



SYSTEM SOLUTIONS

THE INSTITUTE FOR SYSTEMS RESEARCH

The
Institute for
Systems
Research

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Wireless networks proposal wins URI award

Six ISR faculty are members of a team that has won a \$4 million, five-year Department of Defense University Research Initiative (URI) award for "Distributed Immune Systems for Wireless Networks Information Assurance."

The award is one of only 20 successful proposals selected for funding during fiscal year 2001. The team includes Principal Investigator **John S. Baras**, **Anthony Ephremides**, **K.J. Ray Liu** and **Haralabos Papadopoulos** (ECE/ISR); **Carlos Berenstein** (Math/ISR); and **Nicholas Roussopoulos** (CS/UMIACS). **Virgil Gligor** (ECE) is also a member.

The team participated in a targeted competition in the Critical Infrastructure Protection and High Confidence, Adaptable Software (CIP/SW) Research Program of the URI BAA. The researchers will be working with the Army Research Office.

PI John Baras said, "This is indeed great news and will allow us to work on the exciting ideas we put together for wireless information assurance." His assessment was shared by ISR Director Gary Rubloff, "This is clearly a very timely topic. Its success will be a major contribution and very visible."

DoD awarded 20 grants totaling \$9.3 million in fiscal 2001 to 16 academic institutions to conduct research in 13 topic areas. The 20 awards will provide long-term support for research, graduate students, and the purchase of equipment supporting specific science and engi-

neering research themes in the fields related to critical information protection and high confidence, adaptable software. [ES](#)

ISR faculty receive three MURI grants

ISR faculty are participating in three new Department of Defense 2001 Multidisciplinary University Research Initiative (MURI) grants. The grants total \$26.8 million in 2001.

Communicating Networked Control Systems is an Army Research Office project developing mathematical foundations to support the integration of control and communications technologies. Boston University is the lead institution. Other participants include the University of Maryland, Harvard University and the University of Illinois (Urbana).

ISR participants include Principal Investigator **P.S. Krishnaprasad**, **John S. Baras** and **Prakash Narayan** (ECE/ISR); **Roger W. Brockett** (Harvard); **Gregory Walsh** (ME/ISR);

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Director's Corner

ISR IS DEVELOPING new kinds of international partnerships with industry.

We are entering the third year of a partnership with Honda R&D (page 7), in which the company's most promising young engineers are sent here to work directly with ISR faculty, students and related engineering research groups and learn about the broader aspects of American research, development and culture.

This year we have also begun a partnership with Toshiba's Corporate Manufacturing Engineering Center (page 7) that is helping Toshiba develop strategies and tools for a new era of digital manufacturing, beginning with collaborations in global supply chain management and data mining. This challenge is well suited to the diverse portfolio of ISR engineering, business and computer science skills. Mr. Koichiro Atsumi, Director of the Toshiba Center, has joined the ISR Strategic Advisory Council.

New modes for carrying out collaborative research are becoming routine on the research landscape. The Army Research Laboratory (ARL) initiated a successful Federated Laboratory (FedLab) program five years ago, with substantial ISR involvement. This year ARL carried out competitions for a follow-up program, Collaborative Technology Alliances (CTA), in five technology areas.

Clark School faculty are participants in all five winning alliances and ISR faculty are key members of four of them: Communications and Networks, Advanced Sensors, Power and Energy, and Advanced Decision Architectures (see page 3). Each alliance is led by industry and brings together industry and university partners for an eight-year research effort funded in the range of \$50-\$75M for the duration of the project.

ISR is heavily involved in major campus initiatives in both nanotechnology and biosciences. One important component of these is in microelectromechanical systems (MEMS), involving the design and realization of ultrasmall devices and systems with electrical, mechanical, chemical, optical, and other functionality important to system applications.

ISR's early investment in this area placed its young MEMS faculty in central roles which benefit both the Clark School and the systems applications in ISR. Don DeVoe (ME/ISR) began the Center for Microengineering (CEMIE, www.glue.umd.edu/cemie/), which has become the focal point for a cluster of Clark School faculty. Working with MEMS researchers at neighboring institutions, Reza Ghodssi (ECE/ISR) has been an initiator of the MEMS Alliance (www.memalliance.org), comprising about 10 institutions which include government labs, companies and universities.

