STANFORD UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE
PROFILE

Founded in 1965, the Department of Computer Science is a center for research and education at the undergraduate and graduate levels. Strong research groups exist in areas of artificial intelligence, robotics, foundations of computer science, scientific computing, and systems. Basic work in computer science is the main research goal of these groups, but there is also a strong emphasis on interdisciplinary research and on applications that stimulate basic research.

Fields in which interdisciplinary work has been undertaken include chemistry, genetics, linguistics, physics, medicine and various areas of engineering, construction, and manufacturing. Close ties are maintained with researchers with computational interests in other university departments. In addition, both faculty and students commonly work with investigators at nearby research or industrial institutions. The main educational goal is to prepare students for research and teaching careers either in universities or in industry.

FACULTY AND RESEARCH ASSOCIATES

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE AND ROBOTICS: Artificial intelligence consists of a number of related research projects with both basic and applied research objectives. Current projects include basic research in artificial intelligence and formal reasoning, expert systems, large knowledge bases, agent-based architectures, image understanding, robotics, machine learning, mathematical theory of computation, program synthesis and verification, natural language understanding, parallel architectures, design/manufacturing, and portable LISP systems.

The Artificial Intelligence faculty perform their research in collaboration with a number of Stanford laboratories and centers. Some of these are the Robotics Laboratory, the Center for the Study of Language and Information (CSLI), the Center for Integrated Systems (CIS), the Stanford Integrated Manufacturing Association (SIMA), Center for Integrated Facility Engineering (CIFE), and the Knowledge Systems Laboratory (KSL).

- **Russ B. Altman**, *Assistant Professor of Medicine and (by courtesy) Computer Science, M.D. Stanford 1990, Ph.D. Stanford 1989, A.B. Harvard 1983*.
  Affiliation: Medical Computer Science Group within KSL Research Interests: Applications of advanced computing technologies to molecular biology, especially the analysis and prediction of protein structure. Dr. Altman's research concentrates on the development of algorithms for understanding the structure of biological macromolecules and biological sequence information. He is interested in the use of abstract data representations to simplify complex calculations, the use of probabilistic algorithms for data analysis, and the development of intelligent assistants for the scientific process.

- **Thomas O. Binford**, *Professor (Research), Ph.D. University of Wisconsin, 1965.*
  Affiliations*:* Robotics Laboratory, CIS. Research Interests*:* Major Areas: Intelligent systems for computer vision, medical imaging and robotics, and manufacturing; image processing. Subtopics: Representation of object geometry; geometric modeling and display; reasoning with geometry; evidential reasoning; learning in vision; SUCCESSOR model-based system for interpretation; design for manufacturability; tolerancing and inspection; precision engineering; quality control; text reading; color; image segmentation; stereo mapping, tactile sensing; robot hands; mobile robots.
  - **Tod S. Levitt**, *Senior Research Scientist, Ph.D. Univ. of Minnesota, 1981.*
    Research Interests*:* Computer Vision, Robotics, Uncertainty in AI (theories and practice of belief systems for machine intelligence). A key research area is the integration of machine perception with planning and action for robotics. Computer vision is still very limited; good biological and engineering models yield great uncertainty in scene interpretation. Bayesian inference is a fundamental approach to guiding robotic behavior from uncertain perceptions. Recent work involves extensions of Bayesian inference to hierarchical computer vision, connecting image processing and pattern recognition evidence with high level object understanding and manipulation. Binford's quasi-invariant image and geometric features are the basis for probabilistic estimates of evidence of scene objects. Hierarchical utility models and extended influence diagram techniques are being developed to form a physically deep, but combinatorially tractable, method of guiding robotics perception, inference and action.

- **Paul N. Edwards**, *Visiting Assistant Professor, Dept. of Computer Science and Program on Values, Technology, Science and Society. Ph.D. University of California at Santa Cruz, 1988.*
  Affiliations*:* Research Interests*:* History of computers and cognitive science. He is currently completing a book on the relations between computer research, military systems, and early cognitive psychology, focusing primarily on the 1945-65 period. Other interests: politics and philosophy of technology; global climate change and atmospheric science; history of artificial intelligence.

- **Edward A. Feigenbaum**, *Professor of Computer Science, Ph.D. Carnegie-Mellon, 1960.* Affiliation*:* Scientific Co-Director of the Heuristic Programming Project (HPP) within the Knowledge Systems Laboratory (KSL). Research Interests*:* Developing a general framework for modeling physical devices that supports reasoning about their designed structure, intended function, and actual behavior. Investigating basic issues in the representation of engineering and physics knowledge.

  A former chairman of the Department of Computer Science, Professor Feigenbaum founded the HPP in 1965. A Fellow and past president of AAAI, a member of the National Academy of Engineering and the American Academy of Arts and Sciences, he was elected in 1986 to the Productivity Hall of Fame, Republic of Singapore, and lectured as the Prime Minister Lee Kuan Yu Distinguished Professor at the National University of Singapore. He was elected a Fellow of the honorary American College of Medical Informatics and in 1989 was awarded an honorary Doctor of Science degree from Aston University in England. In 1991 he was the first recipient of the Feigenbaum Medal which was established and is awarded by the World Congress on Expert Systems.

  - **Robert Engelmore**, *Senior Research Scientist, Ph.D. Carnegie-Mellon, 1962.* Affiliation*:* Executive Director of the HPP within the KSL. Research Interests*:* Applied Artificial Intelligence. His interests are directed toward knowledge-based systems and intelligent agents to assist engineers in the design and analysis of physical devices. Research topics include design of science and engineering knowledge bases, modeling of devices, and qualitative/quantitative simulation.

  - **Barbara Hayes-Roth**, *Senior Research Scientist, Ph.D. University of Michigan, 1974.* Affiliations*:* KSL, CIFE, CIS. Research Interests*:* Adaptive Intelligent Systems -- systems that pursue multiple goals by perceiving, reasoning, and acting in complex, dynamic environments in real time. Experimental applications include intelligent monitoring systems and intelligent mobile robots. Current research issues include: agent architectures; selective perception; generic methods for component tasks (e.g., exploration, fault detection, diagnosis, prediction, planning); global control and coordination of interacting tasks; machine learning for performance improvement. Dr. Hayes-Roth is a Fellow and Council Member of the AAAI.

- **Richard E. Fikes**, *Professor (Research), Ph.D. Carnegie-Mellon, 1968.* Affiliation*:* Co-Scientific Director of the Knowledge Systems Laboratory. Research Interests*:* Professor Fikes' research is in the general area of knowledge representation and heuristic problem solving. He is best known as co-developer of the STRIPS automatic planning system and as one of the principal architects of IntelliCorp's Knowledge Engineering Environment (KEE) system. He is currently leading projects to develop multi-use representations of engineering knowledge, reasoning methods for performing core engineering tasks, and knowledge interchange technology to enable the sharing and reuse of encoded knowledge.

