V. Patel**
Concordia University, Canada
For contributions to the numerical analysis and design of control systems. (Control Systems)

•**Dr. Herbert E. Rauch, Lockheed**
For pioneering contributions to and leadership in the field of optimal estimation and control (Control Systems)

•**Professor Kang G. Shin**
The University of Michigan
For contributions to the theory of dynamic failure in real-time computing systems. (Computer)

IEEE US Government Fellows and Student Intern Programs

In an effort to increase the understanding of technology by policy makers in the Federal government, the United States Activities unit of The Institute of Electrical and Electronics Engineers, Inc. (IEEE-USA) announced one new program and the continuation of two long-running programs. Only a handful of engineers serves in Congress, according to IEEE-USA Board Chairman Michael J. Whitelaw.

Begun this summer, IEEE-USA's Technology Administration Fellowship program is designed to identify opportunities and actions that will strengthen U.S. competitiveness in critical technologies, especially manufacturing technology. Two Fellows have been appointed by the electrical engineering group to work one year with the U.S. Under Secretary of Commerce for Technology: Marc Brodsky, manager of technical planning, IBM T.J. Watson Research Center, Yorktown Heights, NY; and Malcolm Smith, director of manufacturing systems, Hewlett Packard, Palo Alto, CA.

The Technology Administration Fellows will act as Special Assistants to the Under Secretary for Technology in conducting studies, drafting testimonies, critiquing short and long-range strategies, and providing independent expertise. An IEEE-USA Public Policy Fellow Fund has been established to provide partial support for the program.

In addition, in support of its long-standing involvement in the Congressional Fellows program, IEEE-USA recently appointed three Fellows to serve on the professional and personal staffs of Members of Congress, beginning in January, 1992: Richard J. Jaeger, Jr., retired, West Chicago, IL; Larry L. Stern, Hughes Aircraft Co., Los Angeles; and Kenneth D. Wagner, IBM Corp., Poughkeepsie, NY.

Two IEEE-USA 1991 Congressional Fellows began their assignments on Capitol Hill earlier this year. Dr. Dharmendra K. Sharma is addressing energy issues on the staff of the Senate Majority Whip, Senator Wendell Ford (D-KY). Dr. Sharma is an associate program manager for the Electric Power Research Institute in Palo Alto, CA.

Donald L. Willyard is providing

counsel on general science and technology issues to Representative Steven Schiff (R-NM), who serves on the House Science, Space and Technology Committee. Willyard is on leave from Allied-Signal Aerospace Co. in Albuquerque, NM.

Also, in cooperation with IEEE Technical Activities, IEEE-USA continues to support the Washington Internships for Students of Engineering program. Two students selected to participate recently completed papers on promoting U.S. competitiveness: Steven J. Ebel, an electrical engineering major at the University of Minnesota in Minneapolis; and Robert J. Lasser, an electrical engineering major at Temple University in Philadelphia.

Ebel's paper is titled **An Assessment of SEMATECH: America's Response to the Japanese Semiconductor Challenge.** Lasser's paper is: **The Role of Space Robotics in U.S. Competitiveness.**

Engineering Foundation Research Grants

The IEEE, through the Technical Activities Department and TAB, participates in a program of research grants administered by the Engineering Foundation. The Foundation is associated with the United Engineering Trustees.

The Engineering Foundation, in addition to its other functions, annually administers a program of Engineering Research Initiation Grants (ERIGs) and Air Force Engineering Research Initiation Grants (AFERIGs). This program provides research funds to new full time engineering faculty who are without other research support. These faculty are in fields represented by the Founder Societies of the Foundation.

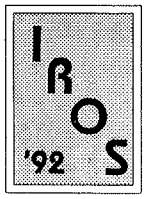
The Technical Activities Department and TAB work together to coordinate and conduct reviews necessary for this program. Early in November of each year, approximately 90 proposals are received, sorted according to technical fields of interest, reviewed by a TAB appointed Committee and then transmitted to the appropriate IEEE Societies for technical review.

Each proposal undergoes multiple reviews by the IEEE Society, then ranked by the TAB Review Committee. The ranked proposals are then submitted to the Engineering Foundation for final evaluation.

Up to twelve ERIGs of $23,000 each may be awarded yearly. Also, up to twenty AFERIGs of $23,000 each may be awarded for proposed research projects of mutual interest to the Air Force, a Founder Society and the Foundation.

This year, four ERIGS and eleven AFERIGs out of a total of 32 grants were awarded in the fields of electrotechnology.