You can find summaries of the essence of our research and its impact online at www.isr.umd.edu/ISR/accomplishments. This area of our web site contains synopses of key accomplishments and their significance, organized along the lines of ISR's major research and education thrusts. ☺

ISR faculty receive three MURI grants

continued from page 1...

and Dimitrios Hritsu-Varsakelis (ME).

Other members of the team are John Baillieul, Thomas Bifano and Yannis Paschalides (Boston University) and P.R. Kumar (University of Illinois).

Hybrid Smart Materials and Adaptive Structures is an Office of Naval Research project to identify and enhance design and performance characterization of new classes of hybrid smart materials and develop enhancements to their use in actuating and sensing macro-structures. The University of Maryland is the lead institution with participation from the University of Minnesota, the University of Rhode Island and California State at Northridge.

ISR-affiliated Ramamoorthy Ramesh (MNE) is one of the investigators. Other Maryland faculty include Principal Investigator Manfred Wuttig, Peter Kofinas, Alexander Royt-Burd, Lourdes Salamanca-Riba and Ichiro Takeuchi (MNE); Amr Baz and Abhijit Dasgupta (ME); and Inderjit Chopra, Darryll Pines and Norman Wereley (AE).

The Effects of Radiofrequency Pulses on Electronic Circuits and Systems is an Air Force Office of Scientific Research project investigating the threats and opportunities associated with the introduction of microwave pulse energy into modern and future electronics. The University of Maryland is the prime institution, with participation from Boise State University. ISR-affiliated Neil Goldman (ECE) is one of the investigators. Other Maryland faculty include Principal Investigator Victor Granatstein, Tom Antonsen, Agis Iliadis, Bruce Jacob and John Melngailis (ECE); Ed Ott (ECE/Physics); Patrick O'Shea, Yuval Carmel and John Rodgers (IPR); Omar Ramahi (ME); and Steve Anlage (Physics). ☺

ISR shares in four Army Research Lab awards

ISR faculty are involved in four new Army Research Laboratory (ARL) Collaborative Technology Alliances programs.

The **Communications and Networks Alliance** will enhance the Army's communication infrastructure in a dynamic, wireless, mobile environment.

Participants include Maryland PI John S. Baras, Anthony Ephremides, Evaggelos Geraniotis, K.J. Ray Liu, Haralabos Papadopoulos and Armand Makowski (ECE/ISR); Carlos Berenstein (Math/ISR); Nicholas Roussopoulos (CS/ISR) and Virgil Gligor (ECE).

The **Advance Sensors Alliance** will focus on electro-optic smart sensors, advanced radio frequency concepts and microsensors.


Participants include Maryland PI Rama Chellappa, Shuvra Bhattacharyya and Mario Dagenais (ECE); and K.J. Ray Liu and Shihab Shamma (ECE/ISR).

The **Power and Energy Alliance** will address novel compact power sources that are not electrochemical in nature, soldier-portable fuel cell systems and their fuel processing, logistics fuel reformation, and power conditioning and efficient energy conversion for platform mobility.

Reza Ghodssi (ECE/ISR) is the Maryland Principal Investigator.

The **Advance Decision Architectures Alliance** will develop analytical tools and a distributed collaboration architecture to filter information for automated analysis and intuitive presentation.

Participants include Maryland PI Rama Chellappa (ECE) and V.S. Subrahmanian (CS/ISR).

More detailed information is available at www.isr.umd.edu/ISR/publications/newsletter/ssfa01/4ARLwards.html. 

FAA Administrator speaks at airspace workshop

"It's an extraordinary time to be in aviation," Federal Aviation Administration Administrator Jane Garvey told the Workshop on Airline and National Strategies for Dealing with Airport and Airspace Congestion.

Garvey highlighted the multiple approaches government, academics and industry are taking together to develop a series of new solutions to the current issues in airport congestion.

Garvey's speech was a highlight of the March 15-16 workshop, which attracted airline executives, leaders from other transportation organizations, FAA and other government officials and academic researchers from across the nation. The workshop's 21 presentations addressed the most current and innovative strategies and techniques for dealing with increased demand and congestion.

Garvey emphasized the necessity for closing the gap between demand and capacity at airports nationally.

Garvey said that by expanding technology incrementally and working simultaneously to decrease demand and increase capacity, specifically runway capacity, the FAA is moving away from the old "highway in the sky" concept of air transportation and using air space more efficiently while maintaining a high record of safety.