  Previously, Professor Fikes was Chief Scientist at the Price Waterhouse Technology Centre, Vice President of Research at IntelliCorp Inc., and on the research staffs of SRI International and the Xerox Palo Alto Research Center. A Fellow of AAAI, he is currently a member of the AAAI Council and the AAAI Press editorial board, and is co-program chair for the 1993 National Conference on Artificial Intelligence. Previously, he was co-program chair for the Second International Conference on Principles of Knowledge Representation and Reasoning, Secretary/Treasurer of the AAAI, and national chairman of the Special Interest Group on Artificial Intelligence of the Association for Computing Machinery.

  - **Sanjay Bhansali** *Research Scientist, Ph. D. University of Illinois, Urbana, 1991.* Affiliation*:* HPP within the KSL. Research Interest*:* Knowledge-based software design, software development environments, process programming, program synthesis, machine learning, planning, analogical reasoning.

  - **Thomas Gruber**, *Research Scientist, Ph.D. University of Massachusetts, 1989.* Affiliation*:* KSL. Research Interests*:* To build a knowledge medium for engineering.

This involves designing sharable representations for design and product knowledge; building interactive systems that can help formulate engineering models, capture design rationale, and explain how devices work; integrating engineering and communications software to support collaborative design and concurrent engineering.

- **Yumi Iwasaki**, *Research Scientist, Ph. D. Carnegie-Mellon, 1988.* Affiliation*:* HPP within the KSL. Research Interests*:* Qualitative physics, causal reasoning, model-based reasoning, knowledge representation, artificial intelligence applications to reasoning about physical systems for purposes of design and simulation. Visual representation and its application to problem solving.

- **Michael R. Genesereth**, *Associate Professor, Ph.D. Harvard, 1978.* Affiliations*:* Director of the Logic Group, Robotics Laboratory, CIFE. Research Interests*:* Knowledge representation, automated reasoning, and agent control and cooperation, with applications in engineering and robotics. Professor Genesereth's research centers on the study of declaratively expressed knowledge, with special attention to problems in knowledge representation, automated reasoning, the control of physical agents (such as robots, automated factories, and autonomous vehicles), and cooperation among agents. While the majority of Professor Genesereth's research is theoretical in nature, a significant portion of the work is devoted to applications of research results. At present, the primary application is Designworld, a computer-robotic system that specializes in the automatic design, manufacture, and repair of small-scale electromechanical devices (such as computers, compact disk players, and robots).

- **David J. Heeger** *Assistant Professor of Psychology, Neuroscience, and Computer Science, Ph.D. Computer Science, University of Pennsylvania, 1987.* Research Interests*:* Human and computer vision, image processing, computational neuroscience. Professor Heeger's current research focuses on developing a theory of visual motion perception. He is developing algorithms for analyzing image sequences to measure three-dimensional motion and depth, with application in robotics. These visual motion algorithms can be implemented using parallel distributed processing networks and distributed representations. The behavior of these networks corresponds well with response properties of specific classes of neurons in the visual cortex of the brain. Professor Heeger is developing computer models to simulate electrophysiology experiments, to explain neurophysiological data. He is using these same models to simulate psychophysical data on human motion perception. Professor Heeger is also interested in other aspects of visual perception (e.g., color vision, binocular/stereo vision), image coding (wavelets, motion compensated sequence coding, perceptually based image coding), and computer graphics (particularly as pertains to relationships between image analysis and image synthesis).

- **Oussama Khatib**, *Associate Professor of Computer Science and (by courtesy) Mechanical Engineering, Ph.D. Ecole Nationale Superieure de L'Aeronautique et de l'Espace (France) 1980.* Affiliation*:* Robotics Laboratory, SIMA, CIFE. Research Interests*:* Robot control architectures, object manipulation, multi-arm cooperation, sensor-based strategies and compliant motion primitives, real-time collision avoidance, robot programming and processing environments, and integrated planning and control systems. One of the primary objectives of this research is the development of a general framework for task-oriented sensor-based robot control with emphasis on its connections with planning systems. The aim is to develop the basic capabilities for the real-time execution of dextrous manipulation tasks in an evolving environment with both uncertainties and tolerance constraints. Addressing the limitations of current robot technology, Professor Khatib is working on the design and development of a new generation of force-controlled robot manipulator and mini-manipulator systems.

- **Jean-Claude Latombe**, *Professor and Director, AI and Robotics Division, Docteur-Ingenieur Grenoble, 1972; Docteur d'Etat Grenoble, 1977.* Affiliations*:* Director, Robotics Laboratory, SIMA. Research Interests*:* Robot reasoning, geometrical and spatial reasoning, including path planning among obstacles, dealing with geometrical uncertainty (sensory interaction), assembly planning, relating shapes and functions, reasoning in multiple-agent worlds, including representing one agent's knowledge about other agents' knowledge, recognizing other agents' goals, reasoning about time-dependent interactions with other agents, and modeling multiple-agent society laws. Applications include space automation, medical surgery, putting many mobile robots in indoor environments, and integration of design and manufacture. With respect to these research areas, robots are regarded as machines that can act, perceive and reason. Manipulator robots and mobile robots equipped with sensors are specific instances of such machines, which are suitable for conducting many experiments.

- **John McCarthy**, *Charles M. Pigott Professor of Engineering, Professor of Computer Science and (by courtesy) Electrical Engineering, Ph.D. Princeton, 1951*.
  Research Interests*:* Artificial intelligence, computing with symbolic expressions, time sharing, formalizing commonsense, non-monotonic logic. One of the founders of artificial intelligence research, Professor McCarthy invented Lisp, the programming language most used in AI research and also first proposed the general purpose time-sharing mode of using computers. The emphasis of his AI research has been in identifying the commonsense rules that determine the consequences of actions and other events, the expression of such rules and other common sense information as sentences in logical languages in the databases of artificial intelligent programs. His recent work concerns non-monotonic common sense reasoning whereby people and computers draw conjectural conclusions by assuming that complications are absent from a situation. McCarthy is working on a programming language, Elephant 2000, suitable for programs that interact with people or with programs belonging to other organizations. His major present project is the formalization of context and its application to artificial intelligence.

  Professor McCarthy received the National Medal of Science in 1990, is a Fellow and past president of AAAI. He received the First IJCAI Research Excellence Award in 1985.

  - **Ian Alistair Mason**, *Research Scientist, Ph.D. Stanford, 1986.*
    Research Interests*:* Logics and semantics of programming languages, mathematical theory of computation and proving properties of programs. Applications of logic to Computer Science and Artificial Intelligence. Logic.

