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ABSTRACT

The National Science Foundation (NSF) first announced the Presidential Young Investigator (PYI) awards program in January 1983 as part of the Fiscal Year 1984 budget submitted by the President to Congress. This program addresses the growing faculty shortages in highly competitive fields of engineering and science. The PYI awards represent a partnership between the investigators, their institutions, private industry and the Federal Government. The NSF provides each awardee with an annual base grant of $25,000 for up to five years. It will also provide up to $37,500 in additional funds each year on a dollar-for-dollar matching basis to funds made available to the awardee from the industrial sector. The grantee institution guarantees the academic-year salary of awardees at that institution. Altogether, this five-year package provides a significant start to an academic teaching and research career. The principal purpose of this booklet is to provide information to facilitate the interaction between PYI awardees and potential industrial sponsors. Section I outlines the major terms and conditions of the awards, and highlights those areas which are likely to be of interest in awardee-industry interactions. Section II contains the research interests and other information for the awardees of 1986. This information was provided by the awardees. Sections III and IV list the active 1985 and 1984 PYIs, their institutions, and fields of research. The research interest statements included were provided by the awardees. In Section V, NSF acknowledged those industrial organizations that have provided matching support for the awardees. (TW)

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Presidential Young Investigators

1986 AWARDS

National Science Foundation
Washington, D.C. 20550

NSF 86-37

CONTENTS

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For general inquiries about the PYI program, please call 357-9466.
Use Area Code 202 for all phone numbers above.

Preface

The National Science Foundation first announced the Presidential Young Investigator awards program in January 1983 as part of the Fiscal Year 1984 budget submitted by the President to Congress. This program addresses the growing faculty shortages in highly competitive fields of engineering and science. The United States depends on technological leadership to sustain economic growth and national security. It is thus essential to the Nation to assure the availability of well-trained scientists and engineers. Critical to providing this assurance is the need to attract outstanding young Ph.D. talent to the faculties of educational and research institutions.

The Presidential Young Investigator awards represent a partnership between the investigators, their institutions, private industry and the Federal government. The NSF provides each awardee with an annual base grant of $25,000 for up to five years. It will also provide up to $37,500 in additional funds each year on a dollar-for-dollar matching basis to funds made available to the awardee from the industrial sector. The grantee institution guarantees the academic-year salary of awardees at that institution. Altogether, this five-year package provides a significant start to an academic teaching and research career.

The principal purpose of this booklet is to provide information to facilitate the interaction between PYI awardees and potential industrial sponsors. Section I outlines the major terms and conditions of the awards, and highlights those areas which are likely to be of interest in awardee-industry interactions.

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Sections III and IV list the active 1985 and 1984 Presidential Young Investigators, their institutions, and fields of research. The research interest statements included were provided by the awardees.

In Section V NSF is pleased to acknowledge those industrial organizations that have generously provided matching support for the awardees.

I. Characteristics of PYI Awards

1. *Recognition*. Presidential Young Investigator (PYI) awards are among the highest honors given by the U.S. government to outstanding young scientists and engineers. The Foundation encourages universities and corporations to give recognition and visibility to these investigators.

2. *Peer Review*. Presidential Young Investigators are selected on the basis of demonstrated ability and potential for contributing to the future vitality of the Nation's scientific and engineering effort. Nominations are evaluated in a multi-level process including external peer review. Awards are made for up to five years based on annual determination of satisfactory performance and subject to the availability of funds.

3. *Types of Nominations*. Nominations for PYI awards are of two types. "Faculty" nominations are made by departments in which the nominees are employed or have been offered employment. "Candidate" nominees are individuals, such as advanced graduate students, postdoctorals, and industrial employees, who are considering academic careers but who have not yet accepted faculty positions. Such a nomination is made by the department in which the Ph.D. was or will be given. The successful 1986 Candidate Nominees are listed on page 4.

4. *Tenure-Track Positions*. PYI awardees must at all times during their award period hold an appointment in a tenured or tenure-track position in a U.S. institution that awards the doctorate in a field of science or engineering supported by the Foundation. "Tenure-track" denotes a position from which advancement to tenure is possible.

5. *Support Levels*. Annual support under a PYI award consists of a base NSF grant of $25,000, plus an additional amount up to $37,500 on a dollar-for-dollar matching basis to funds obtained from industrial sources. Such annual support may be requested for up to a total of 5 years.

6. *Academic-Year Salary*. The grantee institution must guarantee the academic-year salary support of the awardee while he or she holds a PYI award at the grantee institution. No NSF or industrial matching funds may be used for academic-year salaries.

7. *Indirect Costs*. The Foundation allows up to 10 percent of NSF funds to be used to defray administrative expenses for indirect costs.

8. *Source of Matching Funds*. Industry matching in fields of interest to industry, such as most of engineering, is central to the program goals of leveraging Federal funds and fostering industry-university cooperation. NSF therefore expects that matching funds will be obtained in most cases from private, for-profit corporations engaged in the production of goods and services, or their non-profit charitable foundations. Because industrial funds may be difficult to obtain for some areas of research not in the mainstream of industrial interest, matching funds may be accepted from private non-profit foundations (other than founda-

tions associated with particular universities or university systems). A grantee institution must certify in its budget submission that the matching funds have been specifically designated by the donor for the PYI award.

9. *Donations of Equipment.* Industrial or foundation matching funds must be in cash or permanent research equipment. The equipment must be of a type and quality necessary to carry out the research program of the awardee. Donations of equipment should be valued on the basis of fair market value.

10. *Responsibility for Search for Matching Funds.* The Foundation is actively encouraging industrial support for PYI awardees through its contacts with individual corporations and their associations. The Foundation also expects that the awardee's department and institutional administration, as part of their commitment to grantees, will lead the university's efforts to locate matching funds.

11. *Teaching.* PYI awards have a clear educational aspect, in that the objective of the awards is to assure the availability of outstanding faculty for the training of the next generation of engineers and scientists. Thus, the PYI award is not intended to encourage the absence of teaching responsibilities for an extended period of time.

12. *Deadlines for 1986 Awardees.*

	Faculty Awardees	Candidate Awardees
a. Appointment to a tenure-track faculty position at an eligible institution.	(required at nomination)	October 1, 1986
b. Submission of a brief research plan and first-year budget to obtain, at a minimum, a base NSF grant of $25,000.	May 1, 1986	December 1, 1986
c. Submission of a final first-year request to obtain NSF matching funds.	May 1, 1987	October 1, 1987
d. Submission of a research plan and budget, including industrial matching funds, for the second and later years	October 1, 1987, and annually thereafter.	October 1, 1987, and annually thereafter.

13. *Multi-Year Commitment.* In view of the above deadlines, the Foundation encourages multi-year commitments of industrial funds, especially for the first two years of tenure for which the final deadlines for NSF funds coincide.

14. *Other NSF Support.* PYI awards are monitored in the Foundation by the appropriate research directorate program officer. A PYI award does not preclude the possibility of other NSF research support. In recommending other grants, however, NSF program officers take into consideration factors related to the principal investigator's overall commitment of time and the equitable distribution of limited program resources. The principal benefit of a PYI award continues to be the security of a long-term NSF commitment of research support and the relative freedom to pursue individual research interests.

15. *"New" Support.* One goal of the PYI program is to expand the Nation's resources for the support of academic research and teaching, and the NSF funds provided represent an incremental Federal appropriation. The Foundation in turn encourages the development of new resources for the industrial matching support of awardees.

16. *Industrial Gifts or Contracts.* The Foundation recognizes that in particular situations an industrial contribution of matching funds may be most appropriate through either the gift or contract mechanism. The Foundation encourages each contributor to select its own preferred arrangement.

17. *Patents.* PYI awards are subject to the normal NSF patent provisions on research grants Patent questions that most often arise are related to arrangements between the grantee university and the industrial contributor. The Foundation is not a party to such negotiations, but urges that both parties remain flexible and open to compromise.

II. 1986 Presidential Young Investigator Awards

This Section contains biographical information and sketches of the research interests of the 1986 Presidential Young Investigators. Except for candidate nominees, the awardees are now serving or plan to serve in faculty positions at the institutions shown. Telephones listed are office numbers.

Three awards resulted from candidate nominations. These individuals may activate their awards by appointment to a tenured or tenure-track position at an eligible institution by October 1, 1986. The 1986 candidate awardees are:

Paul L. Frattini ....p. 44
Joseph T. Hupp ....p. 21
Brent W. Webb ....p. 49

Alphabetical Listing

Astronomical Sciences

Matthew Arnold Malkan
Dept. of Astronomy
Univ. of California at Los Angeles, Los Angeles, CA 90024

Assistant Professor
(213) 825-3404

Ph.D. (Astronomy) California Institute of Technology, 1983.

Dr. Malkan is studying active galactic nuclei and quasars to understand how they produce such enormous power in such a small volume of space. His work blends theoretical model calculations and observations of their energy spectra over the widest possible range of wavelengths —including radio, infrared, optical, ultraviolet, and X-ray. A universal feature of active galactic nuclei is that a large fraction of their total power is emitted at optical to far-ultraviolet wavelengths. Malkan's research showed that most of this ultraviolet energy is thermal emission, probably from gas accreting onto a massive black hole. He is now analyzing a growing set of multi-wavelength observations (made with an array of ground- and space-based instruments) to learn more about the accretion processes which fuel active galaxies and quasars.

Donald E. Winget
Dept. of Astronomy
Univ. of Texas at Austin, Austin, TX 78712

Assistant Professor
(512) 471-3404

Ph.D. (Physics and Astronomy), Univ. of Rochester, 1982

Dr. Winget's research encompasses various applications of the problem of the behavior of matter at high densities and temperatures, particularly as applied to the study of the late stages of stellar evolution and degenerate stars. His work is currently focused in a developing area best described as stellar archeology. The ultimate goal of his research is to map out the evolutionary history of the galaxy through the study of its oldest population. the white dwarf stars. Many of these stars are multi-periodic pulsating variables. He is using the pulsations as a seismic probe of the white dwarf interior regions with the aim of exploring the physics of hot high-density matter. These probes of the internal structure of the white dwarf stars will also help to resolve questions about the origins for the white dwarfs of different spectral types, the transformations from one type to another, and will help to forge the evolutionary link with the presumed progenitors of the white dwarfs. the planetary nebulae nuclei.

The pulsation periods change in response to evolutionary changes in the physical properties, measurements of this period change yield a direct measure of the secular evolution of a star. Winget, R. E. Nather, and their collaborators have recently completed the first such measurement of secular stellar evolution, and are embarking on a major international campaign to measure period changes in other stars well distributed along the white dwarf cooling (evolutionary) sequence. This will be accomplished using a network of identically constructed instruments on telescopes at major observatories around the globe - permitting the long, continuous, sets of data needed for detailed analysis. The evolutionary timescales measured in this way will be used to check and refine their theoretical calculations. These calculations can then be used to give an accurate estimate of the age of the coolest white dwarfs. This, in turn, will give us an independent, calibrated, estimate for the age of the galaxy, and thereby a strong constraint of the age of the universe.

Biology

David Jeffrey Anderson
Division of Biology 216-76
California Institute of Technology, Pasadena, CA 91125

Assistant Professor
(818) 356-6821

Ph.D. (Cell Biology), The Rockefeller Univ., 1983

Dr. Anderson's research addresses the problem of how environmental influences and cell lineage interact to control the development of different cell types in the embryonic peripheral nervous system of the rat. Currently he has focused on one particular developmental decision, the choice between becoming a sympathetic neuron or an adrenal medullary chromaffin cell (an endocrine cell). This decision is of particular interest because, unlike developmental choices in other lineages, it is not irreversible: mature chromaffin cells retain the ability to convert to sympathetic neurons in response to a specific environmental signal, Nerve Growth Factor (NGF). Dr. Anderson is interested in the relationship of this plasticity to developmental history. He wishes to know when and how cells first acquire the potential to develop along either pathway, how environmental signals such as NGF and glucocorticoids control the initial choice of a pathway, and how the potential to switch to the alternate pathway is sustained throughout life.

Dr. Anderson is interested in both cellular and molecular answers to these questions, using both antibodies and cloned cDNAs as cell-specific markers. He has developed a primary cell culture system which allows him to reconstruct the early development of the adrenal gland outside of the embryo, and to study how the immature cells respond to manipulations of their hormonal environment. He hopes to identify and isolate the intracellular regulatory molecules controlling this developmental decision. Eventually, the function of such molecules may be tested *in vivo* by perturbing their expression in transgenic mice.

Jeffrey Lynn Bennetzen
Dept. of Biological Sciences
Purdue Univ., West Lafayette, IN 47907

Assistant Professor
(317) 494-4763

Ph.D. (Biochemistry), Univ. of Washington, 1980

Dr. Bennetzen's primary research interests involve characterization of the structure and expression of the plant nuclear genome, particularly with respect to the response of the plant to environmental stress and developmental cues. In the area of plant genome structure, he is particularly interested in the interspersion of single copy and repetitive DNA sequences and how these relate to the expression and rearrangement of the nuclear genome. His analyses of plant genome rearrangement focus on the central role of transposable DNA elements. He is interested in the effects of the variable biological and physical stresses on plants both for the selective pressure they exert to evolve new defense mechanisms and for the rapid genomic rearrangements they apparently induce.

The specific systems he is currently investigating focus on three integrated approaches to the study of nuclear genome structure and expression in maize. 1) the interspersion and modification of the repetitive and single copy DNA found near maize genes, 2) the regulation and mechanism of transposition of the *Mutator* and *Bs1* transposable elements, and 3) the isolation of plant genes involved in environmental stress resistance by transposon tagging.

David Bernlohr
Dept. of Biochemistry
Univ. of Minnesota, St. Paul, MN 55108

Assistant Professor
(612) 624-9267

Ph.D. (Biochemistry), Univ. of Illinois at Urbana-Champaign

The major focus of research in Dr. Bernlohr's laboratory centers upon an analysis of the regulation of gene expression during cellular differentiation. To study this process, the murine cell line 3T3-L1 is used as a model system. These cells, which are initially fibroblastic, differentiate into dipocytes in a very controlled and reproducible fashion in culture.

Recent work has focussed upon the expression of a gene encoding a small basic protein believed to function as an adipocyte-specific lipid carrier. A detailed analysis of the structure of the lipid carrier gene and its regulation will be conducted by a combination of transient expression and stable transformation assays. Additionally, Dr. Bernlohr has purified the small basic protein and is characterizing its structure and lipid binding properties in hopes of determining what the function of this specialized protein is.

The long-term goal of his research program will involve a molecular and biochemical analysis of adipose metabolism and in particular the regulation of adipocyte genes.

Judith Susan Eisen
Dept. of Biology
Univ. of Oregon, Eugene, OR 97403

Assistant Professor
(503) 686-4524

Ph.D. (Neurobiology), Brandeis Univ., 1982

Dr. Eisen's primary research interest is in understanding how the growing tips of nerve cells, called growth cones, find their appropriate targets during embryonic development. The adult nervous system contains many nerve cells that interact with one another and with non-neuronal cells, by means of very precise synaptic contacts. The precision of these contacts is essential for proper nervous system function. During embryonic development growth cones explore their environment and choose the correct targets from among a large number of possible, but incorrect targets.

To study how growth cones select the pathways to their targets and how they distinguish their targets from other cells along the pathways, Dr. Eisen and her colleagues have developed a technique for identifying individual nerve cells of the zebrafish and observing them as they grow in live zebrafish embryos. Their work has suggested that several factors contribute to growth cone pathway selection. (1) The pathway itself may contain information important in growth cone guidance. (2) Interactions among growth cones may be important in pathway selection. (3) Growth cones may compete for available pathways based on the time of arrival at specific pathway regions. Dr. Eisen plans to test the role of each of these factors in growth cone guidance using a variety of approaches including biochemical studies to investigate molecules that may play a role in guidance, physiological and anatomical studies to investigate growth cone interactions and laser ablation studies to determine whether growth cones compete for pathways.

James William Golden
Dept. of Biology
Texas A&M Univ., College Station, TX 77843

Assistant Professor
(409) 845-5968

Ph.D. (Biology), Univ. of Missouri, 1983

Dr. Golden's general research interests are in the genetic control of development and cellular differentiation. He is primarily interested in how individual genes or sets of genes are differentially expressed during development, especially those genes exhibiting qualitative, on/off, regulation. One genetic control mechanism of particular interest is genome rearrangement, where a gene's expression is influenced by physical changes in its location or orientation within the chromosome.

His current research involves the rearrangement of nitrogen-fixation (*nif*) genes during heterocyst differentiation in the cyanobacterium *Anabaena*. Heterocysts are terminally differentiated cells that are highly specialized for nitrogen fixation. Dr. Golden found that activation of the *nif* genes is associated with a site-specific recombination within the *nifD* gene which causes deletion of part of the chromosome. The deletion results in the formation of a complete *nifD* gene and allows for the coordinate expression of three *nif* genes from a single promoter. The enzyme that catalyzes this deletion was identified and its expression is currently under investigation. A second genome rearrangement was identified adjacent to the nitrogen-fixation gene *nifS*. This rearrangement also results from a site-specific recombination, but has several properties that differ from the deletion described above. The mechanism and topology of the second DNA rearrangement and its effects on gene expression and nitrogen fixation are the primary subjects of Dr. Golden's current research.

John Arthur Leigh
Dept. of Microbiology and Immunology, SC-42
Univ. of Washington, Seattle, WA 98195

Assistant Professor
(206) 545-1390

Ph.D. (Microbiology), Univ. of Illinois, 1983

Dr. Leigh is interested in polysaccharide biosynthesis in the nitrogen-fixing bacterium *Rhizobium*. In previous work he has used mutants in polysaccharide synthesis to demonstrate a requirement for a particular polysaccharide in legume root nodule invasion. He is currently investigating the exact function of the polysaccharide in nodule invasion. One possibility is that the polysaccharide acts as a signal which induces developmental events in the plant.

He is also studying the genetics and biochemistry of polysaccharide biosynthesis. The mutants form the basis for cloning the genes, mapping them, and studying their regulation. In biochemical work he will determine the functions of the gene products in the pathway of polysaccharide biosynthesis, identify intermediates in the pathway, and try to gain insight into the mechanisms of polymerization and extrusion of the polysaccharide.

Kelly Edward Mayo
Dept. of Biochemistry, Molecular Biology and Cell Biology
Northwestern Univ., Evanston, IL 60201

Assistant Professor
(312) 491-8854

Ph.D. (Biochemistry), Univ. of Washington, 1982

Dr. Mayo's research interests are broadly concerned with gene regulation in the mammalian neuroendocrine system. In particular, he is studying the biosynthesis of a number of peptides that act to influence the synthesis and secretion of pituitary hormones. Molecular cloning techniques have been used to isolate and characterize cDNAs and genes encoding the precursors to two of these peptides, growth hormone-releasing factor (GRF) and corticotropin-releasing factor (CRF), which regulate the synthesis and secretion of pituitary growth hormone and corticotropin, respectively. These cloned probes are now being used to examine the mechanisms by which the biosynthesis of these neuropeptides is regulated during normal growth and development, in response to stress, and in various pathophysiological conditions.

More recently, he has initiated a molecular analysis of gonadal peptides that regulate pituitary functi n. cDNAs encoding the A-subunit of the gonadal hormone inhibin, which negatively regulates pituitary follicle-stimulating hormone secretion, have been isolated and characterized from porcine ovary and human placenta. These cloned probes will be used to fully characterize inhibin and other related gonadal peptide-encoding genes, and tc examine their physiological importance and their role in the normal reproductive cycle and in reproductive disorders. A long-term interest of his concerns the use of transgenic animal models for the study of gene expression and function. Transgenic mice that express a human growth hormone-releasing factor gene are being used to study the physiological roles of GRF in growth control. Future investigations will examine the usefulness of the GRF and CRF gene promoters for targeting hypothalamic-specific expression of genes in transgenic animals.

Henry T. Nguyen
Dept. of Plant and Soil Science
Texas Tech. Univ., Lubbock, TX 79409

Assistant Professor
(806) 742-1622

Ph.D. (Plant Genetics and Breeding), Univ. of Missouri - Columbia, 1982.

Dr. Nguyen's primary research interest is to determine genetic variability and to establish an understanding of the genetic control of fundamental physiological and biochemical mechanisms as they relate to productivity and water-use efficiency of crop plants. This research focuses on the genetics of physiological, biochemical, and molecular responses affecting high temperature and drought tolerance of wheat, which include photosynthetic efficiency, nitrogen metabolism, osmoregulation, and heat-shock protein synthesis. The water-use efficiency research also includes anatomical and morphological aspects such as leaf anatomy, canopy architecture, and root characteristics related to water uptake and transport. A second research interest is to develop new breeding methodology and select techniques, both at the whole plant and cellular level, for genetic improvement of high temperature and water stress tolerance in plants. Of particular concern is the development of random-mating populations for quantitative genetic studies. These experiments rely on the use of isozyme as molecular markers and the use of cell culture techniques for the genetic selection of specific biochemical mechanism(s).

Dr. Nguyen's other research interests include the characterization and enhancement of wheat germplasm using wild relatives, particularly those species adapted to arid and semi-arid regions of the world. New germplasm is necessary to broaden the genetic base of cultivated bread wheat, and potentially will benefit breeding strategies for improved productivity, stress tolerance and water-use efficiency of wheat in the Great Plains.

Pamela Silver
Dept. of Biology
Princeton Univ., Princeton, NJ 08544

Assistant Professor
(609) 452-3857

Ph.D. (Biological Chemistry), Univ. of California, 1982

Dr. Silver is interested in how the eukaryotic cell assembles proteins into subcellular structures and how a dividing cell segregates its full complement of organelles. Her current experiments are aimed at understanding the mechanism of assembly of proteins into the nucleus. The nucleus, like all cellular organelles, is composed of a unique set of proteins responsible for its structure and function.

She has begun to study the process of nuclear protein localization in the yeast *S. cerevisiae*. Yeast offers many advantages for the study of protein localization because they are amenable to both biochemical and genetic analysis. Her approaches are: 1) to define amino acid sequences in nuclear proteins that are sufficient for their nuclear location, 2) to isolate host mutants defective in nuclear protein localization, and 3) to identify the major nuclear envelope proteins. Future experiments will be aimed at understanding how the daughter cell receives the full complement of organelles. Defining these processes is necessary to understand the segregation of determinants for differentiation. In practical terms, understanding how correct protein localization is achieved should help in maximizing expression of proteins in yeast.

Nancy L. Thompson
Dept. of Chemistry
Univ. of North Carolina at Chapel Hill, Chapel Hill, NC 27514

Assistant Professor
(919) 966-1566

Ph.D. (Physics), Univ. of Michigan at Ann Arbor, 1982

Dr. Thompson's research is in cell membrane biophysics, with emphasis on cell surface immunology. In particular, Langmuir-Blodgett films consisting of single phospholipid monolayers or bilayers are deposited on transparent planar supports, and the specific interactions of immunological molecules in solution and immunological cells with the supported planar model membranes are studied using recently developed techniques in fluorescence microscopy. Ongoing projects include the development of new methods of incorporating purified transmembrane proteins and synthetic covalent conjugates of peptides and lipids in supported planar membranes, and investigations of the interactions of molecules (e.g., monoclonal antibodies) and cells (e.g. macrophages) with reconstituted planar membranes. Techniques in quantitative and time-resolved fluorescence microscopy have been or are being developed that can be used to characterize the organizations, motions and interactions of fluorescent-labelled molecules in, on or near planar membranes. Measurable properties include, first, lateral and rotational mobilities. In addition, the technique of total internal reflection fluorescence microscopy has been used to measure, at equilibrium, surface binding kinetic rates and surface diffusion coefficients of molecules in solution with sites on a planar surface,and has been used to measure orientation distributions of fluorophores in planar membranes. Development of a technique for detecting protein clusters is underway, and will be used to monitor the formation of two-dimensional protein crystals in or on membranes.

Chemistry

Rob Duncan Coalson
Dept. of Chemistry
Univ. of Pittsburgh, Pittsburgh, PA 15260

Assistant Professor
(412) 624-5000

Ph.D. (Chemical Physics), Harvard Univ., 1984

Dr. Coalson's primary research area is the theory of Chemical Dynamics, i.e. the study of molecular scale motions of interest in chemistry, molecular physics, surface science, materials science, etc. Specific current interests include optical spectroscopy (infrared, electronic absorption, raman, fluorescence), neutron scattering, atom-molecule or molecule-surface scattering, and the theory of rate processes such as tunnelling (e.g., as a model for optical activity or electron transfer) and radiationless transitions. Most of these phenomena are quantum mechanical in nature. Curiously, the subject of quantum *dynamics* has largely been developed from a *static* point of view. He feels that a great deal of insight as well as computational advantage can be obtained by adopting an explicitly *time-dependent* point of view (e.g., focusing on the spatio-temporal propagation of initially prepared wavepackets). Considerable technical development along these lines remains to be done. His motivation is the potential utility of the product: The ability to predict spectra, cross sections and other measurable rate constants for multidimensional (chemical!) systems enables one to work backwards from experimental data in order to infer details about the underlying molecular dynamics (so that questions concerning energy flow, charge transfer, periodic vs. chaotic motion, etc. may be addressed). Moreover, from a technological perspective, development of spectroscopy-based medical diagnostics (which distinguish different bio-molecules via their spectral signatures), solar-pumped lasers and other interesting devices requires a sophisticated understanding of multidimensional quantum dynamics at both conceptual and computational levels.

Joseph J. Grabowski
Dept. of Chemistry, 12 Oxford Street
Harvard Univ., Cambridge, MA 02138

Assistant Professor
(617) 495-4130

Ph.D. (Organic Chemistry), Univ. of Colorado, 1983

One aspect of Prof. Grabowski's research is directed toward the goal of understanding the forces that dominate and control the interactions of ions and molecules in the gas phase. These studies will be implemented via the Selected Ion Flow Tube (SIFT) technique in which mass-selected ions react with the neutral of choice under well-defined energy conditions, allowing quantitative measurement of all aspects of ion-molecule reactions both at ambient temperature and as a function of reaction ion kinetic energy. A variety of ions, organic and inorganic, cationic and anionic, can be generated, and allowed to react with neutrals that range from stable organics, inorganics and organometallics to atoms, radicals and excited state species. Investigations are planned in a number of different areas including (among others) fundamental aspects of physical organic chemistry, model investigations of enzymatic reactions, chemical aspects of analytical mass spectrometry, role of specific solvation in ionic reactions, survey of new reagents for synthetic purposes and mechanistic aspects of ionic organometallic reactions.

A second area of interest to Prof. Grabowski is the energetics and dynamics of photoinitiated reactions, particulary the reactivities and thermodynamics of transient intermediates. Pulsed photoacoustic calorimetry is a relatively new and simple technique which will be developed to become a routine tool for simultaneously obtaining reaction enthalpies, quantum yields and dynamical information. Applications include (among others). relaxation phenomena, unimolecular decomposition yielding stable species or transient intermediates and bimolecular reactions to produce highly reactive species.

Joseph Thomas Hupp
Dept. of Chemistry
Northwestern Univ., Evanston, IL 60201

Assistant Professor
(312) 491-5371

Ph.D. (Chemistry), Michigan State Univ., 1983

Dr. Hupp's research interests focus on redox activity at electrochemical interfaces, especially in comparison to reactivity in homogeneous solution or polymeric phases. He is particularly interested in understanding the factors that control the rates of multielectron and net atom transfer reactions in inorganic systems. While one-electron transfers are reasonably well understood, catalytically important multi-electron transfers present entirely new experimental and theoretical challenges.

A second area of interest centers on the excited-state reactivity of metal complexes. Photochemically generated molecular excited states can decay by a number of pathways, including electron transfer, energy transfer and perhaps, also, atom transfer. For solar-energy-conversion applications it would clearly be desirable to control the mechanism of decay. Proposed experimental studies (based on pulsed laser, flash photolysis, luminescence, and electrochemical techniques) are aimed towards developing a detailed picture of the factors that cause one pathway to be favored over another, to be followed by synthetic efforts to manipulate such processes.

A third area is polymer-modified electrodes. This research will emphasize: 1) the design of electrochemical and photoelectrochemical devices capable of driving complex reductions catalytically (e.g., oxygen to water, nitrate to ammonia, etc.), and 2) new photochemical synthetic methods for the fabrication of such devices.

Kevin K. Lehmann
Dept. of Chemistry
Princeton Univ., Princeton, NJ 08544

Assistant Professor
(609) 452-5026

Ph.D. (Chemical Physics), Harvard Univ., 1983

Professor Lehmann's research is in chemical physics, particularly in the areas of high resolution laser spectroscopy and intramolecular ar... ollisional dynamics. He is developing capabilities at Princeton to perform double resonance experiments on gas phase molecules using IR, visible and UV laser radiation. The double resonance methods promise to produce m... ecular spectra with extreme sensitivity and resolution, free of all the inhomogenous effects that complicate and limit the interpretation of traditional molecular spectra. These methods will be used in experiments to determine: 1) The rate of intramolecu'... energy transfer and the degree to which the end product of the relaxation looks like a statistical distribution. 2) The rate of molecular predissociation and the influence of rotational and vibrational excitation on the rate. 3) The precise vibrational and rotational spectroscopic constants for both the ground and excited electronic states. These can then be used to determine molecular potential energy surfaces. 4) The state-state inelastic collisional rates, which can be used to help determine intermolecular potential energy surfaces. 5) New analytical methods of extreme sensitivity and specificity using double resonance methods.

He is also interested in understanding the quantum mechanical analogues of classical chaos, currently using double resonance methods to test molecules for the characteristics that have been proposed as signatures of quantum chaos He hopes to begin experiments on molecular rotors perturbed by strong electric fields Such a system may prove a unique model for testing our understanding of the classical-quantum correspondence principle for classically chaotic motion.

Steven Frank Pedersen
Dept. of Chemistry
Univ. of California at Berkeley, Berkeley, CA 94720

Assistant Professor
(414) 642-9146, 642-9040

Ph.D. (Chemistry), Massachusetts Institute of Technology, 1983

Dr. Pedersen's research interests lie within the realm of synthetic inorganic and organic chemistry. Areas of particular interest are: 1) the synthesis of heterometallic nitrides for use as precursors to inorganic materials; 2) the development of new organic synthetic methodology using transition metal reagents, and 3) the use of calixarenes (macrocycles composed of para substituted phenols and ortho methylene units) as supports for the stepwise synthesis of heterometallic complexes and as ligands for the design of shape selective reagents to be used in organic synthesis.

Currently, his major interest in heterometallic nitrides (in particular those outside metal carbonyl cluster chemistry) revolves around the design of general pathways to soluble, well-characterized complexes containing relatively simple ligands. In turn, the selective polymerization or degradation of these species under relatively mild conditions, to materials with predictable ratios of metals and nitrogen will be investigated.

Beyond possessing phenolic oxygens which are currently being used to bind transition metals as well as main group elements (e.g., B, Al, P), calixarenes consist of a cavity which is known to attract and include organic molecules. This latter property reveals the underlying theme of this project, that being the introduction of shape selectivity into both known and yet to be discovered stoichiometric and catalytic organic reactions that involve transition and/or main group elements capable of binding to calixarenes.

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Ph.D. (Chemistry), Northwestern Univ., 1982

Dr. Roberts' current research efforts focus on applying solid-state Nuclear Magnetic Resonance (NMR) techniques to a wide variety of materials research, chemical, and biochemical problems. The Department of Chemistry is well-equipped for this work with the recent acquisition of a General Electric GN-300 Mhz NMR instrument that is dedicated to solid-state NMR research.

One-Dimensional Conductors. Solid-state NMR will be used to probe the structure and electronic properties of stacked aromatic systems. The electronic band structure produces Knight shifts in the observable NMR line positions. These shifts are related to the unpaired spin density on the probe nucleus; in favorable cases it is possible to experimentally map out the unpaired electron distribution. A related topic is paramagnetic relaxation enhancement in solids.

Proton NMR of Solids. Methods will be developed for observing proton NMR from solid materials with better resolution or selectivity than currently available. Magic-angle sample spinning, two-dimensional spectroscopy, selective coherence transfer and homonuclear line narrowing techniques will be employed. Combining these methods promises to be useful in areas such as polymer science, fossil fuel studies, and solid-state conformation analysis of organic molecules.

Biomolecules and NMR. One collaboration follows nitrogen metabolism of bacteria with NMR methods. Solid-state NMR is particularly useful for determining the incorporation rate of labeled materials into the cell wall of the bacteria.

Jonathan L. Sessler
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Ph.D. (Organic Chemistry), Stanford Univ., 1982

Dr. Sessler's primary research interests involve the design and synthesis of novel macrocyclic ligands as a means of studying problems of inorganic or biochemical interest. For instance, porphyrin derived macrocyclic systems are being studied in an effort to develop improved catalysts for the reductive activation of small gaseous molecules such as oxygen and carbon dioxide. Large, semi-rigid macrocyclic ligands are also being synthesized with the objective of controlling the coordination chemistry at metal centers. Specific goals are to generate binuclear mixed-metal complexes and stable, non-labile complexes of uranium. Related studies underway involve attaching radioisotope containing macrocycles to monoclonal antibodies; this may lead to improved anticancer treatments. Highly flexible macrocycles capable of complexing two reduced iron centers are also being synthesized as a means of developing a biomimetic model for hemerythrin, the oxygen carrying pigment of certain worms.