She added that while it is not desirable to limit demand, given an FAA projection of 1 billion airline passengers in 2002, demand must be limited in places where increasing capacity is not viable.

Garvey also presented Dr. Tasha Innis with the FAA Centers of Excellence Student of the Year Award for her research and dissertation on the challenges of dealing with scheduling and the weather. Innis, a recent University of Maryland Ph.D. in Applied Mathematics,



FAA Administrator Jane Garvey

was a student of Michael O. Ball (Robert H. Smith School of Business/ISR).

Ball organized the event with his fellow NEXTOR co-director Amedeo Odoni. Odoni is the T. Wilson Professor of Aeronautics and Astronautics and of Civil and Environmental Engineering at the Massachusetts Institute of Technology. He is one of the Principal Investigators in MIT's Global Airline Industry Center, sponsored by the Sloan Foundation.

The workshop was held at the University of Maryland's University College Inn and Conference Center. It was jointly sponsored by NEXTOR, an FAA-sponsored research consortium of university and public and private sector industry partners; the Global Airline Industry Center, a Massachusetts Institute of Technology team of faculty, staff, and graduate students researching the development, growth, and competitive advantage in the airline industry; and the University of Maryland's Robert H. Smith School of Business. ISR administered the event.

Presentations from the workshop are available at www.isr.umd.edu/airworkshop/agenda.html. — TK

Research Review Day draws hundreds

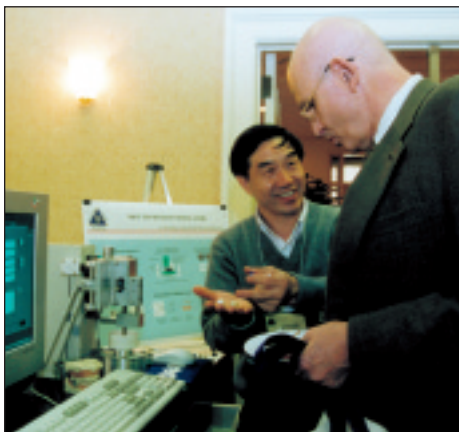
Cutting-edge research and innovative presentations were the draw for more than 200 high-level industry representatives who attended Research Review Day, March 2.

The high-tech review was hosted by ISR, the Department of Electrical and Computer Engineering, the Computer Science Department and the Institute for Advanced Computer Studies.

In the morning's technical talks, **Shihab Shamma** (ECE/ISR) described his research in neuromorphic engineering and **Ben Shneiderman** (CS/UMIACS/ISR) discussed information visualization. Participants also learned about molecular biosciences and the secure management of distributed and wireless networks.

The afternoon showcased more than 25 demonstrations and 150 research posters, ranging from **Guangming Zhang's** (ME/ISR) mouth motion machine, pictured below; to **Scott Corson's** (ISR) work on scalable routing for mobile ad hoc networks.

The full list of posters and demonstrations is at www.ece.umd.edu/RRD/. To receive notification of next year's event, send your address via e-mail to rebeccac@isr.umd.edu. — TK



Professor Guangming Zhang (ME/ISR) demonstrates his mouth motion machine.

NSF grant awarded for systems engineering research and curriculum development

ISR has received a three-year, \$500,000 National Science Foundation grant for "Combined Research and Curriculum Development in Systems Engineering" to develop a program of education in systems synthesis and serve an emerging national need in engineering education critical to the sustained competitiveness of industry.

The team includes Principal Investigator **John S. Baras** (ECE/ISR), Co-Principal Investigator **Mark Austin** (CEE/ISR), **Michael Ball** (Robert H. Smith School of Business/ISR), **Jeffrey Herrmann** (ME/ISR) and **Linda Schmidt** (ME). They will work in partnership with General Electric, Northrop Grumman, Lockheed Martin, and the publishing company John Wiley & Sons, Inc.

The team will develop, disseminate, and evaluate an information-centric curriculum, which will include three graduate level courses (ENSE 621: System Model Building and Analysis; ENSE 622: System Requirements, Design and Trade-Off Analysis; and ENSE 623: System Validation and Verification), graduate systems certificate courses and industry short courses.

The team will stress multi-disciplinary development and communication through information abstractions and representations. Students will employ sophisticated algorithmic, mathematical and quantitative methods that can be implemented in modern software environments.