Continued on Page 32



SPECIAL WORKSHOPS AND TUTORIALS TO BE HELD AT THE

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

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 United States. The theme of IROS '92 is "Sensor-Based Robotics and Opportunities for Its Industrial Applications." The conference will have approximately 300 papers presented at 40 regular sessions and 10 special sessions.

The following Keynote Speech, Plenary Speeches, Tutorials, and Workshops have been scheduled for the conference. The complete schedule and registration form will be available April, 1992 in the Advance Program.

KEYNOTE SPEAKER

Dr. Sei-ichi Takayanagi
Senior Vice President of Toshiba Corp., Japan
Title: *Industrial Robots in Japan—Today and Future*

PLENARY SPEAKERS

Dr. Takeo Kanade, Professor and Co-Director
Robotics Institute, Carnegie Mellon University, USA
Title: *The KISS Solutions of Shape Recovery Problems in Computer Vision*

Dr. Kumpati Narendra, Professor
Yale University, USA
Title: *Neural Network and Adaptive Control in Robotics*

TUTORIALS (each full day July 7)

1. *3-D Computer Vision: Theory and Practical Applications.* Rangachar Kasturi, Pennsylvania State Univ., USA
2. *Robot Vision Based Autonomous Vehicles.* Volker Graefe, Tech. Univ. of Bundeswehr, Germany
3. *Distributed Sensors and Actuators: Theory and Applications.* H. S. Tzou, Univ. of Kentucky, USA
4. *Introduction to Neural Networks for Intelligent Robotics Systems.* Behnam Bavarian, University of California-Irvine, USA.

Note: The Advance Program will be mailed to all IEEE Robotics and Automation Society members in April.

If you are not a member and would like to receive the Advance Program, please contact:

Prof. Ren C. Luo, General Chair IROS '92
Dept. of Electrical and Computer Engineering
Box 7911
North Carolina State University
Raleigh, NC 27695-7911, USA
Phone: (919) 515-5193, -5199
Fax: (919) 515-5523
E-mail: luo@eceris.ece.ncsu.edu

WORKSHOPS (each full day July 7)

1. **Dynamic World Autonomous Systems**

Panel 1: *Requirements Driven Opportunities for Technology Transfer*
Moderator: David W. Hislop, U.S. Army Res. Office

Panel 2: *Future Research Directions for Intelligent Systems*
Moderator: Jagdish Chandra, U.S. Army Res. Office

Session 1: *Machine Perception*

Session 2: *Adaptive Control*

Session 3: *Uncertainty/Incompleteness*

Session 4: *Machine Learning*

Tentative Panelists:

John Baras, Univ. of Maryland
Mike Coombs, New Mexico State Univ.
Peter Crouch, Arizona State Univ.
C. Glover, DOE, Oak Ridge Nat. Lab.
Col. John James, U.S. Army TRADOC
Takeo Kanada, CMU
Ernie Kent, NIST
Dramad Khargonekar, Univ. of Michigan
S. Kulkarni, Princeton Univ.
Reinhold Mann, DOE, Oak Ridge Nat. Lab.
Lt. Col. Erik Mattala, DARPA
Sanjoy Mitter, MIT
Eurique Ruspini, SRI
Randy Shumaker, U.S. Navy Res. Lab.
V. S. Subrahmanian, Univ. of Maryland
Gilead Tadmor, Northeastern Univ.
Alan Tannenbaum, Univ. of Minnesota
Chuck Weisbin, JPL

2. **Medical and Neurological Applications in Robotics: New Trends**

Organizing Co-Chairmen:

Alberto Rovetta, Politecnico di Milan, Italy
Christian Laugier, LIFIA/INRIA, France
Susumu Tachi, Univ. of Tokyo, Japan

Calendar

•**May 10-15 IEEE International Conference on Robotics and Automation.** Nice, France. *Contact:* R&A Conference,(US) Harry Hayman, PO Box 3216, Silver Spring MD 20918. Phone/FAX: 407 483 3037. (Other) Monique Simonetti or Catherine Juncker, Bureau de Relations Exterieures, Unit de Recherche, Sophia- Antipolis 2004, Route des Lucioles, B.P. 109-06561, Valbonne, Cedex France. FAX 33-93-65-77-65.