Other research in Dr. Sessler's laboratory is concerned with the synthesis of small, well-defined structures containing pyrimidine and purine bases. These systems are being explored as possible template-like catalysts for the promotion of organized organic reactions. The long range objective of this work is to develop self-replicating molecular systems. In the near term, this work is expected to provide increased insight into the properties of DNA and RNA, the biomolecules of life.

Matthew Fowler Vernon
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Ph.D. (Chemistry), Univ. of California at Berkeley, 1983

Professor Vernon's general research interest is the application and development of the crossed laser-molecular beams method as a tool for understanding the structure and dynamics of molecules. There are two specific areas of current research. First, the effects of an aqueous environment in the structure and electron distribution of biological molecules will be determined through measurements of the vibrational and electronic spectra of two prototypes of biologial molecules—chemical analogs of the visual chromophore (retinal) and amino acids (acetamides). The effect of the aqueous solvent will be observed by measuring the spectral differences of the isolated compounds with small numbers of water molecules attached. This information is valuable for testing potential energy functions used in molecular mechanics modeling of the interactions between water molecules and the functional groups of amino acids and the visual chromophore.

The second area of research is concerned with understanding the primary photodissociation processes of isolated organometallic compounds using the molecular beam photofragmentation technique. The goal of these experiments is to obtain information on how the laser wavelength and intensity can be used to control the extent of excimer laser light. By understanding the extent of ligand removal in the primary photofragments as the wavelength and intensity are varied, it will be possible to understand from basic principles the extent to which the properties of laser initiated surface metal deposition can be controlled through the gas phase photochemistry either by chemical modifications of the starting compound or through careful choice of the properties of the laser radiation.

Chi-Huey Wong
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Ph.D. (Chemistry), Massachusetts Institute of Technology, 1982

Dr. Wong's research interests are in the area of bioorganic chemistry: new synthetic strategy using natural and altered enzymes, enzyme modification and stabilization, protein chemistry and biochemistry, and synthesis of bioactive molecules.

His current research is focused on the exploration of unnatural catalytic properties of enzymes and the use of immobilized enzymes as practical catalysts in large-scale organic synthesis. Reactions under investigation include oxidoreductions catalyzed by metalloenzymes and NAD(P)(H)-dependent enzymes, group transfer reactions, asymmetric C-C and C-N bond formations in carbohydrate and peptide synthesis and asymmetric hydrolysis and condensation reactions catalyzed by hydrolases. In addition, development of new techniques for enzyme reaction in extreme dielectric environments such as anhydrous media and biphasic systems are also of interest.

Computer Science

Eric Bach
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Univ. of Wisconsin, Madison, WI 53706

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Ph.D. (Computer Science), Univ. of California at Berkeley, 1984

Dr. Bach's research is concerned with efficient algorithms for number-theoretic problems, especially those such as primality testing and factoring whose true computational difficulty is still unknown.

These problems are of interest to computer scientists for a number of reasons. First, complexity theory seeks to classify "natural" problems, and many of the important (and still intractable) ones come from arithmetic. Second, creating an efficient number-theoretic procedure is often a challenge in algorithm design; meeting this challenge requires technical results form various fields of mathematics, which are frequently useful in designing other kinds of algorithms. Finally, many algorithms in the practically important areas of encryption and pseudo-random number generation employ number-theoretic techniques.

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Ph.D. (Electrical Engineering and Computer Science), Massachusetts Institute of Technology, 1982

Dr. Berwick's research focuses on the computational analysis of natural language, including the problems of parsing, language acquisition, and machine translation. Current natural language processing techniques lag behind modern computational analysis and modern linguistic theory, and his research aims to correct this problem. In the area of language parsing, he is investigating modular, non-rule based approaches to language description, suitable for implementation on parallel computer architectures. He is also interested in applying the tools of computational complexity theory to the problems of language recognition. Complexity theory is used to pinpoint processing intractability in current natural language systems and suggest alternative representations and algorithm designs. Currently, he is experimenting with a uniform, non-rule based parsing system capable of analyzing a wide variety of natural languages, including English, Spanish, German, Japanese, and Chinese. The modular, non-rule based design of this analyzer makes it easy to modify for different languages.

In the area of language acquisition, Dr. Berwick aims to build upon computer programs he has already implemented that can automatically adapt to new languages and dialect variation. Such systems will be able, for example, to learn about novel words by processing entire text paragraphs. He is also studying children's language acquisition as a guide for this research.

In the area of machine translation, Dr. Berwick is applying current research suggesting that natural languages can be described as a set of interacting constraints, within some natural range of parametric variation. By modeling these parameters in a computer program, one can show how, for example, Spanish differs from English; one can then use this to map between these two languages (aside from word choice differences).

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Ph.D. (Computer Science), Univ. of California at Berkeley, 1983

Dr. Demmel's primary research interests are in numerical analysis, especially numerical linear algebra, and computer architecture. In numerical analysis his work has centered on error analysis and complexity theory for numerical problems such as matrix inversion, eigenvalue problems, and polynomial zero finding. In particular he has worked on bounds for ill-conditioned problems and a probabilistic analysis of the likelihood of encountering ill-conditioned problems. In computer architecture he has been involved in the design and analysis of the recently adopted IEEE floating point arithmetic standard.

His current research interests involve extending this work to practical problems in control theory. The usual mathematical formulation of many such problems is ill-posed, making the usual error analysis techniques inapplicable. Through extensions of previous work on ill-conditioned problems many of these problems now seem tractable. Also, he is interested in parallel processing and parallel numerical algorithms especially suited for implementation in a shared memory environment

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Ph.D. (Computer Science) Carnegie-Mellon Univ., 1983

Dr. Korf's primary interest is basic research in problem solving, planning, and machine learning in artificial intelligence. An underlying assumption of much of his work is that problem solving can be modelled as search in a problem space. Since search is a completely general problem solving method, the real issue is how knowledge can be brought to bear to improve search efficiency. This amounts to exploring the different types of knowledge that exist and examining how they improve problem solving performance.

For example, he has developed a new heuristic search algorithm, called iterative-deepening-A*, that outperforms all other algorithms for finding optimal solution paths in trees. The algorithm is both probably and practically optimal in terms of time and space efficiency. Another research effort is attempting to unify the use of heuristic evaluation functions in single-person problems with their use in two-person games. The theory explains why heuristic functions improve performance and characterizes the effectiveness of a heuristic in terms of local information in a problem space. This makes it much easier to predict if a given heuristic will be effective for a problem, and makes it possible to automatically learn useful heuristics for problems.

Research on machine learning is focussed on general mechanisms that allow these different kinds of knowledge to be automatically acquired in a given domain. The goal is to build systems whose performance on problems in a given domain automatically improves as more problems are solved. One experiment has shown that a system can learn efficient strategies for some problems by searching for complex macro-operator sequences. In another experiment, polynomial evaluation functions for two-person games were learned by repeated play. Efforts are underway to extend this type of learning to subgoals and abstraction spaces as well.

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The aim of Dr. Reps's research is to create more powerful interactive systems to support computer programming, the goal is the development of language-specific tools that support incremental program development, testing, and debugging, and exploit state-of-the-art personal computing hardware. The scope of the research includes programming systems for novices as well as professionals, developing end-user environments as well as software tools that facilitate the creation of such systems, algorithm design, and prototyping.

Current work centers around the Synthesizer Generator, a processor that enables a language-specific program editor to be created from a description of a language's abstract syntax, context-sensitive relationships, display format, and concrete input syntax. In this system, attribute grammars are used as the underlying formalism because of their utility for specifying how widely separated parts of a program are interrelated. The system has been used to build experimental editors in which attributes control "pretty printing" and code generation, as well as detect program anomalies, type violations, and errors in program proofs. Future research will concern how to integrate language-specific program editors with other programming tools such as configuration-control tools, incremental linker/loaders, and interactive debugging tools.

Vijay Vazirani
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Ph.D. (Computer Science), Univ. of California at Berkeley, 1983

Dr. Vazirani is interested in theoretical computer science as an approach to solving realistic problems in computing. For example, his group has discovered a new algorithm for the maximum matching problem while studying it from the viewpoint of parallel computation. Unlike conventional algorithms for this problem, which are combinatorial in nature, theirs is based on a probabilistic-algebraic approach. He has also studied conventional algorithms which are more efficient but of limited utility because they are complex and hard to program. In contrast, the new algorithm requires less than a page of code and a matrix-inversion subroutine. Other areas of interest include VLSI algorithms and the problems of PLA folding and gate-array routing. Both of these problems are NP-complete. Commercial algorithms are available for solving them approximately, but they are based on heuristics obtained by trial and error. In their studies of PLA folding, Vazirani and his co-workers were able to show that the problem was equivalent to the bandwidth minimization problem, which led to a simple algorithm which has been programmed at Berkeley and competes with the commercially available program. Studies on gate-array routing have similarly led to a routing program superior to the commercially available program. He is also exploring the use of semi-random sources in a randomizing algorithm to overcome the imperfections in sources of randomness such as Zener diodes and improve the use of randomization in obtaining efficient algorithms.

Earth Sciences

Craig M. Bethke
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Ph.D. (Geology), Univ. of Illinois, 1985.

Dr. Bethke is interested in the movement of deep groundwaters within sedimentary basins over geologic time periods and in the transport phenomena associated with groundwater flow. Especially, he seeks to understand more thoroughly the importance of the hydrology of deep basins in processes of 1) petroleum migration and the localization of petroleum reservoirs, 2) formation of economic mineral resources, 3) thermal histories of sedimentary basins, and 4) water-rock interactions and the chemical alteration (diagenesis) of deep sediments open to groundwater flow. He also maintains research in the chemical reactions that transform interstratified clay minerals in the subsurface and in X-ray diffraction analysis of disordered clays.

Dr. Bethke is currently adapting hydrologic modeling techniques to supercomputer technologies in order to describe transport processes on a regional scale. Mathematical results of the modeling are combined with geologic observations to define hydrologic processes in the geologic past. One project involves modeling the combined effects of transport phenomena and multicomponent chemical reactions, allowing quantitative analysis of processes in open systems. Results of this research will be applied to current problems in the minerals, petroleum, and waste isolation industries.

Grant Garven
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Ph.D. (Hydrogeology), Univ. of British Columbia, 1982

Dr. Garven is a groundwater geologist with expertise in the quantitative analysis of the role of gouundwater flow in geologic processes. Although traditional studies in groundwater hydrology have focused on the evaluation of fluid dynamics and contaminant transport in the shallow subsurface, groundwater can percolate to depths of tens of kilometers in the earth's crust and as such it also plays an important role in a number of geologic processes involving water-rock interactions. Dr. Garven's principal research interests are directed to the quantitative understanding of these geologic processes from a hydrologic perspective.

The formation of strata-bound ore deposits, the migration and entrapment of hydrocarbons, and the diagenesis of sedimentary rocks all share a common heritage to large-scale groundwater flow in geologic basins. In the case of hydrothermal ore deposits, Dr Garven's work has shown that regional topography-driven ground-water flow is capable of forming large metal deposits over relatively short periods of geologic time. His current research efforts are aimed at the mathematical modeling of time-dependent groundwater flow in sedimentary basins which evolve over geologic eras The goal of this research is to build a better picture of the dynamic role of groundwater in mineral deposit genesis.

Susan M. Kidwell
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Ph.D. (Geology and Paleobiology), Yale Univ., 1982

Dr. Kidwell's primary research interest is the origin of densely fossiliferous horizons, especially as they relate to unconformities and depositional sequence analysis. Her field and theoretical work pursues: (1) development of taphonomic (fossil preservation) criteria for reconstructing the sedimentary dynamics, paleoenvironment, and duration of non-depositional episodes; (2) analysis of fossil-rich and condensed horizons as source of biostratigraphic and other paleontologic data; and (3) testing the utility of fossil-rich horizons in the differentiation and interpretation of sedimentary facies, as marker beds for within-basin correlation, and in the identification of stratigraphic hiatuses and condensed intervals. Systematic examination of the distribution of fossil-rich deposits is a prerequisite to development of these virtually unexploited approaches to stratigraphic analysis.

The research is aimed at a more comprehensive understanding of the nature of non-depositional episodes and of the dynamics of sediment accumulation across a spectrum of temporal and spatial scales. Current projects address the environments and timing of condensed fossil deposits within transgressive-regressive cycles on passive and active margins, onshore-offshore gradients in skeletal concentrations as a paleobathymetric criterion, and the evaluation of unconformity-based sequence analysis in the marine-to-nonmarine transition.

William Menke
College of Oceanography
Oregon State Univ.
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Assistant Professor
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Ph.D. (Geophysics), Columbia Univ., 1982

Dr. Menke's primary research interest is the propagation of high frequency compressional and shear waves through heterogeneous and attenuating geological structures. In the area of wave scattering theory, he is interested in energy partitioning between coherent and incoherent portions of the wave field, the generation of coda, and apparent attenuation due to scattering. He is also interested in methods for determining the statistical parameters describing earth structure from seismic data, and applications of seismic tomography.

Currently his research is concentrated in two areas: (1) Comparing theoretical predictions of apparent attenuation with the results of laboratory ultrasonic measurements, and (2) using simultaneous measurements of scattered compressional and shear waves to distinguish the effects of apparent attenuation due to scattering from true attenuation due to anelasticity.

Jonathan F. Stebbins
Dept. of Geology
Stanford Univ. Stanford, CA 94305

Assistant Professor
(415) 723-1140, 723-2537

Ph.D. (Geology), Univ. of California at Berkeley, 1983

Dr. Stebbins' primary research interest is in the physical chemistry of molten and solid oxides and silicates at high temperature, and the application of this information to problems in the earth and materials sciences. His recent work has concentrated in two specific areas. The first is the experimental determination of the thermodynamic properties of molten and crystalline silicates at temperatures to 1600 degrees C. Measurements of enthalpy, heat capacity, density, expansivity, and volatile solubility are in this category. In these studies, results are used to attempt to understand the interrelationships of composition, structure, and physical properties at a mechanistic level as well as to develop simple empirical models for applications to calculations of phase equilibria in natural and synthetic systems.

One key question stemming from this research concerns the structural and dynamical differences between the highly structured, viscous melts and their glassy and crystalline relatives. This has led to his second major interest, which is observation of the atomic and molecular motion in high temperature liquids and solids by nuclear magnetic resonance spectroscopy. These studies have resulted in some of the first data on the rates and types of structural motion in these complex systems.

Chemical, Biochemical & Thermal Engineering

Arvind Atreya
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Ph.D. (Engineering Sciences), Harvard Univ., 1983

Dr. Atreya's primary area of research is combustion. He is interested in both experimental investigation and theoretical modeling of combustion phenomena. He is especially interested in designing and conducting experiments that seek to identify the controlling mechanisms of a given combustion process through a parametric study of the pertinent variables. Such experiments are essential both for developing realistic mathematical models and for their validation. His theoretical interests lie in investigating special cases by using approximate analytical methods and in developing more general numerical models.

Currently, his research focuses on the combustion of low-grade solid fuels such as wood, coal and other biomass. A common feature of these materials (that distinguishes them from the widely used liquid and gaseous hydrocarbons) is that they are hygroscopic and rich in carbon. Thus, during combustion significant evolution of moisture occurs and a protective layer of char is formed on the surface. To experimentally investigate the effect of these added complexities, he has designed a unique controlled-radiation and controlled-atmosphere combustion wind tunnel. This tunnel is being used to study thermal decomposition, ignition, extinction, char combustion, flame radiation and flame propagation on these fuels in a well-defined flat-plate boundary layer configuration. He is also developing mathematical models (both numerical and analytical) of these component phenomena. This work is motivated by efficient utilization of low-grade solid fuels and by the prevention of devastating wildland and urban fires.

Theodore L. Bergman
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Ph.D. (Mechanical Engineering), Purdue Univ., 1985

Dr. Bergman's research interest is the experimental and theoretical analysis of engineering systems involving heat and mass transfer processes. More specifically, he has a particular interest in: (1) systems where simultaneous heat and mass transfer (double-diffusion) occurs, (2) systems involving fluids with free surfaces contained in small geometries or at reduced gravities where heat and mass transfer may induce natural or thermo (specio)-capillary convection, (3) systems involving phase change (both solid-liquid and liquid-gas) in binary fluids, and (4) development of species measurement techniques.

Currently, research is being conducted in three closely-related areas. (1) analysis of combined buoyancy/thermocapillary convection with surface radiative interchange. This study is intended to provide a better understanding of commercial crystal growth manufacturing techniques (2) Analysis of Soret (thermal diffusion) effects in binary fluids undergoing natural convection. This study focuses on how thermally-induced diffusion of heavy elements can alter buoyancy-driven convection in several common binary fluids. (3) Microwave drying of initially saturated porous media. This study involves phase change (boiling) induced by microwave absorption in porous media. Thermocapillary effects and binary fluids are considered.

Donna G. Blackmond
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Ph.D. (Chemical Engineering), Carnegie-Mellon Univ., 1984

Dr. Blackmond's research interests focus on fundamental investigations of the surface chemistry of small supported metal crystallites and how surface structure affects their adsorptive and reactive properties. Using techniques such as infrared (IR) spectroscopy and temperature programmed desorption (TPD) as probes, she is interested in achieving a better understanding of the nature of the catalytic surfaces.

One major thrust of Dr. Blackmond's research program involves the adsorption of small molecules on metal crystallites to explore the nature of this bonding as well as the interactions between coadsorbed molecules. This information about adsorption may in turn lead to a more well-defined picture of the complex surface sites found on heterogeneous metal crystallites. Studies of this type are also being used to probe the relative importance of electronic and structural influences of additive species such as alkali promoters.

The second major thrust of Dr. Blackmond's research program also involves probing the surface of metal crystallites, but here the tool is the catalytic reaction of small molecules. CO hydrogenation reactions on supported metals are being carried out in the presence of species which may act as chemical trapping reagents on adsorbed species. This chemical trapping has the potential to be an elegant probe of the nature of reactive surface intermediates. The ultimate goal of both thrusts of Dr. Blackmond's research program is to achieve a better fundamental understanding of the surface chemistry which occurs on supported metal catalysts during adsorption and reaction.

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Ph.D. (Chemical Engineering), Univ. of Wisconsin-Madison, 1984

Dr. Choi's major research interest is polymer reaction engineering and chemical process control. His main research theme is an application of advanced chemical reactor theories and process control techniques to develop novel and improved polymerization systems which will lead to enhanced productivity, tailor made product quality and improved process safety. His research projects include detailed mathematical modelling, simulation and extensive laboratory experimentation.

His current research areas are (1) kinetics, modelling and experimental verification of semi-batch and continuous multi-state melt polycondensation processes for thermoplastic polyester and polyether-ester block copolymers, (2) analysis of catalytic mechanism and mass transfer phenomena in phase transfer catalyzed free radical polymerization, (3) computer aided design, analysis and control of industrial homogeneous and heterogeneous polymerization processes in which optimal stochastic estimation and control strategies are implemented, (4) olefin polymerization using high activity soluble transition metal catalysts, (5) computer control of injection molding processes.

Dr. Choi is also strongly involved in the interdisciplinary research activity in the area of polymer materials science, polymer processing and systems engineering.

Douglas S. Clark
School of Chemical Engineering
Cornell Univ., Ithaca, NY 14853

Assistant Professor
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Ph.D. (Chemical Engineering), California Institute of Technology, 1983

Dr. Clark's research is concerned with the basic principles that determine the engineering properties of immobilized enzyme and cell biocatalysts and immobilized-protein affinity adsorbents. He is also interested in thermophilic microorganisms and heat-stable enzymes. Of central importance to these research areas is the development of new methodologies suitable for analyzing proteins and whole cells in complex environments of biotechnological interest.

For example, Dr. Clark's group is currently studying immobilized glucose isomerase, an important catalyst in the food industry. This work involves the use of EPR spectroscopy, EXAFS analysis, and protein engineering techniques to help determine structure-function relationships in soluble and immobilized glucose isomerase catalysis. Clark's group is also applying NMR spectroscopy techniques to monitor structural changes during immobilized glucose isomerase deactivation, and in related research, to measure intracellular reaction rates and metabolite levels within immobilized cell systems.

Fundamental studies of extremely thermophilic organisms and their enzymes are also in progress. These studies make use of a high performance bioreactor specifically designed for controlled analyses of microorganisms isolated from exotic environments This research will help to identify how microbial cells respond and adapt to extreme cultivation conditions—important information for the utilization of thermophiles in process applications—and ultimately may aid in the development of man-designed thermostable biocatalysts.

Finally, research in affinity chromatography, an extremely powerful method for purifying biological macromolecules, is also underway. Here the goal is to identify factors that govern the efficiency of affinity separations through measurements of key parameters, molecular-level characterization of the immobilized species (e.g. immobilized monoclonal antibodies), and mathematical modeling.

Paul L. Frattini
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Ph.D. (Chemical Engineering), Stanford Univ., 1985

Dr. Frattini's research interests lie in the general area of rheology of colloidal fluids, including both particle suspensions and polymeric liquids. Specifically, he is interested in the development of rheo-optical methods and in their application to experimental studies of the microrheology of these complex fluids.

Currently, time dependent rheo-optical studies in well defined geometries are being initiated with two general themes. to compare structures formed during flow as observed on small (ie., short range) and large (ie., long range) length scales using light scattering techniques in combination with optical microscopy, and, to extend the techniques of optical polarimetry, such as linear birefringence and dichroism, to make them capable of simultaneous measurements at multiple spatial positions.

In the former category, quantitative studies of red blood cell aggregation during flow will be performed with precise control over the dimensions of the scattering volume. Hence, the flow induced structure on both single rouleaux and global network length scales may be observed. Stasis resulting from red cell aggregation is responsible for pathologic venous hypertension with the most common symptom being varicose veins. This work has broader implications in colloid science where few fundamental experiments addressing the effects of flow on the flocculation of non-spherical particles have been accomplished.

In the latter category, rheo-optical methods in general are criticized for their limitation to single point, line of sight measurements. Removing the requirement of translational invariance in the flow field will allow quantitative rheo-optical studies in geometries more directly relevant to process situations. A birefringence method using quantitative digital imaging is being developed which will be capable of probing a wide range of spatially inhomogeneous flow fields.

Alice P. Gast
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Ph.D. (Chemical Engineering), Princeton Univ.. 1984

Dr. Gast's research focuses on the physical properties of dispersed systems such as emulsions, micelles, colloidal suspensions and polymer solutions. The projects combine models of these complex materials from statistical mechanics with experiments providing a direct measure of the property of interest.

One subject of current interest is a quantitative study of block copolymer adsorption. Block copolymers are long chains of two chemical species resembling soap molecules in their tendency to form micelles and adsorb to an interface. D . Gast is developing a novel application of integrated optics to provide a technique allowing the rapid detection of polymer concentrations at a fluid-solid interface. This experimental study, combined with a model based on polymer statistics will provide insight into the mechanism and process of colloidal stabilization. Other projects currently under study include the dynamics of colloidal aggregation and crystallization and the structure of electrorheological fluids. These problems are of technological importance in ceramic processing and many composite fluid systems. A unique aspect of this work is the ability to model concentrated complex systems with theories derived from the physics of condensed phases.

James Nathaniel Michaels
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Sc.D. (Chemical Engineering), Massachusetts Institute of Technology, 1983

Dr. Michaels' research interests are centered around investigations of novel catalytic and electrocatalytic systems. His research is currently drawn from two areas.

First, he is studying the electrocatalytic behavior of stabilized-zirconia electrolytic cells. These solid state electrochemical systems find use as high-temperature oxygen sensors, fuel cells, and water electrolyzers. They also may be used to monitor and control *in situ* the surface coverage of oxygen on catalytic surfaces, and they offer the potential of being highly selective and easily controlled preparative reactors. The primary goal in this effort is to determine the electrochemical, catalytic, and transport processes which dominate the electrode kinetics in these systems.

Second, Dr. Michaels is studying the catalytic chemistry of a variety of transition metal compounds, including carbides, nitrides, borides and silicides. This project, which is part of an interdisciplinary effort in chemistry and chemical engineering, is a systematic study of the chemisorptive and catalytic activity of well-characterized transition metal compounds for a number of probe adsorbents and reactions. The goal of this project is to elucidate the relationship between the catalytic activity and selectivity of these materials and their bulk properties such as stoichiometry, crystal structure, and electronic structure.

Syed Qutubuddin
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Ph.D. (Chemical Engineering), Carnegie-Mellon Univ., 1983

Dr. Qutubuddin's research interests are in colloids and interfacial engineering with emphasis on surfactant systems, particularly micelles and microemulsions, and polymers. The objective is to improve on the understanding of phase transitions, microstructures, bulk and interfacial properties, and interactions in surfactant/polymer systems. Such an understanding is crucial to the engineering of multiphase systems for many applications including separations and oil recovery. A battery of tools is being used for characterization, including the application of electrophoretic light scattering and electrochemical methods to microemulsions. Several model microemulsions with interesting phase behavior have been developed. Solubilization has been modelled, and correlations are being obtained for variation of aggregate size and interfacial tension with temperature, pressure and composition.

Coupled with fundamental investigations are projects aimed at understanding problems in existing applications (e.g. detergency and oil recovery) and developing new applications of microemulsions. Qutubuddin is investigating the thermodynamic behavior of novel surfactants under conditions (T, P, and salinity) representative of oil reservoirs. A new class of separation techniques is being developed using dispersed microemulsions as membranes. Microemulsions are being used to separate chemicals and biotechnology products from dilute solutions. Qutubuddin is working on novel microporous membranes from polymerized microemulsions, and also using microemulsions for electrocatalysis and electrodeposition. Another project involves interactions between pigments and polymers and their effects on the rheology of coatings.

Eric Michael Stuve
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Ph.D. (Chemical Engineering), Stanford Univ., 1984

Dr. Stuve's research is aimed at determining those principles of surface chemistry which are common to reactions at liquid-solid and gas-solid interfaces and those which are unique to one or the other. This information will help provide a unified description of fluid-solid surface chemistry valid at any pressure and in either gaseous or liquid environments. The experiments involve the use of ultra-high vacuum (UHV) surface science techniques to study well-defined adsorption reaction systems suitably chosen as models of either electrochemical or catalytic processes. This entails coadsorption of, in the case of gas-solid systems, the reactants plus any desired surface modifiers, and for liquid-solid systems, the reactants plus solvent and model cations and anions. The structural and thermodynamic properties of these adlayers are then studied as functions of temperature and coverage.

The first phase of this project, the study of model electrochemical systems, is now in progress. Specifically, the structur[illegible] 'sorbed protic (hydrogen bonded) and aprotic, polar solvents is being studied with thermal desorption spectroscopy (TDS) and electron stimulated desorption ion angular distribution (ESDIAD). Another goal of this project is to adsorb polyatomic anions on a metal in UHV and determine whether they are suitable models of adsorbed anions. Finally, both solvent and ions will be coadsorbed for determination of their physical and chemical properties.

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Ph.D. (Mechanical Engineering), Purdue Univ., 1986

Mr. Webb's research interests fall primarily in three broad categories. Areas of investigation he plans to pursue, along with possible applications are: (1) Natural convection and solid-liquid phase change in single and multi-component systems. This finds application in materials processing, metallurgy, biomedical engineering, crystal growth, freezing of foodstuffs, etc. (2) Radiation and its interaction with other modes of heat transfer. This facet of research fills needs in solar energy storage and conversion, geotechnical concerns, oceanography, photochemistry, as well as some aspects of the current space program. (3) Heat transfer in irregular geometries. This is particularly applicable in the study of augmentation techniques, finding strong interest from the process engineering and electronics industries.

His research focus is to characterize experimentally and attempt to model theoretically basic heat and mass transfer phenomena found in these areas of proposed study.

Design, Manufacturing & Computer Engineering

Erik Karl Antonsson
Dept. of Mechanical Engineering
California Institute of Technology, Pasadena, CA 91125

Assistant Professor
(818) 356-3790

Ph.D. (Mechanical Engineering, Engineering Design), Massachusetts Institute of Technology, 1982

Dr. Antonsson is primarily interested in the preliminary (conceptual) phase of engineering design, and development of computational tools to aid designers during these early stages. Contemporary computational tools for engineering design (CAD and CAE) address the last portion of the process, when most aspects of a design are fixed and known. His work addresses a much earlier portion, when little is fixed, and much flexibility in the solution remains. This approach presents the designer with a variety of levels of analysis sophistication, corresponding to a variety of levels of detail in the description of the design: simple descriptions and analysis of many alternatives proceeding to more complex descriptions and analyses. An initial project involves a design system for transfer of fluids.

He is also working in the area of automatic, high-precision measurement of surface geometry using an opto-electronic technique based on lateral photo-effect diode detectors. The motivation is for acquisition of surface geometries of fabricated parts, machined surfaces, biological surfaces and deformed parts. One initial application is the study of surface deformations in the near crack-tip region of a fracture specimen.

A current project in collaboration with the Jet Propulsion Laboratory is centered on the simulation of robot kinematics and dynamics to explore coordinated control of multi-armed manipulators, and the display of experimentally acquired spatial linkage kinematics and dynamics.

Tien-Chien Chang
School of Industrial Engineering
Purdue Univ., West Lafayette, IN 47907

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Ph.D. (Industrial Engineering), Virginia Polytechnic Institute and State Univ., 1982

Dr. Chang's research interest is in the area of manufacturing automation, especially on the study of automated process planning. Process planning is the task of determining manufacturing operations and sequences for making a piece part or assembly. It links the design, production planning and control, and manufacturing process control functions. It is the first and essential step in manufacturing.

He is involved in the study of automated understanding of design models, i.e., the process of extracting manufacturing information from geometric models. This information can be used to plan processes. He is also studying functional modules for automated/intelligent process planning systems. How to best represent manufacturing process knowledge and what is the underlying theory are some of the interesting problems he plans to pursue. The final goal is to develop principles for modelling manufacturing knowledge, for understanding CAD geometric models, and for generating automated CNC control codes, so that direct human intervention can be eliminated from process planning.

A second area Dr. Chang is working on is the area of assembly planning. In particular, he is looking into the problem of automated electronics assembly. He is interested in the study of small batch manufacturing of electronics assembly. The automated configuration, planning and control of flexible assembly systems are some of the issues he is studying.

Paul H. Cohen
Dept. of Industrial Engineering
The Pennsylvania State Univ., University Park, PA 16802

Associate Professor
(814) 863-2357

Ph.D. (Industrial and Systems Engineering), The Ohio State Univ., 1982

Dr. Cohen's primary research interest is in the design, analysis and control of advanced manufacturing systems. His current work is in the areas of cell controllers for flexible manufacturing systems (FMSs), flexible automated inspection systems, flexible fixtures for FMSs, and machine tool/part monitoring and adaptive control.

The FMS controller research seeks to develop an expert system scheduler for a cell based on a model of the cell and real-time input on the status of the various cell components. The expert system will seek to select potential scheduling alternatives which form an alternative space, deterministically simulate these into the future, execute the schedule and resimulate as the status of the cell changes. His interest in the area of computer-aided inspection centers on the extraction of appropriate information from CAD (and interactive addition of missing information), computer-aided asessment of the binding (active) tolerances (including form tolerances), and the subsequent optimal off-line programming of inspection devices based on their accuracy and the tolerance specification of the parts. Flexible fixtures are a missing link in FMS development. Dr. Cohen's work in this area seeks to use group technology as means to code tolerance and fixturing information and to use this and other geometric information to form part families. Going directly from CAD, an expert system will be developed to select the most appropriate flexible fixture for lathe operations and to design flexible fixtures for prismatic parts within a part family. Thus the fixture need only handle a limited range of part geometries.

Mark Robert Cutkosky
Design Division, Mechanical Engineering Dept.
Stanford Univ., Stanford, CA 94305

Assistant Professor
(415) 725-1588

Ph.D. (Mechanical Engineering), Carnegie-Mellon Univ., 1985

Dr. Cutkosky's research interests are robotics and automated manufacturing. In robotics, he has concerned himself with the design and control of advanced manufacturing hands. This has led him to detailed analyses of grasping and fine manipulation. One of his current projects is to develop a hand that will be intelligent enough to work with people rather than replace them. This will entail an exploration of partnering, cooperation and learning.

In automated manufacturing, he is investigating sensor-interpretation strategies to improve the dialogue between CAD and CAM. In particular, he is developing methods for extracting information from sensors in the manufacturing process and using that information to update a manufacturing knowledge base that will assist designers.

Michael John Foster
Dept. of Computer Science
Columbia Univ., New York, NY 10027

Assistant Professor
(212) 280-8188

Ph.D. (Computer Science), Carnegie-Mellon Univ., 1984

Dr. Foster is primarily interested in specialized silicon compilers for the automated design of integrated circuits. A specialized silicon compiler is a design aid that attempts to meet two conflicting goals in custom VLSI design: (1) the design of efficient chips; (2) a simple, rapid design process. These goals are difficult to meet simultaneously, because an efficient chip must take advantage of application-dependent optimizations. These types of optimizations must typically be performed by a skilled human designer rather than by an automated CAD tool. The usual design process for efficient chips is therefore far from simple and rapid, since it depends upon the expertise of a human specialist. Specialized silicon compilers are computer programs that can replace human experts in some situations, thus simplifying the design of efficient chips.