  - **Carolyn Talcott**, *Senior Research Scientist, Ph.D. Stanford, 1985.*
    Research Interests*:* Semantics and design of programming languages, formal methods for proving properties of programs, and mechanization of formal reasoning. The work in programming languages focuses on the study of mathematical properties of expressive programming languages: languages providing function and control abstractions, objects with state, and concurrency. Recent work includes: developing inference systems for proving program equivalence in such languages; and developing high-level logical languages for specifying and reasoning about more complex properties of such programs; and developing general principles for proving properties of programs with effects, and for components of open distributed systems. Recent work in mechanization of formal reasoning includes: analyzing interactions of components of reasoning systems in order to develop a general architecture that supports construction of reasoning systems by interconnection of independent modules; and exploring ideas for formalizing notions of problem, solution, and problem solving principles using a mechanized logic that provides logical contexts represented as data structures that can be constructed, nested, and reasoned about.

- **Mark A. Musen**, *Assistant Professor of Medicine and (by courtesy) Computer Science, M.D. Brown, 1980; Ph.D. Stanford, 1988.*
  Affiliation*:* Medical Computer Science Group within the KSL. Research Interests*:* Knowledge acquisition for expert systems, including the programmatic generation of interactive tools that allow application specialists to build and maintain knowledge-based systems. Dr. Musen's research concentrates on PROTEGE-II, a *metalevel* program that allows developers to construct custom-tailored knowledge-acquisition tools that reflect the semantics of particular application areas. At the same time, PROTEGE-II facilitates the reuse of generic problem-solving methods and domain ontologies in the construction of new knowledge bases.

Additional work concerns elucidation of problem-solving methods for planning medical therapy and for reasoning about changes in time-ordered data.

- **Nils J. Nilsson**, *Kumagai Professor of Engineering, Professor of Computer Science, Ph.D. Stanford, 1958.*
  Affiliations*:* CIS, CSLI, CIFE, Robotics Laboratory, Symbolic Systems Program. Research Interests*:* Communicating, distributed AI systems and robots; robot architectures that combine reasoning and learning abilities with the capacity to react appropriately to environmental changes in real time. A Fellow of AAAI, a past president of AAAI, and former chairman of the Department of Computer Science, he is also interested in exploring the effects of artificial intelligence on society as a whole.

- **David E. Rumelhart**, *Professor, Psychology, Neuroscience and (by courtesy) Computer Science, Ph.D. Stanford, 1967.*
  Affiliation*:* CSLI. Research Interests*:* Connectionist approach to artificial intelligence and cognitive science. Particular areas of interest include machine learning, constraint satisfaction and knowledge representations. Current projects include speech recognition, robot navigation, complex pattern classification, game playing, brain modeling, medical diagnosis, story understanding, cursive handwriting, statistical language modeling, visual scene segmentation and other similar applications of connectionist methods. He is also interested in the relation between artificial intelligence and other approaches to the study of cognition. Professor Rumelhart, a charter Fellow of the American Association of Artificial Intelligenceand a recipient of the MacArthur Prize Fellowship, was elected to the American Academy of Arts and Sciences and to the National Academy of Sciences in 1991.

- **Yoav Shoham**, *Assistant Professor, Ph.D. Yale, 1986.*
  Affiliations*:* Robotics Laboratory, SIMA, CSLI, CIFE, CIS. Research Interests*:* Modeling artificial agents and their environments. Emphasis is placed on computational reasons for ascribing mental attitudes to machines, and on the relation between symbolic reasoning and sensory-motor activity. Theoretical tools include logic and algorithms, and experiments include the implementation of autonomous software agents to assist with email processing, meeting scheduling, and cellular communication with hand-held \ devices.

- **Edward H. Shortliffe**, *Professor of Medicine and (by courtesy) Computer Science; Ph.D. Stanford, 1975; M.D. Stanford, 1976.*
  Affiliation*:* Scientific Director of the Medical Computer Science Group within the Knowledge Systems Laboratory. Also Chief of General Internal Medicine Division in the Department of Medicine and Head of its Section on Medical Informatics. Research Interests*:* Knowledge-based expert systems for medicine and integrated workstations to offer physicians decision support in the context of routine clinical care. Dividing his time between clinical responsibilities in the medical school and medical informatics research, Professor Shortliffe is particularly interested in promoting the study of clinical reasoning and biomedical computing at Stanford. He directs the training program in Medical Information Sciences which offers M.S. and Ph.D. degrees. Current research efforts include the ONCOCIN and T-HELPER projects, therapy advisers designed to assist in the management of patients with cancer and AIDS respectively. His work often draws on research traditions that began with the MYCIN system (the doctoral work for which he received the ACM's Grace Murray Hopper Award in 1976).

  Professor Shortliffe is a member of the Institute of Medicine (National Academy of Sciences) and Fellow of the American College of Medical Informatics and of the AAAI. He received a Research Career Development Award from the National Library of Medicine; Henry J. Kaiser Family Foundation Faculty Scholar in General Internal Medicine; first computer scientist elected to the American Society for Clinical Investigation; first recipient of the Young Investigator Award of the Western Society for Clinical Investigation; also elected to: the Western Society for Clinical Investigation, the Western Association of Physicians, the American Clinical and Climatological Association, and the National Academies of Practice.

  - **Lawrence M. Fagan**, *Senior Research Scientist, Department of Medicine, Ph.D. Stanford, 1980; M.D. Miami, 1983.*

Affiliation*:* Medical Computer Science Group within the KSL. Research Interests*:* Temporal reasoning for expert systems, combining quantitative and qualitative computation methods, the design of therapy-planning computer programs (applications in cancer therapy, radiation therapy, and intensive care unit), and man-machine interface questions including the application of speech and pen-based input devices. Dr. Fagan, co-director of the Medical Information Sciences Training Program and associate director of the Medical Computer Science group, received a New Investigator Award from the National Library of Medicine and was elected as a fellow to the American College of Medical Informatics.

- **Thomas C. Rindfleisch**, *Senior Research Scientist, Department of Medicine, M.S. Caltech, 1965.*
  Affiliation*:* Director, KSL, Scientific Director of the Symbolic Systems Resources Group within the KSL. Research Interests*:* Distributed symbolic computing systems and integrated workstation environments, information management and retrieval systems, and knowledge-based resource management systems. Mr. Rindfleisch is a Fellow of the American College of Medical Informatics.

- **Michael G. Walker**, *Senior Research Scientist, Department of Medicine, Ph.D. Stanford, 1992.*
  Affiliation*:* Section on Medical Informatics Research Interests*:* Statistical methods for DNA and protein sequence analysis. Gene mapping and sequencing methods. Pattern classification algorithms. Statistical applications in biomedical research. Medical imaging.

- **Terry Winograd**, *Professor, Ph.D. MIT, 1970.*
  Affiliation*:* Project on People, Computers and Design, at the Center for the Study of Language and Information (CSLI). Research Interests*:* Human computer interaction design and the design of computer systems for cooperative work. Professor Winograd's focus is on developing the theoretical and practical background needed to incorporate human contextual elements into the design and analysis of computer systems and of the dynamics of people interacting with those systems. He is developing a teaching research programs that address questions of human-computer interaction from a design perspective. During the 92-93 academic year Professor Winograd has been at Interval Research, initiating joint programs in the area of interfaces to large information spaces. He has also continuing to develop a "language-action perspective" in which computing devices are understood and designed in the context of the social activity by which people generate a space of coordinated actions. The People Computers and Design project is partially funded by an NSF grant to create a series of innovative courses on human-computer interaction.

