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*International Conference on  
Systems, Man, and Cybernetics*

*"Decision Making for Complex Systems"*

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**International Conference**

**on**

**Systems, Man, and Cybernetics**

**"Decision Aiding for Complex Systems"**

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## **1991 IEEE International Conference on Systems, Man, and Cybernetics**

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*This Conference is dedicated  
to the memory of*

***Mr. John Egan Gibson, Ph.D., P.E.***



***(1926 - 1991)***

Mr. John E. Gibson died suddenly on the twenty-sixth of August. An early and sustaining contributor to the profession of Systems Engineering, he was scheduled to be one of three special guest speakers at this year's conference.

Jack began his career as an assistant professor in the Department of Electrical Engineering at Yale University, where he received his doctorate in 1956. He joined the faculty of the School of Electrical Engineering at Purdue University the following year, where he organized and directed the Control and Information Systems Laboratory from 1960-1965. While at Purdue, Jack was recognized as a pioneer in research on state-variable control, the stability of nonlinear control systems, adaptive control, learning systems, and hybrid computer simulation. His 1963 textbook *Nonlinear Automatic Control*, published by McGraw-Hill, was a landmark in the field.

Jack moved to Oakland University in Rochester, Michigan, in 1965, to become the founding Dean of the School of Engineering. During his tenure as Dean, Oakland received the only NSF National Center of Excellence Award made to an engineering school. The school also became the first at Oakland to gain approval for a Ph.D. program. In recognition, Jack became the John Dodge Distinguished Professor of Engineering in 1970, the first endowed chair at that University. During this period, Jack's research interests turned to the nascent application of systems engineering concepts to urban and transportation systems. He contributed several insightful articles on these subjects to the *Transactions*, as well as the 1977 text *On Designing the New City: A Systematic Approach*, published by Wiley.

Jack joined the University of Virginia in 1973, as Commonwealth Distinguished Professor and dean of School of Engineering and Applied Science. Under his leadership, the engineering school was placed among the ten most improved in the nation during the years 1975-1980 by a National Academy of Science survey of higher education. Jack relinquished the Deanship in 1983 to return to full-time teaching and research in the Department of Systems Engineering, where he was a vital and active member of the faculty until the time of his death. During a visit to Kansas State University in 1984-85 as Regents Distinguished Professor, Jack directed the organization of state-funded, high technology incubator. He also served as chairman of the World Computer Graphic Association Conference held in Seoul, Korea, in 1985.

Jack was a Fellow of the IEEE, a registered professional engineer in Virginia, founder of the College of CAD/CAM Consortium, a member of the board of directors of the National Computer Graphics Association, a member of the National Academy of Science Panel on USAF Base Level Automation, and a member of the board of directors and a founding member of the executive committee of the University Small Business Innovation Center in Charlottesville, Virginia. During his distinguished career, Jack published over 100 technical articles and research reports. He was responsible for the management of research and development projects worth over \$100 million. He was the author of seven widely-translated books, on subjects ranging from *Control System Components* (1958) to *Modern Management* (1989). At the time of his death, he was actively engaged in innovative research on manufacturing systems engineering and total quality management and was working on his eighth book.

More than for this outstanding record of professional service and accomplishment, however, Jack will be remembered best as a consummate teacher, both inside and outside the classroom—as a mentor to generations of his undergraduate and graduate students and faculty colleagues. With respect, admiration, and gratitude, these *Proceedings* are dedicated to his memory.

# Conference Speakers

## *Andrew P. Sage, Ph.D. - Plenary Speaker*

Andrew P. Sage received the BSEE degree from the Citadel, the SMEE degree from Massachusetts Institute of Technology and the Ph.D. from Purdue, the latter in 1960. He received a Doctor of Engineering Honoris Causa degree from the University of Waterloo in 1987. He has been a faculty member at the University of Arizona, the University of Florida, and Southern Methodist University. He has had industrial and consulting experiences with several firms. At SMU he was the Head of the Electrical Engineering Department and Director of the Information and Control Sciences Center. From 1974 through 1984 he was the Lawrence R. Quarles Professor of Engineering Science and Systems Engineering at the University of Virginia. During portions of this time he was Acting Chairman of the Chemical Engineering Department, Associate Dean for Graduate Studies, and Chairman of the Department of Systems Engineering. In July 1984, he accepted a position as First American Bank Professor of Information Technology and Engineering at George Mason University and Acting Associate Vice President for Academic Affairs. In July 1985, he was appointed as the first Dean of the GMU School of Information Technology and Engineering.