Dr. Foster is currently working on a specialized silicon compiler for building arbiters and synchronizers. These asynchronous circuits are notoriously difficult to design. When the compiler is completed it will accept a path expression as input, and produce a correct, compact chip that can be used to enforce the synchronization specified by the path expression. The ability to produce synchronizers automatically will simplify the construction of asynchronous and distributed computing systems

Dan Koditschek
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Yale Univ., New Haven, CT 06520

Assistant Professor
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Ph.D. (Electrical Engineering), Yale Univ., 1983

Dr. Koditschek received his Ph.D. in the area of nonlinear systems theory and automatic control and has subsequently become interested in the field of robotics.

Currently, his primary interest is in the development of dynamically sound means of robot task encoding. Instead of representing a task as a pre-computed trajectory (presumably the output of a high level planning algorithm) that the arm is forced to track, this methodology attempts to describe the high level task directly in the form of a feedback structure which induces the desired behavior by closed loop response to on-line sensory measurements. Open questions of immediate theoretical interest concern conditions for dynamical stability and other qualitative properties. This analytical work raises a variety of empirical questions concerning actuator and sensor performance and modeling.

The reliance upon error-driven control algorithms enforces a sufficient degree of analytical formality in the definition of a task as to suggest an approach toward a design theory of robotic task encoding. Longer range benefits of such a formalism might include the generation of learning strategies which are analytically guaranteed to translate abstract goals from a well defined domain of tasks into computationally efficient and dynamically sound controllers.

M. Ray Mercer
Dept. of Electrical and Computer Engineering, ENS 143
Univ. of Texas, Austin, TX 78712

Assistant Professor
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Ph.D. (Electrical Engineering), Univ. of Texas at Austin, 1980

Dr. Mercer's primary research interests are digital logic design for testability and digital logic testing. Digital logic testing can be divided into two broad components: 1) design verification and 2) manufacture screening (structural testing). The first component essentially addresses the question, "Is the device design in fact a valid realization of the intended product?" Manufacture screening assumes the design to be correct and attempts to partition fabricated devices into good and malfunctioning sets using test pattern sequences. Usually, test generation in the second case is done assuming some standard fault model.

This problem has been shown (for general logic circuits) to be in the class of *NP-complete* problems, but Mercer's recent research results indicate that for all common fault models, there do exist design methods where test generation complexity is *linear* in the number of logic components and device interconnections.

In addition to the research described above, research plans include: 1) novel methods for automatic test pattern generation using artificial intelligence techniques, 2) new fault tolerant techniques for concurrent fault detection, 3) new methods for enforcing logic design constraints, and 4) new logic design verification techniques

Andrzej Jozef Strojwas
Dept. of Electrical and Computer Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Assistant Professor
(412) 268-3530

Ph.D. (Electrical Engineering), Carnegie-Mellon Univ., 1982

Dr. Strojwas' main research interests are in the area of computer-aided design and manufacturing (CAD/CAM) of very large scale integrated circuits (VLSIC's). In the area of design, he is primarily interested in developing algorithms for statistical design of integrated circuits. Specifically, he has been working on worst-case design and yield maximization methodologies. He has also been working on statistical modeling of VLSI fabrication processes and semiconductor devices. A statistical process/device simulator FABRICS, which is an outcome of this research, plays a key role in design optimization and is currently widely used in the semiconductor industry.

In the area of computer-aided manufacturing, his research efforts focus on algorithms for diagnosis of fabrication processes and methodology for statistical process control. He has developed a complete diagnostic system which uses statistical pattern recognition techniques to identify faults in the fabrication process. Currently, he is working on the cost minimization approach to the control of VLSI fabrication processes Statistical quality control algorithms constitute the basis of the control system under development. The long-range objective of his research is to integrate the above described algorithms in a complete software system which can be applied for real-life tasks in industrial VLSI fabrication lines.

Electrical, Communications & Systems Engineering

Samuel Thomas Alexander
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North Carolina State Univ., Raleigh, NC 27695

Assistant Professor
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Ph.D. (Electrical Engineering), North Carolina State Univ., 1982

Dr. Alexander's main research interests are the theoretical development of modern adaptive filtering and the application of adaptive techniques to problems in communications and signal processing. Specifically, in the theoretical area he is pursuing the development of fast adaptive least squares filters which remain stable under constraints of finite precision implementation and continual recursive computation. Recent advances in VLSI technology now make it feasible to consider real time matrix computional approaches to adaptive least squares solutions. Therefore, another of his theoretical interests is the derivation and performance analysis of real time adaptive least squares filter implementations involving parallel processing and systolic array architectures.

In the applications areas, he is currently investigating the application of fast stable least squares filters to echo cancellation for both voice and data communications, to adaptive beamforming for array processing, and to identification and tracking of rapidly time-varying systems. These techniques will find substantial use in the next generation telecommunication devices, as well as in medicine and robotics.

Stephen P. Boyd
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Stanford Univ., Stanford, CA 94305

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Ph.D. (Electrical Engineering), Univ. of California at Berkeley, 1985

Dr. Boyd's main research interests are in the general areas of nonlinear circuits and systems and algorithms for system analysis and design, with emphasis on control system design. His Ph.D. dissertation concerned Volterra Series, a general representation for many nonlinear operators.

Current research interests include the design of general simulation programs and algorithms which determine whether a system containing incompletely specified subsystems meets performance requirements. Even for simple cases, for example, determining stability of a linear time invariant system with a few parameters know to lie in given ranges, this is a very hard task. Related interests are algorithms for decentralized control design and adaptive control systems.

Weng Cho Chew
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Univ. of Illinois, Urbana, IL 61801

Associate Professor
(217) 333-7309

Ph.D. (Electrical Engineering), Massachusetts Institute of Technology, 1980

Dr. Chew's research interest is in the area of electromagnetic wave propagation and scattering. He has researched on solving mixed boundary value problems for microwave integrated circuits, microstrip antennas and geophysical probing applications. He has also been interested in wave propagation in inhomogeneous media, and deriving efficient algorithms to solve problems of wave propagation and scattering. He has also studied the electrochemical and electrokinetic effects on the dielectric properties of composite materials like rocks and colloidal systems.

Presently, he is interested in studying high-speed techniques to model wave propagation through inhomogeneous media and solving the inverse scattering problem for various applications in geophysical probing and imaging.

Eric R. Fossum
Dept. of Electrical Engineering
Columbia Univ., New York, NY 10027

Assistant Professor
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Ph.D. (Electrical Engineering), Yale Univ., 1984

Professor Fossum is engaged in the research of advanced semiconductor device structures and fabrication technology. The research can be broadly divided into three areas: charge-coupled devices, low-energy ion beam processing of semiconductors, and interdisciplinary collaborative research. In general, he is interested in the use of microelectronics for the local intelligence of sensors and controllers.

Charge-Coupled Devices—a new class of charge-coupled devices for analog signal processing in the charge domain is under investigation. Device structures for charge-coupled computing are being invented, fabricated, and characterized in this effort. Architectures employing charge-coupled computing devices, such as filter, A/D convertors, and charge-coupled computer arrays for focal-plane image preprocessing are being studied. Devices and circuits are being fabricated in silicon and in advanced materials such as gallium arsenide.

Low-Energy Ion Beams—A low energy broad ion beam with energy in the range of 0 to 100 eV is being applied to the ultra-thin oxidation of silicon, nitridization of silicon dioxide, and passivation of semiconductor surfaces. The damage induced by the ion beam on the semiconductor surface and in the bulk of the semiconductor is also being investigated.

Interdisciplinary Collaborative Research—An advanced device structure for interconnecting optical fibers to microelectronic devices is being studied, along with new device structures, fabricated using novel laser-assisted direct write materials etching and deposition processes.

James G. Fujimoto
Dept. of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA 02139

Assistant Professor
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Ph.D. (Electrical Engineering), Massachusetts Institute of Technology, 1984

Dr, Fujimoto's principal field of interest is in optics and quantum electronics. Specifically, he is involved in investigations of picosecond and femtosecond laser generation and measurement techniques and their applications to the study of ultra-high speed dynamical processes in electronic materials and devices.

Research in ultrashort pulse generation will involve the investigation of femtosecond dye laser systems, high intensity dye amplifiers, and optical fiber pulse compression techniques. In addition to high resolution systems, special emphasis will be placed on approaches for the generation of near IR wavelengths which are suited to the investigation of optoelectronic materials and devices.

Studies of ultrafast dynamics in electronic materials will include investigations of excited carrier dynamics and transport phenomena in semiconductors as well as studies of nonlinear optical processes. Other material systems which will be investigated include metals and nonlinear optical materials. Optoelectronic switching and measurement techniques will also be developed and applied to study ultrahigh speed transient electrical phenomena.

Roger Thomas Howe
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Massachusetts Institute of Technology, Cambridge, MA 02139

Assistant Professor
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Ph.D. (Electrical Engineering), Univ. of California at Berkeley, 1984

Dr. Howe's research program focuses on integrated sensors and actuators and the micromachining technology used to make them. The stimulus for this effort is the generally primitive state of sensor and actuator technology relative to the sophisticated information-processing technology created by the microelectronics revolution. His research is addressing this problem by augmenting integrated-circuit process with techniques for fabricating microstructures. This "micromachining" technology enables new transducing concepts that exploit the availability of onchip readout and signal-processing circuitry.

A specific application that he is currently studying is the fabrication of thermally isolated microstructures on silicon substrates for application to gas detection. The microstructure incorporates a metal oxide film that has a conductance sensitive to various gases or vapors at operating temperatures of 300-400 degrees C. Very little power is needed to heat the microstructure to these temperatures, with minimal effect on the temperature of distant areas of the chip. This development will make feasible a high-performance integrated gas sensor incorporating an array of microstructures with differentiated metal-oxide films and on-chip electronics. A selective response is obtained by processing signals from the array of sensing elements.

In order to fully exploit the sensing capabilities of silicon microstructures, advances are needed in the design of readout circuitry. He is developing CMOS analog circuit design techniques for measuring the small sense capacitors typical in silicon microstructures. Recent advances in analog-to-digital circuit design are promising for application to the capacitance measurement problem. Further research is planned in signal-processing circuit design for integrated sensors

George Nicolas Maracas
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Arizona State Univ., Tempe, AZ 85287

Assistant Professor
(602) 965-2562

Ph.D. (Electrical Engineering), Cornell Univ., 1982

Dr. Maracas' research interests are in the area of compound semiconductor materials and heterojunctions. Research is directed toward investigating physical processes in the materials which affect performance of microwave and integrated optoelectronic devices and circuits. This involves designing and fabricating electrical and optical test structures as well as devices such as field effect transistors (FETs), infrared waveguides, modulators and high speed optical detectors. Research on defects and impurities in semiconductor devices is not limited to investigation but also includes controlled introduction to exploit their properties for novel device design. Extensive automated electrical and optical characterization facilities are employed and being further developed to reveal device and material properties.

Currently his research is in three areas: (1) backgating/sidegating and noise in GaAs devices and circuits, (2) band structure and transport properties of quantum well and superlattice structures and (3) development of GaAs integrated optical waveguides and modulators. The goal of this research is to gain a basic understanding of parameters that will affect development of future, highly integrated optoelctronic circuits.

Dean P. Neikirk
Dept. of Electrical and Computer Engineering
Univ. of Texas at Austin, Austin, TX 78712

Assistant Professor
(512) 471-4669

Ph.D. (Applied Physics), California Institute of Technology, 1984

Dr. Neikirk's main research interest is in the area of device structures for monolithic millimeter and submillimeter wave components. In addition, he is particularly interested in the application of advanced integrated circuit processing techniques to the fabrication of new devices for use in these very high frequency bands. For frequencies above 30 GHz (wavelengths shorter than 1 cm), the application of conventional microwave technology, such as the use of metallic waveguide, becomes increasingly difficult. At the same time, the small size of circuit elements and devices suggests the use of integrated circuit techniques for their construction. Dr. Neikirk's research is directed towards the study of very high frequency electromagnetic wave interactions with these integrated structures.

Dr. Neikirk has recently developed the first monolithic, high resolution focal plane detector array for use at wavelegths between 0.1 mm and 1 mm. This work involved the use of novel multi-layer photoresist and lift-off techniques for the fabrication of very sensitive microbolometer detectors.

Dr. Neikirk's present work includes studies of optical interactions with wave guides fabricated on GaAs, the use of GaAs/AlGaAs heterostructures in these waveguides and in millimeter wave oscillators, and the use of plasma processing with both GaAs and InP.

Andreas Polydoros
Dept. of Electrical Engineering/Systems
Univ. of Southern California, Los Angeles, CA 90089

Assistant Professor
(213) 743-7257

Ph.D. (Electrical Engineering), Univ. of Southern California, 1982

Dr. Polydoros' current research interests lie in the area of wideband communication theory, with particular emphasis on spread-spectrum systems. The areas of his particular attention are the following: (a) Spread Spectrum Synchronization: Having formulated fairly general models for the analysis of code acquisition and tracking methods in white noise, he is trying to extend those to account for: nonwhite interference (jamming); imperfect side-information and the impact of gain control; simultaneous temporal and spatial acquisition in phased arrays, and structural tracking loop optimization. (b) Wideband Detection: Further investigation of compound detection rules and performance, both optimal and suboptimal, for wideband random signals using: correlation-domain and/or spectral domain information, autoregressive models, simultaneous detection and estimation rules, etc. The application of such theoretical tools to a dense, multi-signal environment is a high priority. (c) Spread Spectrum Networks: Here, he is trying to quantify the interaction between the physical and link levels of the network; assess jamming effects on the throughput/delay/stability model; optimize modulation/coding/spreading combination in adverse environments.

Mansour Shayegan
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Princeton Univ., Princeton, NJ 08544

Assistant Professor
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Ph.D. (Electrical Engineering), Massachusetts Institute of Technology, 1983

Dr. Shayegan's research interest is in solid state physics with emphasis on the physics and technology of electronic materials and devices. His research includes studies of the formation of new materials and interfaces. He is presently setting up a new laboratory for research on the growth and characterization of III-V semiconductor compounds using the technique of molecular beam epitaxy (MBE). The objective of the MBE laboratory is two-fold. First, it will be used to grow heterojunction thin film structures and superlattices with novel physical properties. Second, he plans to establish a research program to develop MBE growth to its full potential as a technique to fabricate devices and low-demensional structures. The approach is to investigate the physics of the MBE growth by devising new techniques for "on-line" diagnosis of the electronic and atomic structure of the materials during growth and to determine optimum growth and regrowth conditions.

He is also interested in semiconductor surfaces and metal-semiconductor interfaces. In particular he is conducting studies on the formation of the interfaces at very low temperatures. The reduced mobility and reactivity of the surface atoms at low temperatures result in limited surface reactions and more ideal, abrupt interfaces may be formed. Also, since the reactions are slow, the initial stages and the dynamics of the metal-semiconductor interface formation can be investigated.

Currently, he is also carrying out research on the electronic properties of narrow-band-gap semiconductors (HgCdTe, InSb and PbTe). He is investigating the magnetic-field-induced localization of electrons in HgCdTe and InSb, and the electronic structure of PbTe quantum wells and inversion layers.

John N. Tsitsiklis
Dept. of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA 01239

Assistant Professor
(617) 253-6175

Ph.D. (Electrical Engineering), Massachusetts Institute of Technology, 1984

Dr. Tsitsiklis' research interests are in systems theory with an emphasis on large scale and/or decentralized systems, as well as in distributed computation.

In context of systems theory he has worked on a variety of problems in stochastic control, dynamic programming, scheduling and optimal estimation. More recently he has been working on the analysis of large Markov chains with rare transitions, in connection with the simulated annealing algorithm. He has also performed an investigation of the difficulty of classical and decentralizea control problems, by drawing ideas from complexity theory. The general objective of these and future research activities is the development of new theoretical tools for dealing with complex systems.

In the context of distributed computation, he is primarily interested in asynchronous distributed iterative algorithms for optimization problems, with applications in data communication networks, scientific computation and distributed signal processing.

P. P. Vaidyanathan
Dept. of Electrical Engineering
California Institute of Technology, Pasadena, CA 91125

Assistant Professor
(818) 356-4681

Ph.D. (Electrical Engineering), Univ. of California, Santa Barbara, 1983

Dr. Vaidyanathan's main research interests are in digital signal processing, with particular emphasis on filter design and implementations. In the area of implementation, he has specific interests in passivity aspects in digital filter structures. He has applied the concepts of losslessness and passivity of digital networks in order to develop a number of new schemes for low sensitivity digital filter design. In the area of filter design he has been interested in the design of nonrecursive filters with efficient building blocks that reduce design and implementational complexity.

Currently he is interested in signal decimation and reconstruction concepts, and the role of digital passivity and losslessness in multirate signal processing including quadrature mirror filter banks. He also has interests in linear-system theory, image processing, and active networks.

Mechanics, Structures & Materials Engineering

Nicholas John Carpenter
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The Univ. of Notre Dame
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Ph.D. (Theoretical and Applied Mechanics), Northwestern University, 1985

The focus of Dr. Carpenter's research interest is in the develop .ent of advanced finite element methods for the analysis of plate and shell structures. A specific goal of his research is the development of a low-order finite shell element that is sufficiently accurate and computationally economical to be viable in non-linear analysis applications.

He has conducted an extensive study of shell test problems with existing finite shell elements which has led to a categorization of shortcomings with existing shell elements. His work in developing new kinematic formulations has succeeded in correcting specific shell element difficulties. He has developed low-order triangular shell elements that exhibit significantly improved behavior in complex membrane states and membrane/flexural coupling. The success with these formulations is a basis for his ongoing research effort to unify the kinematic requisites of an all-purpcse, theoretically rigorous shell element formulation.

Related activities of his research include transient non-linear analysis for large displacement/strain applications, treatment of composite materials, shell fracture effects, and fluid/structure interaction.

Walter J. Drugan
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Univ. of Wisconsin-Madison, Madison, WI 53706

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Ph.D. (Solid Mechanics), Brown Univ., 1982

Dr. Drugan's major field of research interest is analytical solid mechanics, with principal areas of specialization being fracture mechanics and plasticity. Much of his research is directed toward the development of the theoretical foundations of non-linear fracture mechanics.

A principal thrust is the analysis and prediction of stable crack growth and its transition to catastrophic fracture in elastic-plastic materials. Certain important materials, such as ductile metals, exhibit a phase of stable extension of cracks before catastrophic fracture occurs; accurate strength and safety assessments, and efficient design, of components fabricated from ductile materials must take account of this phenomenon. Recent and ongoing work involves near-tip analyses of the stresses and deformations produced by stably growing cracks in elastic-ideally plastic materials, for plane strain and plane stress conditions. One objective is to develop an approximate analytical method for assessing how different loadings and specimen geometries affect near-tip elastic-plastic fields. Crack growth and instability criteria are then based on the near-tip fields derived. He is particularly concerned with situations in which plastic flow is not highly constrained, and with situations involving substantial amounts of crack growth, as J-integral-based criteria generally do not apply in such cases An ultimate goal is to develop analytical criteria capable of predicting ductile crack growth throughout the range from initial well-contained yielding up through large-scale and general yielding.

Mark F. Hamilton
Dept. of Mechanical Engineering
The Univ. of Texas at Austin, Austin, Texas 78712

Assistant Professor
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Ph.D. (Acoustics), Pennsylvania State Univ., 1983

Dr. Hamilton's primary research interest is physical acoustics, and in particular the nonlinear phenomena associated with finite amplitude sound. Nonlinear effects impose an upper limit on how much sound power can be transmitted at any given frequency, but they also permit the formation of more highly directional sound beams than is possible using conventional techniques. Dr. Hamilton has investigated theoretically the diffraction, dispersion, reflection, and noncollinear interaction of high intensity sound beams. Exploitation of these phenomena has led to improved resolution in acoustic imaging systems.

His current research in nonlinear acoustics involves a combination of theoretical, numerical, and experimental techniques. He has developed a theory and acquired data that describe the highly dispersive nonlinear interaction of guided sound waves in higher order modes. Not only are the results of interest in the study of jet noise, but they may provide insight for current work in fiber optics, where the shorter wavelengths involved prevent similar measurements from being made. His numerical investigation of focused finite amplitude sound is motivated by the unexpectedly high resolution of acoustic microscopes that has been attributed to nonlinear phenomena. He is also studying noncollinear wave interactions for potential application to both measurement of ship noise and a recently demonstrated approach to medical acoustic tomography.

Robert John Hansman, Jr.
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Assistant Professor
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Ph.D. (Interdisciplinary: Physics, Meteorology, Aeronautics & Astronautics, Electrical Engineering), Massachusetts Institute of Technology, 1982

Dr. Hansman's research interests center on understanding and measuring the detailed interaction between flight vehicles and their atmospheric or space environment. For aircraft, he has specific interests in understanding the mechanisms by which environmental contaminants such as ice, rain or insects affect aircraft performance. For spacecraft, his current interests are on the effect of the low earth orbital (LEO) environment on spacecraft surfaces. He also is interested in the behavior of fluids in low gravity, such as those onboard orbiting spacecraft.

His current research ide include. 1) quantifying the effect of surface roughness on the laminar to turbulent transition in airfoil boundary layers, 2) the potential for remote detection of icing zones within the atmosphere utilizing mm wave meteorological radar, 3) fundamental studies of fluid behavior in low gravity including contact angle hysteresis effects, 4) aircraft instrumentation systems including ultrasonic icing sensors, and 5) measurement of the microwave properties of supercooled fluids utilizing resonant cavity perturbation techniques.

Kenneth C. Hover
Dept. of Structural Engineering
Cornell Univ., Ithaca, NY 14853

Associate Professor
(607) 255-3438

Ph.D. (Structural Engineering), Cornell Univ., 1984

Dr. Hover has over ten years of professional experience in the design and construction industry, combined with advanced training in structural materials and materials science. Based on this background, he is studying the influence of construction methods on the properties of concrete, with particular emphasis on durability. His long-term plan is to use the PYI award as a nucleus for the development of a concrete construction research program at Cornell.

Current and recently completed research includes a study of surface cracks in concrete slabs as a function of environmental conditions and surface finishing techniques. Work is also in progress on corrosion of reinforcing steel and alkali-aggregate reaction. Plans for the immediate future include expansion of these projects, plus evaluation of the porosity of concrete as a function of construction procedures.

Experimental work will be coupled with the development of an "Expert System" as a means of packaging advanced concrete technology in a manner accessible to the jobsite.

David L. McDowell
School of Mechanical Engineering
Georgia Institute of Technology, Atlanta, GA 30332

Assistant Professor
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Ph.D. (Mechanical Engineering), Univ. of Illinois at Urbana-Champaign, 1983

Dr. McDowell's primary research topics are relevant to problems faced by the nuclear, gas turbine engine, and ground vehicle industries. Though several areas are represented, his research program is focused on relating structural deformation to fatigue, creep, and fracture. Interests include. development of constitutive equations for deformation and damage of high temperature metals subjected to nonproportional cyclic loading; characterization of cyclic viscoplasticity of high temperature metals via unified creep-plasticity equations, and study of creep-fatigue interaction with emphasis on unified theories and continuum damage concepts, numerical integration techniques for time- and rate-independent and rate-dependent constitutive equations for cyclic stress-strain response which exhibit varying degrees of "stiffness", fatigue under conditions of multiaxial cyclic loading for which the principal axes of stress and strain rotate; mechanical and fatigue behavior of polymers and porous polymeric coatings applied to the interface of bone and high strength hip implants and stress analysis of total hip implant systems, development of constitutive equations for anisotropic creep damage for high temperature stainless steels subjected to non-proportional loading, railroad wheel-track interactions, elastic-plastic contact problems, and cyclic racheting (corrugation) problems for track.

Shantikumar V. Nair
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Assistant Professor
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Ph.D. (Metallurgy and Materials Science), Columbia Univ., 1983

Dr. Nair's research interest is in the area of plastic flow and fracture of composite materials. This involves the study of the mechanisms responsible for the observed fracture properties, such as, for example, ductility, fracture toughness, fatigue crack growth, subcritical crack growth rate in different environments and environmental fracture thresholds. His primary interest is in fracture mechanical properties and in understnding how, mechanistically, the unique composite material microstructure influences such properties. He is interested also in developing analytical and computer oriented mechanistic models of fracture in composites that take account of the novel composite microstructures. One goal of this is the improvement of composite processing and/or microstructural design to result in high performance composites.

Dr. Nair has worked on fracture toughness and environmental crack initiation and growth properties of high strength alloys. Currently, he is working on whisker reinforced metal matrix composites. This study involves experimental identification of the microstructural components responsible for fracture in the crack initiation and growth regimes and tying this to a micromechanistic fracture mechanical model developed by him in other multiphase alloys. He has also developed a unique experimental method for the evaluation of mode III or shear fracture toughness of composites which can additionally provide information on composite wear characteristics.

Alric Paul Rothmayer
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Iowa State Univ., Ames, IA 50011

Assistant Professor
(515) 294-8245

Ph.D. (Aerospace Engineering and Engineering Mechanics), Univ. of Cincinnati, 1985

Dr. Rothmayer's primary research interests lie in the theory and computation of viscous fluid flows. In the area of laminar viscous flows, he is interested in developing computational methods for calculating large Reynolds number highly separated flow. He has accomplished this goal already for two-dimensional thin eddies and is interested in extending his method to unsteady and three-dimensional flows.

In the area of transition and turbulence, he is interested in developing high Reynolds number asymptotic methods based on triple-deck theory in order to track the transition process for laminar to turbulent flow in boundary-layers. Ultimately, he believes that this approach will lead to a fully unsteady microscale theory of turbulence. In addition, he hopes to merge the interacting boundary-layer approach with this asymptotic theory in order to provide a practical means of calculating transition to turbulence at high Reynolds numbers.

Currently, Dr. Rothmayer's research efforts are focused on two specific areas. The first is a generalization of Prandtl thin airfoil theory, involving linearizations about arbitrary curves in space. This method, coupled with a generalized Schwarz-Christoffel mapping for curved surfaces, provides an interacting boundary-layer model which is capable of handling true bluff-body separation as well as unstalled flow over thick airfoils at large angles of attack. The second research area includes the development of an asymptotic theory of two and three-dimensional high-frequency large-amplitude wave-packets in boundary-layers.

Clyde Boswell Tatum
Dept. of Civil Engineering
Stanford Univ., Stanford, CA 94305

Associate Professor
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Ph.D. (Civil Engineering), Stanford Univ., 1983

Dr. Tatum is seeking means to increase the rate of technological advancement in the construction industry. Increasing demands of owners, greater technical complexity of constructed facilities, and more intense foreign competition, each highlight the need for an increased rate of advancing construction technology. In a broad view, his research plans involve analysis and modeling mechanisms for research and innovation in construction, and their role in strategic planning for technological advancement. In addition to this investigation of innovation in construction, his research interests also include two related topics. means to strengthen the engineering/construction interface, and designing constructed facilities to support the automation of construction operations.

His current research involves three major thrusts to increase fundamental understanding of construction technology and provide mechanisms and strategies for its advancement. First, he is developing a technological classification of construction operations which will highlight important differences and provide a measurement tool for studies of technological advancement. Second, he is conducting an exploratory study of fundamental mechanisms for technological innovation in construction. The third phase of this research involves developing long-term strategies for technological advancement in construction, these strategies will identify the changes with the greatest leverage for improvement. In related research regarding means to strengthen the engineering/construction interface, he is also investigating constructibility improvement during conceptual planning and the use of techniques such as modularization and pre-assembly.

Tayfun Ersin Tezduyar
Dept. of Mechanical Engineering
Univ. of Houston-University Park, Houston, TX 77004

Assistant Professor
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Ph.D. (Mechanical Engineering), California Institute of Technology, 1982

Dr. Tezduyar's research interests are in the area of computational mechanics, with particular emphasis on finite element analysis and computational fluid dynamics. His research activities involve the development and methematical analysis of general purpose computational methods for solving fundamental and technological problems in continuum mechanics and aerospace sciences. He has special interest in the application of the finite element method to problems governed by the convection/diffusion/reaction, compressible Euler, and Navier-Stokes equations. The finite element method can easily handle problems with intricate geometries. This method, which has traditionally been very successful in structural and thermal analysis, is expected ultimately to have a significant role in computational fluid dynamics.

Among the particular projects Dr. Tezduyar has undertaken are: numerical simulation for microgravity flows and electrophoresis separation phenomena, single-well chemical tracing for measuring residual oil saturation, transonic and hypersonic flows past bodies of various geometries.

Emerging & Critical Engineering Systems

Prasad S. Dhurjati
Dept. of Chemical Engineering
Univ. of Delaware, Newark, DE 19716

Assistant Professor
(302) 451-2879

Ph.D. (Chemical Engineering), Purdue Univ., 1982

Dr. Dhurjati's primary research interest is in biochemical engineering. Another active area of his research is in engineering applications of expert systems.

The focus of his biochemical engineering research program is to gain a fundamental understanding of the host-plasmid interactions that occur in "genetically engineered" microorganisms and to explain how these interactions affect the stability, growth kinetics and product-gene expression in recombinant systems. The microbial hosts that are being examined include the following. procaryotes such as *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas putida* and *Bacillus subtilis* and eucaryotes such as *Saccharomyces cerevisiae*. By examining these various systems experimentally, he intends to extract general engineering principles on recombinant systems and cast this information in the form of mathematical models.

His research program in the expert systems area is aimed at developing strategies for fault diagnosis in dynamic systems. New methodologies are being developed that combine traditional heuristic expert system methods with quantitative engineering approaches. This hybrid expert system, FALCON, is being tested for fault diagnosis in a commercial scale chemical process. This new expert system methodology is also being extended to the control of complex biological processes.

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Patrick T. Harker
Dept. of Decision Sciences, The Wharton School
Univ. of Pennsylvania, Philadelphia PA 19104

Assistant Professor
(215) 898-4715

Ph.D. (Civil Engineering), Univ. of Pennsylvania, 1983

Dr. Harker's primary research interest is in the area of operations research, especially as applied to problems in the transportation/logistics area and in regional planning. In the area of operations research methodology, he has particular interest in large-scale nonlinear programming and variational inequality theory, a theory which unifies the fields of mathematical optimization, complementarity theory, fixed point theory, and the theory of partial differential equations. He also has interests in the theory of the Analytic Hierarchy Process, a decision-making methodology which is widely used in industry and government. In addition to an interest in the theoretical and computational aspects of variational inequalities, he has been involved in several applications of these techniques to problems in transportation, spatial economic theory, game theory and marketing.

In the area of transportation/logistics planning, Dr. Harker's main areas of interest are in the management of freight transportation systems, especially railroad and intermodal operations and the modelling of hazardous materials movements. In addition, he is involved in research which concerns the privatization of the urban mass transportation industry in the United States.

Benjamin Field Hobbs
Dept. of Systems Engineering, 618 Crawford Hall
Case Western Reserve Univ., Cleveland, OH 44106

Assistant Professor
(216) 368-4463, 368-4053

Ph.D. (Environmental Systems Engineering), Cornell Univ., 1983

Dr. Hobbs is concerned with the use of systems analysis and economics to understand and solve problems concerning the supply, reliability, and quality of energy, water, and environmental resources. He has emphasized the development of mathematical methods for simulating and optimizing resource systems while considering their engineering, economic, and environmental aspects.

Methods for estimating and optimizing the reliability of water supply which consider not only hydrologic reliability but also equipment failures, contamination, and randomness in demand represent a major focus of his work. A second focus is on the problems that arise at the interface between energy and water resources planning. He has been developing and applying mathematical programming methods to simulate the operation of water markets and simulation models to analyze the risks of improper disposal of oil field wastes.

Another direction is the creation of mathematical programming models of oligopolistic spatial markets and their use in better understanding energy markets. Most energy models do not recognize the market power that consumers, producers, and transporters of energy exercise, models which consider that power would be more credible. He has used imperfect market models to analyze the possible price impacts of electric power deregulation.

A final focus is on the improvement of multiobjective decision making methods and their application to power and water system planning problems. He has emphasized experimental comparisons of methods, which yield critical information on what improvements are needed.

Wei-Shou Hu
Dept. of Chemical Engineering and Materials Science
Univ. of Minnesota, Minneapolis, MN 55455

Assistant Professor
(602) 373-2366

Ph.D. (Biochemical Engineering), Massachusetts Institute of Technology, 1983

Dr. Hu's primary research area is biochemical engineering, with emphasis on experimental studies and the development of kinetic models. The systems employed include anchorage-dependent and suspension-grown mammalian cells as well as microorganisms.

A research project on mammalian cell culture focuses on the kinetic relationship between growth and the metabolism of two major nutrients: glucose and glutamine. Review of the existing knowledge of cell metabolism suggests that a multiplicity of steady states can possibly exist in a continuous culture. The implication of this postulate for a batch culture is that cells can be cultivated at the same growth rate but with various combinations of nutrient consumption and metabolite accumulation rates. Since a high concentration of metabolites is growth inibitory it is necessary to define the optimum path for a batch reaction along which the metabolic state is controlled to minimize the effect of product inhibition. These postulates are now being examined both experimentally and theoretically.