Consulting Faculty

- **Patrick J. Hayes**, *Consulting Professor, Ph.D. Edinburgh, 1973.*
  Affiliation*:* Technical Staff, MCC; Co-director, CYC project. Research Interests*:* Mechanical reasoning and the representation of knowledge, especially everyday physical knowledge. He is particularly interested in the representation of time and of shapes and more generally in theories of the ordinary physical world which can support the sort of mundane but pervasive inferences which we take for granted in everyday life. Dr. Hayes is also interested in basic issues of semantics and pragmatics of representational formalisms and some of the links between AI and philosophy and psychology. A AAAI Fellow, Dr. Hayes is President of AAAI during 1991-93.

- **Jussi A. Ketonen**, *Consulting Professor, Ph.D. University of Wisconsin, 1971.*
  Research Interests*:* Dr. Ketonen has published extensively on areas ranging from mathematical logic and set theory to the use of formal methods in Computer Science and the implementation of systems for mechanized reasoning. His current research interests include object-based distributed systems, object-oriented programming, and architectures for symbolic computation.

- **John Koza**, *Consulting Professor, Ph.D. University of Michigan, 1972.*

Affiliation*:* President, Third Millennium Venture Capital Limited. Research Interests*:* Genetic algorithms, classifier systems, artificial life, cellular automata and in particular, discovery using simulated evolution of ways by which computers can genetically breed programs to solve problems.

- **Joshua Lederberg**, *Consulting Professor, Ph.D. Yale, 1947.*
  Affiliations*:* KSL, SUMEX Project, and its successor (CAMIS), for which he chairs the advisory committee. University Professor and President emeritus, The Rockefeller University. Research Interests*:* molecular genetics and informatics; models of scientific reasoning using AI methods with molecular genetics as the object domain. He is especially interested in how to deal with anomalies that appear to formally contradict an effective working hypothesis. Also: intelligent interfaces to retrieval of bibliographic information from a vast literature; criteria of relevance. Professor Lederberg, who received the Nobel Prize in Medicine in 1958 and the Medal of Science in 1989, is a past Professor, Genetics and Computer Science (1959-1978). He is a member of the National Academy of Sciences, the Royal Society, London, and has received eleven honorary degrees.

- **Douglas B. Lenat**, *Consulting Professor, Ph.D. Stanford, 1976.*
  Affiliation*:* Principal Scientist and Director of AI at MCC, Austin, Texas. Research Interests*:* Representation of common-sense knowledge, ontological engineering, non-monotonic reasoning, machine learning. He is currently working on a large common sense knowledge base which may reduce expert systems' brittleness, enable natural language systems' semantic disambiguation, and facilitate learning by analogy. Professor Lenat is a Fellow of AAAI.

- **Stanley J. Rosenschein**, *Consulting Professor, Ph.D. Pennsylvania, 1975*
  Affiliations*:* Director of Research, Teleos Research; CSLI. Research Interests*:* Theoretical issues in artificial intelligence, particularly formal approaches to the design of software for robots and other intelligent real-time agents. Dr. Rosenschein is currently leading a research effort aimed at building integrated robotic systems combining real-time perception, action, and learning. Dr. Rosenschein is a Fellow of AAAI.

- **Jay M. Tenenbaum**, *Consulting Professor, Ph.D. Stanford, 1971.*
  Affiliations*:* President, Enterprise Integration Technologies Corp (EIT); CIS; SIMA. Research Interests*:* Applications of information technology in manufacturing, concurrent engineering and electronic commerce. At Stanford, Dr. Tenenbaum is currently involved in two DARPA-sponsored projects: an intelligent agent architecture for factory control; and a multimedia engineering environment that enables design teams to work together over the Internet, sharing information and tools. These systems are being developed in collaboration with faculty from the departments of Electrical and Mechanical Engineering. Dr. Tenenbaum's long-term goal is the creation of a national information infrastructure for electronic commerce on the Internet. At EIT, he is developing a prototype that will provide access via email to hundreds of experimental and commercial services for design, engineering, and rapid prototyping. Dr. Tenenbaum is a Fellow of AAAI.

EDUCATION

- **James Finn**, *Senior Lecturer, Ph.D. Princeton, 1982.*
  Areas of Interest*:* Teaching, personal computing, computers and writing, algorithms, database technology, programming languages.

- **Allison Hansen**, *Lecturer, MS Computer Science Stanford, 1992.*
  Interests*:* Teaching, Human-Computer Interaction, Philosophical Issues in Computing. Ms. Hansen teaches introductory software engineering courses, and she is working on the transition from Pascal to C as the language in which these courses are taught.

- **James Kent**, *Lecturer, Ph.D., The Ohio State University, 1992, M.S., The Ohio State University, 1989*
  Areas of Interest*:* Teaching, Computer Graphics and Animation, Parallel Algorithms.

- **Nicholas Parlante**, *Lecturer, MS Stanford, 1990.*
  Interests*:* Teaching, Cryptography, Computer Languages, Discrete Mathematics. Mr. Parlante teaches undergraduate computer science courses on software engineering, computer languages, Lisp, and introductory theory. He is a very enthusiastic teacher.

- **Eric Roberts**, *Associate Professor (Teaching), Associate Chair for Educational Affairs, Ph.D. Harvard, 1980.*
  Affiliations*:* CSD. Research Interests*:* Computer Science Education, Social Implications of Computing, Programming Languages, Programming Environments, Multiprocessor Systems. Professor Roberts oversees the curriculum and teaching program in the Stanford Computer Science Department. He is interested in developing new approaches and methodologies for teaching computer science concepts at the college level and in making sure that the computer science curriculum tracks the developments in the field. He is also actively engaged, primarily in his role as national president of Computer Professionals for Social Responsibility, in the area of social implications of computing.

SCIENTIFIC COMPUTING

SCIENTIFIC COMPUTING: The research in scientific computing involves two closely related aspects: development of mathematically based theory to solve particular problems, and implementation of appropriate computer algorithms. Particular emphasis is placed on numerical accuracy of a computation; additional considerations are made of algorithm design, computational efficiency, data structures and parallel procedures. Seminars are held almost every week of the year with members of the Stanford community and industrial researchers. Close cooperation and collaboration with government and industrial laboratories is maintained, and there is an active visitors program.

Research is done in collaboration with the Scientific Computing and Computational Mathematics Program.