Dr. Sage is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and the American Association for the Advancement of Science (AAAS). Among the awards that he has received are the Frederick Emmonds Terman Award from the American Society for Engineering Education (ASEE), and Outstanding Service Award from the International Federation of Automatic Control (IFAC), and the Norbert Wiener Award and an Outstanding Contribution Award from the IEEE. He is on the editorial board of several journals including *Computer and Electrical Engineering*, *Control: Theory and Advanced Technology*, *Future General Computer Sciences*, *IEEE Expert*, the *International Journal of Expert Systems: Research and Applications*, and the *Journal of Intelligent Systems*. He is editor of the *IEEE Transaction on Systems, Man, and Cybernetics*; *AUTOMATICA*; *Large Scale Systems*; and the John Wiley textbook series on Systems Engineering. He is a member of a number of professional societies including the American Institute for Artificial Intelligence, the Operations Research Society of America, the AAAS, the IEEE, the ASEE, and The Institute for Management Sciences. He was Chairman of the IEEE/SMC annual conference in 1974 and again in 1987. He was President of the IEEE Systems Man and Cybernetics Society for the two-year period 1984-85. Centennial Medals were awarded by the Case Western Reserve University in 1981 and by the IEEE in 1984. He is the Chair of Section M of the AAAS for calendar year 1990.

His initial research concerned optimization, estimation, system modeling and identification, and associated computational algorithms for communications and control systems design. Current interests include decision support systems engineering, command and control, information system design and evaluation, and software systems engineering; as well as application of these information technologies in defense and industry.

## *The Honorable Linwood Holton - Banquet Speaker*

Mr. Holton was elected president of Virginia's Center for Innovative Technology in September 1988 by CIT's 20 member board of directors. He served as governor of Virginia from 1970 to 1974.

He was born in Big Stone Gap in Southwest Virginia on September 21, 1923. He earned a B.A. degree from Washington & Lee University in Lexington and was awarded his diploma in absentia while on active duty with the U.S. Navy in 1944. In 1949, he was awarded a law degree from Harvard University.

Mr. Holton also serves as Chairman of the Metropolitan Washington Airports Authority, an 11 member board with representatives from Virginia, Maryland and the District of Columbia. Washington Dulles International Airport and Washington National Airport, both located in Virginia, were transferred to this authority pursuant to federal legislation which was recommended by a commission headed by Mr. Holton. He had been named to head the commission in 1984 by former U.S. Department of Transportation Secretary Elizabeth Dole. After the transfer of airports was approved by the U.S. Congress, Governors Charles Robb and Gerald Baliles appointed Mr. Holton to the Board of the Airports Authority.

Prior to forming CIT, Mr. Holton was associated with the law firm of Zuckert, Scoutt and Rasenberger in Washington, D.C. Earlier in his career he was a partner in two Roanoke law firms: Huner and Fox, and Eggleston, Holton, Butler and Glenn. From 1975 to 1978, he was with the Washington firm of Hogan and Hartson, and from 1978 to 1984 he was vice president and general counsel of the American Council of Life Insurance.



*Madan G. Singh, Ph.D. - Closing Luncheon Speaker*

Madan G. Singh B.Sc. (Exeter), M.Sc. (Manchester), Ph.D. (Cambridge), Docteur es Science (Toulouse), C. Eng. Fellow of the IEE, Fellow of the IEEE is the Professor of Information Engineering at the University of Manchester Institute of Science and Technology (UMIST) since 1987. He held the chair of Control Engineering at UMIST from 1979-1987 and he was the Head of the Control Systems Centre from 1981 to 1983 and from 1985 to 1987. Before taking up a chair in UMIST in 1979 he had been an Associate Professor at the University of Toulouse, France (1976-78), a researcher of the French CNRS (1978-79), a Fellow of St. John's College, Cambridge (1974-77), and an ICI European post doctoral Fellow in Toulouse, France (1973-75).

Professor Singh's research interests are on the application of Complex Systems and Information Engineering Methodologies to decision making problems in industry and commerce. He was a part time visiting Research Professor of Management Science at INSEAD (the European Institute of Business Management), Fontainebleau, France, over the period 1980-84.

Madan Singh is the author or co-author of 8 books, the editor or co-editor of a further 9 books, and an author or co-author of over 140 scientific articles. He is the editor-in-chief of the 8 Volume Encyclopedia of Systems and Control (Pergamon books Ltd., 1987) and of the Series "Advances in Systems, Control and Information Engineering" which aims to keep the main Encyclopedia up to date by producing Supplementary Volumes and Concise Subject Encyclopedias. He is the editor-in-chief of the Journal "Information and Decision Technologies: (North Holland) and he is on the Editorial Boards of a number of other International Journals including the IEEE Transactions on Systems, Man, and Cybernetics. He is also the Coordinating Editor of 3 book series (with Pergamon, North Holland and Plenum). He is the Editor of the IEEE SMC Newsletter.