Research on hybridoma cell culture concentrates on the kinetic relationship between growth rate and monoclonal antibody production. Special attention is given to the applicability of models of the Monod type to hybridoma cell cultivation. The variables being measured include not only the concentration of extracellular substrates, metabolites and products, but also the transcription rate of immunoglobulin messenger RNA. A second aspect of this research deals with the genetic stability of hybridoma cells in culture. Hybridoma cells cultivated in vitro often lose their ability to produce monoclonal antibodies. Such loss of productivity can be a problem in scaling up a hybridoma cell culture. The approach being pursued is in-situ selective immobilization of producer cells.

Michael Ira Miller
Dept. of Electrical Engineering
Washington Univ., St. Louis, MO 63130

Assistant Professor
(314) 889-6195, 362-2135

Ph.D. (Biomedical Engineering), The Johns Hopkins Univ., 1983

Dr. Miller's primary research interests are in speech coding, image processing, and inference on stochastic processes. He has been involved in the use of recursive algorithms for the generation of maximum-likelihood and maximum-entropy estimates in problems in which the data is noisy, as well as incomplete.

Currently, his research applications are predominantly in the areas of speech coding in the auditory system, image processing and spectral estimation for array processing. In the auditory system, he has studied how the inherently statistical nature of the auditory nerve determines the fundamental limitations for the coding of speech and other complex acoustic stimuli. His work in image processing has been toward the development of new quantitative algorithms for the inference of physiologic mechanisms from image data generated with a single photon gamma camera and from autoradiographs generated at the electron-microscope level. His work in spectral estimations has been oriented towards generating maximum-likelihood and maximum-entropy covariance estimates from time-series in array processing problems.

Peter A. Rogerson
Dept. of Civil Engineering
Northwestern Univ., Evanston, IL 60201

Assistant Professor
(312) 491-4037

Ph.D. (Geography), State Univ. of New York at Buffalo, 1982

Dr. Rogerson's area of expertise is the analysis and forecasting of demographic-economic changes at the regional, metropolitan, and submetropolitan levels of detail. His research has an impact on both public and private sector decision making. For the public sector, his concern is with applications to urban planning, the sizing and location of public facilities, and the regional allocation of public expenditures. On the private sector side, his work has applications in improving the location, job expansion, and marketing strategies of firms and industries. His research also has important implications for improving manpower planning capabilities through its focus on improved forecasts of urban and regional labor pools and their characteristics.

His current research involves the development of a comprehensive framework to forecast changes in the size, structure, and location of households. In light of dramatic changes in household composition during the last two decades, there is a pressing need to develop models of household change to complement our better understanding of population change. A related area of research to which he is devoting attention concerns the efficiency with which households and housing vacancies are matched in local housing markets.

Frieder Seible
Dept. of Applied Mechanics and Engineering Science
Univ. of California at San Diego, La Jolla, California 92093

Assistant Professor
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Ph.D. (Civil Engineering), Univ. of California at Berkeley, 1982

Dr. Seible's research is focused on the behavior of structural systems under service loads, overloads and failure loads. His research interest is in the area of the development and validation of analytical models to predict the highly nonlinear post-working stress behavior of reinforced concrete, prestressed concrete and reinforced concrete masonry structures under critical loads, such as seismic forces.

One of his continuing research interests is in the area of design, analysis and state determination of reinforced and prestressed concrete bridge structures and the effects of rehabilitation repair or strengthening measures. Complex analytical models and simplified engineering models are used to predict time and environment dependent behavior, progressive structural damage and possible failure modes.

The validation of analytical models can be achieved by large or full scale testing of structural systems up to 5 stories high and over 100 feet in length in the UCSD Charles Lee Powell Structural Systems Laboratory. This laboratory features a 50 foot high reaction strong wall and a 120 foot long box girder reaction floor.

Mitchell J. Small
Depts. of Civil Engineering and Engineering & Public Policy
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Assistant Professor
(412) 268-8782

Ph.D. (Environmental and Water Resources Engineering), Univ. of Michigan, 1982

Dr. Small's research is on the mathematical modeling of environmental quality. He has developed and applied models for surface water, ground water, air, and multimedia systems; with an emphasis on the use of probabilistic methods to represent random processes in the environment. He has developed methods which incorporate variability and uncertainty, providing more effective assessment tools for environmental decision makers in both the regulatory and industrial community.

Dr. Small's major application interests include models to predict the response of regional lake chemistry and fish resources to acid deposition and liming, the incorporation of meteorological variability in long-range atmospheric transport models, methods for representing uncertainty in groundwater transport models, and the evaluation of inspection programs for liquid underground storage tanks. Newer interests include air-water exchange of chemicals under varying meteorological or process conditions and models for the regional distribution and mitigation of indoor radon.

Doreen Anne Weinberger
Electrical Engineering and Computer Science Dept.
Univ. of Michigan, Ann Arbor, MI 48109

Assistant Professor
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Ph.D. (Optical Sciences), Univ. of Arizona, 1984

Dr. Weinberger's interests lie in the area of nonlinear optics. Much of her previous work has involved investigation of nonlinear mechanisms in semiconductor materials, with particular emphasis on optical bistability. Currently her research interests comprise three main areas: 1) investigation of III-V semiconductor multiple quantum well (MQW) structures (e.g. GaAs-AlGaAs) using time-resolved, ultra-fast laser techniques. Such MQW's have extremely large room-temperature nonlinearities. Pump-probe and transient four-wave mixing techniques will allow characterization of the complex carrier dynamics, including relaxation and diffusion processes, which give rise to the nonlinearities. 2) Improvement of MQW device operating characteristics and realization of novel optical devices. For example, demonstration of parallel operation of many optically bistable elements, functioning as optical switches or logic gates, is of great interest for image processing applications. She is investigating techniques involving holographic "beam-steering" to address the individual pixels. Similarly, tunneling in MQW's under applied transverse electric fields may result in extremely fast optical modulators. 3) Integration of optical and optoelectronic MQW devices directly onto optical fibers via a novel lateral coupling technique, facilitating on-line signal processing. She is also performing theoretical calculations of such coupling to optical fibers, as well as computations of nonlinear processes in the fibers themselves (such as frequency mixing via a quadrupolar nonlinearity).

Materials Research

Louis Aub Bloomfield
Dept. of Physics
Univ. of Virginia, Charlottesville, VA 22901

Assistant Professor
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Ph.D. (Physics), Stanford Univ., 1983

Dr. Bloomfield's research interests include the study of atomic clusters, atomic and molecular physics, and nonlinear optics. In the area of atomic clusters, he is primarily interested in the emergence of solid state band structure from the discrete molecular energy levels of small particles. This work involves both the production of ultrafine aggregates and subsequent analysis of their electronic and material properties. His research in atomic physics centers around Rydberg and autoionizing states in one and two electron atoms with the goal of understanding highly correlated electronic systems and atoms in strong fields. His interests in nonlinear optics involve the production of short wavelength coherent radiation, using both pulsed and continuous-wave lasers, as well as a number of nonlinear laser spectroscopies.

He is currently developing equipment to generate intense, continuous beams of neutral and charged atomic clusters for use in electron photoemission, laser photodissociation, and electron photodetachment experiments. These sources will also be suitable for vacuum deposition to imbed clusters in normal bulk solids. This process will produce macroscopic materials with cluster properties and permit the studies of matter in confined goemetries and cluster-solid interfaces.

Alex L. de Lozanne
Dept. of Physics
Univ. of Texas at Austin, Austin, TX 78712

Assistant Professor
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Ph.D. (Physics), Stanford Univ., 1982

Tunneling microscopy is a new technique that uti[illegible] the quantum mechanical tunneling of electrons between a sharp tip and a sampl[illegible] [illegible] the tip is rastered at a constant separation of about 5 angstroms (about two at[illegible] diameters) from the surface, an image of the surface topography is obtained. Impressive results have already been achieved with this technique, like the image of a silicon surface which directly shows every atom on the surface unit cell. This particular image has settled many controversial questions because it gives much more information than was available from all of the other surface techniques.

Dr. de Lozanne is interested in the application of tunneling microscopy to current scientific and technological problems in superconductivity, semiconductors, magnetic films, and surface chemistry. At present, he has a tunneling microscope operating in ultra high vacuum at room temperature and is studying the growth of nickel films on silicon. In the near future this microscope will be able to operate at temperatures near 4 degrees Kelvin, which will allow him to study superconductors, charge density waves and surface chemistry.

A secondary interest is in the area of Josephson devices, which have important practical applications as the most sensitive detectors of magnetic fields, voltage, and current, as well as high frequency analog and digital curcuitry.

Stephen Douglas Kevan
Physics Dept.
Univ. of Cregon, Eugene, OR 97403

Associate Professor
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Ph.D. (Physical Chemistry), Univ. of California, Berkeley, 1980

Dr. Kevan's research effort is centered primarily in surface chemical physics. In particular, the goal is to characterize the interplay between the processes involved in the growth of thin metallic and semiconducting films and the resulting structural and electronic properties. He is in the process of developing and applying novel surface techniques having sufficient dynamic range to study not only static film properties but also the dynamic processes involved in film growth. By tuning the critical experimental parameters involved—temperature, growth rate, and ambient environment—procedures will be developed to produce films of high crystalline perfection with the desired characteristics.

Emphasis is currently on three distinct techniques. Thin film electronic structure is being characterized by high resolution angle-resolved photoemission experiments. Extensive experimental capabilities at the National Synchrotron Light Source are allowing a detailed analysis of the valence electronic structure of metallic films on metallic and semiconducting substrates and of semiconductor heterojunctions. The second direction is in the area of vibrational spectroscopy. A novel, high signal spectrometer under construction will allow real-time studies of the dynamical steps involved in the growth process itself. Finally, future efforts in surface nonlinear optical studies are planned. In addition to characterizing the optical properties of the films, it is hoped that these will have particular sensitivity to defect sites on the growing surface.

Thomas J. McCarthy
Dept. of Polymer Science and Engineering
Univ. of Massachusetts, Amherst, MA 01003

Assistant Professor
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Ph.D. (Organic Chemistry), Massachusetts Institute of Technology, 1982

Dr. McCarthy's research involves the chemistry of surfaces and interfaces and olefin metathesis polymerization. He is interested in the extent to which solution organic chemistry can be applied to organic functional groups confined to two dimensions and exploiting olefin metathesis chemistry for the preparation of polymeric materials.

His current research includes 1) the synthesis of two-dimensional arrays of versatile organic functional groups on chemically resistant polymer surfaces, 2) the preparation of gradient modulus interfaces in composites, 3) the synthesis of chemically defined metal-polymer and polymer-polymer interfaces, and 4) controlling initiation, propagation and termination reactions in olefin metathesis polymerization.

His long range scientific objective is to establish a molecular basis for controlling structure in solids, particularly at interfaces between dissimilar materials

Stephen Eric Nagler
Dept. of Physics, 215 Williamson Hall
Univ. of Florida, Gainesville, FL 32611

Assistant Professor
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Ph.D. (Physics), Univ. of Toronto, 1982

Dr. Nagler's field of interest is experimental condensed matter physics. In particular he utilizes synchrotron radiation, X-ray scattering, (i.e diffraction), and neutron scattering techniques to probe the microscopic structure and dynamics of materials. Some of his recent projects include studies of non-linear excitations in "one-dimensional" magnetic materials, phase transitions in adsorbed monolayers, and ordering in random magnetic and dielectric materials.

A new thrust of his current research is the study of non-equilibrium phenomena using time resolved scattering techniques. The systems under investigation include the kinetics of phase transitions in thin films and annealing processes in ion implanted semiconductor materials.

Mark Owen Robbins
Dept. of Physics and Astronomy
Johns Hopkins Univ., Baltimore, MD 21218

Assistant Professor
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Ph.D. (Physics), Univ. of California at Berkeley, 1983

Dr. Robbins' research covers several areas within theoretical condensed matter physics. His thesis work focused on ordering trends in intermetallic alloys. Recently, this work has been extended to calculations of alloy phase diagrams. As a postdoctoral fellow at Exxon his focus shifted to studies of novel nonlinear behavior of charge-density wave conductors. A continuing interest is development of new techniques for calculating the conductivity and other properties of these complex materials. He has also been involved in experimental measurements of the noise in charge-density wave conductors which can be used as a probe of the underlying conduction mechanism.

Current research interests include simulation studies of colloidal systems, the structure of monolayers of surfactant molecules, fluid flow through porous media and "why raindrops stick on window panes." The thread connecting the last two topics and his previous work on alloys and charge-density wave conductors is an interest in the effects of disorder on physical properties. Another major interest is in the dynamics of systems far from equilibrium. Examples include charge-density wave conduction and melting of colloidal crystals under an applied shear.

Mathematics

F. Michael Christ
Dept. of Mathematics
Princeton Univ., Princeton, NJ 08544

Assistant Professor
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Ph.D. (Mathematics), Univ. of Chicago, 1982

Dr. Christ's research is in Fourier and harmonic analysis. Topics studied have included delicate aspects of the convergence of Fourier series in several variables, mapping properties of the Radon and x-ray transforms, and analysis on nilpotent Lie groups. The principal focus of his work in the last two years has been the extension of the Calderon-Zygmund theory of singular integrals, which has had extensive applications in the study of partial differential equations over the past thirty years, to a variety of more singular operators and problems. Some of these operators arise in hyperbolic and subelliptic partial differential equations. This work has been based on a mixture of analytic techniques from Fourier analysis with more geometric reasoning, and has centered largely around curvature and its ramifications. This program is currently being actively pursued, and much remains to be understood.

Recently Dr. Christ has also investigated higher-dimensional analogues of the Calderon commutator operators. These arise in connection with boundary value problems for elliptic partial differential equations with nonsmooth coefficients. One goal of this work is to construct an algebra and calculus of operators appropriate for the treatment of such equations.

Jonathan B. Goodman
Courant Institute of Mathematical Sciences, 251 Mercer Street
New York Univ., New York, NY 10012

Assistant Professor
(212) 460-7310

Ph.D. (Mathematics), Stanford Univ., 1982

Dr. Goodman is interested in theoretical and computational problems in applied mathematics. He has studied problems in supersonic and transonic flow. This included design and analysis of numerical methods for shock wave computations with or without boundaries. To understand shock wave formation in steady transonic flow, he studied a simple model (Tricomi's equation) boundary value problem and constructed formal solutions with singularities at the point where shock waves are observed to form. He has proved local existence theorem for nonlinear equations of transonic type. Finally, he has studied the stability of traveling viscous shock waves and other traveling waves.

Another general interest of his is applied problems involving random behavior. In some cases, such as Chorin's random vortex method, the randomness is artificially introduced into computations. In other cases, such as in statistical mechanics and Euclidian lattice field theories, the randomness is part of the physics. Finally, in analysis of comunication networks, randomness is a crude approximation to unpredictable loads.

He is currently working on topics discussed above and on the behavior of dispersive waves and fluid mixtures.

Lloyd Nicholas Trefethen
Dept. of Mathematics
Massachusetts Institute of Technology, Cambridge, MA 02139

Assistant Professor
(617) 253-4986

Ph.D. (Computer Science), Stanford Univ., 1982

Dr. Trefethen's field of research is numerical analysis and scientific computation, with specializations in three areas:

1) Finite difference and spectral methods for partial differential equations. Trefethen has been particularly concerned with stability, wave phenomena, and specification of boundary conditions, including "absorbing" boundary conditions. Principal application areas have been fluid mechanics, geophysics, and underwater acoustics.

2) Numerical conformal mapping and applications. He has developed a Fortran package for computation of conformal maps of polygons, and applied these methods to problems in integrated circuitry, queueing theory, and the fluid dynamics of wakes, jets, and cavities (free-streamline flows).

3) Approximation theory and applications. Trefethen is the inventor of the "CF method" for near-optimal approximation by rational functions on intervals and disks, and he is currently involved with CF-related and other questions in approximation theory. Applications of special interest include the design of recursive digital filters and of efficient iterative methods for solving large systems of linear equations.

Shmuel Weinberger
Dept. of Mathematics, 5734 University Avenue
Univ. of Chicago, Chicago IL 60637

Assistant Professor
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Ph.D. (Mathematics), New York Univ., 1982

A major interest of Dr. Weinberger is the understanding of geometric topological invariants of spaces and spaces with group action. Even if one starts with manifolds, one is quickly and inevitably led to study singular spaces. This area is currently active because of connections to algebraic geometry and representation theory. The study of invariants of group actions, notably the equivariant signature, is intimately connected to the number theory of cyclotomic fields, index theory, global analysis on Lipschitz manifolds, and draws as well on the more familiar techniques of manifold theory and homotopy theory.

Brian Cabell White
Mathematics Dept.
Stanford Univ., Stanford, CA 94305

Assistant Professor
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Ph.D. (Mathematics), Princeton Univ., 1982

Dr. White works in geometric measure theory, differential geometry, and the calculus of variations. His main interest is the nature of singularities in the solutions of variational problems. In particular, he studies surface energy phenomena in equilibrium configurations of immiscible fluids, soap films, and liquid crystals.

Dr. White also investigates the interplay between topology and analysis in the multidimensional calculus of variations.

Physics

Douglas Earl Holmgren
The Institute of Optics
Univ. of Rochester, Rochester, NY 14627

Assistant Professor
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Ph.D. (Applied Physics), Stanford Univ., 1985

Dr. Holmgren's research interest is in the area of extreme ultraviolet physics and optical phenomena. The development of new sources of short wavelength radiation (less than 1000 Angstroms) has been one of his primary interests. He has investigated methods of exciting atoms to highly excited states, and has been interested in the spectroscopy of atoms which radiate in the extreme ultraviolet.

His current research in this area of atomic physics includes an investigation of two techniques for producing core-excited atoms. multiphoton absorption and atomic collisions. With regard to the latter, he has demonstrated a technique of selective excitation of core-excited atoms using laser-switched charge exchange collisions. In addition he is investigating the fabrication of short wavelength optical elements in collaboration with the Optical Coating Facility of the Institute of Optics.

Lawrence Maxwell Krauss
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Yale Univ., New Haven, CT 06511

Assistant Professor
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Ph.D. (Physics), Massachusetts Institute of Technology, 1982

Dr. Krauss' research activities involve principally four areas; the interface between particle physics and cosmology/astrophysics, particle phenomenology, ultrasensitive detection methods, and field theory and condensed matter physics. These reflect in different ways his interest in extending the realms in which we may empirically explore fundamental physics. Three recent problems on which he is focussing attention include:

a) Dark matter in the universe: he has investigated how new particles and interactions can affect evolution both in the early universe and in stellar interiors. He has also proposed new signatures and detection mechanisms for dark matter candidates. He hopes to extend his work in these areas by the use of numerical modelling methods.

b) Theoretical and experimental constraints on elementary particles and their interactions: he has recently been investigating new sensitive detection methods for "invisible" axions and associated CP violation.

c) Development of new cryogenic and bolometric techniques for ultrasensitive detection in particle physics, condensed matter physics and technology: this program originated in an effort to develop a new bolometric detector for low-energy reactor and solar neutrinos, utilizing the very low specific heat of silicon or other materials. This project has the potential for significant technological application, in condensed matter physics, nuclear reactor and weapons monitoring, and in trace analysis, for example.

Jeffrey B. Peterson
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Assistant Professor
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Ph.D. (Physics), Univ. of California at Berkeley, 1985

Dr. Peterson's primary interest is the evolution of the early universe. The spectrum of the Cosmic Background Radiation (CBR) carries information about energetic processes that occurred between 10 hours and 10,000 years after the initial singularity of the Big Bang. By making accurate measurements of the spectrum cosmologists can constrain the masses and decay rates of long lived neutrinos, axions and Higgs scalar particles. These measurements also constrain the rate of annihilation of residul antimatter, the degree of turbulence of the primordial plasma and the production rate of dust in the earliest stars. Dr. Peterson works on improvements to instruments which measure the CBR spectrum.

From measurements of the isotropy of the CBR cosmologists believe that the primordial plasma was highly isothermal. After the plasma recombined to form neutral hydrogen, slightly overdense regions were no longer supported by radiation pressure. Galaxies and clusters of galaxies began to form through gravitational collapse. If in the early universe protons were formed in proportion to the local density of photons, the seeds of clusters of galaxies should be visible in the CBR as temperature fluctuations. Dr. Peterson is contributing to the design of a 1 meter telescope capable of detecting these seeds.

Other questions which interest him include. How can the quantum Johnson noise of a very cold resistor be measured? What laboratory experiments in general relativity are possible through recent advances in technology? Do vacuum fluctuations have active gravitational mass?

Lee Gordon Sobotka
Dept. of Chemistry
Washington Univ., St. Louis MO 63130

Assistant Professor
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Ph.D., (Chemistry), Univ. of California, 1982

Dr. Sobotka's research interests involve the study of the reaction pathways when two heavy nuclei collide. This includes the study of fusion and fission of nuclei throughout the periodic table. In some of his most recent work, Dr. Sobotka has studied the fission of medium mass nuclei. In this work he was able to explain the resulting mass distribution and the dependence of the mass distribution of angular momentum. Work along these lines is also directed at understanding with a single formalism the decay of excited nuclei into two or more fragments, with any range of fragment size asymmetry.

Another project involves the measurements of the division of excitation energy between nuclear decay products and determination of the partition function which describes the distribution of excitation energy in the individual decay products.

Dr. Sobotka's experimental work is conducted at various heavy-ion accelerators located in the U.S. and in Europe. At Washington University, he designs and constructs detectors for ionizing radiation as well as performs data analysis and theoretical calculations.

Social & Behavioral Sciences

Peter Galison
Dept. of Physics, Dept. of Philosophy and Program in History of Science
Stanford Univ., Stanford, CA 94305

Associate Professor
(415) 723-9461

Ph.D. (Physics and History of Science), Harvard Univ., 1983

Dr. Galison's research is divided between the history of recent physics and phenomenological high-energy physics.

The most obvious change in modern fundamental physics is the growth of industrial-sized experimental facilities, yet little is known about the effects of teamwork, computers, and instruments on the evolution of the discipline. In his historical work, Galison is tracing two twentieth-century traditions of experimental apparatus as they have grown to massive proportions: instruments designed to exhibit visual information about individual events, such as the bubble chamber, cloud chamber and emulsion stacks, and a competing tradition that seeks to collect vast amounts of data through electronic logic circuits—such as counters, spark chambers and wire chambers.

Along with the fusion of the two instrumental traditions, experiments have grown to teams of 150 Ph.D.'s, and may soon expand to several hundred. One can ask: how are scientific projects divided among different subgroups? How do the sociological divisions in the experimental workplace affect the construction of arguments? How does the apprenticeship system function in a ten-year long, multi-university project? What can other branches of the natural sciences learn from the experience of high-energy physicists with the transition between desk-top and big-team experimentation?

In his physics research Galison is working on model building in particle physics, and phenomenology associated with the superconducting super collider.

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Lawrence H. Summers
Dept. of Economics
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Professor
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Ph.D. (Economics), Harvard Univ., 1984

Dr. Summers' research interests center on the economic analysis of capital and labor markets. His reseach on capital accumulation explores the impact of tax policies on capital investment and economic growth. A primary concern has been the development of an "asset price approach" to capital income taxation. This approach permits analysis of the effects of alternative tax policies on both existing wealth holders and on new investment. Future research will concentrate on elucidating the interrelationships between capital accumulation and productivity.

Particular attention will be devoted to the linkages between investment and the creation and assimilation of new technologies. International comparisons of countries with differing investment rates will play a major role.

Research on the labor market will focus on the development and testing of theories explaining how unemployment can persist in competitive labor markets; alternative "efficiency wage" theories explaining why firms do not find it profitable to reduce their wages even in the face of an excess supply of labor; and econometric tests of the theories using both time series and cross section data. Applications of the efficiency wage to problems in macro-economics, trade and labor market theory will be pursued. Potential industrial policy implications of efficiency wage theories will also be explored.

III. Active 1985 Presidential Young Investigators

Astronomical Sciences

Stephen Kent
Dept. of Astronomy
Harvard Univ., Cambridge, MA 02138

Observational and theoretical problems in extragalactic astronomy, searches for unseen matter in the universe; dynamics of galaxies. Use of CCD's and other high quantum-efficiency detectors in critical low-light level imaging applications.

Arieh Konigl
Dept. of Astronomy and Astrophysics
Univ. of Chicago, Chicago, IL 60637

Theoretical astrophysics: energetic phenomena and high-Mach-number flows, especially in connection with cosmic jets and active galactic nuclei, applications of magnetohydrodynamics and plasma physics to galactic and extragalactic studies.

E.S. Phinney
Dept. of Theoretical Astrophysics
California Institute of Technology, Pasadena, CA 91125

Theoretical astrophysics: plasma astrophysics, magnetohydrodynamics, physics of black holes: especially as applied to radio galaxies and jets. Radiation processes; models of the continuum emission of active galactic nuclei and galactic X-ray sources. Expanding interests in the oscillations of the sun and stars.

Ethan T. Vishniac
Dept. of Astronomy
Univ. of Texas, Austin, TX 78712

Astrophysics: cosmology and the formation of large scale structure in the universe; particular interests include hydrodynamic processes at moderate redshifts, constraints on galaxy formation from microwave background, shock wave fragmentation and application to interstellar medium; origin of turbulent viscosity in accretion disks.

Atmospheric Sciences

Robert L. Lysak
School of Physics and Astronomy
Univ. of Minnesota, Minneapolis, MN 55455

Space plasma physics: auroral electrodynamics, particle acceleration, MHD and plasma waves, wave-particle interaction; MHD computer modelling of large-scale auroral plasma including kinetic effects as nonlinear transport coefficients to understand auroral current generation and the interaction of auroral currents with the ionosphere.

Biology

Paul G. Ahlquist
Biophysics Laboratory
Univ. of Wisconsin, Madison, WI 53706

Molecular biology: replication and gene expression of eukaryotic RNA viruses, development of eukaryotic gene expression vectors based on RNA viruses, for plant and other host systems; new approaches to RNA virus genetics, long- and short-term evolution of RNA-based genetic systems.

Stuart Allison
Dept. of Chemistry
Georgia State Univ., Atlanta, GA 30303

Brownian dynamics (diffusional) simulation of diffusion controlled reactions, fluorescence depolarization and energy transfer, and light scattering. Light scattering from macromolecules.

Kathryn V. Anderson
Dept. of Molecular Biology
Univ. of California - Berkeley, Berkeley, CA 94220

Early embryonic determination, genetic and molecular analysis of the generation of the dorsal-ventral pattern of the Drosophila embryo, currently cloning two of the genes specifically required for this process in order to have molecular probes for defining the spatial distribution and activity of their protein products.

S. Marc Breedlove
Dept. of Psychology
Univ. of California - Berkeley, Berkeley, CA 94720

Developmental neurobiology. steroid hormone influences on the development and function of the nervous system in rodents, regulation of cell death in development and pathology; factors altering the synaptic structure of the mature nervous system, interaction of motoneurons and their target muscles, seasonal variations in neuronal morphology.

Jeannette Chloe Bulinski
Dept. of Biology
Univ. of California, Los Angeles, CA 90024

Cell and molecular biology. biochemistry and function of cytoskeletal proteins, peptides and peptide antibodies for research and diagnostics. Investigates the differential expression and function of isoforms and post-translationally modified forms of proteins whose slight (1-4 amino acids of sequence) differences are distinguished by highly specific antisera.

Vicki L. Chandler
Dept. of Biology
Univ. of Oregon, Eugene, OR 97403

Plant molecular biology: combining genetics and molecular biology to investigate the regulation of gene expression during the development of the maize plant; tissue-specific and developmental time-specific synthesis of anthocyanin (purple) pigments; transposable genetic elements, their origin, and the role DNA methylation may play in controlling transposable element activities.

Paul Alan Cox
Dept. of Botany and Range Science
Brigham Young Univ., Provo, Utah 84602

Ethnobotany: tropical ethnomedicine, interested in medicinal plants containing promising new pharmacological compounds. Tropical ecology. evolution of plant breeding systems in tropical rainforests; island colonization and forest conservation. Theoretical ecology: computer simulation, analytical modelling, wind-tunnel simulation of pollination systems; numerical analysis of gamete motion.

Timothy A. Cross
Dept. of Chemistry
Florida State Univ., Tallahassee, FL 32306

Biophysics: membrane bound protein structure and dynamics by solid state nuclear magnetic resonance. Presently studying the ionophoric conformation of Gramicidin A in a phospholipid bilayer. Oriented samples are used to study the angular dependence of spin interactions for structural characterizations. Unoriented samples are used for lineshape analyses and relaxation time measurements for dynamic characterizations.

Scott D. Emr
Dept. of Biology
California Institute of Technology, Pasadena, CA 91125

Molecular genetics: yeast cell biology, protein secretion, protein sorting, organelle assembly; sequences in proteins that serve as sorting signals directing intracellular protein traffic; yeast mutants affected in the cellular apparatus that recognizes and interprets certain of these protein sorting signals, these mutants may prove useful for improved expression and secretion of industrial and pharmaceutical products.

Michael R. Green
Dept. of Biochemistry and Molecular Biology
Harvard Univ., Cambridge, MA 02138

Biochemical mechanisms involved in regulating gene expression in higher eukaryotes: studying transcriptional regulation using the human DNA tumor virus, adenovirus, as a model system; using *in vitro* systems to determine how the primary transcripts of genes are processed to functional messenger RNAs.

Stephen M. Hedrick
Dept. of Biology
Univ. of California - San Diego, La Jolla, CA 92093

Immunology: Molecular analysis of cellular receptors important in immune recognition; receptor function analysed by gene transfection; immune system development in transgenic mice.

William H. Karasov
Dept. of Wildlife Ecology
Univ. of Wisconsin at Madison, Madison, WI 53706

Nutritional physiology and ecology: adaptation of the digestive tract, especially of intestinal absorption of nutrients; regulation of nutrient absorption according to diet composition, nutritional or physiological status; effects of antiherbivory compounds in plants on digestion and metabolism of animals; factors affecting energy metabolism and productivity of wild animals.

Jeffery K. Kondo
Dept. of Nutrition and Food Sciences
Utah State Univ., Logan, UT 84322

Microbial genetics: biology of plasmids in group N streptococci and lactobacilli; relationship of plasmids to expression of physiological properties involved in industrial fermentation; characterization of DNA rearrangements due to transposable genetic elements and how they affect gene expression, development and use of gene transfer and molecular cloning systems in group N streptococci.

Hsiao-ping Hsu Moore
Dept. of Physiology & Anatomy
Univ. of California - Berkeley, Berkeley, CA 94720

Cell Biology: protein sorting and targeting, organelle assembly, membrane biogenesis; current research focuses on mechanisms for intracellular targeting of neuropeptides and the biogenesis of secretory granules, approaches include DNA-mediated gene transfer, in vitro mutagenesis, biochemical fractionation of organelles, immunoelectron microscopy and in vitro reconstitution techniques.

Janice Moore
Dept. of Zoology
Colorado State Univ., Fort Collins, CO 80523

Parasite ecology and host parasite associations (emphasis on eucaryotic parasites). behavioral effects of parasites on hosts, especially insect and molluscan hosts, parasite-parasite interactions within hosts, immunosuppression of hosts by parasites.

Michael Moore
Dept. of Zoology
Arizona State Univ., Tempe, AZ 85287

Physiological and ecological aspects of vertebrate reproduction.

Jeffrey D. Palmer
Div. of Biological Sciences
Univ. of Michigan, Ann Arbor, MI 48109

Plant molecular biology: organization, recombination and expession of plant chloroplast and mitochondrial DNA; mechanisms of transfer of genetic material between organelles and the nucleus; mechanisms of repeat-mediated high frequency recombination; mitochondrial determinants of cytoplasmic male sterility.

Richard H. Scheller
Dept. of Biological Sciences
Stanford Univ., Stanford, CA 94305

Molecular neurobiology: neuropeptide gene expression, protein processing, electrophysiology and biophysics; mainly focusing on the cellular and molecular basis of animal behavior; especially interested in regulatory mechanisms utilized by the central nervous system to govern behavioral processes.

Joseph S. Takahashi
Dept. of Neurobiology and Physiology
Northwestern Univ., Evanston, IL 60201

Neurobiology: primary areas of research interest are circadian rhythms (biological clocks), photoreception, and cellular regulatory mechanisms; long-term goals are to understand the cellular and molecular mechanisms that generate circadian oscillations among the vertebrates.

Paula Traktman
Dept. of Cell Biology & Anatomy
Cornell Univ. Medical College, New York, NY 10021

Molecular genetics of Vaccinia virus, particularly of viral DNA replication. Analysis of viral replication mutants, and identification and molecular characterization of relevant genes. Purification and study of viral enzymes involved in DNA replication and in regulating DNA structure and topology. Collaborative interest in Vaccinia as a recombinant vaccine vector.