Concurrent research projects will produce technical knowledge directly applicable to systems engineering education:

- Function/architecture co-design of smart structures;
- Design and planning of broadband communication networks;
- Heterogeneous data for system design

processes; and

- Enterprise models and financial/cost issues in systems engineering.

The team will fully explore and capitalize on web-based instructional material, presented hierarchically in interconnected layers of increasing depth and sophistication of coverage. They will organize various courses of self-study, visiting different materials according to the student's desired depth and sophistication. [ES](#)

DeVoe receives DURIP award for deep reactive ion etcher

Don DeVoe (ME/ISR) is the principal investigator for a new Defense University Research Instrumentation Program (DURIP) award. DeVoe's award is for a Deep Reactive Ion Etcher. The award is one of six recently announced DURIP awards for the University of Maryland, five of which were won by faculty in the Clark School of Engineering.

ISR Director Gary Rubloff called the Deep Reactive Ion Etcher "a critical component of ISR's capability for Microelectromechanical Systems (MEMS) fabrication and nanotechnology, central to a number of key ISR efforts in a broad range of sensor/actuator technologies and their systems-level implications and applications."

The DURIP program supports the purchase of state-of-the-art scientific equipment costing \$50,000 or more. [ES](#)

Druin, Gupta, Papadopoulos, Poovendran receive NSF CAREER awards

Three ISR faculty members and a recent ISR Ph.D. graduate have received National Science Foundation Faculty Early Career Development (CAREER) Awards. The CAREER program supports junior faculty within the context of their overall career development.

Allison Druin's (EDU/UMIACS/ISR) award supports "A Classroom of the Future: Developing and Infusing New Technologies in Early Childhood Education." The project addresses questions surrounding bringing technology into the classroom, particularly when it involves early childhood education. The 5-year research program is taking place at the University of Maryland's Center for Young Children and Yorktown Elementary School in Bowie, Md.

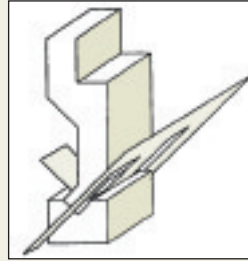
S.K. Gupta's (ME/ISR) research is entitled "Automated Design of Multi-Piece Molds—A Step towards Manufacturing of Geometrically Complex Heterogeneous Objects."

Haralabos Papadopoulos' (ECE/ISR) award will support research in "Efficient Encoding and Data Fusion Strategies for Wireless Networks of Sensors and Actuators."

ECE/ISR 1999 Ph.D. grad Radha Poovendran, now an assistant professor in the University of Washington, Seattle's Electrical Engineering Department, received the award for his work on secure group communications and will use it to help him establish his research program at Washington. He was advised by John S. Baras (ECE/ISR) while at Maryland. [ES](#)

patentsISSUED

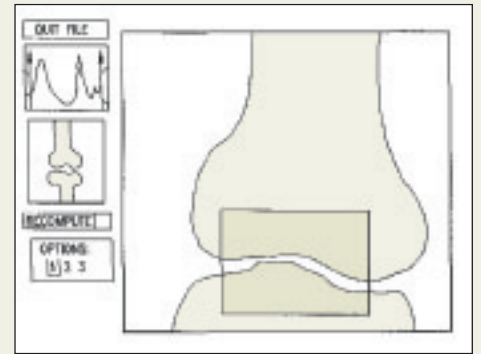
Gupta, Baras, Raghavan are awarded U.S. patents



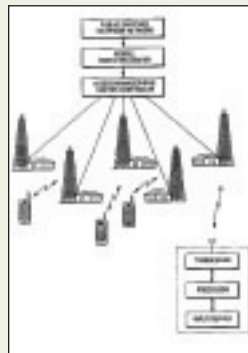
S.K. Gupta (ME/ISR) and David Alan Bourne of Carnegie Mellon University were issued U.S. Patent 6,233,538 on May 15, 2001 for an "Apparatus and Method for Multi-Purpose Setup Planning for Sheet Metal Bending Operations." This setup planning technique identifies a family of parts to be manufactured and determines

setup constraints imposed by the various bending operations in the part family.