Madan Singh is the Chairman of the IMACS Technical Committee on Managerial Decision Making and was a Vice-Chairman of the Systems Engineering Committee of the IFAC (1981-84). He is the Vice-President (Publications) of the IEEE Systems, Man, and Cybernetics Society. He gave the 1988 Rank Xerox Lecture.

Madan Singh has acted as a consultant to a large number of major companies (Midland Bank, Lloyds Bank, TSB, Halifax Building Society, Shell UK Oil, BP Oil, Unilever, Audi-Volkswagen, Glaxo, GMT, British Airways, etc.). He is the Chairman and founder of Control Sciences Ltd. and its subsidiary Knowledge Support Systems Ltd. These companies provide services concerned with Decision Technologies as applied to key tactical decision making problems for large companies based on products developed by Professor Singh as a part of his research. Through marketing and franchise agreements, these products are currently being used by major corporations worldwide to improve their decision making.

Professor Singh is a dual citizen of the UK and France. He is married and has 2 children. He is listed in a number of directories including American Men and Women of Science and in Debrett's distinguished people of today.

# **1991 IEEE International Conference on Systems, Man, and Cybernetics**

## **Organizing Committee**

General Chair:	Chelsea C. White, III University of Michigan
Program Chair:	Donald E. Brown University of Virginia
Invited Sessions and Tutorials:	Donald E. Brown University of Virginia
Contributed Sessions:	Julia Pet-Edwards University of Virginia
Publications:	K. Preston White, Jr. University of Virginia
Finance:	Edward A. Sykes University of Virginia
Publicity & Public Relations:	Stephen G. Strickland University of Virginia
Local Arrangements:	William T. Scherer University of Virginia



# Conference History

The IEEE Systems, Man, and Cybernetics Society has far ranging interests in such disciplines as biocybernetics, biomedical systems, artificial intelligence, robotics, adaptive systems, societal systems, large scale socio-economic systems, man-machine systems and systems science -- all of which are based on Wiener's interdisciplinary cybernetics concepts which, to a large measure, originated in the development planning of large hardware systems.

The Society traces its ancestry to the founding of the Human Factors in Electronics Group of the Institute of Radio Engineers (1957) and the Systems Science and Cybernetics Committee of the American Institute of Electrical Engineers (1961). The International Conference on Systems, Man, and Cybernetics has been a feature of the Society since the merger of the IEEE Man-Machine Systems Group and the IEEE Systems Science and Cybernetics Group in 1970:

<b>YEAR</b>	<b>LOCATION</b>	<b>CHAIRMAN</b>	<b>SOCIETY PRESIDENT</b>
1971	Disneyland	Gary Hollander	William H. von Alven
1972	Washington	K. S. Narendra	John Warfield
1973	Boston	Ahmed Meer	Kan Chen
1974	Dallas	Andrew P. Sage	Thomas B. Sheridan
1975	San Francisco	L. Stephen Coles	Thomas B. Sheridan
1976	Washington	William H von Alven	Edward A. Patrick
1977	Washington	William H von Alven	Edward A. Patrick
1978	Tokyo / Kyoto, Japan	Michael S. Watanabe	James D. Palmer
1979	Denver	James D. Palmer	James D. Palmer
1980	Boston	Richard F. Vidale	S. Basheer Ahmed
1981	Atlanta	Robert P. Zimmer	S. Basheer Ahmed
1982	Seattle	James A. Wise	William B. Rouse
1983	Bombay / Delhi, India	Faqir C. Kohli	William B. Rouse
1984	Halifax, Nova Scotia	Mohammed El Hawari	Andrew P. Sage
1985	Tucson	William R. Ferrell	Andrew P. Sage
1986	Atlanta	William B. Rouse	G. V. S. Raju
1987	Alexandria	Andrew P. Sage	G. V. S. Raju
1988	Beijing / Shenyang, China	J. Xinsong / A. T. Bahill	Arye R. Ephrath
1989	Boston	Sheldon Baron	Arye R. Ephrath
1990	Los Angeles	Amos Freedy	James M. Tien
1991	Charlottesville	Chelsea C. White, III	James M. Tien

# Tutorials

## 1. Risk of Extreme Events and the Fallacy of the Expected Value

*Who should attend:* Engineering managers and public officials interested in risk assessment and management.

*Synopsis:* Addresses the risk assessment/management process, which comprises both quantitative/empirical and qualitative/normative analyses. The process encompasses:

- Risk identification
- Risk quantification
- Risk evaluation
- Risk acceptance or aversion
- Risk control/management

Considers the subjective trade-off between the noncommensurate beneficial and adverse consequences that precedes an "acceptable risk" decision. Focuses on risk of extreme events and the fallacy of the expected-value approach, and introduces a modified conditional expected value function with real-life applications.