Fred Winston
Dept. of Genetics
Harvard Medical School, Boston, MA 02115

Genetics: yeast, transcription factors, transposable genetic elements, suppressors of insertion mutations.

Chemistry

Scott E. Denmark
Dept. of Chemistry
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Organic chemistry: invention of new synthetic reactions; mechanistic and stereochemical studies on the origin of stereoselectivity in reactions of allylmetals with aldehydes. Rational design of new synthetic transformations based on pericyclic processes. Structural, stereochemical and computational investigations of phosphorus-stabilized allyl anions and their reactions with electrophiles.

Cynthia M. Friend
Chemistry Dept.
Harvard Univ., Cambridge, MA 02138

Surface chemistry: reaction mechanisms and adsorption structure for molecular species adsorbed on clean and modified transition metal surfaces. Reactions of transition metal compounds and organic molecules on semiconductor surfaces. Surface photochemistry.

A.D.J. Haymet
Dept. of Chemistry
Univ. of California - Berkeley, Berkeley, CA 94720

Physical chemistry. theory and applications of statistical mechanics and Quantum Mechanics. 1) Structure and dynamics of interfaces between condensed phases; crystal growth, glass formation, freezing, nucleation and spinodal decomposition. 2) Proton transfer in aqueous solution, structure of solution interfaces, properties of colloidal and polyelectrolyte solutions.

Daniel G. Nocera
Dept. of Chemistry
Michigan State Univ., East Lansing, MI 48824

Inorganic chemistry, organometallic and coordination compounds. excited state reaction mechanisms, electrochemistry, electrogenerated chemiluminescence, electronic spectroscopy and structure, and photochemistry with special emphasis on using electronically excited molecules to facilitate useful chemical reactions, excited state reactivity of molecules incorporated in inorganic host structures (e.g. zeolites, layered silicates) to develop new heterogeneous photocatalysts.

Michael C. Pirrung
Dept. of Chemistry
Stanford Univ., Stanford, CA 94305

Organic chemistry: methodology for organic synthesis; heterocycles; medium-ring syntheses and conformational analysis; photochemistry; design and mode of action of drugs; bioorganic chemistry; ethylene biosynthesis in higher plants including mechanisms and inhibition; design of enzyme inhibitors for key plant enzymes as a method of herbicide discovery.

Geraldine L. Richmond
Dept. of Chemistry
Univ. of Oregon, Eugene, OR 97403

Analytical and physical chemistry: 1) Development and application of novel laser techniques for *in situ* measurements of solid/liquid interfaces; current emphasis on monitoring reactive kinetics and adsorptive interactions at semiconductor and metal surfaces. 2) Optical studies of the metal binding properties of selected polymers, membranes and proteins by laser induced fluorescence methods.

Stuart L. Schreiber
Dept. of Chemistry
Yale Univ., New Haven, CT 06511

Organic chemistry: the design and synthesis of new materials with serviceable properties, e.g., new drug candidates, catalysts, probes for biological systems, and complex natural or unnatural products; the development of new reagents, methods, and strategies for asymmetric synthesis.

Peter G. Schultz
Dept. of Chemistry
Univ. of California—Berkeley, Berkeley, CA 94720

Design, synthesis and study of new biological catalysts. Methodology for site specific substitution of novel synthetic amino acids into proteins. Strategies for introducing catalytic activity into antibody combining sites. Semisynthetic DNase's and RNase's by covalently modifying nonspecific phosphodiesterases with synthetic binding sites.

Robert A. Scott
Dept. of Chemistry
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Inorganic biochemistry: use of x-ray absorption spectroscopy (XAS) to investigate structures of metalloenzyme active sites; use of XAS to study supported organometallic catalysts and speciation of sulfur in coal; studies of biological electron transfer, including metal-labelled metalloproteins, stopped-flow kinetics, protein chemical modification.

John D. Simon
Dept. of Chemistry
Univ. of California, La Jolla, CA 92093

Chemical physics: applications of picosecond spectroscopy to chemical dynamics; molecular dynamics simulations; currently studying effects of solvation dynamics on rotational diffusion of medium sized solute molecules.

Klaus H. Theopold
Dept. of Chemistry
Cornell Univ., Ithaca, NY 14853

Inorganic and organometallic chemistry: synthesis and characterization of novel molecular transition metal compounds and extended structures; electron transfer processes, intercalation reactions; reaction mechanisms and catalysis.

Patricia A. Thiel
Dept. of Chemistry
Iowa State Univ., Ames, IA 50011

Surface chemistry of thin films, catalysis, corrosion, and lubrication. Model systems created to understand aspects of these four areas of technology on an atomic scale. Structure and thermodynamic properties of thin films of platinum group metals. Influence of water on heterogeneous catalysis of hydrocarbons. Oxidative corrosion. Surface reactions of oxygenated fluorocarbons.

Computer Science

Mikhail J. Atallah
Dept. of Computer Science
Purdue Univ., West Lafayette, IN 47907

Computer science: design and analysis of computer algorithms, data structures, parallel computation (with particular emphasis on parallel algorithms), computational geometry; recent activity has focused on simulations between networks of processors, and on parallel solutions to computational geometry problems.

Eli Gafni
Computer Science Dept.
Univ. of California - Los Angeles, Los Angeles, CA 90024

Optimization and combinatorial algorithms. linear and nonlinear programming, graph theory, algorithms for distributed systems; data communication networks. routing, flow-control, load management; especially interested in iterative on line optimization schemes; currently studying a unified approach to distributed graph algorithms.

John R. Gilbert
Dept. of Computer Science
Cornell Univ., Ithaca, NY 14853

Combinatorial algorithms, especially as related to numerical analysis. Algorithms on graphs. Sparse matrix algorithms. Currently studying sparse Gaussian elimination (and other sparse matrix problems) on message-passing multiprocessor systems.

Paul N. Hilfinger
Dept. of Electrical Engineering and Computer Sciences
Univ. of California - Berkeley, Berkeley, CA 94720

Parallel computation: implementation and use of Lisp for parallel applications; high-level language support for signal processing and its implementation on custom VLSI architectures; high-level language support for scientific computation.

Paul Hudak
Dept. of Computer Science
Yale Univ., New Haven, CT 06520

Computer science: Parallel programming languages and their implementation; especially Lisp-like and functional/logic programming languages. Techniques are being develped to: 1) automatically decompose such programs into tasks that are dynamically scheduled on parallel machines, and 2) provide to the user ways to explicitly map such programs onto multiprocessor topologies such as meshes, hypercubes, rings, etc.

Deborah A. Joseph
Computer Science Dept.
Univ. of Wisconsin - Madison, Madison, WI 53706

Theoretical computer science, design and analysis of algorithms, structural properties of complexity classes: in the design and analysis of algorithms, particular interests are in the construction of algorithms for geometric problems relating to computer vision and motion planning for robotics; in the study of structural properties of complexity classes, interests are in proof techniques for separating complexity classes - the use of recursion and model theoretic techniques.

Yuen-wah Eva Ma
Dept. of Computer and Information Science
Univ. of Pennsylvania, Philadelphia, PA 19104

Reconfigurable computer architectures: parallel computer architectures, partitionable and reconfigurable computer systems, mappings of parallel algorithms on parallel architectures, design and analysis of interconnection network, parallel architectures for image processing and robotics applications, connectivity analysis of dynamic computer networks, design of reconfiguration strategies for fault-tolerant and high performance systems.

Udi Manber
Computer Science Dept.
Univ. of Wisconsin, Madison, WI 53706

Distributed processing: design, analysis and implementation of distributed algorithms; especially interested in multicomputers consisting of a set of independent workstations; distributing tasks and resources; parallelizing programs. Local-area networks: currently studying extensions to networks allowing more primitive operations. Fault tolerance.

Theodore A. Slaman
Dept. of Mathematics
Univ. of Chicago, Chicago, IL 60637

Definability in mathematics: particularly, computations. Constructions of special interest guarantee mathematical properties necessarily too complicated to verify effectively. For example, now developing the machinery to show that increasingly sophisticated methods of approximation are inherent in any proof of the theorems of classical recursion theory.

Richard N. Taylor
Dept. of Information and Computer Science
Univ. of California - Irvine, Irvine, CA 92717

Software Engineering: software development environments and techniques for analyzing, testing and debugging concurrent/real-time Ada programs. Environment research is focused on developing Arcadia, an advanced, extensible, integrated environment supporting Ada software development. Testing/debugging work stresses cooperative application of static and dynamic techniques to host-target software development problems.

Mary K. Vernon
Computer Science Dept.
Univ. of Wisconsin - Madison, Madison, Wisconsin 53706

Computer systems modeling and analysis: modeling and performance analysis of parallel computer systems; Generalized Timed Petri Nets and related performance models. Performance of multiprocessor cache coherency algorithms and multicomputer network interfaces. Currently interested in characterizing parallel task system workloads, and evaluating multiprocessor architectures for high-speed numeric and symbolic computing.

Jeffrey S. Vitter
Dept. of Computer Science
Brown Univ., Providence, RI 02912

Mathematical analysis of algorithms, computional complexity, parallel processing, software design and optimization. Especially interested in methods for information storage and retrieval, order statistics, and combinatorial optimization, as well as models for parallel computation and computer memory.

Earth Sciences

William E. Dietrich
Dept. of Geology and Geophysics
Univ. of California - Berkeley, Berkeley, CA 94720

Fluvial and hillslope geomorphology: mechanics of river channels through detailed investigations of flow, boundary shear stress and sediment transport fields; bedload transport processes in sand and gravel; landsliding, subsurface and overland flow, and controls on channel initiation, drainage network development and hillslope form; weathering, soil formation and supergene enrichment processes.

Mark S. Ghiorso
Dept. of Geological Sciences
Univ. of Washington, Seattle, WA 98195

Geochemistry: thermodynamics, kinetics, computer modelling of dis-equilibrium processes; especially interested in pétrological problems involving the crystallization of magmas and the generation of igneous rocks; currently studying multi-component diffusion in silicate melts in relation to the growth kinetics of solid phases and assimilation mechanisms in igneous systems.

T. Mark Harrison
Dept. of Geological Sciences
State Univ. of New York at Albany, Albany, NY 12222

Thermal history of the continental lithosphere; application of th 0Ar/39Ar methods to problems of crustal evolution; experimental determination and geological application of diffusion laws for stable and radiogenic isotopes; solubility, partition and kinetic relationships in mineral-melt systems; temperature histories of sedimentary basins.

Stein B. Jacobsen
Dept. of Earth and Planetary Sciences
Harvard Univ., Cambridge, MA 02138

Geochemistry: radiogenic isotopes, trace element distributions, especially interested in using radiogenic isotopes and trace elements to study the chemical evolution of the Earth's crust, mantle and oceans.

Thorne Lay
Dept. of Geological Sciences
Univ. of Michigan, Ann Arbor, MI 48109

Seismology and geophysics: determining radial and lateral velocity variations in the crust and mantle; scattering and attenuation of short period seismic waves; wave propagation in three-dimensionally varying media; rupture process of subduction zone earthquakes; explosion source theory.

James M. Mazullo
Dept. of Geology
Texas A&M Univ., College Station, TX 77843

Sedimentology, stratigraphy, and sedimentary petrology; studies of the depositional and diagenetic histories of clastic sediments; measurement and analysis of sediment grain-size, grain-shape, and surface textures; sediment sources and dispersal patterns in sedimentary basins; shelf sediment provenance; sedimentation in Permian backreef environments, Permian Basin of Texas.

Tullis C. Onstott
Dept. of Geological and Geophysical Sciences
Princeton Univ., Princeton, NJ 08544

Geophysics: 40Ar/39Ar laser microprobe dating technique and paleomagnetism; current research includes thermal and diagenetic history of sediments, tectonic and metamorphic evolution of Alaska, Taiwan, Himalayas, Adirondacks and African and South American Proterozoic mobile belts, mantle and atmospheric evolution from mantle xenoliths, dating of microtektites, and argon diffusion studies.

Leigh Royden
Dept. of Earth, Atmospheric and Planetary Sciences
Massachusetts Institute of Technology, Cambridge, MA 02139

Geology and geophysics. regional geology and geophysics, plate tectonics, thermal effects and consequences of continental deformation, mechanics of large-scale continental deformation.

Brian P. Wernicke
Dept. of Earth and Planetary Sciences
Harvard Univ., Cambridge, MA 02138

Structural geology and regional tectonics. Processes of formation and modification of the continental lithosphere, including processes of intracontinental extensional tectonics and the consolidation of familiar plate tectonic environments into stable continental interiors.

Alan Zindler
Dept. of Geology and Geochemistry
Lamont-Doherty Geological Observatory of Columbia Univ.
Palisades, NY 10964

Research in mantle chemical geodynamics. Projects include isotopic and geochemical investigations of mantle-derived ultramafic rocks and basalts from oceanic ridges, arcs, seamounts, and islands, and a variety of continental provinces, the role of fluids in the mantle through a comparison of experimental results with observations of mantle-derived materials, quantitative models for crust-mantle-atmosphere evolution.

Chemical, Biochemical, and Thermal Engineering

C. Thomas Avedisian
Dept. of Mechanical Engineering
Cornell Univ., Ithaca, NY 14853

Heat tranfer and combustion: high pressure bubble growth within liquid droplets, reduced gravity droplet combustion, evaporation of coal slurry and emulsified liquid droplets on hot impermeable surfaces and porous/ceramic materials, critical heat flux of fluid mixtures, and development of a heat pipe for cooling multichip modules and circuit boards; emphasis is on experiments.

Mark A. Barteau
Dept. of Chemical Engineering
Univ. of Delaware, Newark, DE 19716

Surface science and catalytic chemistry of metals and metal oxides. Currently investigating the reactivity of model oxides, and characterization by electron spectroscopies. Development of new techniques to probe surface acid-base properties. Application of gas-phase ion-molecule thermochemistry to surface reactions, including selective oxidation.

Lorenz T. Biegler
Dept. of Chemical Engineering
Carnegie Mellon Univ., Pittsburgh, PA 15213

Large-scale optimization including that of flowsheets using process simulators; differential/algebraic equation optimization, e.g. reactor-based flowsheets, batch optimization, optimizing control; sensitivity analysis, decomposition and problem formulation for optimization; reactor network synthesis.

John F. Brady
Dept. of Chemical Engineering
California Institute of Technology, Pasadena, CA 91125

Chemical engineering: transport processes in multiphase, fluid-particle systems; rheology of concentrated suspensions; Brownian motion; colloids; dynamic simulation of particle motion; interest in the relationship between microstructure and macroscopic properties; dispersion, reaction and mixing in disordered media and in turbulent flows.

Van P. Carey
Dept. of Mechanical Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Heat and mass transfer: boiling heat transfer, two-phase flow, combined forced and free convection; especially interested in convective boiling in high-performance geometries used in compact heat exchangers; applications of interest include compact evaporators for refrigeration systems, spacecraft thermal control, and electronics cooling.

Hsueh-Chia Chang
Dept. of Chemical Engineering
Univ. of Houston, Houston, TX 77004

Chemical engineering. control of nonlinear chemical systems, tuning of controllers and loop coupling, oil well perforation, multi-phase flow and reservoir simulation, currently working on the characterization of shaped charge perforators and the modeling of foam flooding in secondary oil recovery processes.

Mark E. Davis
Dept. of Chemical Engineering
Virginia Polytechnic Institute and State Univ., Blacksburg, VA 24061

Molecular sieve synthesis and catalysis. synthesis of zeolites and molecular sieves with new structures, synthesis of transition-metal-containing zeolites and molecular sieves, catalyis by immobilized homogeneous complexes, catalysis by solid bases.

Robert H. Davis
Dept. of Chemical Engineering
Univ. of Colorado, Boulder, CO 80309

Fluid dynamics of suspensions. solid-liquid separations, membrane filtration, sedimentation of polydisperse suspensions, coagulation of particles in suspension, particle size classification in liquid suspensions, inertial filtration and elastohydrodynamic rebound of particles, hydrodynamic diffusion, composite materials processing and properties, biotechnology applications including microbial flocculation and crossflow microfiltration.

Gerald G. Fuller
Dept. of Chemical Engineering
Stanford Univ., Stanford, CA 94305

Rheology and fluid dynamics of polymeric and colloidal liquids, application of optical methods to the response of such liquids to flow. Orientation of rigid and deformable particles for magnetic recording media, size and shape distributions of colloidal particles, infra-red dichroism of polymeric melts, aggregation of colloidal particles during flow; fluid dynamics of liquid crystals.

T. Alan Hatton
Dept. of Chemical Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139

Bioseparation processes: liquid extraction, liquid membranes, emulsions and microemulsions; two-phase aqueous polymer solutions, protein solubilization in reversed micelle systems. Colloid science: thermodynamics of solubilization in reversed micelles, spectroscopic, light- and neutron-scattering studies, transport processes. Enzymes in organic media: biosynthesis and separations in reversed micelle solutions.

Bradley R. Holt
Dept. of Chemical Engineering
Univ. of Washington, Seattle, WA 98195

Process control: relationship between design and control. Multivariable control; especially problems caused by non-minimum phase elements, constraints, and uncertainty. Artificial intelligence: application of expert systems to the design of control systems, the use of expert systems in adaptive controllers.

Jeffrey C. Kantor
Dept. of Chemical Engineering
Univ. of Notre Dame, Notre Dame, IN 46556

Chemical engineering: control, nonlinear dynamics; especially interested in problems with model uncertainty. Currently studying application of geometric methods for global nonlinear control design to systems with unstable inverses; developing symbolic methods for computation. Developing time and frequency domain criteria for robust stability and performance in linear control design.

Sangtae Kim
Dept. of Chemical Engineering
Univ. of Wisconsin, Madison, WI 53706

Fluid dynamics and rheology: dynamics, rheology and stability of particulate suspensions; contaminant trajectories and filtration in clean rooms; modelling of colloidal systems such as drilling muds, paper coatings, emulsion polymerization products. Currently developing models for edge-face and face-face flocculation in clay/water systems. Dielectric measurements of clay suspensions.

Michael T. Klein
Dept. of Chemical Engineering
Univ. of Delaware, Newark, DE 19711

Reaction engineering: chemical modelling of complex reaction systems. Specific complex reaction systems include biomass and coal liquefaction, catalytic hydroprocessing, asphaltene reaction pathways and polymer synthesis. Definition of a methodology for using information resolved or model systems in the analysis of the reactions of complex systems is unifying goal.

HaeOk Lee
Dept. of Mechanical Engineering
Univ. of Minnesota, Minneapolis, MN 55455

Radiation and combined mode heat transfer. seeking scaling laws for radiation heat transfer - scattering effects, nongray effects, multidimensional effects. Computational efforts to model radiative transfer and its coupling with conduction and convection in multidimensional media. Experimentally determine radiation properties of scattering media. Planning high temperature experiments involving scattering media.

Terry Papoutsakis
Dept. of Chemical Engineering
Rice Univ., Houston, TX 77251

Biochemical engineering/process biotechnology. 1) hydrodynamic effects (shear, turbulence and collisions) on viability, growth and product expression of normal and hybridoma cells for the design of mammalian-cell bioreactors, 2) regulation and enzymology of anaerobic fermentations, 3) effect of cell-membrane processes on biological kinetics and bioreactor design.

Janice A. Phillips
Dept. of Chemical Engineering
Lehigh Univ., Bethlehem, PA 18015

Biochemical engineering. fundamental kinetics of microbial, enzyme, and mammalian cell systems, development of sensors for monitoring biological reactions and separations - currently emphasizing the use of fluorescence and Fourier transform infrared spectroscopy, investigation of strategies for controlling bioreactors and bioseparations, analysis of microbial and enzyme systems associated with polyphosphate metabolism.

Richard Pollard
Dept. of Chemical Engineering
Univ. of Houston, Houston, TX 77004

Processing of electronic materials and coatings. chemical vapor deposition of metallization materials, insulators, compound semiconductors, dopant incorporation, stoichiometry control, conformal deposition, plasmas, reactor optimization, formation of ceramics. Design of electrochemical systems. porous electrodes, solid polymer electrolytes and membranes, transport properties, precipitation of crystals from electrolytes; molten salts; high temperature corrosion.

Dimos Poulikakos
Dept. of Mechanical Engineering
Univ. of Illinois, Chicago, IL 60680

Thermal sciences: heat and mass transfer; forced natural and mixed convection; heat and fluid flow processes in porous media; double diffusion; energy conservation in buildings; solidification and melting processes; thermal insulation design; geothermal systems and oil extraction; filtering processes; numerical and experimental methods.

Joseph M. Prusa
Dept. of Mechanical Engineering
Iowa State Univ., Ames, IA 50011

Fluid mechanics and heat transfer: phase-change heat transfer, thermally induced flow instabilities. Especially interested in melting, freezing, and boiling processes. Currently developing models for predicting the thermal performance of latent energy storage systems; and for predicting bubble growth, departure time and heat transfer enhancement due to boiling.

Jeffrey A. Reimer
Dept. of Chemical Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Nuclear magnetic resonance and chemical vapor deposition techniques.

James E. Rollings
Dept. of Chemical Engineering
Worcester Polytechnic Institute, Worcester, MA 01609

Biochemical engineering: biopolymer structure, function, properties; main interests in polysaccharides of industrial importance; starches, amylose, amylopectin, pullulan, xanthan, other gums and resins used as enzyme and fermentation substrates and products, viscosifiers, coating agents, etc. Material analysis via SEC/LALLS/visco;solvent/non-solvent fractionation and other polymer methods.

David Neil Ruzic
Dept. of Nuclear Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Plasma physics: plasma-material interactions, diagnostics for process plasmas, modeling of process plasmas and the edge region of fusion-relevant plasmas; current work includes measuring the neutral atom flux for reflections of low-energy ions off of surfaces, and measuring electron energy distributions in a plasma etching system.

Katherine S. Shing
Dept. of Chemical Engineering
Univ. of Southern California, Los Angeles, CA 90089

Classical and statistical thermodynamics: computer simulation of fluid mixtures; experimental measurement of activity coefficients and solubilities; particularly interested in highly non-ideal mixtures such as those involved in gas solubilities and supercritical extraction, development of molecular-based predictive solution theories for these systems.

Gary S. Was
Dept. of Nuclear Engineering
Univ. of Michigan, Ann Arbor, MI 48109

Ion beam surface modification. microalloying, depth profiling, alteration of physical and mechanical properties, metastable and amorphous phase formation, thin film studies, ion beam mixing, laser modification of surfaces. Environmentally induced cracking: scc and hydrogen embrittlement of Ni-CR-Fe alloys; grain boundary cracking, cohesion, embrittlement and chromium depletion, high temperature scc mechanisms.

Design, Manufacturing & Computer Engineering

Alice M. Agogino
Dept. of Mechanical Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Design methodologies. computer-aided design, multiobjective optimization and decision and expert systems. Manufacturing systems. sensor-integrated expert systems in automated manufacturing.

Brian Barsky
Dept. of Electrical Engineering and Computer Science
Univ. of California - Berkeley, Berkeley, CA 94720

Computer graphics and computer aided geometric design and modelling. developing new approaches for geometric modelling, curve and surface representation, clipping, natural phenomena, filling algorithms, ray-tracing, animation, motion specification, paint systems, color science.

Mark A. Horowitz
Dept. of Electrical Engineering and Computer Science
Stanford Univ., Stanford, CA 94305

VLSI. new circuit design and design methods, computer architecture and computer aided design tools, especially interested in the design of very high speed circuits and systems. Current projects include. MIPS-X (a 20Mip microprocessor), improved switch level simulation, custom chips for testing, and high speed multiplication and division.

Petros Ioannou
Dept. of Electrical Engineering-Systems
Univ. of Southern California, Los Angeles, CA 90089

Control systems: design of robust adaptive control algorithms for unknown or partially known plants; adaptive control of nonlinear time varying plants; application of robust adaptive control algorithms to flexible structures, high performance aircraft, engine-control problems, robotics, etc.

Bruce H. Krogh
Dept. of Electrical and Computer Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15235

Real-time supervisory control of discrete manufacturing and assembly systems; feedback control of mobility and manipulation in unstructured environments. Current projects include synthesis of discrete control logic for flexible manufacturing cells; automatic programming of on-line control computers; hybrid simulation of manufacturing processes; implementation of dynamic steering control for mobile robots.

Charles E. Leiserson
Dept. of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA 02139

Theory of computing machinery, parallel and VLSI computation, graph theory, combinatorial algorithms, mathematical foundations of computer science.

Tomas Lozano-Perez
Dept. of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA 02139

Robotics and artificial intelligence: automatic planning of robot motions, programming systems for robots, tactile sensing, and object recognition from sensory data (tactile, visual or range).

Kazuo Nakajima
Dept. of Electrical Engineering
Univ. of Maryland - College Park, College Park, MD 20742

VLSI systems and fault-tolerant computing: CAD tools for VLSI circuit layout, placement and routing algorithms, parallel algorithms, VLSI architectures, logic compilation, VHDL, custom VLSI circuit design, gate array and standard cell approaches, system-level fault diagnosis, fault-tolerant distributed computing, data transfer scheduling in computer networks, computer network layout.

Albert P. Pisano
Dept. of Mechanical Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Computer-aided mechanical design: conceptual design via kinematic structure; mechanical/electromechanical system modelling and optimization; combined, lumped/distributed mechanical system analyses; combined, experimental/analytical optimization of high-speed mechanical systems; parallel processing algorithms for mechanical system analysis; optimal mechanical system synthesis; applications to automobile engines and computer peripheral equipment.

Cauligi S. Raghavendra
Dept. of Electrical Engineering - Systems
Univ. of Southern California, Los Angeles 90089

Computer engineering: parallel and distributed architectures and algorithms; fault-tolerant computing and interconnection networks. Design of parallel algorithms to given architectures. Reliability and fault-tolerance issues in multi-processors and distributed systems. Currently studying fault-tolerant interconnection networks and reliability analysis of distributed systems.

Robin Roundy
School of Operations Research and Industrial Engineering
Cornell Univ., Ithaca, NY 14853

Theory and practice of inventory control in manufacturing and distribution, scheduling, and production planning.

John P. Shen
Dept. of Electrical and Computer Engineering
Carnegie Mellon Univ., Pittsburgh, PA 15213

Digital systems testing, fault tolerant computing, and integration of algorithms and architecture.

Renjeng Su
Dept. of Electrical and Computer Engineering
Univ. of Colorado, Boulder, CO 80309

Automatic control. hierarchical control of autonomous vehicles, motion planning, learning, and database construction for robotic systems, automatic maneuvering of flexible structures with current focus on open-loop motion planning in real-time operations.

Kenneth J. Supowit
Dept. of Computer Science
Princeton Univ., Princeton, NJ 08544

Computer engineering. hardware design automation, especially logic-based design tools such as synthesis and verification of (functional correctness) cf curcuits specified at logic-level, plans to extend this work to register-transfer-level designs.

Electrical, Communications & Systems Engineering

Dimitris Anastassiou
Dept. of Electrical Engineering
Columbia Univ., New York, NY 10027

Digital image processing algorithms and their implementation.

L. Richard Carley
Dept. of Electrical and Computer Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Synthesis, analysis and simulation of joint analog-digital systems; i.e., systems which include both analog and digital functions on a single IC. Special interest areas include: quantization noise, effects of dithering, oversampled A/D and D/A systems, Delta-Sigma Modulation systems, and developing general hierarchical simulator for these systems.

Rama Chellappa
Dept. of Electrical Engineering-Systems
Univ. of Southern California, Los Angeles, CA 90089

Image analysis and computer vision: develop model based algorithms for; a) estimation of kinematics and structure of a rigid object from a sequence of noisy images, b) edge detection, texture segmentation, c) shape recognition, and d) shape from shading, texture, and contour. Emphasis on computionally elegant mathematical approaches.

William R. Eisenstadt
Dept. of Electrical Engineering
Univ. of Florida, Gainesville, FL 32611

High frequency and ultra-high frequency measurements and modeling of integrated circuit devices and interconnects using on-substrate picosecond photoconductor based transient measurements. Advanced bipolar transistor modeling, parameter extraction and model implementation in circuit simulation software, s-parameter measurements of transistors.

Dan Elliott
Dept. of Electrical Engineering
Purdue Univ., West Lafayette, IN 47907

Nonlinear optics: competition between different optical processes, as present, for example, when very intense laser beams lead to the nonlinear generation of additional fields; laser bandwidth effects, important to very sensitive nonlinear optical detection techniques which often employ broadband lasers; saturation of optical transitions; quantum optical effects; and statistical properties of light.

Robert O. Grondin
Dept. of Electrical and Computer Engineering
Arizona State Univ., Tempe, AZ 85287

General field of interest is solid state electronics: specific interests include femtosecond photoconductivity, superlattices, hot carrier transport in semiconductors, and architectures for ultrasubmicron integrated circuits. These architectures include cellular arrays and neural network analogs meant for implementation of artificial intelligence. Also has worked with microwave and millimeter-wave electronics.

Mohammed Ismail
Dept. of Electrical Engineering
Univ. of Nebraska, Lincoln, NE 68588

Microelectronic circuits and systems: active, switched-capacitor and digital filters, analog linear and nonlinear standard cells for VLSI, CAD tools for VLSI, circuits for communication and instrumentation. Basic research in z-domain circuit theory and applications in digital signal processing. MOS analog VLSI circuits using the continuous-time approach and a new automated analog IC design system.

Pramod P. Khargonekar
Dept. of Electrical Engineering
Univ. of Minnesota, Minneapolis, MN 55455

Control and system theory: robust-adaptive control and filtering; specific interests include analysis and design of systems required to operate under large parameter variations; nonlinear, optimal, and adaptive controllers, optimal control algorithms, distributed and multidimensional systems, spectral factorization and spectrum estimation.

Kenneth W. Martin
Dept. of Electrical Engineering
Univ. of California, Los Angeles, CA 90024

Integrated circuit and system design: formant analysis speech recognition and compression systems, adaptive systems, equalization and noise cancelling systems, phase-locked loop systems; data acquisition circuits, analog MOS circuits, switched-capacitor circuits, GaAs ultra-high-speed analog and digital circuits, spectral analysis circuits, CAD for circuit design including a hierarchical logic timing simulator.

James B. Orlin
Sloan School of Management
Massachusetts Institute of Technology, Cambridge, MA 02139

Operations research: mathematical programming, design and analysis of heuristics. Basic research in algorithms for fundamental paradigms in combinatorial optimization to the development of efficient solution techniques for very large scale (partially unstructured) problems in production scheduling and transportation scheduling. Investigating possibilities of computer aided design of algorithms and heuristics for scheduling problems.

Jorge J. Rocca
Dept. of Electrical Engineering
Colorado State Univ., Fort Collins, CO 80523

Quantum electronics: new lasers. Presently studying electron beam excited recombination lasers. Interested in practical sources of XUV and soft x-ray laser radiation. Gaseous electronics: creation of intense electron beams using glow discharges. Plasma modeling and diagnostics. Applications to microelectronic materials processing. Currently studying electron beam assisted etching.

James J. Rosenberg
Division of Engineering
Brown Univ., Providence, RI 02912

MISFET technology for manufacturing and strained lattice structures.

Michael J. Sabin
Dept. of Electrical Engineering and Computer Science
Univ. of California - Berkeley, Berkeley, CA 94720

Digital signal processing: practical and theoretical aspects of quantization; currently studying new vector quantization/clustering methods for speech recognition, data domain testing of analog-to-digital converters, and theory of roundoff noise in digital filters.

S. Shankar Sastry
Dept. of Electrical Engineering and Computer Sciences
Univ. of California - Berkeley, Berkeley, CA 94720

Research interests in adaptive control systems, robotics, and non-linear circuits and systems. Worked on the kinematic design of robotic manipulators and is currently doing research in robot programming and algorithms involving sensors. Exploring relationships between machine learning, intelligent sensors and adaptive control for robotics applications.

Mark A. Shayman
Dept. of Systems Science and Mathematics
Washington Univ., St. Louis, MO 63130

(after July 1, 1986)
Dept. of Electrical Engineering
Univ. of Maryland, College Park, College Park, MD 20742

Automatic control: feedback control of linear and nonlinear systems; adaptive control; applications to robotics and process control; geometric methods in numerical linear algebra.

Michael Spencer
Dept. of Electrical Engineering
Howard Univ., Washington, D.C. 20059

Solid state electronics: compound semiconductors GaAs/SiC; epitaxial crystal growth by MBE, VPE, LPE; materials characterization by DLTS, photoluminescense, and Hall mobility; annealing studies; fabrication of microwave FET's, mixer diodes and solar cells. Currently interested in optical techniques for characterizing and modifying MBE growth; also development of novel quantum device structures particularly involving tunnelling.

Wayne Stark
Dept. of Electrical Engineering and Computer Science
Univ. of Michigan, Ann Arbor, MI 48109

Communication and information theory: design and analysis of coding and modulation techniques for frequency-hop and direct-sequence spread-spectrum systems subject to multi-user interference, unknown interference or fading. Performance measures are bit error rate, cutoff rate and channel capacity. Coding for computer memories.

Andre L. Tits
Dept. of Electrical Engineering
Univ. of Maryland - College Park, College Park, MD 20742

Optimization theory: nonlinear programming, semi-infinite programming; optimization-based computer-aided design of engineering systems: formulation issues, interactive refinement of design specifications, man-machine interaction, multiobjective optimization; computer-aided design of robust control systems.