•**May 18-20. 42nd Electronic Components and Technology Conference.** San Diego. Sponsors: Components, Hybrids, and Manufacturing Society of IEEE and the Electronic Industries Assoc. Contact: Jim Bruorton, c/o KEMET electronics Corporation, PO Box 5928, Greenville SC 29606. Tel: (803)853-6621.

•**May 18-22 ECCV2 European Conference on Computer Vision.** Santa Margherita Ligure Italy. Contact: 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.

•**May 20-22 3rd Int. Conf. on Computer Integrated Manufacturing.** Troy, New York. Sponsors: Rensselaer Polytechnic Institute and New York Center for Advanced Technology in Automation and Robotics. Contact: Alan Desrochers, RPI, CII 8015, Electrical, Computer and Systems Engineering, Troy NY 12180-3590.

•**May 20-22 IFAC Symposium on Intelligent Components and Instruments for Control Applications.** Malaga, Spain. *Contact:* SICICA '92, Facultad de Informatica, Plaza El Ejido s/n, 29013 Malaga SPAIN. (Tel:) (34)52-131412; FAX: (34)52-264270. E-mail: sicica@octima.uma.es.

•**June 1-5. ISATA: Int. Symposium on Automotive Technology and Automation.** Florence, Italy. Contact: ISATA Secretariat, 42 Lloyd Park Avenue; Croydon, Surrey CRO 5SB England. (Tel) 081 681 3069; (FAX)081 686 1490.

•**June 7-10. IJCNN: International Joint Conference on Neural Networks.** Baltimore. Contact: Ms. Nomi Feldman, IJCNN '92 5665 Oberlin Drive, Suite #110 San Diego, CA 92121 Telephone (619) 453-6222 FAX (619) 535-3880

• **June 14-17 The Fifth IEEE Symposium on Computer-Based Medical Systems:** Durham, North Carolina. Pete Santago, Department of Radiology, Bowman Gray School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157-1022 (telephone 919-748-4260; FAX 919-748- 2870; e-mail cbrns@mrips.bgsm.wfu.edu))

•**June 30-July 2 FAIM 92: Joint International Conference on Flexible Automation and Information Management.** Limerick, Ireland. Contact: (US) Prof. W.G. Sullivan, 302 Whitetener Hall, Virginia Polytechnic Institute and State University, Blacksburg, VA USA. 24061-0118, Tel. (703)231-3322 FAX: (703)231-3322 (Other) Prof. M.M. Ahead, Air.-AMT Research Park, Paisley Technology Park, Limerick, Ireland, Tel: (353)61-333644 FAX: (353)61-330316.

•**July 7-10 IEEE International Conference on Intelligent Robots and Systems IROS '92.** Raleigh NC. Contact: Dr. Ren C. Luo, Dept. of ECE, NC State University, Box 7911, Raleigh NC 27695-7911, Tel 919 515 5199, email luo@eceris.ece. ncsu.edu; fax 919 515 5523 or Kazuo Tanie, Program Co-Chair, Mechanical Engineering Laboratory, MITI, 1-2 Namiki, Tsukubi-shi, Ibaraki-ken 305, Japan. Ph. 81-298-54-2656, Fax: 81-298-54-2518; email M1750@mel.go.jp.

• **July 13-15 Japan-USA Symposium on Flexible Automation.** San Francisco ASME and Institute of Systems, Control and Information Engineers of Japan. Contact: Professor Ming C. Leu, Dept. of Mechanical and Industrial Engineering, Rm. 311, MEC, New Jersey Institute of Technology, University Heights, Newark NJ 07152.

•**July 14-17. Image VI, Conf. & Expo on Real Time Visual Simulation.** Image Society Inc. Contact: The Image Society Inc, 1308 E. Greentree Drive, Tempe, AZ 85284 4503.

•**August 2-14. ISPRS XVII Congress.** Washington DC. *Sponsor:* International Society for Photogrammetry and Remote Sensing. *Contact:* Galaxy Registration, PO Box 4088, Frederick, MD 21701.

•**August 4-7 International Conference on Control and Robotics.** Vancouver, Canada.Sponsor: IASTED Contact: Prof. C.C.H. Ma, Dept. of Electrical Engineering, University of British Columbia, Vancouver, B.C., Canada. V6T-1Z4, Tel: 604-822-2045; Fax 604-822-5949.

• **August 11-13, IEEE International Symposium on Intelligent Control. Glasgow. Contact:** ***Edward Grant,*** The Turing Institute, George House, 36 North Hangover Street, Glasgow G12AD, UK. Ph.: 041-552-2085. email: eddie@turing.ac.uk.