**Yacov Halmes** is Lawrence R. Quarles Professor of Engineering and Applied Science (Department of Systems Engineering and Civil Engineering) and director, Center for Risk Management of Engineering Systems at the University of Virginia. Before coming to the University of Virginia, he was on the faculty of the systems engineering (also former department chairman) and civil engineering departments at the Case Western Reserve University, Cleveland, Ohio. He was the first American Geophysical Union Congressional Science Fellow (1977-78), serving as a staffer in the Executive Office of the President and in the U.S. House of Representatives. He has participated in numerous short courses, and is the author of five books and the editor of 15 volumes. He is a registered professional engineer, a fellow of the AAAS, ASCE, AWRA, IEEE, and IWRA; and a member of the AGU, ASEE, ORSA, ORSIS, Sigma Xi, Tau Beta Pi, and the Society for Risk Analysis. He serves as vice president for technical activities of the IEEE/SMC Society.

## 2. Petri Net Modeling, Analysis, and Control for Manufacturing Systems

*Who Should Attend:* Engineers and managers responsible for the design and efficient operation of automated production systems, flexible manufacturing cells, flexible assembly station, and computer - integrated manufacturing systems; and faculty, staff, and graduate students who are interested in research and teaching in manufacturing and automation, discrete event systems, Petri nets, and performance modeling.

*Synopsis:* Examines how flexible technology and computer integration challenges the engineers and managers who coordinate and synchronize factory production. Considers how Petri nets and related concepts have given rise to new theory and graphical tools over the last two decades. Reaches beyond current approaches such as relay ladder logic diagrams and finite state machines. Shows how to evaluate the benefits and applicability of Petri net-based methods and tools for a specific academic or industrial application. Covers:

- Graphical modeling of manufacturing systems
- Petri net theory and properties relating to manufacturing control
- Control design methodologies
- Software generation for supervisory control
- Case studies: shop floor control and flexible assembly systems
- Performance analysis of manufacturing systems
- Current and future research

Includes the showing of a 15-minute video tape which demonstrates an FMS control system implementation using Petri nets.

**Frank DiCesare** received his Ph.D. degree in electrical engineering from Carnegie-Mellon University, Pittsburgh, Pennsylvania in 1970. In 1969 he joined the Rensselaer Polytechnic Institute, Troy, New York, where he is presently professor of electrical, computer, and systems engineering and is a faculty affiliate of the Center for Manufacturing Productivity and Technology Transfer. Since then he has been involved in research and teaching in information and decision systems. His current research focus and graduate level teaching are in the area of control of discrete event systems with application to manufacturing. He has worked on several major industrially-sponsored research programs, including discrete event control and computer-integrated manufacturing, and authored many articles in this area. He has consulted on information and control systems for numerous companies and agencies at all levels of government and the private sector. He was a recipient of the 1965 Koppers Fellowship, received the IEEE Centennial Award and Medal in 1984, and was cited in the 1987 Leadership and Excellence in the Application and Development of Computer-Integrated Manufacturing (LEAD) Award, presented by the Society of Manufacturing Engineers.

**MengChu Zhou** is assistant professor of electrical and computer engineering at the New Jersey Institute of Technology. He is also affiliated with the Center for Manufacturing Systems and the Manufacturing Program at NJIT. He received his bachelor's degree in computer and control engineering from East-China Institute of Technology, Nanjing, China in 1983, the master's degree in automatic

control at Beijing Institute of Technology, Beijing, China in 1986, and Ph.D. degree in computer and systems engineering from Rensselaer Polytechnic Institute, Troy, New York. He was an assistant engineer in the Institute for Computer Application, Beijing, China for one year. His research areas include computer-integrated manufacturing, intelligent manufacturing and automation, modeling and control of discrete event systems, and Petri net theory and applications. He has co-authored over 20 international journal and conference proceedings papers in the above areas. Dr. Zhou is a member of the IEEE.

### 3. *Reactive Robotic Control Systems*

**Who Should Attend:** Engineering and computer science professionals who are concerned with developing real-time sensory response in robotic plan execution. An exposure to basic sensor and robotic control and planning is preferable.