- **George B. Dantzig**, *Professor of Computer Science and Operations Research, Criley Chair of Transportation, Ph.D. University of California, Berkeley, 1946.*
  Research Interests*:* Modeling and optimization of large-scale energy systems, combinatorial mathematics, mathematical programming. Professor Dantzig has been active in developing the Systems Optimization Laboratory that uses as its principal tools numerical analysis, advanced methods of data handling, linear and non-linear programming, and systematic experiments comparing algorithms on representative models -- for example, energy/economic planning models. Additional honors include: National Medal of Science, 1975; War Department Exceptional Civilian Service Medal; John von Neumann Theory Prize; Harvey Prize in the field of science and technology by Technion, the Israel Institute of Technology in Haifa; Silver Medal, the highest honor of the Operational Research Society of Great Britain; Fellow of the Econometric Society and the Institute of Mathematical Statistics; Adolph Coors American Ingenuity Award, 1989; Gibbs Lecturer of 1990, American Mathematical Society; eight honorary degrees.

- **Gene H. Golub**, *Fletcher Jones Professor of Computer Science and (by court esy) Electrical Engineering, and Director, Scientific Computing Division, Ph.D. University of Illinois, 1959.*
  Affiliation*:* Chairman, Scientific Computing and Computational Mathematics (SCCM); CIS. Research Interests*:* Numerical analysis, mathematical programming, statistical computing.

- Professor Golub's work has the unifying theme of matrix computations with the aim of devising and analyzing algorithms for solving numerical problems that arise in scientific and statistical computations. He has been active in developing new numerical methods which have been incorporated into many program libraries. Additional honors include: ACM/SIGNUM Award for Leadership in Numerical Analysis (Forsythe Lecturer); SIAM Award for Distinguished Service to the Profession; Honorary Fellow, St. Catherine's College, Oxford; Alumni Honor Award for Distinguished Service, University of Illinois at Urbana-Champaign; President of SIAM; elected to the National Academy of Engineering, 1989;

Honorary Member: Royal Swedish Academy of Engineering; six honorary degrees. Professor Golub is a former chairman of the Department of Computer Science.

- **John G. Herriot**, *Emeritus Professor, Ph.D. Brown, 1941.*
  Research Interests*:* Numerical analysis. Professor Herriot is interested in the development and testing of efficient algorithms for spline interpolation. Algorithms for spline interpolation with fairly general end conditions have been developed. He is also interested in studying and comparing methods for numerical solution of partial differential equations.

- **Joseph Oliger**, *Professor, Ph.D. Uppsala, 1973.*
  Affiliation*:* SCCM. Research Interests*:* Numerical analysis, numerical methods for partial differential equations. Professor Oliger's research deals with problems arising in the simulation of physical systems whose behavior is determined by systems of partial differential equations. Most of his work is directed toward applications in meteorology, oceanography, aerodynamics and hydrodynamics. His research involves the construction and analysis of algorithms for these problems and the design and analysis of computers, systems and languages for such large scale scientific computations.

- **Andrew M. Stuart**, *Assistant Professor of Computer Science and Mechanical Engineering, D. Phil Oxford, 1986.*
  Affiliations*:* SIAM. Research Interests*:* Numerical Analysis and Differential Equations. The study of algorithms for the approximation of initial value problems by techniques from dynamical systems theory. Modeling and numerical approximation of dissipative processes.

Consulting Faculty

- **Victor L. Pereyra**, *Consulting Professor, Ph.D. University of Wisconsin, 1967.*
  Affiliation*:* Principal, Weidlinger Associates. Research Interests*:* Numerical algorithms for forward and inverse modeling wave phenomena and their application to energy resource exploration and exploitation, earthquake seismology, and nondestructive inspection of materials.

SYSTEMS

SYSTEMS:

The systems area encompasses both experimental and theoretical work growing out of topics in operating systems and compilers, computer communication and networks, architecture, programming languages and environments, distributed systems, VLSI design and fabrication, graphics, reliability and fault tolerance, system specification and verification, and user interfaces. A large concentration of systems research takes place within the Computer Systems Laboratory, a joint laboratory of the Departments of Computer Science and Electrical Engineering.

- **Dennis R. Allison**, *Lecturer, Electrical Engineering, B.S. Physics, U.C. Berkeley.*
  Affiliations*:* CSL, HaL Computer Systems, Independent Consultant. Research Interests*:* Programming language design, compiler and operating systems implementation, computer architecture, microprocessor and VLSI design, distributed systems, parallel algorithms, analysis of algorithms, personal computing, software engineering, and the sociology of computing.

- **Charles Bigelow**, *Associate Professor of Art and Computer Science (Teaching), B.A. Reed, 1967, C.A.S. Harvard University, 1991.*
  Research Interests*:* Digital and typographic designs. Professor Bigelow's major interest is in the design and development of digital fonts for workstations and printers. A second area of research is the graphical design and typography of workstation screen images. Bigelow won the Goudy Award from Rochester Institute of Technology and the MacArthur Prize Fellowship.

- **David R. Cheriton**, *Associate Professor, Ph.D. University of Waterloo, 1978.*

Affiliations: CIS, CSL. Research Interests: design of distributed computer systems, scalable shared memory multiprocessors, operating systems, communication protocols and parallel simulation software. Recently, in the communications area, Professor Cheriton has been investigating techniques for high-speed computer communication with extensions for multicast. He has also been developing scalable shared memory multiprocessor hardware, a distributed parallel operating system for this hardware, and parallel simulation application structuring techniques for this architecture.

- **Giovanni De Micheli**, *Associate Professor, Electrical Engineering and (by courtesy) Computer Science, Ph.D. University of California, Berkeley, 1983.*
  Affiliations: CIS, CSL. Research Interests: Computer-aided design of microelectronic VLSI circuits. Professor De Micheli is interested in synthesis and optimization methods for digital circuits, especially at the functional and logic level. His research is centered on the development of algorithms, the study of their properties as well as their implementation.

- **David L. Dill**, *Assistant Professor, Ph.D. Carnegie Mellon, 1987.*
  Affiliations: CIS, CSL.
  Research interests: finite-state concurrent systems, protocol and hardware verification, asynchronous circuits and concurrency. Professor Dill's recent work involves modelling and verification of real-time systems.

- **Michael J. Flynn**, *Professor of Electrical Engineering and (by courtesy) Computer Science, Ph.D. Purdue, 1961.*
  Affiliations: CIS, CSL. Research Interests: computer architecture and organization, especially the simulation and modeling of physical and conceptual processors and the basic characteristics of "optimal" instruction processors. Professor Flynn investigates approaches to massively parallel machines including sparse memory. His research includes the realization of subnanosecond arithmetic processors. Other areas of his research include memory hierarchy design, understanding and modeling program behavior, and studying characteristics of parallel processors such as limits on their performance.

- **Hector Garcia-Molina**, *Professor, Ph.D. Stanford, 1979.*
  Affiliations: CIS, CSL. Research Interests: Database Systems and Distributed Computing. Advanced transaction models for long-running activities and autonomy. Real-time database systems. Fault-tolerance and synchronization in distributed systems. Performance evaluation of database and distributed systems. Electronic libraries and database management systems for unstructured data.