• **August 12-14 International Workshop on Emerging Technologies & Factory Automation.** Melbourne, Australia. Sponsors: IEEE Industrial Electronics Society and Swinburne Inst. of Technology. Contact: Dr. Richard Zurawski, Lab. for Concurrent Computing Systems, Swinburne Inst. of Technology, PO Box 218, Melbourne 3122, Australia. Ph. 61 3 819 8036; Fax: 61 3 819 6443 email: rzz@stan.xx.swin.oz.au.

• **August 17-19 8th Int. Conf. on CAD/CAM: Robotics & Factories of the Future,** Univ. of Metz FRANCE. Sponsor: ISPE. Contact: Dr. J.-M. Proth, INRIA LORRAINE Technopole Metz 2000, 4, rue Marconi, 57070 France. Fax 33 87 76 39 77; Ph. 33 87 20 35 00

•**August 24-28 Government Neural Networks Applications Workshop.** Dayton OH. *(See Call for Papers)*

•**August 26-28. IAPR Int. Workshop on Structural and Syntactic Pattern Recognition. Bern Switzerland.** *(See Call for Paers)*

•**August 30-Sept. 93 IAPR: 11th International Conference on Pattern Recognition.** The Hague, Netherlands. *Sponsor:* International Association for Pattern Recognition. Four simultaneous conferences: *Computer Vision and Applications* (H.Niemann); *Pattern Recognition Methodology and Systems* (J. Kittler); *Image, Speech and Signal Analysis,* (I.T. Young); *Architectures for Vision and Pattern Recognition,* (V. Cantoni). 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:

IAPR@ET.TUDELFT.NL.

•**August 31-Sept. 2 IEEE Workshop on Neural Networks for Signal Processing.** Copenhagen. Spons. by the Computational Neural Network Center (CONNECT).

•**September 7-10. EURO-DAK '92. European Design Automation Conference.** Hamburg, Germany. *Contact:* EURO-DAK;92 Sec., 7490 Clubhouse Rd., Ste. '01, Boulder CO 80301;

•**September 17-19. IEEE International Conference on Systems Engineering** International Conference Center, Kobe, Japan. sponsored by the Pascal Research Institute, Kobe and organized under the General Chairmanship of Professor Kotaro Hirano, Electronics Engineering Department, Kobe University, Japan. Contact: Professor B.A. Shenoi, Electrical Engineering Dept. Wright State University, Dayton, OH 45435.

•**September 15-18 ICARCV'92: 2nd Int. Conf. on Automation, Robotics, and Computer Vision.** Singapore. *(See Call for Papers)*

•**September 16-20. International Symposium on Robotics, Mechatronics and Manufacturing Systems '92.** Kobe Japan. Sponsors: IMACS tech. com. on Control Systems and Robotics and Society of Instrument and Control Engineers, Japan (SICE). Contact: Mr.Yasutaka Saito, Secretariat of IMACS/SICE RM^{2}S '92 Kobe, Society of Instrument and Control Engineers, Japan, 1-35-28-303 Hongo, Bunkyo-ku, Tokyo, Japan. Tel: 81 3 3814 4121, FAX 81 3 3814 4699.

•.**October 1-2 International Workshop on Intelligent Manufacturing Systems. Dearborn MI.** *Sponsor:* International Federation of Automatic Control. *CoSponsors:* ASME, IEEE Control Systems Soc., SCS, SME **Contact:** Dr. Naim A. Kheir, Dept. Electrical & Systems Engineering, Oakland University, Rochester MI 48309-4401.

• **Oct 7 - Oct 10 RNNS/IEEE Symposium on Neuroinformatics and Neurocomputing.** Rostov-on-Don, USSR Sponsors: Russian Neural Networks Society and the IEEE

Faculty Positions in Robotics
Carnegie Mellon University
Robotics Ph.D. Program

Applications are invited for tenure-track faculty positions in the Robotics Ph.D. Program at Carnegie Mellon University. Appointees are expected to play major roles in education and research in the program. Appointments are expected to be at the assistant professor level in the Robotics Ph.D. Program, although joint appointments with other departments or non- tenure-track research appointments could also be considered.

Applicants must have a Ph.D. in a related discipline and have demonstrated competence in one or more areas of robotics research, as well as potential for excellent teaching.

Outstanding candidates in all areas of robotics are invited, including, but not limited to, mechanisms, manipulation, sensors, control, locomotion, vision, design, planning, knowledge-based systems, simulation, graphics, micro-electronics, parallel computing, manufacturing, and management.