Craig A. Tovey
School of Industrial and Systems Engineering
Georgia Institute of Technology, Atlanta, GA 30332

Algorithms in operations research and computer science. Sequencing and scheduling, with emphasis on automated and flexible manufacturing systems. Probabilistic algorithms and algorithm analysis. Simulated annealing. Heuristics for combinatorial optimization. Development of effective probabilistic algorithms for global optimization of unconstrained and linearly constrained nonlinear programming problems.

Vijay Vittal
Dept. of Electrical Engineering and Computer Engineering
Iowa State Univ., Ames, IA 50011

Power systems. system dynamics, operation and control, computer aided analysis; especially interested in applying direct methods of transient stability analysis for dynamic security assessment; also interested in applying new system theoretic approaches to analyze power systems.

Mechanics, Structures & Materials Engineering

Triantaphyllos R. Akylas
Dept. of Mechanical Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139

Applied mechanics: wave propagation, hydrodynamic stability, flow-induced noise; especially interested in nonlinear effects on water wave propagation, flow stability and transition to turbulence.

Hassan Aref
Dept. of Applied Mechanics and Engineering Science
Univ. of California - San Diego, La Jolla, CA 92093

Theoretical and computational fluid mechanics, in particular vortex dynamics. Fundamental aspects such as "chaos" in vortex systems, solitons on vortex filaments. Computational "vortex methods" applied to shear flows, coherent structures in turbulence, flow-induced vibrations, and stratified flows. Stirring and mixing. Computations on supercomputers and "hypercube" concurrent processor.

Michael David Bryant
Dept. of Mechanical and Electrical Engineering
North Carolina State Univ., Raleigh, NC 27695

Theoretical and experimental problems in contact physics and tribology: friction, wear, lubrication, electrical contacts, electromagnetic surface interactions; currently studying wear in electrographic brushes and leakage in rotating seals. Electromechanical devices: Design and control of electrical motors and piezoelectric and magnetostrictive devices; actuation and measurement of submicron motions.

James L. Burati, Jr.
Dept. of Civil Engineering
Clemson Univ., Clemson, SC 29631

Construction engineering and materials: evaluation and quality assurance of construction processes and materials; particularly interested in asphalt cement and asphaltic concrete pavement materials and construction; currently studying quality management procedures in large construction projects; also investigating relationships between asphalt cement composition and asphalt pavement performance.

Ilene Busch-Vishniac
Dept. of Mechanical Engineering
Univ. of Texas - Austin, Austin, TX 78712

Transduction: modeling and analysis of sensors and actuators with finite spatial extent, their application to robotics, distributed control, acoustics; innovative use of new materials (e.g. thin polymer films), new techniques (e.g. silicon-based fabrication methods) to address long-standing transducer problems including miniaturization, ruggedness, high sensitivity demands; laser generated sound underwater.

Edward F. Crawley
Dept. of Aeronautics and Astronautics
Massachusetts Institute of Technology, Cambridge, MA 02139

Aerospace structures, structural dynamics and aeroelasticity, especially the control of spacecraft structures and aeroelastic structures with intelligent structural elements. Spacecraft design and commercialization of ventures in space.

David L. Freyberg
Dept. of Civil Engineering
Stanford Univ., Stanford, CA 94305

Contaminant transport in groundwater. mathematical modeling, parameter uncertainty, prediction uncertainty, model validation, especially interested in the role of spatial variability in prediction uncertainty and model validation, the design of monitoring networks, and modeling the effects of complex chemical interactions.

David E. Goldberg
Dept. of Engineering Mechanics
Univ. of Alabama, University, AL 35486

Genetic algorithms and machine learning. genetic algorithms applied to large scale parameter and combinatorial optimization problems, as learning heuristic in learning expert system, structural, hydraulic, operations research examples, effect of operators, dominance, crowding, niche, migration, inversion, alternate crossover, efficient reproduction; theoretical underpinnings and mathematics.

C. William Ibbs
Dept. of Civil Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Construction management. project control systems and theory. Productivity measurement and forecasting. Advanced computer technologies and applications to construction including parallel processor simulation. Contract administration. risk and incentive allocation, product specification practices and problems.

Joseph Katz
Dept. of Civil Engineering
Purdue Univ., West Lafayette, IN 47907

Hydrodynamics. experimental fluid mechanics, cavitation around submerged bodies and in free shear flows, currently studying the flow structures on hydrofoil tips where the onset of cavitation occurs, and around inclined bodies of revolution to determine the causes of asymmetric loads, experiments include the application of holography and laser induced fluorescence, most carried out in a towing tank.

Ming C. Leu
Sibley School of Mechanical and Aerospace Engineering
Cornell Univ., Ithaca, NY 14853

Robotics, CAD/CAM, dynamics & control: solid modeling based simulation of robotic applications, control of dynamical systems including motors and robots, optimal design of electromechanical force and torque motors, optimal robot trajectory planning and control, computer generation of robot kinematics and dynamics equations, analytical and experimental studies of robot stiffness and accuracy.

Arne J. Pearlstein
Dept. of Aerospace and Mechanical Engineering
University of Arizona, Tucson, AZ 85721

Fluid mechanics and mass transfer in materials processing applications: numerical and analytical modelling of convective and diffusive transport phenomena in electrodeposition processes; thermal runaway and convective instability in chemically reacting fluids; buoyancy-driven convection in multicomponent fluids; transport and reaction in optically thick photochemical systems.

William J. Rasdorf
Depts. of Civil Engineering and Computer Science
North Carolina State Univ., Raleigh, NC 27695

Engineering databases and information processing, automated representation, use and management of structural engineering data, integration of engineering processes, computer-aided design and geometric modeling in civil engineering and expert system development, and artificial intelligence applications in problem solving, analyses and design. Now investigating databases as an information storage and integration mechanism.

Daniel R. Rehak
Dept. of Civil Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Computer applications in civil engineering: knowledge-based expert system (current work includes geotechnical site characterization and construction management); applications of alternative hardware and software technologies for finite element systems; database management systems; design and development of large-scale, interdisciplinary computer-aided engineering systems; AI programming techniques for engineering applications.

James R. Rinderle
Dept. of Mechanical Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Interaction between design and manufacturing and the control of manufacturing systems.

Ares J. Rosakis
Graduate Aeronautical Laboratories
California Institute of Technology, Pasadena, CA 91125

Mechanics of solids: dynamic fracture mechanics of structural metals. Experiments on fracture dynamics using optical techniques and high speed photography. Rate sensitive metals (nuclear pressure vessel steels, pipe-line steels, titanium alloys, etc.) Static and dynamic fracture of ceramics. Experiment and numerical study of elastic-plastic crack growth, three dimensional aspects of fracture mechanics.

Raymond B. Seed
Dept. of Civil Engineering
Stanford Univ., Stanford, CA 94305

Geotechnical engineering. constitutive modelling. finite element analyses of compaction-induced stresses and deformation, analyses and field measurements of soil structure interaction (retaining structures, buried tanks and conduits, reinforced soil systems, excavation bracing), soil liquefaction (analyses, laboratory and in-situ testing); residual strength and flow characteristics of saturated soils.

Marc K. Smith
Dept. of Mechanical Engineering
Johns Hopkins Univ., Baltimore, MD 21218

Fluid mechanics. free-surface flows, surface-tension-driven flows, hydrodynamic stability, contact-line problems. Currently studying the thermocapillary instabilities that can appear in the melt during the processing of single crystals and in the melt pool of laser surface alloying and laser welding.

Paul S. Steif
Dept. of Mechanical Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Solid mechanics. micro-mechanics of materials, deformation and failure of composite and clad materials, modeling of processing operations. powder compaction and deformation processing of clad materials.

Kim A. Stelson
Dept. of Mechanical Engineering
Univ. of Minnesota, Minneapolis, MN 55455

Computer integrated manufacturing. Computer control of metal forming (pressbrake bending, upset forging, tube bending, and rolling) and solidification processing (die casting and injection molding). Digital signal processing and sensor development for closed loop control of flexible automation. Finite element analysis and simplified model development for real time control.

S. Suresh
Division of Engineering
Brown Univ., Providence, RI 02912

Deformation and fracture of novel materials; microstructural evolution and aging characteristics of metal-matrix composites and lithium-containing aluminum alloys; micromechanical modelling of fracture; cyclic fracture of metals, ceramics and composites.

Michael A. Sutton
Dept. of Mechanical Engineering
Univ. of South Carolina, Columbia, SC 29208

Solid mechanics, computer vision, automated vision systems: special emphasis in quantifying the utility of computer vision in solid mechanics for static, and later, dynamic problems; currently studying optimization methods for use in digital correlation, and novel techniques for improving both the accuracy and speed of computation in computer vision; future work includes robotic and vision systems.

Benson H. Tongue
School of Mechanical Engineering
Georgia Tech, Atlanta, GA 30332

Nonlinear systems: dynamics of interconnected multi-degree-of-freedom systems; response of nonlinear rotor systems- especially helicopters; complicated dynamics of structural systems- limit cycles, bifurcations and chaos; modeling of flexible manipulators.

Emerging & Critical Engineering Systems

Linda M. Abriola
Dept. of Civil Engineering
Univ. of Michigan, Ann Arbor, MI 48109

Groundwater hydrology: modeling organic chemical transport in the unsaturated and saturated zones; especially interested in multiphase flow situations in which the pollutant is present as a separate phase (such as gasoline or organic solvent spills); conceptualization, development, and verification of laboratory- and field-scale numerical models.

Les Atlas
Dept. of Electrical Engineering
Univ. of Washington, Seattle, WA 98195

Speech processing, VLSI signal processing and auditory sciences. Past work: design and implementation of speech processors. Current work: speech recognition algorithms for noisy environments, AI tools for signal processing algorithm development, space-time representations for VLSI signal processing design.

Etan Bourkoff
Dept. of Electrical Engineering and Computer Science
Johns Hopkins Univ., Baltimore, MD 21218

Quantum electronics: ultrafast optics and electronics; new laser mode-locking techniques and applications; also interested in semiconductor diode laser modulation capabilities.

Edward J. Bouwer
Dept. of Environmental Engineering
Johns Hopkins Univ., Baltimore, MD 21218

Environmental engineering. degradation of halogenated organics, groundwater contamination, and biofilm kinetics, currently studying biological treatment methods to control toxic organic contaminants, reaction pathways, reaction rates, and environmental factors needed for degradation are being investigated to aid engineering design.

Jean-Lou Chameau
Dept. of Civil Engineering
Purdue Univ., West Lafayette, IN 47907

Fundamental aspects of soil behavior, including dynamic behavior. Soil-structure interaction problems, under both static and dynamic loading conditions. Uncertainty in civil engineering design. Fuzzy sets and expert systems in geotechnical and transportation engineering.

Dominique Durand
Dept. of Biomedical Engineering
Case Western Reserve Univ., Cleveland, OH 44106

Biomedical engineering. applied neural control, neural prostheses, computer modeling of neuronal networks, especially interested in the control of epilepsy with electrical stimulation, analysis of biomagnetic fields in the brain and drug effects on neuronal membranes.

Catherine Wolfgram French
Dept. of Civil Engineering
Univ. of Minnesota, Minneapolis, MN 55455

Structural engineering. testing of reinforced and prestressed concrete structural systems, connections, earthquake, impact, fatique loadings, retrofit and repair of earthquake, impact and corrosion damage, investigating reinforced concrete T beams and connections between precast elements subjected to cyclic lateral loads (earthquake), techniques to repair earthquake damage and to repair impact damage in prestressed bridge girders.

Kristina M. Johnson
Dept. of Electrical and Computer Engineering
Univ. of Colorado, Boulder, CO 80309

Research in optical information processing and computing, fast liquid crystal logic gates and light valves, special purpose optical systems for automated manufacturing inspection, artificial intelligence and associative memory. Two and three-dimensional displays, holography.

Kim Kearfott
Dept. of Electrical Engineering
Arizona State Univ., Tempe, AZ 85287

Medical physics, biomedical instrumentation, tomographic imaging: currently developing miniature high-spatial resolution Single Photon Emission Computerized Tomograph (SPECT) system; investigating novel uses of thermoluminescent materials and new applications for self-scanning photodiode arrays; developing new physiological imaging modalities.

Nabil M. Lawandy
Division of Engineering
Brown Univ., Providence, RI 02912

Laser dynamics: experimental and theoretical studies of deterministic laser dynamics; emphasis on experimental verification of single mode instabilities and multichromatic dynamical states. Laser assisted transport: laser induced diffusion; theoretical models based on nonlinear Fokker-Plank equations and experimental studies on molecular systems.

Desmond F. Lawler
Dept. of Civil Engineering
Univ. of Texas, Austin, TX 78712

Environmental engineering: particles in water and wastewater treatment, interested in how particle size distribution, density, and surface charge influence, and are changed by, processes such as flocculation, sedimentation, filtration, thickening, digestion, and dewatering, including chemical additions therein, approach includes experiments and mathematical modeling; also study interactions between treatment processes.

Hua Lee
Dept. of Electrical and Computer Science
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Imaging systems optimization: system analysis and evaluation, signal processing, high-resolution and low bit-rate techniques, optimal algorithms for holographic and tomographic imaging, synthetic aperture radar, acoustic microscopy, computer vision, and NMR imaging.

Pao-Lo Liu
Dept. of Electrical and Computer Engineering
State Univ. of New York at Buffalo, Buffalo, NY 14260

Optoelectronics: design, fabrication and testing of optical devices and circuitry for high speed and coherent communications applications, growth of compound semiconductor substrate by organo-metallic chemical vapor deposition, material characterization by short, tunable, infrared, optical pulses, development of optical sensors for plant automation.

Michael G. McNally
Dept. of Civil Engineering
Univ. of Southern California, Los Angeles, CA 90089

Complex travel behavior. dynamics of household decision-making, pattern simulation, recognition, and classification, multiobjective constrained choice models. Integrated models of transportation and land development. economics of real estate development and transportation infrastructure, public facility location, design, and financing. Transportation networks. flow prediction, operations and control, network design.

John A. Pearce
Dept. of Electrical Engineering
Univ. of Texas, Austin, TX 78712

Investigations presently underway include. 1) Quantitative thermographic image processing. improvement in minimum resolvable temperature difference, 2) Tumor hyperthermia therapy. evaluation of radio frequency applicators in inhomogeneous lossy media, 3) Tomographic image reconstruction. Fourier optics in real-time reconstruction, 4) Theoretical prediction of tissue damage due to radio frequency field heating and surgical laser pulse impingement.

Warren B. Powell
Dept. of Civil Engineering
Princeton Univ., Princeton, NJ 08544

Transportation science. network modelling, applied probability and their application to problems in vehicle routing and scheduling and network design, vehicle dispatching under uncertainty, coordinated production and transportation, numerical methods in stochastic modelling, and their application to the efficient simulation of transient transportation networks.

Nitish V. Thakor
Dept. of Biomedical Engineering
Johns Hopkins Univ., Baltimore, MD 21205

Biomedical instrumentation. Applications of microcomputers, VLSI and robotics technologies to medicine. Currently studying origins and signal analysis of the heart (ECG, fibrillation), brain (evoked potentials, magnetoencephalography), and muscle (EMG) signals. Collaborative industrial/medical projects: ECG processing/defibrillation VLSI chip, array processor for brain electrical and magnetic activity mapping, EMG-controlled multi-finger robot hand.

Sandra L. Woods
Dept. of Civil Engineering
Oregon State Univ., Corvallis, OR 97331

Environmental engineering: development of biological and physical/chemical processes to remove toxic organic compounds from industrial wastes and leachates; anaerobic processes for the degradation of chlorobiphenyls and chlorophenols; use of methylotrophs in degrading low molecular weight chlorinated solvents; biofilms; characterizing sorption reactions; developing methods to extract organics from contaminated soils.

Information Science

Kathleen McKeown
Dept. of Computer Science
Columbia Univ., New York, NY 10027

Artificial intelligence: natural language processing, language generation, user modelling; especially interested in the influence of knowledge about the user on decisions about the content and organization of a response to a given question: being explored within context of explanation generation for expert systems and response generation for information systems.

James A. Reggia
Dept. of Computer Science
Univ. of Maryland, College Park, MD 20742

Computer science: artificial intelligence, knowledge-based expert systems, diagnostic problem-solving, parallel processing methods relevant to artificial intelligence, natural language processing.

Materials Research

Brent L. Adams
Dept. of Mechanical Engineering
Brigham Young Univ., Provo, UT 84602

Mechanical metallurgy. modelling of plasticity and fracture, especially interested in the effects of crystallographic texture and grain boundary structure on flow and fracture, currently studying new stereological characterizations of microstructure and corresponding micro-mechanical models which use them.

Glenn Agnolet
Dept. of Physics
Texas A&M Univ., College Station, TX 77843

Low temperature physics. interested in interfacial phenomena with emphasis on cooperative phenomena at surfaces and interfaces and the modification of material properties in confined or low-dimensional systems. Specific topics include the roughening transition and crystal growth, wetting and nucleation processes, and ordering transitions in two-dimensional layers.

Barbara H. Cooper
Dept. of Physics
Cornell Univ., Ithaca, NY 14853

Surface physics and ion beam - surface interactions (1eV - 10keV beam energies). 1) surface structure and composition (adsorbate structures, reconstructions, phase transitions), 2) ion beam - surface charge exchange (collision-induced chemistry, fundamentals of ion analysis techniques), 3) fundamentals of ion-surface interactions at 1-100eV (reactive ion etching mechanisms), 4) computer simulations of 1-100eV ion-surface scattering.

Robin L. Garrell
Dept. of Chemistry
Univ. of Pittsburgh, Pittsburgh, PA 15260

Analytical and polymer chemistry. characterization of solution-metal and polymer-metal interfaces, particularly by spectroscopic methods, development of polymers for coatings and modified electrode applications, synthesis of new latex materials, new computational methods for IR and Raman spectral assignments.

Jorge E. Hirsch
Dept. of Physics
Univ. of California - San Diego, La Jolla, CA 92093

Theoretical condensed matter physics. study of collective effects in solids, such as magnetism and superconductivity, using numerical simulation techniques, new mechanisms for superconductivity, dilute magnetic alloys and "heavy fermion" materials, quasi one- and two-dimensional materials, development of Monte Carlo simulation techniques for quantum systems.

Ciriyam Jayaprakash
Dept. of Physics
Ohio State Univ., Columbus, OH 43212

Equilibrium shapes of crystals, low-temperature behavior of Josephson junction arrays in magnetic fields.

Thomas F. Kelly
Dept. of Metallurgical and Mineral Engineering
Univ. of Wisconsin-Madison, Madison, WI 53706

Materials science: structure and properties of thin-film dielectrics; localized dielectric breakdown in thin films, local variations in complex dielectric function: solidification of materials; liquid-to-crystal nucleation, solute partitioning during solidification: analytical electron microscopy; energy dispersive x-ray spectroscopy, electron energy loss spectroscopy.

Gary M. Michal
Dept. of Metallurgy and Materials Science
Case Western Reserve Univ., Cleveland, OH 44106

Physical metallurgy and materials: application of rapid thermal cycles to create nonequilibrium precipitation reactions. The adhesion at interfaces examined with UHV surface science and high resolution EM techniques. The effect of ordering reactions on the magnetic and mechanical behavior of intermetallic compounds. Rapidly solidified and novel intermetallic compounds for ultra high temperature applications.

George Mozurkewich
Dept. of Physics
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Experimental solid state physics: quasi-one dimensional metals, especially interested in effects of sliding charge density waves on elastic, thermal, and nonelectrical transport properties.

Keith A. Nelson
Dept. of Chemistry
Massachusetts Institute of Technology, Cambridge, MA 02139

Physical chemistry: femtosecond time-resolved spectroscopy of chemical reactions; picosecond spectroscopy of structural phase transitions, stimulated light scattering, vibrational dynamics and interactions, and vibrationally-induced rearrangements. Applications under study include ultrafast, ultraefficient optical modulation and switching; optical acoustic-wave generation; characterization of viscoelastic fluids, membranes, and other condensed media.

Michael D. Sacks
Dept. of Materials Science and Engineering
Univ. of Florida, Gainesville, FL 32611

Ceramic processing. properties and behavior of aqueous and nonaqueous suspensions, tape casting, slip casting, sol-gel processing, injection molding, role of polymeric additives (binders, plasticizers, dispersants, etc.) in ceramic processing, binder burnout, processing of ceramic/ceramic composites, sintering and microstructure evolution.

James P. Sethna
Laboratory of Atomic and Solid State Physics
Cornell Univ., Ithaca, NY 14853

Solid state theory. glasses and amorphous materials, defects in crystals, and liquid crystals. Low frequency and low temperature properties of glasses and amorphous materials. Point defects and tunneling centers in alkali halides, hole burning and vibrational lasers. Energetics and defect structures of liquid crystals.

Mathematics

David Donoho
Dept. of Statistics
Univ. of California - Berkeley, Berkeley, CA 94720

Signal processing. deconvolution problems in seismology, astronomy, spectroscopy, particularly interested in quantifying the resolving power of constraints like positivity and sparsity of the signal to be recovered. Multivarate data analysis. particularly robust methods and graphical methods.

David Jerison
Dept. of Mathematics
Massachusetts Institute of Technology, Cambridge, MA 02139

Partial differential equations. applications of Fourier analysis and homogeneity techniques to problems of existence, uniqueness, and stability of solutions to partial differential equations, boundary value problems, overdetermined systems, optimization, and problems in geometry.

Iain M. Johnstone
Dept. of Statistics
Stanford Univ., Stanford, CA 94305

Statistics. variance reduction techniques for efficient simulation design, applications to bootstrap computations, resistant regression methods Performance characteristics of computationally intensive methods. Volume methods from geometry applied to development of new significance tests. Statistical decision theory, its analogs in potential theory and probability, applications to direct and inverse smoothing problems.

William L. Kath
Dept. of Engineering Science and Applied Mathematics
Northwestern Univ., Evanston, IL 60201

Applied mathematics: development of more effective methods for understanding the factors affecting signal propagation in optical communication systems; especially interested in fiber optics and the losses caused in such systems, including those due to bending, manufacturing defects and alignment errors; also interested in nonlinear optical devices, such as phase conjugate optics.

Robert K. Lazarsfeld
Dept. of Mathematics
Univ. of California - Los Angeles, Los Angeles, CA 90024

Algebraic geometry: linear systems and their relation with the geometry of curves and varieties of higher dimensions; positivity and its applications.

Ngaiming Mok
Dept. of Mathematics
Columbia Univ., New York, NY 10027

Complex manifolds: Kahler geometry, Einstein metrics, effect of curvature conditions on the geometry of complex manifolds: rigidity theorems of holomorphic mappings between classical manifolds, uniformization theorems, compactification of complete Kahler manifolds satisfying curvature conditions.

Michael Renardy
Dept. of Mathematics
Virginia Polytechnic Institute and State Univ., Blacksburg, VA 24061

Nonlinear partial differential equations: mathematical problems in viscoelasticity, especially existence problems for initial value problems as well as steady flows, propagation and development of singularities in solutions to such problems, stability and bifurcation in fluid dynamics, especially flows involving two fluids and viscoelastic fluids.

Peter Sarnak
Dept. of Mathematics
Stanford Univ., Stanford, CA 94305

Analysis and number theory: theory of primes, automorphic forms, combinatorics and applications.

W. Hugh Woodin
Dept. of Mathematics
California Institute of Technology, Pasadena, CA 91125

Mathematical logic and foundations of mathematics: set theory, independence proofs and applications. Strong axioms of infinity; large cardinals and inner models, large cardinals and determinacy. Descriptive Set Theory in the context of AD.

Physics

Dana Z. Anderson
Dept. of Physics
Univ. of Colorado, Boulder, CO 80309

Optical physics: optical gyroscopes: theory and applications; nonlinear optics, especially two- and four-wave mixing in condensed matter; nonlinear optical implementations of associative memory based on neural network models; generation of optical squeezed states and photon antibunching; experimental General Relativity.

Leslie C. Bland
Dept. of Physics
Indiana Univ., Bloomington, IN 47405

Experimental nuclear physics. studies of simple modes of nuclear excitation—low-lying and giant-resonance states, pion-nucleus interactions, pion-production reactions, isospin mixing. Also interested in equipment development. establishing detector-test laboratory, development and testing of multiwire proportional chambers, scintillation detectors, and other ionizing-radiation detection techniques.

Joan M. Centrella
Dept. of Physics and Atmospheric Science
Drexel Univ., Philadelphia, PA 19104

Astrophysics. origin of structure in the universe, clusters of galaxies, Computing: supercomputers, numerical simulations, three-dimensional computer models, Computer graphics, high resolution color graphics, computer generated films of dynamical physical systems.

James D. Hanson
Physics Dept.
Auburn Univ., Auburn, AL 36849

Theoretical plasma physics. wave propagation and rf plasma heating, stellarator vacuum magnetic field optimization. Nonlinear dynamics. elimination of stochasticity in Hamiltonian systems, quantum mechanics of stochastic Hamiltonian systems.

Blayne R. Heckel
Dept. of Physics
Univ. of Washington, Seattle, WA 98195

Low energy measurements of parity, time reversal symmetry violation.

Wendell T. Hill, III
Institute for Physical Science and Technology
Univ. of Maryland, College Park, MD 20742

Chemical physics: intermolecular and intramolecular energy transfer processes responsible for the formation and decompostion of simple molecules. Particular emphasis characterizing collisional energy exchange and internal energy redistribution following selective excitation of molecular systems to quasi-bound states.

John Huennekens
Dept. of Physics
Lehigh Univ., Bethlehem, PA 18015

Experimental atomic physics: line-broadening, radiation trapping and collisional processes in atomic vapors. Currently engaged in test of the Holstein theory of radiation trapping and demonstration of its use to determine pressure broadening rates. Also, studies of alkali molecule triplet bands with emphasis on possible tunable near-infrared laser applications.

David Levinthal
Dept. of Physics
Florida State Univ., Tallahassee, FL 32306

High energy physics.

Robert G. Littlejohn
Dept. of Physics
Univ. of California - Berkeley, Berkeley, CA 94720

Physics of wave propagation: WKB theory, short wave asymptotics, theoretical structure thereof. Applications to: quantum chemistry, electromagnetic waves in plasmas, optics, sound waves, seismology, etc. Especially interested in wave packet methods, Gaussian beams, application of nonlinear dynamics to wave evolution.

William G. Lynch
Dept. of Physics and Astronomy
Michigan State Univ., East Lansing, MI 48824

Nuclear physics: statistical and dynamical aspects of reactions between complex nuclei, fragmentation processes: currently investigating the relative populations of decay configurations of highly excited systems formed by collisions between complex nuclei at intermediate energies (E/A = 10-100 MeV).

Mark Oreglia
Dept. of Physics
Univ. of Chicago, Chicago, IL 60637

Elementary particle physics (experimental high energy physics.). basic structure of matter at small distance scales; particle interactions and nature of the forces; currently performing experiments at Fermilab (Batavia, IL) and the European facility CERN (Geneva, Switzerland).

Stephen Shenker
Dept. of Physics
Univ. of Chicago, Chicago, IL 60637

Topics in two dimensional critical phenomena and the theory of strings. Two dimensional conformal invariance, infinite dimensional Lie algebras, supersymmetry in condensed matter physics, dynamics of string compactification, moduli space as an arena for conformal field theory and string theory.

Social and Behavioral Sciences

Jennifer J. Freyd
Dept. of Psychology
Cornell Univ., Ithaca, NY 14853

Cognition and perception, especially the role of dynamic information in mental representation; experiments demonstrating that representations of static stimuli involve knowledge of past and future events (for instance, during handwriting recognition perceivers may detect and use information relating to production inherent in the static trace of handwritten letters).

Christine A. Hastorf
Dept. of Anthropology
Univ. of Minnesota, Minneapolis, MN 55455

Anthropological archaeology. prehistoric economics, cultural ecology, agricultural production and consumption, the onset of political stratification, paleoethnobotany, Andean archaeology, application of stable isotopes, macrobotanical remains and pollen to address questions of prehistoric plant-use, currently studying paleoethnobotanical methods for cultural interpretation and prehistory of the central Andes of Peru.

Robert G. King
Dept. of Economics
Univ. of Rochester, Rochester, NY 14627

Macroeconomics: financial intermediation and economic growth. Research includes i) models of monetary economies based on costly information; ii) appropriate equilibrium concepts for information based theories of financial structure; iii) equilibrium processes of dynamic stochastic models that possess balanced growth paths under certainty, focusing on econometric methods appropriate for study of economic fluctuations.

Barbara Mellers
Dept. of Psychology
Univ. of California - Berkeley, Berkeley, CA 94720

Mathematical psychology: human judgment and decision-making, especially interested in mathematical models of equity such as "fair" cost and reward allocations, "fair" selection decisions, and judgments of inequity. Also, investigating issues in risky decision-making, judgements under uncertainty, and how contextual effects due to variations in the stimulus distribution influence judgment.

IV. Active 1984 Presidential Young Investigators

Astronomical Sciences

Mitchell Begelman
Joint Institute for Laboratory Astrophysics
Univ. of Colorado, Boulder, CO 80309

Theoretical astrophysics: gasdynamical and radiative processes. Currently studying: quasars and active galactic nuclei; cosmic jets; interactions between galactic nuclei and their environments. Research goals: understanding of energetic phenomena in galactic nuclei, and their role in galaxy formation and evolution. Determination of the occurence and significance of black holes in the universe.

A. Gordon Emslie
Physics Dept.
Univ. of Alabama, Huntsville, AL 35899

Solar physics: energy transport in flares, dynamics of high energy electron beams, radiation mechanisms; also interested in magnetic structure of solar active regions and implications for flare prediction.

Eric D. Feigelson
Dept. of Astronomy
Pennsylvania State Univ., University Park, PA 16802

Observational radio and X-ray astronomy, emphasizing active galactive nuclei (quasars, radio galaxies) and young stars. Developing advanced supermicro computers with array processors for scientific computing and image processing.

Thomas Prince
Dept. of Physics
California Institute of Technology, Pasadena, CA 91125

High-energy astrophysics: hard x-ray and gamma-ray astronomy, including galactic and extragalactic sources and solar flares. Development of hard x-ray and gamma-ray imaging techniques including coded-aperture and Fourier-transform imaging. Computation: development and utilization of concurrent computational techniques.

Simon D. M. White
Steward Observatory
Univ. of Arizona, Tucson, AZ 85721

Astrophysics: the dynamics of galaxies, the distribution of mass within our own and other galaxies; the origin and evolution of structure in the universe, particularly interested in elucidating the nature of the "dark matter" which appears to make up most of the mass of our universe.

Atmospheric Sciences

Duane E. Stevens
Atmospheric Science Dept.
Colorado State Univ., Fort Collins, CO 80523

Dynamic meteorology. understanding the physical and fluid dynamical processes that govern the time-dependent behavior of the earth's atmosphere. Linear waves and instabilities; influences of moist convection on large-scale circulations, tropical, midlatitude and global scale phenomena, weather and general circulation studies, analytic and mumerical modeling techniques.

Biology

David Agard
Dept. of Biochemistry and Biophysics, School of Medicine
Univ. of California - San Francisco, San Francisco, CA 94143

Three-dimensional structure and organization of chromosomes, three-dimensional optical and electron microscopy, relationship between protein structure and function, protein folding; site-directed mutagensis.

Sue G. Bartlett
Dept. of Biochemistry
Louisiana State Univ., Baton Rouge, LA 70803

Plant biochemistry. chloroplast development, specifically transport of cytoplasmically synthesized proteins into the organelle, use of site-specific and TAB linker mutagenesis to elucidate roles of various regions of precursors in transport, probing the surface of the chloroplast for protein components involved in movement of precursors across the organelle envelope.

May R. Berenbaum
Dept. of Entomology
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Chemical ecology, entomology, insect control chemicals, currently investigating genetic resistance mechanisms of plants to insects, interested in effects of ultraviolet light on potentiating insecticidal effects of natural products, also studying natural synergists that circumvent insect resistance to pesticides.

Andrew N. Binns
Dept. of Biology
Univ. of Pennsylvania, Philadelphia, PA 19104

Plant molecular, cellular and developmental biology. plant cell culture, hormonal physiology, *Agrobacterium* mediated transformation, currently testing activities of novel plant cell division promoting substances, characterizing attachment of *Agrobacterium* to plant cells, analyzing ·· ppropriately expressed hormone biosynthesis genes and their effect on hor ·etabolism and activities.

Steven G. Boxer
Dept. of Chemistry
Stanford Univ., Stanford, CA 94305

Biophysical chemistry; molecular biology; charge separation in photosynthesis and model electron transfer systems; heme proteins; site-directed mutagenesis; photochemical hole burning and molecular information storage, molecular devices; DNA oligomer structure and dynamics; CIDNP and magnetic field effects on chemical reaction dynamics.

Daniel Cosgrove
Dept. of Biology
Pennsylvania State Univ., University Park, PA 16802

Plant physiology: physical and cellular control of plant growth, especially as influenced by water stress, light and growth substances, studies include the role of turgor pressure in plant growth, visco-elastic properties of cell walls, and biochemical control of wall properties.