**Synopsis:** Presents the need, rationale, motivation and techniques for developing real-time robotic control systems, especially in the context of mobile robot systems. Discusses the drawbacks of using traditional artificial intelligence techniques in robot navigation: basing the decision-making process on abstract models generated from a priori or derived sensory information leads to several pitfalls, such as an inherently slow system response time. Examines reactive control strategies, designed to skip the abstract modeling process, evoking robot response directly from sensory input. Encompasses:

- Overview of traditional robot planning and control
- Motivation for reactive control
- Artificial intelligence as a basis for reactive systems
- Sensing requirements for reactive control
- Representative reactive control architectures
- Hybrid architectures
- Detailed case study: autonomous robot architecture

**Ronald Craig Arkin** is currently associate professor, College of Computing, at the Georgia Institute of Technology, Atlanta, Georgia. His previous experience has been at the Laboratory for Perceptual Robotics and VISIONS groups at the University of Massachusetts, Amherst; Hawthorne College, Antrim, New Hampshire, where he chaired the computer science department; and Napp Chemical, Inc. He received his doctorate from the University of Massachusetts, Amherst; his master's degree from the Stevens Institute of Technology and his bachelor's degree from the University of Michigan (Ann Arbor). His research focuses around action-oriented perception for robots and computer vision, with the use of models of existing biological motor and perception systems within intelligent robotic systems. Intelligent mobility and autonomous robot survivability are two specific areas of interest, with applications in manufacturing, aerospace and undersea environments, and compass settings, as well as robotic operation in hazardous environments and hardware failure handling. Dr. Arkin has written six published journal articles and refereed 19 published conference proceedings. He served as technical reviewer for a dozen more science and technology publications, including five IEEE productions, and has contributed to dozens more publications. He appears in several *Who's Who* volumes, and was named Faculty Member of the Year by Hawthorne College (1982-83).

### 4. *Building Expert Critiquing Systems: A Human Computer Collaborative Paradigm*

**Who Should Attend:** Artificial intelligence researchers who are interested in paradigms which support humans rather than replace them; those who seek an understanding of the state of the practice and the art of the critical system.

**Synopsis:** Examines how a shift from replacing humans to supporting them will affect AI system design. Proposes critiquing and argumentation as an alternative paradigm, evaluating human-generated solutions from the perspective of missing knowledge or recurring judgement errors. Promotes systems in which the computer need not solve the whole problem, but serves as a critic of the user's judgements, in order to stimulate the user's problem-solving ability. Discusses applications such as word-processing grammar, style and spelling checkers; engineering design environments which detect design flaws; knowledge base acquisition systems; and diagnostic aids for doctors who object to the didactic nature of expert systems but will accept feedback from a critiquing system. Covers:

- Introduction to the critiquing paradigm
- Survey of early, frontier-breaking critics
- Today's research frontiers

**Barry G. Silverman** is a full professor of engineering and director of the Institute for Artificial Intelligence, The George Washington University. He has designed and built several critics in the past few years as well as a general-purpose critic programming shell. This work has included:

→ COPE - a general purpose shell, written in C and operating on DOS and UNIX platforms, that may be used as a high - level language for critic programming and for embedding critics in electronic work environments

→ Two applications built with COPE, used for experimental purposes to detect and critique expert statisticians' errors in failing to recognize common sense situations as requiring probability and statistics techniques for their solution

→ A critic embedded in a CAD environment to help U.S. Navy warship designers understand the electro-magnetic interference effects of the antenna placement decision in their designs

(*Naval Engineers J.*, May '89)

→ A large-scale critic (1,200 rules, 2,000 screen messages), which passed a successful field test for the U.S. Army during 1990 and is now being deployed as a knowledge acquisition / report generation aid

→ A second large-scale critic, which is currently in the third year of a six-year cycle to integrate argumentation and analogy in an electronic warfare system CAD environment

→ A prototype curriculum planning critiquing system which will appear in the Fall '90 issue of *AI Magazine*

During these various projects, a number of research experiments have been completed concerning the design issues surrounding "criticism based problem solving". Dr. Silverman is in the final stages of publishing several articles and a textbook on the critiquing paradigms as well as on the lessons learned and research insights generated from these efforts.

Dr. Silverman holds the BSE, MSE, and Ph.D. from the University of Pennsylvania; is listed in *Who's Who in the World*; is a frequently invited keynote and seminar speaker at International AI conference/workshops; has over 50 published articles plus 10 books/proceedings; and is Associate Editor of *IEEE Expert* and *ORSA/TIMS' INTERFACES*.

## 5. Knowledge-Based Systems for Design and Manufacturing

*Who Should Attend:* Professionals with or without background in artificial intelligence/expert systems (AI/ES) concepts.

*Synopsis:* Presents applications of artificial intelligence (AI) and expert systems (ES) to design and manufacturing.