John S. Baras (ECE/ISR) and Nick Sidiropoulos were issued U.S. Patent 6,127,669 for "Computer-Aided Determination of Window and Level Settings for Filmless Radiology" on Oct. 3,



2000. Sidiropoulos, a former ISR student and assistant research scientist, earned his Ph.D. with the Electrical and Computer Engineering Department and is now an associate professor in the Electrical and Computer Engineering Department at the University of Minnesota.



S. Raghavan (Robert H. Smith School of Business) was issued U.S. Patent 6,128,500 on Oct. 3, 2000. The invention, "Method and System to Optimize Capacity of a CDMA Cellular Communication System," allows for dynamic shrinking and enlarging of cell boundaries to enhance the system capacity advantages of CDMA while maintaining contiguous coverage and avoiding coverage holes.

Raghavan's four co-inventors are S. Vasudevan, Jennifer Sanchez, Steve Y. Chiu, and Victoria L.C. Okeson.

Complete information about ISR patents and pending patents is available at www.isr.umd.edu/ISR/research/patents.html. [ES](#)

Fellows



Kyu-Yong Choi (ChE) was elected to membership in the Korean Academy of Science and Technology. Choi also was elected to the National Academy of Engineering of Korea last year.



Prakash Narayan (ECE/ISR) was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for

his contributions to Shannon theory and its application to the evaluation of communication channel reliability.



Ben Shneiderman (CS/ISR), former director of HCIL, was named a fellow of the American Association for the Advancement of Science.

Awards



Anthony Ephremides (ECE/ISR) received the 2000 Fred W. Ellersick Milcom Award for the "Best Paper in the Unclassified Technology Program." The award,

sponsored by the IEEE Military Communications (Milcom) Conference Board in conjunction with the IEEE Communi-

cations Society, was given to Ephremides for a paper entitled "Algorithms for Bandwidth-Limited Energy-Efficient Wireless Broadcasting and Multicasting."



S.K. Gupta (ME/ISR) is one of nine 2001 recipients of the Society of Manufacturing Engineers' Robert W. Galvin Outstanding

Young Manufacturing Engineer Award. The international award recognizes Gupta's significant achievements and leadership in manufacturing engineering as a young engineer.

Ramamoorthy Ramesh (MNE) received the prestigious Alexander von Humboldt Foundation Senior Scientist Award.

Ramesh is being honored for the excellence and worldwide reputation of his research. In conjunction with the award, Ramesh will be spending time at the Max Planck Institute for Microstructure Physics in Halle, Germany.



Stuart S. Antman (Math) was named a Distinguished University Professor, the highest campus honor bestowed on faculty. Antman is

known worldwide for his research in mechanics and solid matter, specifically mathematical elasticity. He is a leading authority on problems involving rods, plates and shells.

Newsmakers

Michael C. Fu (Robert H. Smith School of Business/ISR) was quoted in a Dec. 3, 2000 *Baltimore Sun* article on the effectiveness of using the Monte Carlo simulation process in retirement planning.

James Hendler (CS/ISR) co-wrote an article for the April 19 issue of *Scientific American* on how the advent of the semantic web will bring structure to the meaningful content of web pages. The article is online at www.scientificamerican.com/2001/0501issue/0501berners-lee.html.

Hendler wrote a second article on how the semantic web will affect electronic publishing for the April 26 issue of *Nature*. The semantic web is an extension of the current web, in which information is given well-defined meaning, better enabling computers and people to work in cooperation.

Hendler also was featured in a *Washington Post* article, "Mastering The Robot," on Sunday, Sept. 17, 2000. The article described research and projects in robotic systems. The article is online at www.washingtonpost.com/wp-dyn/articles/A26318-2000Aug25.html.

Publication

A new book in Birkhauser's Control Engineering series, *Nonlinear Control and Analytical Mechanics: A Computational Approach*, by Gilmer Blankenship (ECE) and Harry Kwatny (Drexel University) is now available. **William Levine** (ECE) is the series editor of the books.

New faculty members

David J. Lovell (CEE) specializes in traffic engineering, operations, control, and roadway design using differential geometry methods.

Dimitrios Hristu (ME) has research interests in limited communication control, control of smart structures, tactile sensing, and dynamical systems. He is a former ISR postdoctoral appointee.

New tenured faculty

Ray Adomaitis (ChE/ISR) has research interests in simulation and model reduction techniques for distributed parameter systems, numerical techniques for solving boundary value problems, numerical analysis, parallel computing, and object-oriented simulation.