Gary L. Firestone
Dept. of Physiology-Anatomy
Univ. of California - Berkeley, Berkeley, CA 94720

Molecular endocrinology: steroid regulation of phosphoprotein maturation and glycoprotein sorting; characterization of cellular mutants with defects in their ability to produce cell surface antigens; hormonal control of cellular proliferation and mechanisms of hormonal control of cell density-dependent arrest of cell growth; *in vitro* mutagenesis and expression of cell surface glycoprotein genes.

Elaine Fuchs
Dept. of Molecular Genetics and Cell Biology
Univ. of Chicago, Chicago, IL 60637

Molecular mechanisms underlying differentiation and development in human epthelial tissues: studies of extracellular factors that regulate keratin gene expression, using isolation, mapping and sequencing methods to determine the gene sequences essential for proper regulation.

Alice B. Fulton
Dept. of Biochemistry
Univ. of Iowa, Iowa City, IA 52242

Cell biology: organization and assembly of the cytoskeleton, muscle development, translational assembly; tensegrity models of the cytomatrix.

Stanton B. Gelvin
Dept. of Biological Sciences
Purdue Univ., West Lafayette, IN 47907

Plant molecular biology: crown gall tumorgensis; mechanism of transfer and expression of *Agrobacterium tumefaciens* T-DNA to/in plant cells; plant genetic engineering using *Agrobacterium* (specifically, zein gene expression in transgenic tobacco plants, proline overproduction to enhance osmotolerance, and use of antisense RNA to inhibit gene expression), induction of *Agrobacterium* genes after plant cell contact.

Charles Gilbert
Dept. of Neurobiology
Rockefeller Univ., New York, NY 10021

Neurobiology. mechanism of visual information processing in the cer cortex. Relationship of cortical intrinsic microcircuitry, receptive field properties and functional architecture. Mapping brain circuitry with intracellular recording, dye-injection and 3-dimensional reconstruction. Exploring function of connections with pharmacology, multielectrode recording and cross-correlation analysis, and *in vitro* brain slice preparation.

Leonard Guarente
Dept. of Biology
Massachusetts Institute of Technology, Cambridge, MA 02139

Genetics. regulation of eukaryotic gene expression, currently studying DNA sequences in yeast promoters and trans acting proteins that mediate regulation of yeast cytochrome genes. Protein import into yeast mitochondria, currently identifying signal sequences of imported proteins and mitochondrial receptors that recognize them.

Margaret Livingstone
Dept. of Neurobiology
Harvard Univ. Medical School, Boston, MA 02115

Neurobiology. information processing in the primate visual system, especially parallel processing of different aspects of vision. form, color, movement and stereopsis. Biochemical/genetics studies on learning and memory in Drosphila.

Sharon Long
Dept. of Genetics
Stanford Univ., Stanford, CA 94305

Plant molecular biology.

Richard B. Marchase
Dept. of Cell Biology and Anatomy
Univ. of Alabama at Birmingham, Birmingham, AL 35294

Cell biology: oligosaccharides as mediators of intracellular trafficking of newly synthesized glycoproteins; oligosaccharide binding proteins as targets for the selective uptake of extracellular glycoproteins by epithelial cells or neurons; particularly interested in phosphodiester-linked glucose as a molecular signal in these events.

Robert F. Murphy
Dept. of Biological Sciences
Carnegie Mellon Univ., Pittsburgh, PA 15213

Cell biology: pathways of endocytosis and exocytosis in fibroblasts and lymphoid cells, biochemical characteristics of organelles involved in endocytosis, protein localization, mechanisms of growth factor action; fluorescence techniques, especially multiparameter flow cytometry, automated techniques for analysis of flow cytometric data, cluster analysis, application of computers in biomedical sciences.

Timothy W. Nilsen
Dept. of Molecular Biology and Microbiology
Case Western Reserve Univ., Cleveland, OH 44106

Gene regulation in eukaryotic cells. Current research is being conducted on the activation and expression of cellular oncogenes; the molecular mechanism of action of interferon; and eukaryotic RNA processing.

Douglas Rees
Dept. of Chemistry and Biochemistry
Univ. of California - Los Angeles, Los Angeles, CA 90024

Enzyme mechanisms; x-ray diffraction studies of protein structure, electron-transfer reactions in biochemistry; computer analysis of enzyme structure. Nitrogen fixation; photosynthesis.

G. Shirleen Roeder
Dept. of Biology
Yale Univ., New Haven, CT 06511

Molecular genetics. Molecular mechanisms of genetic recombination in yeast with an emphasis on a cis-acting recombination-stimulating sequence in the ribosomal RNA gene cluster of yeast Control of yeast gene expression by transposable elements. Yeast genes involved in meiotic recombination and chromosome segregation.

Daniel Rubenstein
Dept. of Biology
Princeton Univ., Princeton, NJ 08544

Behavioral ecology.

Aziz Sancar
Dept. of Biochemistry
Univ. of North Carolina at Chapel Hill, Chapel Hill, NC 27514

Biochemistry. action mechanism of DNA repair enzymes, development of sensitive assays to test the efficiency of second generation cisplatin anticancer drugs, study of activation of oncogenes by chemical carcinogens.

Terrence J. Sejnowski
Dept. of Biophysics
Johns Hopkins Univ., Baltimore, MD 21218

Computer neuroscience. massively-parallel network architectures, applications to computer vision and speech production, learning algorithms for parallel networks, synaptic plasticity in the nervous system.

Lawrence J. Shimkets
Dept. of Microbiology
Univ. of Georgia, Athens, GA 30602

Molecular and developmental biology. mechanisms by which cell-cell interactions control gene expression. Currently using molecular genetics, classical genetics and biochemistry to elucidate the mechanism and consequences of cell interactions in the myxobacterium *Myxococcus xanthus.*

C. R. Somerville
DOE Plant Research Laboratory
Michigan State Univ., East Lansing, MI 48824

Plant molecular genetics. especially interested in problems associated with photosynthetic carbon metabolism and lipid metabolism, also developing generally applicable methods for transposon mutagenesis in higher plants.

William Whitman
Dept. of Microbiology
Univ. of Georgia, Athens, GA 30602

Physiology and biochemistry of the strictly anaerobic methane-producing archaebacteria, development of genetic techniques for the study of the unique physiology of these bacteria including plasmid and phage isolation, transformation and transduction systems, isolation and characterization of new methanococci, prokaryotic phylogeny by ribosomal RNA structure.

Chemistry

Hector D. Abruna
Dept. of Chemistry
Cornell Univ., Ithaca, NY 14853

Electrochemistry: electroanalysis and electrocatalysis with chemically modified electrodes; photoelectrochemistry with semiconductor electrodes for solar energy conversion; electrochemistry in liquid crystalline media, in-situ study of the electrode/solution interface via surface EXAFS (Extended X-ray Absorption Fine Structure), electrochemical reactivity of transition metal complexes.

Peter B. Armentrout
Dept. of Chemistry
Univ. of California - Berkeley, Berkeley, CA 94720

Physical and organometallic chemistry: chemistry, kinetics and thermodynamics of transition metals, metal clusters, and semiconductor elements. Develop fundamental insight into catalysis, combustion, oxidation, CVD and semiconductor etching and processing Thermodynamic data base for metal and semiconductor reactive species. Ion beam and mass spectrometric studies of ion-molecule reactions.

Paul F. Barbara
Dept. of Chemistry
Univ. of Minnesota, Minneapolis, MN 55455

Physical chemistry: photophysics, photochemistry, high resolution spectroscopy, nonlinear optical properties of organic materials, the kinetics of isomerization reactions in solution and the gas phase, and the development of new technology for making ultrafast spectroscopic measurements.

Jacqueline K. Barton
Dept. of Chemistry
Columbia Univ., New York, NY 10027

Inorganic and biophysical chemistry: development of metal complexes as site-specific probes for molecular biology and in pharmaceutical design, specifically developing chiral metal complexes as luminescent probes to recognize and photochemically modify DNA; more generally concerned with the role of metals in biology and understanding site-specific reactions of metals along macromolecules.

Steven D. Burke
Dept. of Chemistry
Univ. of South Carolina at Columbia, Columbia, SC 29208

Organic chemistry. synthesis of biologically active natural and unnatural products, molecular modeling, drug design, enzyme inhibition, synthesis and structure/activity studies of antitumor and antibiotic substances, intramolecular ligand-directed organometallic transformations applied to total synthesis, pericyclic synthetic methods; catalytic hydroformylation in organic synthesis.

Nathan S. Lewis
Dept. of Chemistry
Stanford Univ., Stanford, CA 94305

Electrochemistry. photoeffects at semiconductor/liquid interfaces, electron transfer reactions at chemically modified electrodes, physical inorganic reactions of transition metal complexes immobilized in polymer supports on electrode surfaces.

Robert R. Lucchese
Dept. of Chemistry
Texas A&M Univ., College Station, TX 77843

Theoretical physical chemistry. modeling of interactions of molecules with surfaces using classical trajectory methods, treating such processes as energy transfer, adsorption, desorption, bond breaking, and vibrational spectroscopy, electron-molecule collision dynamics especially electron-impact excitation and ionization and photoionization including polarization and interchannel coupling effects.

Peter J. Rossky
Dept. of Chemistry
Univ. of Texas, Austin, TX 78712

Theoretical chemistry. statistical mechanics of liquids, computer simulation, structure and dynamics of polar and associated liquids with emphasis on aqueous systems, solvent environmental effects in biochemical systems, quantum effects in chemical solutions.

Richard Saykally
Dept. of Chemistry
Univ. of California - Berkeley, Berkeley, CA 94720

Infrared laser spectroscopy. velocity modulation, spectroscopy of ions and plasmas, dynamics of reactive plasmas, spectroscopy and structure of metal clusters, surface science on a molecular level.

James L. Skinner
Dept. of Chemistry
Columbia Univ., New York, NY 10027

Nonequilibrium statistical mechanics, theory of chemical reactions, polymer dynamics in condensed phases, energy transport in liquids and molecular crystals, optical and vibrational dephasing, theory of nonlinear optical experiments, the glass transition.

Angelica M. Stacy
Dept. of Chemistry
Univ. of California - Berkeley, Berlekey, CA 94720

Solid state chemistry: synthesis and characterization of advanced materials; studies of reactions which occur at the interface between transition metals and metal oxides; growth of transition metal silicide films on silicon; electrochemical synthesis of novel transition metal polychalcogenides.

Nancy S. True
Dept. of Chemistry
Univ. of California - Davis, Davis, CA 95616

Physical chemistry: molecular spectroscopy, inter and intramolecular energy transfer. Especially interested in development of gas phase NMR and microwave techniques to study the dynamics of conformational processes. Currently investigating microwave spectra of vibrationally excited molecules and gas phase NMR relaxation processes.

Isiah M. Warner
Dept. of Chemistry
Emory Univ., Atlanta, GA 30322

Analytical chemistry: fluorescence spectroscopy, development of novel analytical methods for improved multicomponent analysis, chemometrics, especially interested in the development and application of novel analytical methods involving a combination of chemistry, instrumental development and chemometrics, currently have several projects involving diode array detected fluorescence.

Computer Science

James Allen
Dept. of Computer Science
Univ. of Rochester, Rochester, NY 14627

Artificial intelligence: natural language understanding, especially use planning model to account for natural dialogues in task-oriented domains, knowledge representation, especially in the areas of time, action and plans; models of planning in temporally rich domains including simultaneous actions and events.

David R. Cheriton
Dept. of Computer Science
Stanford Univ., Stanford, CA 94305

Computer systems. distributed and parallel operating systems, parallel computation and high-level application systems, especially interested in high-performance interprocess communication and structuring of parallel systems, currently developing techniques to minimize communication overhead in multiprocessor systems.

Merrick Furst
Dept. of Computer Science
Carnegie Mellon Univ., Pittsburgh, PA 15213

Computer science with an emphasis on theoretical aspects of the design and analysis of algorithms. Specifically interested in graph algorithms, group and number-theoretic algorithms and complexity theory. Also studying workstation software design.

John Hennessy
Dept. of Electrical Engineering and Computer Science
Stanford Univ., Stanford, CA 94305

High performance and VLSI computer architectures. Multiprocessor architectures and software. Optimizing compiler systems.

John R. Kender
Dept. of Computer Science
Columbia Univ., New York, NY 10027

Artificial intelligence and computer vision. applications to multiprocessors, surface analysis from texture, stereo, and shading, spatial relations for robotic navigation. Especially interested in shape related real-time applications of computer vision in unconstrained environments.

F. Thomson Leighton
Mathematics Dept.
Massachusetts Institute of Technology, Cambridge, MA 02139

Theoretical computer science. design and analysis of algorithms, parallel computation on fixed-connection networks, VLSI design, wafer-scale integration, probabilistic and asymptotic analysis, fault tolerance and avoidance, combinatorial methods.

Ernst W. Mayr
Dept. of Computer Science
Stanford Univ., Stanford, CA 94305

Design and analysis of algorithms, complexity theory, parallel computation and architectures, graph theory, combinatorics, symbolic mathematics, especially interested in paradigms for parallel programming and properties of problems and algorithms permitting or inhibiting efficient parallel speedup, studying methods and algorithms for scheduling of parallel processes.

Tom M. Mitchell
Computer Science Dept.
Rutgers Univ., New Brunswick, NJ 08903

Artificial intelligence, computer-aided design, robotics. Applications of AI to design of digital circuits and mechanical systems. Research on machine learning in the context of knowledge-based design aids and robotics.

Dana S. Nau
Dept. of Computer Science
Univ. of Maryland, College Park, MD 20742

Artificial intelligence: searching and problem-solving techniques including tree search and Branch and Bound; applications of AI to diagnostic problem solving, including ways to handle multiple simultaneous disorders; applications of AI to process planning in automated manufacturing.

Joseph O'Rourke
Dept. of Electrical Engineering and Computer Science
Johns Hopkins Univ., Baltimore, MD 21218

Computational geometry: including aspects of computer graphics and pattern recognition; specific current projects: motion planning, shortest-paths, hidden surface removal, intersection calculations, shape approximation, polygon decomposition, multiobjective programming, randomized computational geometry, polyhedra.

John Zahorjan
Dept. of Computer Science
Univ. of Washington, Seattle, WA 98195

Computer science: performance analysis using analytic models, control policies for load sharing among distributed processors, name services in large, distributed systems; issues in heterogeneous distributed systems, software performance on multiprocessors.

Earth Sciences

Robert Clayton
Dept. of Geophysics
California Institute of Technology, Pasadena, CA 91125

Research in the area of seismic inversion and imaging, and in the modeling of seismic waveforms. Tomographic inversion techniques applied to whole earth problems, regional upper mantle problems, and local crustal studies; also to exploration geophysics to separately determine velocity and structure.

Michael H. Engel
Dept. of Geology and Geophysics
Univ. of Oklahoma, Norman, OK 73019

Organic geochemistry: effect of migration on the composition of crude oils, simulation studies: diagenetic reactions of organic matter in recent sediments. separation of amino acid and peptide stereoisomers by H.P.L.C. and GC/MS: stable isotope analyses by conventional (MS) and nondestructive (PIXE) methods.

Raymond Jeanloz
Dept. of Geology and Geophysics
Univ. of California - Berkeley, Berkeley, CA 94720

High-pressure research. Studies of material properties and synthesis of new materials at extreme conditions of pressure and temperature, involving basic studies in laser processing and application of diamond cells; mineral physics, thoeretical and experimental studies emphasizing thermal, electronic, optical and mechanical properties of complex oxides, sulfides and metallic alloys.

Joseph L. Kirschvink
Dept. of Geological and Planetary Sciences
California Institute of Technology, Pasadena, CA 91125

Biomineralization. biogenic production of single-domain magnetite (potential use in magnetic recording industry); geomagnetic sensitivity in animals and the prediction of oceanic migration routes (fishing industries). Geophysics & geobiology. measurements of long-term slip rates along active faults, magnetic polarity time scale for the Early Paleozoic (Cambrian-Devonian); studies of bacterial magnetofossils.

Larry Ruff
Dept. of Geological Sciences
Univ. of Michigan - Ann Arbor, Ann Arbor, MI 48109

Physics of the earthquake process. large earthquakes represent the violent release of accumulated strain energy, this process is quantified by the space-time dependence of slip across the fault plane. Currently developing the theory and data processing techniques to produce a tomographic "image" of the fault slip history.

E. Bruce Watson
Dept. of Geology
Rensselaer Polytechnic Institute, Troy, NY 12180

Experimental geochemistry/silicate science. kinetics and phase equilibria of silicate systems at elevated temperatures and pressures, with emphasis on chemical phenomena and processes occurring in the Earth's crust and upper mantle, currently studying fluid flow and grain boundary phenomena in rocks, secondary interest in glass science.

Engineering - Chemical & Process

Ignacio E. Grossmann
Dept. of Chemical Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Computer-aided process design and optimization: synthesis of integrated process flowsheets and energy management systems (heat exchanger networks, utility systems); design under uncertainty, design of flexible processes, batch processes; long-range planning models. Currently developing retrofit design methods to improve flexibility and energy management; algorithms for mixed-integer nonlinear programming.

James M. Haile
Dept. of Chemical Engineering
Clemson Univ., Clemson, SC 29634

Chemical physics and engineering: thermophysical properties of dense fluids; statistical mechanics and computer simulation applied to fluids, fluid mixtures, and disordered materials; studies underway on molecular explanations for non-ideal solution behavior, internal structure of quasi-spherical surfactant micelles, and microstructure in random media.

Klavs F. Jensen
Dept. of Chemical Engineering and Materials Science
Univ. of Minnesota, Minneapolis, MN 55455

Chemical engineering: processing of electronic materials; especially transport phenomena and reaction mechanisms underlying chemical vapor deposition of compound semiconductors, plasma processing, and laser assisted chemical vapor deposition of semiconductors and conductors; experiments and large scale computations; also interested in transport and reaction in porous media, including percolation theory applications.

Eric W. Kaler
Dept. of Chemical Engineering
Univ. of Washington, Seattle, WA 98195

Colloid and surfactant science. Microemulsions, micellar solutions, and vesicles. Currently studying solubilization of particles in microemulsions, detergency, microemulsion liquid membranes, and ionic transport across vesicle walls. Thermodynamic and structural studies, characterization with quasielastic light and small-angle x-ray and neutron scattering. Development of new scattering methods for turbid samples.

William John Koros
Dept. of Chemical Engineering
Univ. of Texas - Austin, Austin, TX 78712

Chemical engineering: thermodynamics and transport phenomena associated with polymeric media; especially interested in fundamental aspects of material selection for membrane separation and barrier polymer applications, currently studying high pressure sorption and dilation processes for polymers exposed to high pressure gases, pure and mixed gas permeation through polymers is also being studied.

Michael R. Ladisch
Dept. of Agricultural Engineering
Purdue Univ., West Lafayette, IN 47907

Bioseparations. process liquid chromatography, adsorption, and fundamentals of multicomponent separations. Enzyme and biochemical reactor design and kinetics. mechanisms of hydrolytic enzymes. Fermentation of cellulolytic microorganisms. Coagulation of protein micelles. Biomass conversion. production of fermentable sugars from biomass. Pentose fermentations.

Douglas Lauffenburger
Dept. of Chemical Engineering
Univ. of Pennsylvania, Philadelphia, PA 19104

Molecular/cellular bioengineering. receptor-mediated cell behavior, including cell adhesion, cell growth factors, receptor-mediated endocytosis, and chemotaxis, with application to cell growth and separations, and diagnosis and therapy in infections, allergic, and malignant diseases.

Richard I. Masel
Chemical Engineering Dept.
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Catalysis. development of theoretical and experimental techniques to identify active sites in heterogeneous catalysts. Currently studying active sites for NOx removal, HCN synthesis, and coke formation during reforming reactions. Semiconductor growth. examining the surface chemistry of semiconductor growth, Currently examining the mechanism of laser assisted chemical vapor deposition.

Manfred Morari
Dept. of Chemical Engineering
California Institute of Technology, Pasadena, CA 91125

Process control. robustness, effect of model error on closed loop stability and performance, modeling for control, constrained and nonlinear control, computer-aided control system design, expert system for control system design, applications to distillation, reactors. Process design. energy integration, heat exchanger networks, operability, flexibility and resilience. Effect of process design on process control.

Brij M. Moudgil
Dept. of Materials Science and Engineering
Univ. of Florida, Gainesville, FL 32611

Mineral engineering: aggregation-dispersion of fine particle suspensions, selective coating of surface modifying agents through adsorption and desorption. Presently investigating adsorption-desorption mechanisms of surface active agents and polymers on solid substrates as applied to solid-solid and solid-liquid separations in the fine particle size range.

Julio M. Ottino
Dept. of Chemical Engineering
Univ. of Massachusetts, Amherst, MA 01003

Fluid mechanics of mixing: kinematics, chaos-theoretical and experimental, analysis of breakup and dispersion, visualization of mixing. Reactive mixing: mixing effects in chemical reactions including polymerization. Transport processes in disordered media: modeling studies, applications to transport of gases in polymer blends, transport morphology relationships.

Michael Paulaitis
Dept. of Chemical Engineering
Univ. of Delaware, Newark, DE 19711

High-pressure fluid phase equilibria: supercritical-fluid extraction; polymer processing with compressed gases; supercritical-fluid chromatography; solvent effects on reactions in compressible fluids at elevated pressures. Solvent effects on enzyme catalysis in organic media.

David W. Pershing
Dept. of Chemical Engineering
Univ. of Utah, Salt Lake City, UT 84112

Incineration of hazardous industrial wastes: use of new laboratory and pilot-scale experimental facilities and related computer model to characterize the destruction of hazardous solids in a rotary kiln environment; also thermal cleanup of PCB and dioxin contaminated soils.

Mark A. Prelas
Dept. of Nuclear Engineering
Univ. of Missouri-Columbia, Columbia, MO 65201

Laser physics: high power laser design, kinetics, optics, system design; interested in coupling of lasers to nuclear energy sources and nuclear pumped lasers. Plasma physics: diagnostics, particle transport, RF; specific interests in experimental physics associated with tandem mirrors.

Robert Prud'Homme
Dept. of Chemical Engineering
Princeton Univ., Princeton, NJ 08544

Chemical transport phenomena.

Asit K. Ray
Dept. of Chemical Engineering
Univ. of Kentucky, Lexington, KY 40506

Aerosol physics and chemistry with special interests in formation and growth of micro-particles in vapor and liquid phases, and gas-particle (liquid or solid) reactions, vapor-surface interactions, ultra-low vapor pressure determination, measurement of multi-component vapor-liquid equilibrium data, elastic and inelastic light scattering, mathematical modeling related to heat and mass transfer.

Robert F. Savinell
Dept. of Chemical Engineering
Univ. of Akron, Akron, OH 44325

Electrochemical engineering. reactor modeling and scale up, electrosorption at activated carbon surfaces, characterization and modeling of fluidized bed, packed bed, and porous electrodes, characteristics and dynamics of gas bubbles at gas evolving electrodes, simulation and optimization of batteries and fuel cells, AC impedance and photoexcitation studies of coated and uncoated electrogalvanized steel.

James C. Seferis
Dept. of Chemical Engineering
Univ. of Washington, Seattle, WA 98195

Polymer composites. processing-structure-property relations of polymers reinforced with continuous fibers for improvement of load-bearing characteristics. Both thermoplastic and thermosetting polymers as matrices are being studied with emphasis on the kinetics of cure/solidification during processing. A balance between theory and experiments is maintained throughout this research.

Gregory Stephanopoulos
Dept. of Chemical Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139

Biochemical enginering and biotechnology. fundamentals of mammalian cell biochemistry, novel bioreactors for mammalian cell cultivation, on-line bioreactor monitoring and optimal control with applications to amino acid, mammalian cell and recombinant yeast and bacteria fermentations, immobilized cell systems, mixed culture fermentations.

Matthew Tirrell
Dept. of Chemical Engineering and Materials Science
Univ. of Minnesota, Minneapolis, MN 55455

Polymer physics and engineering: diffusion mechanisms, theoretical modelling, diffusion measurement, diffusion-controlled reactions of polymers, interfacial properties, adhesion, colloid stability, welding and sintering of polymers, adsorption, lubrication, flow of polymer fluids in porous media. Interested in engineering applications of fundamental developments in polymer physics.

Engineering - Civil & Environmental

David B. Ashley
Dept. of Civil Engineering
Univ. of Texas - Austin, Austin, TX 78712

Construction engineering and project management. risk identification, analysis and management for construction projects; development of analysis techniques for preconstruction planning; use of project data to identify potential risks and determinants of construction project success; development of planning aids including knowledge-based expert systems.

Mark S. Daskin
Dept. of Civil Engineering
Northwestern Univ., Evanston, IL 60201

Logistics and transportation systems analysis. optimal plant and warehouse location models as well as supplier location models; vehicle routing models. Currently developing and implementing computer algorithms for facility location models with minumum and maximum utilization constraint and proxies for inventory handling costs.

Charles T. Driscoll
Dept. of Civil Engineering
Syracuse Univ., Syracuse, NY 13244

Environmental engineering: environmental chemistry, water quality modeling; especially interested in effects of anthropogenic stress to watersheds and surface waters; currently evaluating effects of acid rain and tree harvesting practices on soil and surface water quality.

Achintya Haldar
Dept. of Civil Engineering
Georgia Institute of Technology, Atlanta, GA 30332

Civil engineering. risk-based design in structural and geotechnical engineering, nonlinear (material and geometric) dynamic response of Type 3 semi-rigid steel frames considering loading and unloading, non-Gaussian fatigue response of steel jackets, stochastic dynamic response of compliant offshore structures, stochastic finite elements, modeling of nonhomogeneous soil properties using random field theory.

Anthony R. Ingraffea
Dept. of Structural Engineering
Cornell Univ., Ithaca, NY 14853

Computer simulation of fracture processes. finite and boundary element modeling of brittle, fatigue, and dynamic fracture, especially interested in modeling three-dimensional crack propagation with automatic rezoning for arbitrary trajectory, current applications, fatigue of aerospace structures, hydrofracturing and dynamic fracturing for oil/gas well stimulation, using highest level interactive computer graphics.

Ahsan Kareem
Dept. of Civil Engineering
Univ. of Houston, Houston, TX 77004

Structural engineering and engineering mechanics. computational and experimental techniques in structural and fluid dynamics, fluid structure interactions, dynamic response of land-based, offshore and aerospace structures subjected to environmental load effects, e.g., wind, waves and earthquakes, mitigation of natural and man made hazards, probabilistic methods, simulation of random fields, stochastic finite element modeling techniques, knowledge based expert systems for analysis and design.

William R. Knocke
Dept. of Civil Engineering
Virginia Polytechnic Institute, Blacksburg, VA 24061

Optimization of physico chemical treatment of industrial wastewaters, emphasizing the processes of coagulation, precipitation, adsorption, surface exchange, and ultra filtration, sludge dewatering and disposal characteristics, hazardous waste management options, emphasizing recycle/recovery systems.

Roman Krzysztofowicsz
Dept. of Systems Engineering
Univ. of Virginia, Charlottesville, VA 22901

Systems engineering: intelligent decision systems, decision support systems, computer-aided engineering design, knowledge-based (expert) systems, forecast-decision systems; stochastic control, risk analysis, decision analysis, systems analysis; interface between mathematical (normative) and cognitive (behavioral) aspects of human judgment and decision making, human-computer interface.

Stelios Kyriakides
Dept. of Aerospace Engineering and Engineering Mechanics
Univ. of Texas-Austin, Austin, TX 78712

Structural mechanics: buckling and post-buckling behavior of inelastic structures. Current work: experimental and numerical studies of a) propagating buckles in offshore pipelines, b) the stability of tubular structures under combined bending, tension and pressure, c) instability of tubular structures under cyclic loading, d) inelastic constitutive models for cyclic loading histories.

Daniel R. Lynch
Thayer School of Engineering
Dartmouth College, Hanover, NH 03755

Numerical methods applied to advanced engineering and scientific problems. Finite element, boundary element, hybrid, and deforming element simulations of hyperbolic and moving-boundary problems. Applications in fluid mechanics; electricity and magnetism (solution of Maxwell equations on lossy, inhomogeneous media with applications in hyperthermia), basic transport processes in crystal growth; and geophysics.

Gregory J. McRae
Dept. of Chemical Engineering
Carnegie-Mellon Univ., Pittsburgh, PA 15213

Atmospheric processes responsible for acid deposition, transport and transformation in multimedia environments, toxic waste management, sensitivity analysis, parameter estimation, and optimization of nonlinear systems, artificial intelligence, use of models in the policy process, and design of cost effective environmental controls.

J. Jeffrey Peirce
Dept. of Civil and Environmental Engineering
Duke Univ., Durham, North Carolina 27706

Basic mechanisms (physical, chemical, biological) which control particle movement in fluids and, similarly, fluid movement through particles. Currently developing theories with application to: 1) air classification for separation of particle mixtures, for example mica/sand, wheat/chaff, peanuts/shells, and combustible/noncombustible fractions of municipal solid waste and 2) clay liners to contain hazardous wastes.

Bruce E. Rittmann
Dept. of Civil Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Environmental engineering: biological detoxification, biofilm processes, trace-organics biodegradation. Currently studying the design of fluidized-bed biofilm reactors, for treatment of leachates, the enhanced *in situ* bioreclamation of contaminated aquifers, and biological treatment to produce drinking water.

Nicholas Sitar
Dept. of Civil Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Geotechnical engineering: properties of weak rocks and cemented soils; slope stability, including seismic slope response and mechanism of initiation of debris flows. Hydrogeology and contaminant transport: transport of organic solvents in groundwater including clay/solvent interaction, regional hydrogeology, stochastic modeling of groundwater flow.

Pol D. Spanos
Dept. of Civil and Mechanical Engineering
Rice Univ., Houston, TX 77251

Dynamics and vibrations with emphasis on nonlinear and random aspects and applications to aerospace engineering, earthquake engineering, and offshore engineering, currently studying with analytical and numerical methods a variety of structural mechanics problems.

Jery R. Stedinger
Dept. of Environmental Engineering
Cornell Univ., Ithaca, NY 14853

Water resource systems engineering. models for identification of efficient multiple-reservoir and hydropower system operating policies, generation of stochastic stream flow sequences for the simulation of such systems, use of historical and paleoflood data in flood frequency analysis, regional hydrologic regression and network analyses, and gound-water monitoring and management.

Engineering -Electrical, Computer & Systems

Narendra Ahuja
Dept. of Electrical Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Computer vision, robotics and artificial intelligence. Early vision, inference of three-dimensional surfaces from stereo, image texture and motion, perceptual grouping, generation of three-dimensional octree representation of objects for images, maintenance of octree representation of moving objects, collision avoidance and path planning; multiprocessor architectures for vision.

John J. Bartholdi, III
Dept. of Industrial and Systems Engineering
Georgia Institute of Technology, Atlanta, GA 30332

Design and analysis of algorithms for problems of logistics, coordination, and scheduling. Especially interested in problems within automated storage-and-retrieval systems and automated manufacturing systems.

Gershon Buchsbaum
Dept. of Bioengineering
Univ. of Pennsylvania, Philadelphia, PA 19104

Visual system and image processing: processing and analysis of visual signals including image coding and transmission; image parameters and feature extraction and signal reconstruction from partial information or limited sampling, a special interest in color vision, color and brightness systems. Applications in visual aids and image-processing.

James A. Bucklew
Dept. of Electrical and Computer Engineering
Univ. of Wisconsin - Madison, Madison, WI 53706

Communication systems: data digitization, noise analysis of receiver structures, robust filtering techniques; currently interested in new analysis techniques for spread spectrum digital receivers.

Roland T. Chin
Dept. of Electrical and Computer Engineering
Univ. of Wisconsin - Madison, Madison, WI 53706

Digital image processing and pattern recognition. image restoration, multidimensional signal processing, image modelling, machine vision, studying new methods for autonomous satellite data analysis and classification, also interested in applications to industrial visual inspection and object recognition.

Samuel Chiu
Dept. of Engineering-Economic Systems
Stanford Univ., Stanford, CA 94305

Operations research and systems engineering. location theory, transportation of hazardous materials, scheduling of work crews, location of service facilities incorporating the effect of congestion; methodology to evaluate and identify appropriate routings for the transportation of hazardous materials, distributed algorithms on communication networks; scheduling of work force for urban service systems.

Supriyo Datta
Dept. of Electrical Engineering
Purdue Univ., West Lafayette, IN 47907

Electron transport in sub-micron structures, quantum wells, heterostructures and superlattices.

David F. Delchamps
Dept. of Electrical Engineering
Cornell Univ., Ithaca, NY 14853

Control of nonlinear systems, complicated dynamical phenomena in nonlinear systems; robust nonlinear control, especially interested in how uncertainty about initial conditions and system parameters propagates in time as a function of complicated dynamics, quantitative analysis of how uncertainty is introduced into models via finite-precision simulation of physical processes.