- Uses of ES shells on personal computers and workstations
- Incorporation of computer graphics in knowledge-based tools
- Integration of AI/ES into the larger CAD/CAM/CAE environment
- How to apply AI/ES to your work to increase productivity

Demonstrates the actual development of an ES for manufacturing using the Texas Instruments Personal Consultant Plus shell. Discusses other shells or environments for personal computers and workstations, such as VP-Expert, 1st-Class, ART, KEE, Goldworks, and Nexpert Object. Provides the basic information and tools necessary to build a knowledge-based ES for your particular needs. Saves months of research in AI/ES, and shows what products are right for you. Includes:

- The design process
- Selecting the right problem to apply AI/ES technology
- Knowledge acquisition for design and manufacturing
- Computerized tools for a design or manufacturing problem
- Advanced engineering modelers
- Expert systems for design/manufacturing
- Computer graphics and ESs for design

**Ileana Costea** is presently professor in the civil and industrial engineering and applied mechanics department at California State University, Northridge (CSUN). She received her Ph.D. in systems engineering from the University of California at Los Angeles (UCLA) in 1982. She has published numerous papers and made presentations at national and international professional meetings. Her research interests are in the fields of CAD/CAM/computer graphics, decision aids, artificial intelligence/expert systems (AI/ES) application to design and manufacturing, knowledge engineering, and human factors in computer systems. Dr. Costea is a member of IEEE, NGCA, CASA/SME, ACM, SIGGRAPH, AIIE, AIAA, AAAI, Eurographics and other professional organizations.

Dr. Costea is a member of the Computer-Aided Productivity for Engineering (CAPE) Committee, an inter-campus California State University forum of education. In 1986 she chaired the Academic Council and the CAD/CAM Committee of the School of Engineering and Computer Science, CSUN. For two years she was on the Board of Directors of NCGA for Academia.

For several years Dr. Ileana Costea has been heavily involved with the integration of computers in the engineering curriculum and the evaluation of utilization of hardware/software for computer-aided engineering (CAE) and interactive computer graphics.

## 6. Tools to Help Design Complex Systems

**Who Should Attend:** People who design complex systems. No prerequisites.

**Synopsis:** Discusses the modern method for coordinating big design projects, often called concurrent engineering. The concurrent engineering process is usually coordinated by systems engineering departments, responsible for ensuring that systems designed by their companies do what they were intended to do. They typically include concurrent engineering teams working on all facets of the system's operation (customers, sales, purchasing, supplies, etc.). The seminar introduces SEDSo, a hypertext tool which documents the efforts which go into such a complex design task. Incorporates the Japanese concept of quality function deployment to extract knowledge from people and put it into computer documentation.

**Terry Bahill** has been a professor of systems engineering at the University of Arizona in Tucson since 1984. He received his Ph.D. in electrical engineering and computer science from the University of California, Berkeley, in 1975. He is a senior member of the IEEE Systems, Man, and Cybernetics Society. His research interests are in the fields of modeling physiological systems, eye-hand-head coordination, validation of expert system knowledge bases, concurrent engineering, and systems design theory. He is the author of *Bioengineering: Biomedical, Medical, and Clinical Engineering*, Prentice-Hall, 1981; *Keep Your Eye on the Ball: The Science and Folklore of Baseball*, (with Bob Watts), W. H. Freeman, 1990; *Verifying and Validating Personal Computer-Based Expert Systems*, Prentice-Hall, 1991; *Linear Systems Theory* (with F. Szidarovszky), to be published by CRC Press, Fall 1991; and *Engineering Modeling and Design*, (with Bill Chapman and Wayne Wymore), to be published by CRC Press, Fall 1991.

## 7. Computer Vision Systems

**Who Should Attend:** Engineers, scientists, and applied researchers with interest in image analysis and machine vision fields. Mathematical training equivalent to a graduate of a typical science or engineering curriculum is assumed.

**Synopsis:** Discusses the computational mechanisms underlying the complete vision system hierarchy. Covers the analysis of images and vision systems developed for application in manufacture, robotics, remote sensing, and biomedical fields. Views computer vision processing on three levels: low, which deals with filtering and enhancement; intermediate, which is concerned with determining boundaries and regions within the image; and high, which derives the final description of the scene. Includes:

- Hierarchy of computational vision tasks
- Model-based approach to computer vision
- Image segmentation: region and boundary analysis
- Texture analysis
- Object recognition strategies and matching
- Extraction of 3-D depth information: stereo and range analysis

In addition, covers case studies involving the design and development of vision systems for aerial image understanding and robotic inspection.