Applicants should send their applications with curriculum vitae and names of at least four references to:

Chair, Faculty Search Committee
The Robotics Institute
Carnegie Mellon University
Pittsburgh, PA 15213-3890
Attn: Nancy Serviou

Carnegie Mellon is an Equal Opportunity/Affirmative Action employer.

Council on Neural Networks. Contact: Dr. Wesley E. Snyder, Dept. of Radiology, Bowman Gray School of Medicine, Wake Forest University, Winston-Salem NC 27157-1022. 919-748-3908, FAX 9 19-748-2870. email: wes@mrips.bgsm.wfu.edu.

- **October 13-16. VBC'92: Visualization in Biomedical Computing. Chapel Hill, NC.** *Sponsor:* Dept. Computer Science, UNC-CH in coop. w/ Alliance for Engineering in Medicine & Biology, IEEE EMBS, and SPIE. *Contact:* Dept. of Computer Science, CB #3175, Sitterson Hall, UNC, Chapel Hill, NC 27599-3175.
- **October 11-14 MILCOM '92: Communications: Fusing, Command, Control and Intelligence.** San Diego CA. Sponsors: IEEE, IEEE Communications Society, and the Armed Forces Communication and Electronics Association. Contact: John Peckham, (619) 592-5153.
- **November 9-13 ISRAM '92: International Symposium on Robotics and Manufacturing.** Santa Fe, New Mexico. *Contact*: 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 USA. Tel: 505-277-0558; FAX: 505-277-0813.
- **November 15-20. Intelligent Robots and Visual Communications.** Boston. *Sponsor*: SPIE. Part of OE/Technology '92; an applications symposium on optics, electro-optics and lasers in industry. Sessions on Robot Vision, Telemanipulators, Computer Vision, 3-D Recognition, Airport Security, Image Sequence Processing, Compression Standards, Morphological Image Processing, Video Sequence Coding, Image Segmentation. *Contact:* SPIE; International Society for Optical Engineering; PO Box 10, Bellingham WA 98227-0010;Tel: 206 676 3290; Fax 206 647 1445
- **November 16-18 ISMCR'92: Second International Symposium on Measurement and Control in Robotics.** Tsukuba Science City, Japan. *Sponsor:* IMEKO. *Contact*: Prof. S.

Tache, RACST, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153 JAPAN. Tel: 81 3 3481 4467 FAX: 81 3481-4469.

- **December 16-18, 1992, 31st IEEE Conference on Decision and Control**, Tucson, AZ. *Contact:* Professor T. Basar, Coordinated Science Lab, Univ. of Illinois, 1101 West Springfield Ave., Urbana, IL 61801, (217) 333-3607, (217) 244-1764 (FAX) e-mail: tbasar@markov.csl.uiuc.edu.

- **May 10-12, 1993. IMACS Symposium on Signal Processing and Neural Networks.** SPANN'93 MONTREAL Canada. *Contact:* Prof. Z. Jacyno, Department of Physics, University of Quebec at Montreal, P.O.Box 8888, Station A, Montreal, P. Quebec, Canada, HC 3P8.

Calls For Papers

Government Neural Network Applications Workshop
August 24-28, 1992 Dayton, Ohio.
- Main Meeting (includes export-controlled session)
- Classified Meeting (tentative)

* Authors are invited to submit abstracts on any application-oriented topic of interest to government agencies. Submissions. Presentations will be selected based upon two-page abstracts. Please note that abstracts longer than two pages will be returned.

Deadline: April 15,1992. Abstracts should be accompanied by a cover letter stating the affiliation, address and phone number of the author, and whether the presentation will be unclassified (open dissemination), unclassified (export controlled) or classified.

Unclassified abstracts should be sent to: GNN 92, Maj. Steven K. Rogers, AFIT/**ENG**, WPAFB, OH 45433

Classified abstracts should be sent to: GNN 92, Maj. Steven K. Rogers, AFIT/**ENA**, WPAFB,OH 45433

The export-controlled session will be open to U.S. citizens only. Please use this session for unclassified material that you wish to present in a limited way.