Jeffrey Herrmann (ME/ISR) is the director of the Computer-Integrated Manufacturing Lab. His current research includes projects such as Design for Production, Intelligent Process Planning and Scheduling, and Adaptable Simulation Models for Manufacturing.

Linda C. Schmidt (ME/ISR) has research interests in computational design, design optimization, and developing formal methods for design.

Greg Walsh (ME/ISR) works primarily in the Intelligent Servosystems Laboratory, and his research interests focus on automatic control. [ES](#)

GE becomes official ISR partner



GE's Paul Houpt

General Electric is continuing its historically strong relationship with ISR by becoming an official partner in the ISR Industrial Affiliates Program. One of the ways GE participates in ISR is through sponsoring the ISR/General Electric Fellowship, one of several fellowships in ISR's industrial fellowship program.

Toshiba joins ISR as partner

Toshiba Corporation is a new ISR Industrial Affiliates Program Partner. ISR Director Gary Rubloff and Mr. Koichiro Atsumi, the director of Toshiba's Corporate Manufacturing Engineering Center, acknowledged the new partnership during Toshiba's spring visit to ISR.



Toshiba visitors meet with ISR's Michael Ball.

Toshiba has sent two visiting scientists to ISR as part of the agreement. Haruhiko Kondo is in residence from April through October 2001. He is working on data mining techniques with **V.S. Subhranian (CS/ISR)**. Atsushi Takada arrived in May and is spending a year working on supply chain management with **Michael Ball (Robert H. Smith School of Business/ISR)**.

Honda visiting scientist program continues

Since last summer, Honda motorcycle engineer Eiji Adachi has been working with Balakumar Balachandran of the Mechanical Engineering Department in dynamic analysis of a motorcycle structure through modeling and simulation. He will return to Japan at the end of July 2001.



Eiji Adachi



Hirokatsu Nakaie

Two new visiting scientists came to ISR in June 2001. Hirokatsu Nakaie, an engineer designing scooter chassis and brake drum systems, will work with **William Levine (ECE)** on the dynamic characterization of suspension systems in motorcycles. Kazutomo Nishida, who designs electrical components for general purpose commercial engines, will be researching sensor and control systems for general purpose engines. [ES](#)



Kazutomo Nishida

shortTAKES

THE TELLURIDE NEUROMORPHIC ENGINEERING WORKSHOP will continue, thanks to a three-year, \$180,000 NSF grant awarded to **Shihab Shamma** (ECE/ISR), **Avis Cohen** (Biology/ISR) and **Timothy Horiuchi** (ECE/ISR). This three-week summer workshop focuses on neurobiological and engineering aspects of sensory systems and sensory-motor integration.

A \$1,000 CHALLENGE was issued in April 2001 by **K.J. Ray Liu** (ECE/ISR) and undergraduate students **Daniel Bendor** and **Javier Oviedo** to the first person or team to break a secure multicasting encryption scheme. Although more than 1,600 hits were recorded at the site, no one was able to hack the scheme by the April 30 deadline. The team used a simplified version of "A Dynamic Key Distribution Scheme Using Data Embedding for Secure Multimedia Multicast," U.S. Patent Application No. 60/233,841, a key distribution scheme developed for use in a scalable multicast environment.

The students prepared a report about the contest as part of their submission to the Texas Instruments Digital Signal Processing (DSP) Challenge. Although the cash prize has expired, the site will remain open for those wishing to try their hand at breaking the scheme. It is located at dsp.serv.eng.umd.edu/dspchallenge/.

THE DISCOVERY CHANNEL featured the Intelligent Servosystems Lab, **Shihab Shamma** (ECE/ISR) and **Catherine Carr** (Biology) last fall in a segment on the Learning and Intelligent Systems barn owl auditory system project. The segment appeared in the premier episode of "Science Daily," Discovery's Science Channel. **P.S. Krishnaprasad** (ECE/ISR) is a principal in the project.

THE COMPUTER INTEGRATED MANUFACTURING LAB has a newsletter available online at www.isr.umd.edu/ISR/publications/CIMnews/CIMnews032901index.html. ☺

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ISR is a permanent state-supported institute of the University of Maryland, within the A. James Clark School of Engineering. ISR is a National Science Foundation Engineering Research Center.

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