**Mohan M. Trivedi** is a professor of electrical and computer engineering at the University of Tennessee, Knoxville. He is actively engaged in research in computer vision, image analysis, robotics and multispectral remote sensing under the sponsorship of various funding agencies. He is a frequent consultant to various industry and government agencies. He has published over 90 papers in leading journals and conference proceedings. He is an associate editor of *IEEE Transactions on Systems, Man, and Cybernetics* and the *International Journal of Approximate Reasoning*, and the *Optical Engineering Reports*. He served as the chairman of the Robotics Technical Committee of the Computer Society of the IEEE (1987-1989). He chairs the Pattern Recognition, Image Processing and Computer Vision Committee of the IEEE Systems, Man, and Cybernetics Society. He was awarded the Meritorious Service and the Technical Activities Pioneer awards by the IEEE Computer Society. He is a fellow of the International Society for Optical Engineering (SPIE) and a senior member of IEEE. He is listed in the *Who's Who in the Frontiers of Science and Technology*, *Who's Who of Emerging Leaders in America*, *American Men and Women of Science*, *Who's Who in the World* and other similar publications.

## 8. Knowledge Support Systems for Managerial Decision Making

**Who Should Attend:** Professionals who advise managers on the use of information technology for improving productivity; potential designers of knowledge support systems; managers and other decision makers.

**Synopsis:** Provides an overview of knowledge-support systems. Shows that a key managerial decision-making area where useful systems have been developed is for tactical decisions. For such decision, two decision types are seen to dominate i.e. pricing and resource allocation. Concrete knowledge support systems for pricing in different industries and for different kinds of resource allocation are then described. Provides case studies for:

- Pricing of gasoline products in the U.S. and France
- Determination of interest rates for liability products for a U. K. retail bank
- Advertising budget allocation for a U.K. retail bank



**Madan Singh** is the author of 17 books and 140 articles. He was the editor-in-chief of the eight volume *Encyclopedia of Systems and Control* (Pergamon Press, 1987) and of the effort to keep it up to date. He is a fellow of the IEE and of the IEEE and currently serves as the vice-president for publications of the IEEE/SMC. He has developed a number of knowledge-support systems which are marketed worldwide.

**Andrew Sage** is the author of over 20 books and more than 200 articles. He is the editor of the *IEEE Transactions on Systems, Man and Cybernetics, Automatica* and the journal *Information and Decision Technologies*. He is a former president of the SMC. He is a fellow of the IEEE. He was recently awarded an honorary doctorate by Waterloo University. His recently published *Concise Encyclopedia of Information Processing in Systems and Organization* (Pergamon Press 1990) is already a classic in the field.

## **9. Neural Network Approaches to Higher Brain Functions**

**Who Should Attend:** The session is intended for engineers, scientists and managers who want to obtain in-depth understanding of this important emerging technology and to evaluate its relevance to high-tech based problems. It starts with fundamental physiological and engineering principles and extends into advanced topics, including overviews for the most important applications and strategies for exploring future prospects.

**Synopsis:** Provides systems conceptualization of natural and artificial higher intelligence processes. Benefits those who have no prior knowledge, but who want to make use of these approaches in the future as well as those who have had previous exposure to neural networks and seek deeper understanding of the reasons why they work. Serves as an introduction to higher-brain function and structure in humans from a systems viewpoint, combining neurophysiological principles with the theory, design and operation of neurocomputers and cognitive machines. Includes:

- Notion of static and dynamic information patterns, encoding, brain information processing elements, and circuits
- Physiological principles and machine architectures for adaptation and learning, cognition, decision making, and generalizations
- The most successful current generic implementations and performance evaluation
- Applications to problems in pattern recognition, robotics, system identification, and diagnosis

**Nicholas DeClaris** is director of the Division of Medical Informatics and professor of pathology and epidemiology and preventative medicine in the School of Medicine of the University of Maryland at Baltimore. A past head of the electrical engineering department, he is also currently professor of electrical engineering and applied mathematics at the University of Maryland at College Park. He has extensive collaborative and consulting experience with universities, research institutions, and industrial organization in the U.S.A., Europe, and South America, including service as advisor to the National Science Foundation and to the National Institutes of Health. Before joining the faculties of the Universities in Maryland he was a professor at Cornell University and taught at the Massachusetts Institute of Technology, where he received his D.Sc. He acquired medical education and experience at the University of Maryland and has served as Associate Director of the Shock-Trauma Center in Baltimore. A frequent scientific lecturer and writer, he serves in the editorial committees of several publications at the international level.

## ***Panel Discussion***

### ***MD9      The IEEE SMC Society: Past, Present and Future***

#### ***Overview:***

In the evolution of any professional organization, it is both informative and somewhat necessary to take stock of what has occurred and to consider and plan for the future. In this panel discussion, we - a group of four current and former SMC Presidents - will consider the past, present and future of the IEEE Society. In particular, we will consider our Society in terms of its conferences (i.e., technical areas covered by the conferences; background of conference attendees; U.S. versus non U.S. conference locations; etc.); publication (i.e., growth of the *Transactions*; topics covered by the *Transactions*, theory versus practice; etc.); professional role (i.e., SMC's incubator status within the IEEE; relationship with Human Factors, ORSA, TIMS, IIE, and other societies; competing publications/conferences; etc.); and organization (i.e., birth of the Society; membership characteristics; appropriateness of the SMC name; etc.).