- **Anoop Gupta**, *Assistant Professor, Ph.D. Carnegie-Mellon, 1985.*
  Affiliations: CIS, CSL. Research Interests: Design of general-purpose scalable parallel computer architectures -- mechanisms for cache consistency; ways to reduce or tolerate memory latency; hardware/software support for efficient synchronization of processes; design of interconnection networks for multiprocessors; understanding the role of locality. Professor Gupta's research group is currently building a scalable directory-based shared-memory multiprocessor using very high performance individual nodes. In the software area, he is working on multiprocessor scheduling and resource allocation issues and on the design of a concurrent object-oriented programming language. In the applications area, he is studying parallelism in various applications in VLSI CAD and scientific domains. The applications work is also used for evaluating the hardware and software research efforts.

- **John L. Hennessy**, *Willard R. and Inez Kerr Bell Professor of Engineering, Professor of Computer Science and Electrical Engineering, and Director, Systems Division, Ph.D. State University of New York at Stony Brook, 1977.*
  Affiliations: Director of CSL Research Interests: computer architecture, compiler technology, VLSI technology. Professor Hennessy's interests are on the boundaries between compilers and computer architecture; he has explored the interaction of programming languages with the design and VLSI implementation of instruction set architectures. He has done research on several issues in compiler design and optimization, including work on symbolic debugging and new optimization algorithms (e.g., register allocation and instruction scheduling). His

current work focuses on multiprocessor architecture and compiler technology for parallel processors.

- **Mark A. Horowitz**, *Associate Professor of Electrical Engineering and (by courtesy) Computer Science, Ph.D. Stanford, 1984.*
  Affiliations: CIS, CSL. Research Interests: Digital integrated circuit / system design. Professor Horowitz's research interests span the range from evaluating new technologies for fast static RAM design, to architectural tradeoffs in the design of large-scale parallel machines. Recent research projects include work in high-speed BiCMOS SRAM, Self-timed processor design, CAD tools for switch-level simulation of MOS circuits, CAD tools for estimating the power supply quality in an IC, PLL design, Superscalar processor design, multiprocessor design. His current research projects include work in low-power digital design, architecture and component design for a large-scale shared-memory multiprocessor, and tools and circuit techniques to support these projects.

- **Monica S. Lam**, *Assistant Professor of Computer Science, Ph.D. Carnegie Mellon University, 1987.*
  Affiliations: CSL, CIS. Research Interests: parallel computer systems: architectures, compilers and languages. Professor Lam's current research goal is to exploit multiple granularities of parallelism simultaneously via language, compiler and architecture innovations.

- **Marc Levoy** *Assistant Professor of Computer Science and Electrical Engineering, Ph.D. University of North Carolina at Chapel Hill, 1989.* Affiliations: CSL, CIS. Research Interests:

  Computer graphics, scientific visualization, and interactive techniques. Professor Levoy's current research focuses on the analysis and rendering of multidimensional sampled data (i.e. volume rendering), digitization of 3D objects using novel scanner technologies, and the design of languages and user interfaces for data visualization. He is also interested in realistic image synthesis, computer animation, high-performance graphics architectures, parallel algorithms as they apply to graphics, and exotic user interface technologies such as eye tracking, head tracking and head-mounted displays.

  Professor Levoy received the NSF Presidential Young Investigator and the IBM Faculty Development Awards in 1991.

- **David Luckham**, *Professor (Research) of Electrical Engineering, Ph.D. MIT, 1963.*
  Affiliations: CIS, CSL. Research Interests: design of prototyping languages for rapid construction of large distributed time-critical systems containing hardware and software components; architecture definition languages; concurrent specifications. Tools to support rapid prototyping, particularly application of formal analysis and testing methods. Professor Luckham has also researched specification languages for parallel programs and automated tools supporting applications of formal specifications to systems development. Other areas of interests are in program verification and formal methods in software development, Ada and VHDL. His recent research also includes automated theorem proving.

- **Edward J. McCluskey**, *Professor of Computer Science and Electrical Engineering, Sc.D. MIT, 1956.*
  Affiliations: Director, Center for Reliable Computing, CIS, CSL. Research Interests: Computer design -- especially the design of reliable or fault-tolerant computers; Design for Testability; Synthesis of Testable Systems; Improved Testing Techniques for chips, mcms, boards and wafers. Current projects include: experimental and theoretical studies of the characteristics of temporary failures and their effects on system operation, Delay Testing Methodologies, High-level synthesis methods for designing testable systems and Built-in self-test implementations. Past president of the IEEE Computer Society, Professor McCluskey received the first IEEE Computer Society Technical Achievement Award in Testing, IEEE Centennial Medal, and the 1991 Taylor L. Booth Education Award.

- **Teresa Meng**, *Assistant Professor of Electrical Engineering and (by courtesy) Computer Science, Ph.D. U.C. Berkeley, 1988*

Affiliations*:* CSL, CIS. Research Interests*:* digital signal processing and system designs. Professor Meng's research activities include low-power video compression for wireless communication, asynchronous logic synthesis and circuit design, and dedicated-hardware design of personal communication devices. She received the IEEE ASSP Society's Paper Award for a paper published in the IEEE Transcripts on ASSP in 1987. She has been awarded the 1989 NSF Presidential Young Investigator Award, the 1989 ONR Young Investigator Award, a 1989 IBM Faculty Development Award, and the 1988 Eli Jury Award at U.C. Berkeley for recognition of excellence in systems research.

- **William F. Miller**, *Professor of Public and Private Management, Graduate School of Business, and Professor of Computer Science, School of Engineering.*
  Affiliations*:* President Emeritus, SRI International; Member, National Academy of Engineering; Fellow, American Academy of Arts and Sciences, IEEE, American Association for Advancement of Science. National Science and Technology Board, Singapore; International Advisory Board Multifunction Polis, Australia; International Advisory Council B.H.P., Ltd.; National Research Council Computer Science and Telecommunications Board; National Research Council Board of Assessment NIST; U.S. National Committee PECC; Board of Directors: Varian Associates, Inc., Pacific Gas and Electric Company, First Interstate Bancorp; First Interstate Bank of California. Research Interests*:* Technology Management, Technical Economic Development, Global Business Practices.

- **Oyekunle A. Olukoton**, *Assistant Professor of Electrical Engineering, Ph.D. University of Michigan 1991*.
  Affiliations*:* CSL, CIS. Research Interests*:* All aspects of high-performance computer design, architecture, computer-aided design tools, advanced integrated circuit and packaging technologies.

- **Mendel Rosenblum**, *Assistant Professor of Computer Science, Ph.D. Berkeley, 1991.*
  Affiliations*:* CSL. Research Interests*:* Operating systems, Distributed Systems, Computer architecture. Professor Rosenblum's research focuses on storage management issues in high performance operating systems and distributed systems. At present his research group is examining high performance file system design techniques using simulations and prototypes. He is also interested in the design of high performance I/O subsystems, disk arrays (RAIDs), and distributed operating system organization.