* Classified abstracts must contain a description of the classified portion and authors must make clear why classified material is important to the presentation. Please note that any "classified" abstracts without well marked classified content will be automatically rejected. Finally, the classified meeting will only take place if the classified program committee deems there to be a sufficient number of quality papers on worthwhile classified subjects. If authors are concerned about reducing the dissemination of unclassified material, they should use the export-controlled session of the main meeting. If the classified portion is unimportant to the main thrust of the abstract, it should be "sanitized" and submitted as unclassified. If accepted, classified authors will be allotted space in the proceedings for an (optional) unclassified paper.

NORTH CAROLINA STATE UNIVERSITY
The Dept. Of Electrical And Computer Engineering is seeking a candidate for the position of Visiting Assistant Professor for teaching one course per semester (Computer Control of Robots) and to conduct research in the area of Dynamic Motion Planning Sensor-Based Mobile Robots, Multisensor Fusion and Integration for Automatic Target Recognition. Candidates with experience in Microsensors and Microactuators are also encouraged to apply.

Appointment is for 1 year with a possibility of renewal. Department is considering making this a tenure track position. Nine month salary range $32,000-$40,000. To apply: Send resume and names and phone numbers of three references to: Dr. Ren C. Luo, Robotics and Intelligent Systems Laboratory, Dept. of ECE, Box 7911, North Carolina State University, Raleigh, NC 27695-7911 or fax to (919) 515-5523.

North Carolina State University is an Equal Opportunity/Affirmative action employer

Rensselaer Polytechnic Institute
Director, Center for Manufacturing Productivity and Technology Transfer

The School of Engineering at Rensselaer Polytechnic Institute is seeking an outstanding individual to lead the Center for Manufacturing Productivity and Technology Transfer (CMPTT). The CMPTT, founded in 1979, is an interdisciplinary research center within the School of Engineering and a focal point for major research initiatives in manufacturing at Rensselaer. The Director of the CMPTT reports to the Dean of Engineering and occupies a position of research and academic leadership within the School.

With over six million dollars in annual research expenditures, participation from over 25 academic faculty, and 34 full-time staff including project managers, research engineers, technicians and support personnel, the CMPTT has established an international reputation for its contributions to manufacturing research and successful interactions with industry. The technical programs of the CMPTT include: Advanced Materials: Processing, Evaluation, and Recovery, Electronics Manufacturing, Computer-Integrated Manufacturing, Manufacturing Control, Sensors and Inspection, and Product/Process Design and Support Systems. The Northeast Manufacturing Technology Center, a National Institute of Standards and Technology program, is managed within the CMPTT and focuses on technology transfer activities. The CMPTT occupies a major portion of a recently constructed research building and maintains extensive laboratory and computing facilities.

The successful candidate for this position should have a strong record of academic and/or industrial research in manufacturing, as well as a background and demonstrated capability in strategic planning, innovative program development and management of interdisciplinary teams. Candidates with experience and qualifications appropriate to a tenure-track appointment in one of the academic departments of the School of Engineering are especially encouraged to apply.

Please send applications and nominations to: Professor Arthur C. Sanderson Chair, Search Committee Electrical, Computer, and Systems Engineering Department, Rensselaer Polytechnic Institute, Troy, New York 12180-3590

Applications should include a resume, a summary of research and managerial experience, and the names of at least three references.

Rensselaer Polytechnic Institute is an Equal Opportunity/Affirmative action employer.

The all-day tutorial on August 24 will be conducted by AFIT faculty. It will be oriented toward those who are new to the field and would like sufficient background for the remainder of the meeting. There will be no extra cost for the tutorial.

- **ICARCV'92 The Second International Conference on Automation, Robotics and Computer Vision** Singapore, September 15-18, 1992. The conference is jointly organized by Nanyang Technological University and the Institution of Engineers (Singapore), co-sponsored by the Institution of Electrical Engineers (IEE), UK and the Institute of Measurement and Control (InstMC), UK, and in cooperation with the IEEE Computer Society, the IEEE SMC Society, IEEE Robotics and Automation Society (solicited), the IEEE Singapore Section, the Instrumentation and Control Society (ICS), Singapore Section and other local professional organizations. ***Submissions:*** Four copies of an extended summary (300-500 words) of the NEURAL NETWORKS in engineering/scientific applications papers to: Professor Yoshiyasu Takefuji Dept. of Electrical Engineering Case Western Reserve University Cleveland, OH 44106 E-mail: takefuji@axon.eeap.cwru.edu. Authors of the other subjects are invited to submit four copies of an extended summary of 300-500 words to: ICARCV'92 Conference Secretariat Associated Conventions and Exhibitions 204 Bukit Timah Road, #04-00 Boon Liew Building, Singapore 0922 Fax: (65) 791-2687 Tel: (65) 799-5470 Telex: RS 28615 E-mail: EMITAL@NTUVAX.BIT
- *Deadline:* 30 April 1992
- **30th Annual Allerton Conference on Communications, Control, and Computing.** September 30 - October 2, 1992. Allerton House, University of Illinois-Urbana-Champaign. Papers presenting original research are solicited in the areas of communication systems, information the-