#### ***Format:***

The first half of the panel session will contain four presentations of about 10 minutes each, while the latter half will be an open discussion with audience participation.

#### ***Panel Members:***

James D. Palmer	IEEE-SMC 1978-1979 President	George Mason University, Fairfax, VA 22030
Andrew P. Sage	IEEE-SMC 1984-1985 President	George Mason University Fairfax, VA 22030
Thomas B. Sheridan	IEEE-SMC 1974-1975 President	Massachusetts Institute of Technology Cambridge, MA 02139
James M. Tien	IEEE-SMC 1990-1991 President	Rensselaer Polytechnic Institute Troy, NY 12180-3590

## Panel Discussion

### TB9      *Information Transfer In Systems, Man, and Cybernetics Publications And Roles For Archival Publications*

#### Overview

There are a number of publication opportunities in *Systems, Man, and Cybernetics*. These include books, archival journals, and conference proceedings.

A variety of studies have concluded that archival journals have a direct impact on research, but a limited direct impact on applications. Other types of archival publication such as handbooks and textbooks have a more direct impact, but tend to be rather dated relative to the current state of knowledge. Publications such as conference papers, technical reports, and working papers are usually more timely. However, the validity and reliability of the results presented in these types of publication are often questionable -- hence, practitioners may be quite unwilling to utilize these results.

The consequences of the above situation include a very sluggish process of information transfer from research to applications, as well as much rediscovery and redevelopment of ideas that have already appeared in archival journals but remain unread.

This panel will discuss the scope of the journals they edit. In particular, they will discuss the information transfer situation noted, whether or not this situation is inevitable and, if not, how the roles of archival publications might be extended and/or modified to improve efficiency and/or effectiveness. A panel was held on this subject at the 1986 SMC meeting. This seems to be an appropriate time to continue this discussion.

#### Format

Each panel member will be allocated 10 minutes to react to the following questions:

- a.      What is the scope of the journal you edit?
- b.      To what extent do you agree with the above characterization of the information transfer problem?
- c.      What roles should archival publications have in the information transfer process?
- d.      Should there be different types of archival publication for research and applications roles?

Following these presentations, each panel member will react to the comments of the other panel members. The remaining time will be allocated for questions from the audience as well as questions among panel members.

#### Panel

Dr. Peter Denning, Editor, *Communications of the ACM*  
Dr. Larry Kerschberg, Editor, *Journal of Intelligent Information Systems*  
Dr. Andrew P. Sage, Editor, *IEEE Transactions on Systems, Man, and Cybernetics*  
Dr. Edgar Sibley, Editor, *Information and Management*  
Dr. Madan Singh, Editor, *Information and Decision Technologies*  
Dr. Edward Wegman, Editor, *Journal of the American Statistical Association*

# Panel Discussion

## WB9      *Emerging Technical Issues in Systems Engineering*

### Overview:

In March 1961, Norbert Wiener, who is considered by many to be one of the fathers of what is known today as systems engineering, wrote the following in the Preface of the second edition (the first edition was published in 1948) of his book *Cybernetics*:

If a new scientific subject has real vitality, the center of interest in it must and should shift in the course of years. ... The role of information and the techniques of measuring and transmitting information constitute a whole discipline for the engineer, for the physiologist, for the psychologist, and for the sociologist. ... Thus it behooves the cyberneticist to move on to new fields and to transfer a large part of his attention to ideas which have arisen....

It seems the Wiener's philosophical and almost prophetic statements are as appropriate in the 1990s as they were in the 1960s. The panel will focus on select emerging technical issues in systems engineering and address trends, challenges, aspirations and needs. Furthermore, the incredible growth of the field during the last two decades necessitates a continuous reevaluation of not only the past but also the technical and human resource challenges as perceived by the chairs of the SMC Technical Committees.

### Format:

Each panel member will present his views in 10 minutes to be followed by an open discussion from the audience.

### Panel Members:

Yacov Y. Haimes, Moderator -- University of Virginia; IEEE-SMC Vice President, Technical Activities  
Nicholas DeClaris -- University of Maryland; IEEE-SMC Chair, Cognitive Systems Science and Engineering  
Mohan Trivedi -- University of Tennessee; IEEE-SMC Chair, Pattern Recognition, Image Processing, and Computer Vision  
Arye R. Ephrath -- Bell Communications Research; IEEE-SMC Chair, Human-Computer Interaction