- **Fouad Tobagi**, *Professor of Electrical Engineering and (by courtesy) Computer Science, Ph.D. UCLA, 1974.*
  Affiliations*:* CSL, CIS, Stanford Center for Telecommunications. Research Interests*:* telecommunications networks, computer networks, and packet radio. Professor Tobagi is currently investigating issues related to high speed networks, broadband integrated services digital networks, and multimedia personal communication systems. He is involved in the design and implementation of fast packet switches, high speed network interfaces, and network operational protocols.

- **Gio Wiederhold**, *Professor (Research) of Computer Science and Medicine and (by courtesy) Electrical Engineering, Ph.D. U.C. San Francisco, 1976.*
  Affiliations*:* CIS, CSL, Med. Inf. Sci., CIFE. Research Interests*:* Conceptual database models for design of centralized, distributed, and autonomous databases. Professor Wiederhold is also interested in object transformations for multi-user database query and update processing and the development of knowledge-based techniques to overcome hard problems in database management, query and update. This led to further research in the management and structuring of the large knowledge-bases which are needed to support comprehensive information systems for planning and design support and formalizable software engineering methods to deal with such applications. He has developed algorithms and software to exploit modern hardware technology to support such systems and the further development of several medical, engineering, and planning support database projects. Professor Wiederhold will be on research leave at DARPA during the 91-92 and 92-93 academic years.

- **Arthur M. Keller**, *Senior Research Scientist, Ph.D. Stanford, 1985.*
  Affiliations*:* KBMS, CSL, CIFE, CIS; Private Consultant. Research Interests*:* Interoperability of heterogeneous databases, database integration, object-oriented databases, database implementation, databases on parallel computers, federated autonomous databases, database views including updates, incomplete information and nulls, software integration and reuse, and large system integration. Dr. Keller manages the Penguin project on interoperability of object-oriented and relational databases and the Fauve project on federated autonomous databases. He also collaborates on the Tsimmis project on integration of heterogeneous databases for information finding and distributed constraints, and on the CEDB project on configuration management and distributed constraints for collaborative design. He previously worked on the Paradata project performing research on databases on parallel computers and the development of DADAISM, a formally specified, modular database system in Ada that includes multiple interfaces at multiple levels as well as support for database security and integrity. Dr. Keller teaches the Introduction to Databases course each fall and will be working on Professor Wiederhold's projects during his leave at DARPA.

Consulting Faculty

- **Forest Baskett**, *Consulting Professor of Computer Science and Electrical Engineering, Ph.D. University of Texas at Austin, 1970.*
  Affiliations*:* CIS, CSL, Senior Vice President, Silicon Graphics. Research Interests*:* design and analysis of computing systems and computing system components. Professor Baskett is also interested in designing and developing display oriented personal computing systems in a scientific networking environment, including large and small parallel processing computing engines.

- **Richard Gabriel**, *Consulting Professor, Ph.D. Stanford, 1981.*
  Affiliation*:* Lucid Fellow, Lucid, Inc. Research Interests*:* Programming language design, object-oriented programming and languages, programming environments, user interfaces, prototyping, prototyping environments and languages, Lisp implementation, compilers, parallel Lisp, Lisp performance analysis, and parallel computation. Gabriel and McCarthy developed the Qlisp dialect of Lisp, which is suitable for shared memory parallel processors. Dr. Gabriel is one of the designers of Common Lisp and CLOS, and he is currently doing research in programming environments, programming languages, and development methodologies based on the work of Architect Christopher Alexand er.

- **Robert Hagmann**, *Consulting Associate Professor, Ph.D. University of California, Berkeley, 1983.*
  Affiliation*:* Sunsoft. Research Interests*:* Primary interests are database systems, operating systems, programming environments, performance, and distributed systems.

- **Ruby B. Lee**, *Consulting Associate Professor of Electrical Engineering, Ph.D. Stanford, 1980.*
  Affiliations*:* CIS, CSL, Lead Architect, Hewlett-Packard. Research Interests*:* Computer architecture and design, multimedia systems and mobile computers. Her research activities include parallel RISC architectures, multiprocessor and parallel memory optimizations, innovative user interfaces and computing paradigms, and cooperative computing environments. She is interested in making computer systems faster and more balanced. She is also interested in making computers more intuitive, and information more accessible to individual users, and teams of users. At HP, she was a principal architect of PA-RISC, and has been instrumental in the design of VLSI microprocessors and systems implementing this architecture.

- **Stephen F. Lundstrom**, *Consulting Associate Professor of Electrical Engineering, Ph.D. Texas A&M, 1977.*
  Affiliations*:* PARSA (Parallel systems and applications consultant), CSL. Research Interests*:* high-performance computing systems, system development environments and

tools; system modeling and simulation; system performance projection and analysis; advanced visualization approaches (sound, panoramic displays).

- **Susan Owicki**, *Consulting Professor, Computer Science and Electrical Engineering, Ph.D. Cornell, 1975.*
  Affiliations*:* Member, Research Staff, Digital Equipment Corporation, CIS, CSL. Research Interests*:* Performance analysis, networks, parallel and distributed systems. Professor Owicki's primary research interest is the analysis of performance in computer and communication systems. Her current work focuses on the analysis of performance in switch-based local area networks, including such issues as deadlock avoidance, congestion management, and topological design.

- **John F. Wakerly**, *Consulting Associate Professor of Electrical Engineering, Ph.D. Stanford, 1973.*
  Affiliations*:* CSL, Alantec Research Interests*:* Professor Wakerly's research involves high-performance local-area-network connection engines, telecommunications switching, computer architecture, structured logic design, and reliable digital system design. Professor Wakerly is the author of several textbooks in computer engineering, a contributing editor of Microprocessor Report, a co-founder of David Systems, Inc., and vice president of engineering and co-refounder of Alantec.

THEORY

THEORY:

Faculty in the theory division seek greater understanding of fundamental computational techniques and their inherent limitations. Research includes the development of new sequential and parallel algorithms, computational problems in databases, computational geometry, design and analysis of programs and programming languages, and supporting studies in combinatorial, logical, and algebraic mathematics.

- **Robert W. Floyd**, *Professor, B.A., 1955; B.S. University of Chicago, 1958.*
  Research Interests*:* Design and analysis of algorithms, including sorting, searching, sampling, digital halftones. A former chairman of the Department of Computer Science, Professor Floyd is currently working on a textbook on device-based computability theory.

- **John T. Gill, III**, *Associate Professor of Electrical Engineering and (by courtesy) Computer Science, Ph.D. University of California, Berkeley, 1972.*
  Affiliations*:* CIS, ISL. Research Interests*:* Computational complexity and theory of computation, with emphasis on the connections between probability and computation. Noiseless coding and VLSI implementations of data compression.