First World Robot Ping Pong Championships

Hong Kong
September 26-27 1992.
Sponsorship is available for selected entries that will include air fare and accommodation and reasonable transportation costs for the robot. Those interested in taking part may obtain an application form and a copy of the rules from: *Robin Bradbeer, City Polytechnic of Hong Kong Dept. of Electronic Engineering Tat Chee Ave. Kowloon Tong Hong Kong*
(T)+852 788 7199
(F)+852 788 7791

Calls for Papers (continued)

ory and coding, detection and estimation, communication networks, mobile radio, control systems, adaptive control, optimization, dynamic games, large scale systems, robotics and automation, manufacturing systems, adaptive *signal* processing, spectral estimation and sensor arrays, signal and image reconstruction, image processing, neural networks, combinatorial and geometric algorithms, computational complexity, parallel and distributed computation and VLSI algorithms, numerical methods for signals and systems. Submissions: Short Papers: 10 minute presentations on preliminary results: Title and 1000 word summary; Long Papers, 20 minute presentations: Title and 5-10 page extended abstract. Send 2 copies by July 13, 1992 to Allerton Conference, University of Illinois at Urbana-Champaign, Coordinated Science Laboratory, 1101 West Springfield Avenue, Urbana, Illinois 61801. Contact Conference Sect'y Janet Reese, Univ. of Illinois (217) 333-8553

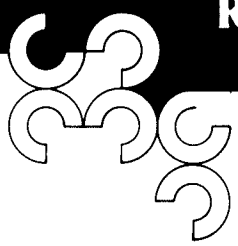
Sensuous Robot (cont. from p. 6)

technique does not utilise byproducts of the white rhino or other endangered species. Venture capitalists wishing to contact the authors about marketing potential should register at the door.)

- •A New Algorithm for Robot Curve-Following Amidst Unknown Obstacles *(Includes Demonstration by a martial arts expert in a modification of the algorithm which can be used to overcome obstacles.of the special class [XY])*
- •Approaching and Grasping Strategies for Unknown Objects *(A field trip to local bars and beaches will be arranged)*
- •Mating Constraint Languages *(Avoiding harassment or accusations or charges thereof)*
- •Fuzzy Logic *(An interpretation of the US presidential campaign debate)*
- •Swarm Robotics: *(An evaluation of media coverage of current political events)*
- •PANEL DISCUSSION: Planning for Reactive Robot Behavior; Perception And Uncertainty; Intelligent Sensing And Control *(Freudian vs. Jungian approaches will be debated)*
- •Dealing with Blocking in Supervisory Control of Discreet Event Systems *(Strategies for both utilization and avoidance of listening devices and private detectives)*
- •Navigation with Uncertainty: Reaching a Goal in a High Collision Risk Region *(Including strategies specific to Nice, Paris, Berlin, London, and New York)*
- •*SPECIAL SUBSESSION ON ABNORMAL PSYCHOLOGY:*
- •A Perturbation Analysis of Stick-Slip
- •Inducing Patterns of Behaviors Using Deviation Bounds.

1993 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION

Sponsored by the IEEE Robotics and Automation Society



May 2-7, 1993
Atlanta Hilton and Towers
Atlanta, Georgia

DEVELOPING COUNTRIES FELLOWSHIP:

Travel and registration supplements will be provided to individuals selected based on need and merit. For further information contact:

George Bekey
Computer Science Department
University of California
Los Angeles, CA 90089-0782, U.S.A.
Telephone: (213) 740-4501
Electronic Mail: bekey@pollux.usc.edu

WORKSHOPS AND TUTORIALS:

The conference sessions will be conducted from Monday, May 3, 1993 to Wednesday, May 5, inclusive. Sunday, May 2 will be scheduled for workshops. Thursday, May 6 and Friday, May 7 will be scheduled for tutorials. Workshop and tutorial proposals are solicited and should be submitted to:

Pradeep K. Khosla
Dept. of Electrical & Computer Engr.
Carnegie Mellon University
Pittsburgh, PA 15213-3890, U.S.A.
Telephone: (412) 268-5090
FAX: (412) 268-3890
Electronic Mail: PKK@cs.cmu.edu

CALL FOR VIDEOS

As a tradition of the IEEE International Conference on Robotics and Automation, a video tape session on current experimental results will be organized. A video proceedings of up-to-date research results will be produced. The video proceedings will be shown at the conference and available to the attendees. For submission of videos contact:

Rajiv V. Dubey
Dept. of Mechanical and Aerospace Engr.
The University of Tennessee
Knoxville, TN 37996-2210
Telephone: (615) 974-5275
FAX: (615) 974-2669
Electronic Mail: DUBEY@utkvx.utk.edu

The deadline for submission of Videos is October 2, 1992. $500 will be awarded to the best video.

EXHIBITION:

There will be a table-top exhibition of current hardware/software products at the conference. For further information contact:

Wiley D. Holcombe
Intelligent Machines Branch
Georgia Institute of Technology
Atlanta, GA 30332, U.S.A.
Telephone: (404) 894-6144
FAX: (404) 894-8051
Electronic Mail: WHOLCOMB@gtri01.gatech.edu

LOCAL ARRANGEMENTS:

Atlanta, Georgia Invites you to the 10th IEEE International Conference on Robotics and Automation. As the first site of this conference, Atlanta proudly marks one decade of progress in automation. The city provides outstanding national and international access by air. The historical charm of the "Old South", and a progressive cultural, social and economic environment will enhance your visit. Preview the site of the 1996 Summer Olympics. Tour research laboratories at nearby Georgia Institute of Technology, government and industrial sites. Or, enjoy natural attractions in the north Georgia mountains in addition to the conference.

For general conference information contact:

Wayne J. Book
George W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0405
Telephone: (404) 894-3247
FAX: (404) 894-9342
Electronic Mail: WBOOK@gtri01.gatech.edu

RA Conference Travel Grants Available to Attendees from Developing Countries

The Robotics and Automation Society will provide a limited number of grants to enable students, engineers and scientists from Developing Countries in Africa, Asia and Latin America to attend the IEEE International Conference on Robotics and Automation in Nice.

. The grants will consist of (1) travel assistance of $500 and (2) no charge for Registration. Preference will be given to University students working in Robotics and Automation.

To apply for a Grant, applicants should write a one page letter containing the following information:

•1. Name, address, telephone and FAX number, if available

•2. Professional affiliation and nature of work (if student, describe current level in University, major field, etc.)

•3. Brief description why attendance at the conference would be beneficial to your studies and/or professional career.

The letter should be sent to:
Professor George A. Bekey
Computer Science Department
Univ.of Southern California
Los Angeles, CA 90089-0781
FAX: (213) 740-7285

Calls for Papers (continued)

• **Telemanipulator Technology Part of SPIE's OE/Technology '92 15-20 November, 1992** HynesConvention Center, Boston, Massachusetts, USA. This program will address problems associated with technologies developed to facilitate remote manipulation by human operators. Target applications for these technologies include hazardous and/or unstructured workplaces, where the task environment may be beyond the range of direct human manipulation and sensing, and where human sensory information processing and decision-making skills allow telemanipulators to outperform purely autonomous systems. In addition to hardware implementation (e.g., electronics and computer architectures, master-slave systems, anthropomorphic manipulators, hand controllers, and sensors), new telemanipulator developments in modeling, analysis and control that help deal with communication delays and provide stable high bandwidth operation will be considered. . *Submissions:* four copies of your abstract (at least 200 words) by 20 April 1992 to: OE/Technology '92 SPIE, P.O. Box 10, Bellingham, WA 98227-0010 , Fax: (206) 647-1445 Phone: (206) 676-3290

Engineering Foundation Grants (cont. from p.23)

The TAB Review Committee is chaired by Dr. James M. Tien with members: Drs. John B. Anderson; Lawrence K. Anderson; Edward Della-Torre; and Oscar N. Garcia.

The Engineering Foundation is an operating division of the United Engineering Trustees, which is composed of representatives from the five Founder Societies; IEEE, American Society of Chemical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers and American Institute of Mining, Metallurgical and Petroleum Engineers.

For applications and other information about these grants contact *John Vitale, Society Support Services Director, IEEE Technical Activities Department.*

IEEE Robotics & Automation Society

ROBOTICS AND AUTOMATION

THE INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS, INC.
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