- **Andrew V. Goldberg**, *Assistant Professor and (by courtesy) Operations Research, Ph.D. MIT., 1987.*
  Research Interests*:* Algorithm design and analysis, parallel and distributed computation, computational complexity, combinatorial optimization, and graph theory. Prof. Goldberg's thesis, "Efficient Graph Algorithms for Sequential and Parallel Computers", won the 1988 A. W. Tucker Prize for an outstanding paper authored by a student. The Tucker Prize was established by the Mathematical Programming Society.

- **Leonidas J. Guibas**, *Professor, Ph.D. Stanford, 1976.*
  Affiliation*:* Theory, Robotics, CSL. Research Interests*:* Computational geometry and computer graphics. Common to both of these areas are issues concerning the representation and manipulation of geometric objects. Professor Guibas has recently been working on the development of general tools for the study of arrangements of curves and surfaces in two and three dimensions. He has found many interesting uses of randomized techniques in computational geometry -- these methods give rise to simple and practical algorithms for a variety of fundamental problems. He is also studying techniques for making geometric algorithms robust in the presence of numerical errors. In the graphics area he has

been investigating hierarchical Monte-Carlo algorithms for the efficient solution of the global illumination problem. Other current interests include geometric approximations, robot navigation problems, model-based recognition in computer vision, motion planning, physically-based modeling, and tools for generating high-quality illustrations.

- **Donald E. Knuth**, *Professor Emeritus of The Art of Computer Programming and (by courtesy) Professor, Electrical Engineering, Ph.D. Caltech, 1963.*
  Research Interests: Analysis of algorithms, programming languages, mathematical typography, combinatorial mathematics. Since January 1, 1990, Knuth has been Professor of the Art of The Art of Computer Programming. In recognition of the unique importance of his publications to the foundations of computer science, Knuth's role will be to devote essentially all of his time to writing the remaining volumes of the widely acclaimed work having that title. Additional honors: California Institute of Technology Distinguished Alumnus; American Mathematical Society Steele Prize for Expository Writing.

  Awards: W. Wallace McDowell; Priestley; IEEE Computer Pioneer; ACM SIGCSE; ACM Software Systems; Lester R. Ford, Mathematical Association of America; Gold Medal Award, Case Alumni Association; Foreign Associate, French Academy of Sciences; fourteen honorary degrees, including the University of Paris, University of Oxford, Brown and Dartmouth Universities.

- **Zohar Manna**, *Professor, Ph.D. Carnegie-Mellon, 1968.*
  Research Interests: Mathematical theory of computation, logic of programs, automated deduction, concurrent programming, verification and synthesis of programs.

  One aspect of Professor Manna's work is the development of temporal logic and similar logic-based approaches to the specification, verification, analysis, and construction of reactive, concurrent, real-time, and hybrid systems. Another aspect is the automation of the programming process. New deductive methods and theorem-proving techniques have been developed for constructing a program to meet a given specification.

- **Grigori Mints** *Professor of Philosophy and (courtesy) Computer Science, Ph.D. Mathematics, Leningrad University 1965, Sc.D. Mathematics, Leningrad University 1989*
  Affiliations: CSLI. Research Interests: Proof theory, logic in computer science, automated deduction. This includes normal form results for derivations, their use in connection with extraction of programs from proofs and for devising efficient proof-search methods.

- **John C. Mitchell**, *Associate Professor, Ph.D. MIT, 1984.*
  Affiliations: CSLI. Research Interests: Programming language theory and its applications, including program semantics, type systems, and logics of programs; applications of mathematical logic to programming languages and automated reasoning; algorithms for static analysis of programs. Recent work involves object-oriented language design, theory of imperative programs, linear logic, and algorithms for inferring types of programs.

- **Rajeev Motwani**, *Assistant Professor, Ph.D. University of California, Berk eley, 1988.*
  Research Interests: Design and analysis of algorithms and data structures with particular emphasis on randomization; approximation algorithms; complexity theory; computational and combinatorial geometry; theoretical issues in robotics and real-time computing.

- **Serge A. Plotkin**, *Assistant Professor, Ph.D. MIT., 1988.*
  Research Interests: Design and analysis of efficient parallel and distributed algorithms. Most of the questions are drawn from optimization problems related to management of resources in large-scale communication networks, and in particular problems related to on-line routing. Synchronization and locality issues that arise in the context of computation over a distributed network of processors.

- **Vaughan Pratt**, *Professor, Ph.D. Stanford, 1972.*
  Affiliation: CIS. Research Interests: Languages and logics for specifying and reasoning about behavior, time, information, and probability. Other interests: image processing, digital typography, and shape analysis, and quantum mechanics.

- **Jeffrey D. Ullman**, *Professor and Chairman of Computer Science and Professor (by courtesy) Electrical Engineering, Ph.D. Princeton, 1966.*
  Affiliation*:* CIS. Research Interests*:* Database systems. Professor Ullman's interests center around the use of logic as a database query language. He is looking at logic as a constraint language and the implementation of constraints among distributed databases. He also is concerned with languages for integrating information among heterogenous databases.

Consulting Faculty

- **Robert Cypher**, *Consulting Assistant Professor of Computer Science, Ph.D. University of Washington, 1989.*
  Affiliation*:* Research Staff Member, IBM Almaden Research Center. Research Interests*:* Parallel algorithms and architectures. Professor Cypher's main research interest is the design of parallel algorithms for distributed memory parallel computers. He is particularly interested in the interaction between parallel architectures and algorithms and in the communication of data between processors. He is also interested in fault-tolerant parallel systems.

- **Joseph Halpern**, *Consulting Professor, Ph.D. Harvard, 1981.*
  Affiliation*:* Research Staff Member, IBM Almaden Research Laboratory. Research Interests*:* Reasoning about knowledge and probability, fault-tolerant distributed computation, and logics of programs. Professor Halpern is particularly interested in understanding distributed systems better through reasoning about how a processor's state of knowledge changes as a result of communication and in understanding the subtle relationship between knowledge and probability. Dr. Halpern has received best paper awards at two IJCAI conferences and two IBM Outstanding Innovation Awards.

- **Moshe Y. Vardi**, *Consulting Professor, Ph.D. Hebrew University, 1981.*
  Affiliation*:* Research Staff Member at the IBM Almaden Research Center. Research Interests*:* Database theory, finite-model theory, knowledge theory and its applications to distributed systems and artificial intelligence, logic programming, program specification and verification. A common theme of his research interests is the application of logic and automata theory to the analysis of computer systems.

- **Richard Waldinger**, *Consulting Professor, Ph.D. Carnegie-Mellon, 1969.*
  Affiliations*:* Principal Scientist, SRI International, KBMS. Research Interests*:* Deductive approach to program synthesis and related problems in software engineering and artificial intelligence including theorem proving and planning.