William Randolph Franklin
Dept. of Electrical and Systems Engineering
Univ. of California - Berkeley, Berkeley, CA 94720

Artificial intelligence applied to computer aided design. using Prolog for efficient robust computer graphics algorithms such as polyhedron combination, analysis of the internal consistency and completeness of expert systems written in ESDE, portable Prolog programming, cartographical algorithms such as map overlay, octrees, hidden surface algorithms; Voronoi diagrams for minimum paths in robotics.

Victor S. Frost
Dept. of Electrical & Computer Engineering
Univ. of Kansas, Lawrence, KS 66045

Communications systems engineering. modeling, analysis and simulation of integrated voice data transmission techniques and networks. Research problems being addressed include developing computationally efficient techniques for modeling and simulation of communication networks based on the OSI model.

Hector Garcia-Molina
Computer Science Dept.
Princeton Univ., Princeton, NJ 08544

Distributed computing systems. synchronization, reliability, performance, especially interested in distributed database systems. Also interested in computer architectures supporting large main memories and high band with input/output paths.

Ronald M. Gilgenbach
Dept. of Nuclear Engineering
Univ. of Michigan, Ann Arbor, MI 48109

Applications of intense laser and particle beams. laser guided discharges, plasma effects in laser machining and welding, rapid energy deposition in gases and metals, new manufacturing applications of intense energy beam technology.

Bruce Hajek
Dept. of Electrical and Computer Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Communication and computer networks: dynamic routing, access control and scheduling. Currently investigating interconnection strategies for multiprocessing. Stochastic optimization techniques for large scale problems.

Monson H. Hayes
Dept. of Electrical Engineering
Georgia Institute of Technology, Atlanta, GA 30332

Digital signal processing: theory and application of DSP to one-dimensional and multidimensional problems; especially interested in signal restoration from incomplete or partially degraded information; currently studying problems in spectrum estimation, system identification, phase retrieval, and deconvolution.

Chris Heegard
Dept. of Electrical Engineering
Cornell Univ., Ithaca, NY 14853

Magnetic, optical recording; signal design, detection, error-control for disk, tape. Trellis coded, high speed modems; data rate, integrity, synchronization, hardware complexity; sequence estimation; new trellis codes, adaptive equalization. Coding for VLSI RAM's: analysis coding gains; error-control codes. Digital signal processing; source coding; universal data compression, coding theory, information (Shannon) theory.

John M. Hollerbach
Artificial Intelligence Lab.
Massachusetts Institute of Technology, Cambridge, MA 02139

Robotics: manipulator kinematics, dynamics, and control, multi-fingered robot hands, tactile sensing, control, and computational architecture. ...cient algorithms, minimum time trajectory planning, kinematic redundancies, load and link inertial parameter dynamic estimation, kinematic calibration, direct drive arm control. Human motor control: 3-D arm movement measurements and modeling. Grasping, haptics, and tactile sensing.

William E. Hopkins, Jr.
Dept. of Electrical Engineering
Princeton Univ., Princeton, NJ 08544

Applications of systems and control theory. algorithms for nonlinear filtering and signal processing, adaptive control of infinite dimensional systems, robust stabilization of families of linear systems with parameter uncertainty.

Marija Ilic'-Spong
Dept. of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign, Urbana, IL 61801

Electric power systems. analysis and control, systemwide voltage problems and real-time control strategies to prevent them. Electric drives. analysis and control. Power Electronics: analysis and control.

Janice M. Jenkins
Dept. of Electrical Engineering and Computer Science
Univ. of Michigan - Ann Arbor, Ann Arbor, MI 48109

Real time signal processing of the electrocardiogram, biomedical pattern recognition, computer analysis of physiological signals, medical image processing, computer architecture.

Antoine Kahn
Dept. of Electrical Engineering
Princeton Univ., Princeton, NJ 08544

Semiconductor surfaces and interfaces. atomic geometry, chemical reaction and electronic structure of vacuum-, metal- and insulator-compound semiconductor interfaces, particularly interested in problems related to Schottky barrier formation and III-V compound surface passivation.

Randy H. Katz
Dept. of Electrical Engineering and Computer Science
Univ. of California - Berkeley, Berkeley, CA 94720

VLSI systems. microprocessor architectures, impact of VLSI on computer system design, techniques for rapid prototyping of VLSI hardware, computer aided design tool synthesis (module generation) and data management (computer-aided design databases).

Hoi-Sing Kwok
Dept. of Electrical and Computer Engineering
State Univ. of New York at Buffalo, Buffalo, NY 14260

Ultrafast laser spectroscopy. generation of synchronized tunable ultrafast laser pulses in the infrared, visible and ultraviolet wavelength regions and their applications to the study of semiconductors and chemical physics. Laser-materials interaction. application of high power laser pulses to materials synthesis and processing.

Michael R. Lightner
Depts. of Electrical and Computer Engineering and Computer Science
Univ. of Colorado, Boulder, CO 80309

Computer-aided design for very large scale integrated circuits, hardware description languages and mixed logic through behavioral level simulation tools; integration of CAD tools into a silicon compiler system. Systolic systems for the dynamic programming solution of the maximum likelihood estimation problem on Markov chains. Algorithms for the effective use of multi-criteria optimization and approximation theory.

Stephen A. Lyon
Dept. of Electrical Engineering
Princeton Univ., Princeton, NJ 08544

Semiconductor physics: hot carrier relaxation, quantum wells and quasi two-dimensional electrons, disorder in superlattices, defects at heterojunction interfaces; interested in problems pertaining to very small, high-speed semiconductor devices. Currently studying hot electron relaxation in quantum wells and the generation of interface states in the Si-SiO2 system.

Armand M. Makowski
Dept. of Electrical Engineering
Univ. of Maryland, College Park, MD 20742

Engineering systems: modeling, performance evaluation, and optimal design of control and communication systems; focus on computer communications and, more generally, resource-sharing environments subject to uncertainty, currently studying non-standard queueing models (with synchronization constraints and blocking) and their adaptive design.

John Ousterhout
Dept. of Electrical Engineering and Computer Science
Univ. of California - Berkeley, Berkeley, CA 94720

Computer science: operating systems; particularly interested in issues related to networks, distributed filesystems, engineering workstations, computer-aided design of integrated circuits; interactive graphics.

Clifford R. Pollock
Dept. of Electrical Engineering
Cornell Univ., Ithaca, NY 14853

Lasers: tunable infrared lasers, color center lasers, and ultrashort pulse generation. Invention and application of better tunable infrared lasers to studies of semiconductors, solid state defects, and optical fibers. Fiber optics. nonlinear properties of fibers, pulse compression, and sensors (temperature, stress, position, etc.) based on optical fibers.

David M. Pozar
Dept. of Electrical and Computer Engineering
Univ. of Massachusetts, Amherst, MA 01003

Electromagnetics. theoretical solutions and experimental verification of analyses for millimeter wave antennas and phased arrays. Novel phased array architectures, wide-angle impedance matching; spectral transform domain techniques, and scan blindness phenomenon. Applications to monolithic integrated phased arrays.

Rafael Reif
Dept. of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA 02139

Novel processing technologies for the fabrication of integrated circuits. Low pressure, plasma-enhanced chemical vapor deposition of silicon epitaxy, polycrystalline silicon, and titanium silicide. Plasma-enhanced, metal-organic chemical vapor deposition of compound semiconductors. Low-temperature fabrication technology for thin film transistors. Process modeling and simulation.

Ronald J. Roedel
Dept. of Electrical Engineering
Arizona State Univ., Tempe, AZ 85287

Solid state electronics. compound semiconductors (especially GaAs, InP, and CdTe based materials); processing of these materials (including growth, diffusion, dielectric depositions, and metallization), design and construction of devices based on these materials (especially opto-electronic devices, LED's, laser diodes, photodetectors); characterization of these materials and devices (electron microscopy, photoluminescence, etc.)

David Rutledge
Dept. of Electrical Engineering
California Institute of Technology, Pasadena, CA 91125

Monolithic millimeter-wave integrated circuits, millimeter-wave phased arrays, electronic beam-steering, millimeter-wave imaging antenna arrays, integrated-circuit antennas; submillimeter-wave devices.

Robin N. Strickland
Dept. of Electrical and Computer Engineering
Univ. of Arizona, Tucson, AZ 85721

Digital image processing. image sequence analysis, image modeling and characterization, estimation of objects in noise, color image restoration and enhancement, target tracking in image sequences. Digital signal processing. recursive median filters for noise smoothing.

B. Stuart Trembly
Thayer School of Engineering
Dartmouth College, Hanover, NH 03755

Electrical engineering: medical applications; specifically, antenna design for microwave hyperthermia cancer therapy; reshaping of the cornea through microwave heating; acoustical diagnosis.

Jan Van der Spiegel
Dept. of Electrical Engineering
Univ. of Pennsylvania, Philadelphia, PA 19104

Microelectronics: rapid thermal annealing of electronic materials, including binary and ternary silicides for interconnects and contacts, rapid thermal oxidation and nitridation. Microsensor technology: use of microfabrication technology for fabrication of new microsensor structures.

Sally Wood
Dept. of Electrical Engineering
Univ. of Santa Clara, Santa Clara, CA 95053

Bioengineering.

Engineering - Mechanical & Applied Mechanics

Ronald G. Askin
Dept. of Systems and Industrial Engineering
Univ. of Arizona, Tucson, AZ 85721

Production systems: integrated production planning, process planning, scheduling and facility layout; production lot siting with load variability and work-in-process considerations; generalized assembly line balancing group technology configuration.

John L. Bassani
Dept. of Mechanical Engineering and Applied Mechanics
Univ. of Pennsylvania, Philadelphia, PA 19104

Mechanical behavior of materials - solid mechanics: inelastic deformation and fracture, micromechanics; current research: 1) high-temperature crack growth in metals and ceramics, 2) large-strain deformation and fracture of polymers, 3) cyclic plasticity of crystals, 4) deformation of metal-matrix composites, and 5) plasticity of intermetallic compounds (ordered alloys)

Haim H. Bau
Dept. of Mechanical Engineering and Applied Mechanics
Univ. of Pennsylvania, Philadelphia, PA 19104

Heat/mass transfer: transport processes in porous and particulate media; buoyancy induced flows; cooling of electronic equipment; use of expert systems. Stress waves in solid waveguides and their interaction with adjacent media: dependence of wave speed, attenuation and dispersion on waveguide and media characteristics; currently developing sensors for the measurement of fluid parameters.

Joseph J. Beaman
Dept. of Mechanical Engineering
Univ. of Texas, Austin, TX 78712

Dynamic systems and control. control - interest in control of nonlinear systems in the presence of uncertainty especially granular nonlinearities such as back lash and friction. Automation - limits to speed of electronic assembly. Modeling - bond graph techniques; adsorption systems; on board oxygen and nitrogen generation.

M. Quinn Brewster
Dept. of Mechanical Engineering
Univ. of Utah, Salt Lake City, UT 84112

Heat transfer. combustion, radiative effects, optical properties of materials. Laser cutting, drilling, machining and welding. Currently studying radiative properties of aluminized propellant flames.

Charles S. Campbell
Dept. of Mechanical Engineering
Univ. of Southern California, Los Angeles, CA 90089

Mechanical engineering. multiphase flow and heat transfer, currently using experiments, theory and computer simulation to examine granular flows aiming towards the optimization of both the flow and heat transfer properties.

Michael Corradini
Dept. of Nuclear Engineering
Univ. of Wisconsin, Madison, WI 53706

Reactor engineering and safety. two-phase flow and heat transfer as applied to reactor design and safety, in particular interfacial momentum and heat transfer between phases at interfaces; object is to reduce the hazards during reactor operation and improve the design of inherent safety.

Paul R. Dawson
Dept. of Mechanical and Aerospace Engineering
Cornell Univ., Ithaca, NY 14853

Manufacturing engineering with concentration in physical process modeling. Emphasis on numerical (finite element) simulation of forming, joining and casting of metals and polymers. Experience includes rolling, drawing, extrusion and solid-state welding of metals, ultrasonic bonding of thermoplastics, and binary alloy solidification using mixture theories.

Max Donath
Dept. of Mechanical Engineering
Univ. of Minnesota, Minneapolis, MN 55455

Robotics: integration of sensors, intelligence and motor control functions in performance of human-like activities, such as two-legged walking, multi-fingered hand control, high precision motion control of lightweight arms using end point sensing and automatic planning of tasks such as precision machining, parts assembly, and measurement.

John K. Eaton
Dept. of Mechanical Engineering
Stanford Univ., Stanford, CA 94305

Fluid mechanics: complex turbulent flows including three dimensional shear flows, unsteady separated flows, flows with rotation, and particle laden gas flows; emphasis on active control of turbulence with applications in aerodynamic control of stall, particle dispersion for coal combustion, gas turbine disk cooling, and vibration reduction for computer disk drives.

James B. Grotberg
Biomedical Engineering Dept.
Northwestern Univ., Evanston, IL 60201

Biological fluid mechanics: flexible tube flows and flutter instability, oscillatory flow and mass transport in branching tube networks; deposition of inhaled toxins and drugs; droplet spreading on liquid films and mass transfer; enhancement of mucus transport; pulmonary heat transfer; high frequency ventilation.

Jonathan J. L. Higdon
Dept. of Chemical Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Fluid mechanics: porous media, single phase flow and multiphase displacement processes; viscous flow and mass transfer in microscopic regions with application to microelectronics, corrosion, cleansing of rough surfaces; mixing, coalescence and breakup of droplets in shear flows; instabilities of multiphase suspensions with application to sedimentation and hydrofracture slurries.

Kathleen Howell
School of Aeronautics and Astronautics
Purdue Univ., West Lafayette, IN 47907

Spacecraft dynamics and control. trajectory design and maneuver analysis in orbit mechanics; nominal path control and station keeping, nonlinear control systems/orbit determination; state estimation and error analysis, currently studying techniques to reduce the effects of the principal error sources in estimating satellite orbits.

Daniel J. Inman
Dept. of Mechanical & Aerospace Engineering
State Univ. of New York at Buffalo, Buffalo, NY 14260

Vibrations. modal analysis and testing, comparison of finite element models and test data, development of physical models from modal tests with particular interest in damping and system identification methods. Structural control. vibration suppression of large flexible space structures using active damping, electronic damping and proof mass actuators.

Edward J. Kerschen
Dept. of Aerospace and Mechanical Engineering
Univ. of Arizona, Tucson, AZ 85721

Unsteady fluid dynamics. theoretical modeling of unsteady fluid flow phenomena, emphasis on aeronautical applications. Currently studying. a) aspects of the noise and unsteady structural loading caused by interactions between aircraft propulsion system blades, and b) the influence of free-stream disturbances of boundary layer instability wave development and transition to turbulence.

Jack Lohmann
Dept. of Industrial and Operations Engineering
Univ. of Michigan, Ann Arbor, MI 48109

Engineering economics.

Marshall B. Long
Dept. of Mechanical Engineering
Yale Univ., New Haven, CT 06520

Laser diagnostics. the use of laser light scattering techniques (Lorenz/Mie, Rayleigh, fluorescence, and Raman) for characterizing the large-scale structures in turbulent reacting and nonreacting flows. Emphasis is on techniques which provide quantitative two- and three-dimensional data.

G. Paul Neitzel
Dept.of Mechanical and Aerospace Engineering
Arizona State Univ., Tempe, AZ 85287

Fluid mechanics: hydrodynamic stability, particularly for unsteady swirling flows; fluid mechanics of crystal-growth processes such as float-zone and Czochralski and the stability of flows associated with them; vortex breakdown, numerical simulation of flows.

Daniel Nosenchuck
Dept. of Mechanical and Aerospace Engineering
Princeton Univ., Princeton, NJ 08544

Experimental fluid dynamics.

Helen Reed
Dept. of Mechanical Engineering
Univ. of Arizona, Tucson, AZ 85721

Hypersonics: boundary-layer stability and transition including non-equilibrium chemistry effects (theoretical and computational approaches). Hydrodynamic stability and laminar flow control: three-dimensional flows, receptivity (theoretical, computational, and experimental approaches); unsteady separation and dynamic stall (theoretical, computational, and experimental approaches).

Andy Ruina
Dept. of Theoretical and Applied Mechanics
Cornell Univ., Ithaca, NY 14853

Earthquake prediction, rock mechanics, friction, stick-slip. work is aimed at understandng the possible mechanics of earthquake sources using simple deterministic models based on laboratory inferred material properties. Other mechanics: metal deformation and fracture, fruit bruising, plows, wind and human powered vehicles.

Satwindar Singh Sadhal
Dept. of Mechanical Engineering
Univ. of Southern California, Los Angeles, CA 90089

Heat transfer and fluid dynamics: compound multiphase drops and bubbles, three-fluid systems, direct-contact heat exchangers, condensation and evaporation. Thin film phenomena, spray droplet evaporative cooling of solid surfaces, microlayer evaporation in boiling, solid-liquid thermal interaction in thin films. Heat conduction in composite media, thermal analysis of electronic equipment.

Eric Sandgren
Dept. of Mechanical and Aerospace Engineering
Univ. of Missouri - Columbia, Columbia, MO 65201

Computer aided design. large scale optimization, computational analysis, nonlinear programming, computer graphics, especially interested in parallel processing implementations.

Kyra D. Stephanoff
Dept. of Mechanical Engineering and Mechanics
Lehigh Univ., Bethlehem, PA 18015

Transition to turbulence in finite shear layers such as those that span openings in aircraft fuselages, mixing of very viscous fluids using pulsatile flow, studying the unsteady flow field downstream of models of stenosed arteries.

Charles L. Tucker, III
Dept. of Mechanical and Industrial Engineering
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Processing of polymers and composite materials. Mathematical modeling of processes. fluid flow, heat transfer, development of material structure. Computer simulations, finite element methods. Study of short fiber composites. prediction of fiber orientation, measuring fiber orientation via image analysis, rheology of fiber/resin mixtures. Simulations of compression molding.

Information Science

Wendy G. Lehnert
Dept. of Computer and Information Science
Univ. of Massachusetts - Amherst, Amherst, MA 01003

Artificial intelligence. natural language processing, knowledge representation and memory organization. Specific interests include text summarization. Knowledge-based inference, and software design issues for natural language sentence analyzers. Currently investigating episodic memory structures and knowledge acquisition in case-based reasoning systems. Possible applications include tools for automating "institutional memory."

David Maier
Dept. of Computer Science and Engineering
Oregon Graduate Center, Beaverton, OR 97006

Knowledge management systems. object-oriented databases, compiling logic queries over databases, display of complex objects. Studying hybrids of logic and object-oriented languages for database rules and queries. Working on generating interactive displays of database objects automatically from high-level specifications.

Materials Research

Tai-chang Chiang
Dept. of Physics
Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801

Solid state physics: growth and the electronic properties of surfaces, interfaces and thin films; using molecular beam epitaxy techniques for sample preparation and synchrotron photoemission, Auger spectroscopy, and electron diffraction for characterization and measurements; currently studying metal systems, metal-semiconductor interfaces, semiconductor-semiconductor heterojunctions, and strained layers.

Katherine T. Faber
Dept. of Ceramic Engineering
Ohio State Univ., Columbus, OH 43210

Materials science and engineering: fracture of brittle solids, toughening mechanisms including particle, whisker and fiber reinforcement for high performance applications; reliability; thermal stresses and thermal shock resistance; strengthening of electronic materials, such as GaAs.

Martin Harmer
Dept. of Metallurgy and Materials Engineering
Lehigh Univ., Bethlehem, PA 18015

Physical ceramics: sintering mechanisms and dopant effects, aluminum nitride and alumina ceramics, electron microscopy of capacitor dielectrics, relaxor ferroelectrics such as lead magnesium niobate, dielectric properties, mechanical property - microstructure relationships.

Paul A. Heiney
Dept. of Physics
Univ. of Pennsylvania, Philadelphia, PA 19104

X-ray scattering studies of lower-dimensional materials and phase transitions. Quasicrystals, liquid crystals, adsorbed gasses, intercalated graphite. Currently studying strand-like disoctic liquid crystals, icosahedral alloys.

Gretchen Kalonji
Dept. of Materials Science and Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139

Theoretical studies of defects in crystalline solids, grain boundary phase equilibria, rapid solidification of oxides, computer simulation techniques in materials science.

Thomas F. Rosenbaum
Dept. of Physics
Univ. of Chicago, Chicago, IL 60637

Experimental solid state physics. disordered systems at low temperatures where collective effects dominate, systems studied include doped silicon and germanium, metallic glasses, narrow gap semiconductors, heavy fermion superconductors, radiation-damaged superconductors, and solid state (magnetic) lasers.

Michael Thompson
Dept. of Materials Science and Engineering
Cornell Univ., Ithaca, NY 14853

Dynamics of rapid melt and solidification induced by pulsed laser and ion beam irradiation. Measurements of time-resolved interfacial velocities and determination of critical transformation rates. Formation of metastable phases and measurements of the thermodynamics properties. Effects of impurities on high velocity crystal growth.

David Tirrell
Dept. of Polymer Science
Univ. of Massachusetts, Amherst, MA 01003

Organic polymer chemistry, thin films, self assembly, bioorganic chemistry, photoaffinity labeling, free radical chemistry, cooperative functional group interactions.

Robert H. Wagoner
Dept. of Metallurgical Engineering
Ohio State Univ., Columbus, OH 43212

Deformation properties of materials. plasticity and elasticity, forming analysis (particularly sheet metal forming), nonlinear finite element method, mechanical constitutive equations, non-isothermal deformation effects, work hardening, strain-rate sensitivity, dislocation theory. fundamental deformation mechanisms.

Ellen D. Williams
Dept. of Physics and Astronomy
Univ. of Maryland, College Park, MD 20742

Surface physics. structural stability and phase transformations at surfaces and interfaces. The role of surface defect structure in the growth and resulting stability of metal-semiconductor interfaces. Use of electron diffraction and scanning tunneling microscopy to characterize surface defects and surface diffusion. Tunneling spectroscopy.

Alex Zettl
Dept. of Physics
Univ. of California - Berkeley, Berkeley, CA 94720

Solid state physics: transport processes, low dimensional conductors; particular interest in collective-mode electronic response (charge and spin density waves) in inorganic and organic linear chain metals. Experimental methods include dc and ac conductivity (rf, infrared), to study mode-locking and chaos, switching and coherent noise generation, with and without applied magnetic fields.

Mathematics

Gregory Baker
Dept. of Mathematics
Univ. of Arizona, Tucson, AZ 85721

Computational fluid mechanics with particular emphasis on vortex flows in incompressible fluids; boundary integral techniques for free-surface flows; application of spectral methods to multi-rate problems in process modelling and dynamical systems.

Robert Bryant
Dept. of Mathematics
Rice Univ., Houston, TX 77001

Differential geometry: partial differential equations in geometry; main special interest is in equations with symbol degeneracies caused by diffeomorphism groups and equations which possess "hidden" symmetries; also interested in special solutions of Einstein's equations, complex geometry and differential invariants; currently working on variational problems associated with "bending ene[illegible] shells.

Ralph Cohen
Dept. of Mathematics
Stanford Univ., Stanford, CA 94305

Algebraic and differential topology; the investigation of geometric and topological invariants of high dimensional surfaces (manifolds) using algebraic techniques; the study of embeddings of one manifold into another and self equivalences (homeomorphisms) of a fixed manifold. The determination of the extent to which the geometric and analytic structure of a manifold is detected algebraically.

Stuart Geman
Division of Applied Mathematics
Brown Univ., Providence, RI 02912

Image processing: a mathematically coherent and common foundation for various tasks of image reconstruction and analysis. Algorithms, based upon this foundation, for blur and noise removal, grey-level and texture based segmentation, object detection and labelling, font-independent optical character recognition, and tomographic reconstructions. Implementations in special purpose hardware.

Klaus Hollig
Computer Sciences Dept.
Univ. of Wisconsin - Madison, Madison, WI 53706

Numerical analysis, computer aided design. currently interested in approximation by multivariate B-splines, parametric Bezier surfaces (in particular construction of smooth interpolants) and numerical approximation and regularity of free boundary problems.

Peter W. Jones
Dept. of Mathematics
Yale Univ., New Haven, CT 06520

Fourier analysis. wavelet transforms and image reconstruction. Dynamical systems: diffusion limited aggregation and harmonic measures, dynamics of rational functions. Complex analysis: solutions of the delta bar equation.

Mitchell Luskin
School of Mathematics
Univ. of Minnesota, Minneapolis, MN 55455

Scientific computing and applied mathematics. mathematical modeling, computer modeling, and software development for scientific and engineering problems. The modeling of elastohydrodynamical problems for magnetic recording, the modeling of liquid crystals, and the computational study of the long-time behavior of infinite dimensional dynamical systems.

Jean-Marc Vanden-Broeck
Dept. of Mathematics
Univ. of Wisconsin - Madison, Madison WI 53706

Applied mathematics, scientific computing, fluid mechanics, interested in nonlinear free surface flow problems (water waves, deformation of drops and bubbles, jets and cavities), currently working on ship waves, interfacial waves and the effect of surface tension of free surface flows.

Ocean Sciences

David M. Karl
Dept. of Oceanography
Univ. of Hawaii-Manoa, Honolulu, HI 96822

Marine microbial ecology; production and decomposition of particulate matter in the ocean; microbiology of deep-sea hydrothermal vents; especially interested in the development of new methods for estimating microbial rate processes in nature and in the transfer of existing technology in molecular biology to the field of biological oceanography.

M. A. R. Koehl
Dept. of Zoology
Univ. of California - Berkeley, Berkeley, CA 94720

Biomechanics: fluid dynamics and solid mechanics applied to study interactions of organisms with flowing water; hydrodynamic forces on and breakage of organisms that foul man-made structures (e.g. oil-drilling platforms); how water motion affects seaweed productivity (e.g. mariculture); mechanics of particle filtering by aquatic organisms; mineral deposit effects on mechanics of pliable biomaterials.

Physics

Roger W. Falcone
Dept. of Physics
Univ. of California - Berkeley, Berkeley, CA 94720

Quantum electronics, X-ray physics (atomic and solid state): new pulsed x-ray source having applications to spectroscopy, electronic and structural studies of materials and short wavelength lasers. Extending this source down to femtosecond time scales to study phase transitions. Investigating behavior of solids at non-equilibrium conditions of million degree temperatures.

Chris H. Greene
Dept. of Physics and Astronomy
Louisiana State Univ., Baton Rouge, LA 70803

Theoretical atomic and molecular physics: strong correlations between a few particles; behavior of highly excited atoms in strong external fields; primarily interested in developing new theoretical methods to treat nonseparable, nonperturbative problems in quantum mechanics.

Roderick V. Jensen
Dept. of Applied Physics
Yale Univ., New Haven, CT 06520

Theoretical studies of the behavior of nonlinear dynamical systems in plasma physics, fluid mechanics, atomic physics and solid-state physics, economics, and biology: onset of chaotic and turbulent behavior; statistical description of turbulence, interaction of high intensity electromagnetic radiation with atoms and charged particles, and localization of electron wavefunctions on random or quasi-periodic lattices.

H. Jeff Kimble
Dept. of Physics
Univ. of Texas - Austin, Austin, TX 78712

Quantum optics. dynamic processes in quantum electrodynamics for simple atom-field systems, nonequilibrium critical phenomena in optical systems. Research includes investigations of atomic cooperativity and nonclassical behavior for "two-level" atoms within an optical interferometer and of squeezed states of light for measurements beyond the standard quantum limit.

T. R. Kirkpatrick
Dept. of Physics
Univ. of Maryland, College Park, MD 20742

Theoretical physics - chemical physics. transport in disordered solids, transport in liquids and viscous liquids, glasses and the glass transition, Anderson localization effects in disordered electronic systems, Anderson localization of phonons and acoustic waves in "disordered" solids and liquids, crystal growth. Especially light scattering from a crystal-melt interface.

Frank Kowalski
Dept. of Physics
Colorado School of Mines, Golden, CO 80401

Optics and spectroscopy. analysis of optical components, design of optical instruments (including lasers), high resolution laser spectroscopy.

Robert D. McKeown
Dept. of Physics
California Institute of Technology, Pasadena, CA 91125

Experimental nuclear physics. study of nuclear properties using high-energy electrons, including nucleon form-factors, delta excitation, and deep-inelastic scattering, low-energy particle physics, including nuclear beta decay, free quark searches, and neutrino oscillations; pion absorption in the delta region.

Jon Orloff
Dept. of Applied Physics and Electrical Engineering
Oregon Graduate Center, Beaverton, OR 97006

Research interests: electron and ion optics; development and application of high brightness ion and electron sources; semiconductor testing and inspection with electron beams; optics of electron beam lithography; applications of high brightness ion sources for micromachining and modification of materials; use of high resolution ion beams for semiconductor fabrication.

John Preskill
Dept. of Physics
California Institute of Technology, Pasadena, CA 91125

Theoretical particle physics and cosmology: strong interactions, chiral symmetry, dynamical symmetry breakdown; physics of the very early universe, large scale structure of the universe.

Serge Rudaz
School of Physics and Astronomy
Univ. of Minnesota, Minneapolis, MN 55455

Theoretical high energy physics: phenomenology of unified gauge theories, including astrophysical and cosmological implications. Models of hadronic interactions at very high energies.

Wesley Smith
Dept. of Physics
Columbia Univ., New York, NY 10027

High energy particle physics.

Alexander Vilenkin
Dept. of Physics
Tufts Univ., Medford, MA 02155

Cosmology; phase transitions in the early universe; cosmic strings, their role in galaxy formation; observational effects of strings; gravitational and quantum effects on cosmological phase transitions, quantum cosmology; the wave function of the universe.

V. Participating Organizations

AEL
AMF
Alcoa
AMCA International
Amoco
Ampex
AMP
ANIF
AT&T
Abbott Laboratories
Actagen
Aerojet General
Agrico Chemical
Agrigenetics
Air Products & Chemicals
Alcoa
Allied
Amax
American Cyanamide
American Gas Association
American Heart Association
American Institute of Steel Construction
Analog Devices
Apollo Computer
Argo Systems
Armco
Arzco Medical Electronics
Ashland Oil
Astor Fund for Neurosciences
Atlantic Richfield
BDM International
BNR
BRN
Ball
Bat Conservation International
Bayer
Beckman Instruments
Becton, Dickinson
Bellcore
Ben C. Gerwick
Bethlehem Steel
Boeing
Brah/Whitaker Foundation
British Petroleum
Brown & Root
Brown & Williamson
Business & Technology Partnership
Caterpillar Tractor
Celanese Research
Champion
Chemical Waste Management
Chevron
Ciba-Geigy
Cincinnati Milicron
Clini-Therm
Clorox
Coca Cola
Combustion Engineering
Commodore
Commonwealth Edison
Control Data
Cooper Laser Sonics
Coors
Creare Innovations
Daltex Biomedical
Deere
Digital Equipment
Dow Chemical
Dow Corning
Dravo
Dreyfus Foundation
Dupont
Durodyne
EG&G
Electric Power Research Institute
Elegant Society
Elis Olsson-Chesapeake Foundation
Elscint
Eltech Systems
Empire State Electric Energy Research
Engleberger
Evans and Sutherland Computer
Explorers Foundation
Exxon
Firestone
Ford
Frigi-Tronics
GE
2G Enterprises
GM
GTE
Gardinier
Garrett Turbine Engineering
Gas Research Institute
General Dynamics
Georgia Power
Georgia-Pacific
Getty Oil
Goodyear Aerospace
Grainger
Grumman Aerospace
Halliburton
Hardwick Chemical
Harris
Hewlett Packard
Honeywell

Hughes Aircraft
IBM
ITT
Imperial Chemical Industries
Inland Steel
Intel
International Minerals & Chemical
James Irvine Foundation
Johnson & Johnson
C. S. Johnson & Son
Kansas City Power & Light
Kirkwood
Kodak
Kraft
LDC/Milton Roy
LVAD Technology
Lee Wan & Associates
Lever Research
Lighting Research Institute
Eli Lilly
Link Foundation
Litton Industries
Lockheed
3M
MAD Computer
MDA
M/A-Com Semiconductor Products
Martin Marietta
Mass Electric
Matteson Institute
McDonnell Douglas Foundation
McKnight Foundation
Andrew Mellon Foundation
Memorex
Mentor Graphics
Merck
Microelectronics
Microelectronics Information Science Center
Midgley-Huber
Miles Pharmaceuticals
Miller High Life
Mobay
Mobil
Monsanto
Montgomery Elevator
Morton-Thiokol
Motorola
NBR
NCR
NL Industries
National Foundation For Cancer Research
National Geographic Society
National Semiconductor
Navistar
New England Telephone
Norand
Norsk Hydro
North American Phillips
Northern States Power
Northrop
Norton
New York Power Pool
NY Zoological Society
Occidental Chemical
Occidental Petroleum
Owens-Corning Fiberglass
Oxford Instruments
PPG
Pacific Gas & Electric
Panametrics
Pennzoil
Pepsico
Perkin-Elmer
Petroleum Research
Pfizer
Phillips Petroleum
Photochemical Research Association
Charles Lee Powell Foundation
Power Affiliates Program
Proctor & Gamble
RCA
Ralph M. Parsons Foundation
Raychem
Raycon
Research Application for Management
Research Institute of Colorado
R. J. Reynolds
Robinson & Halpern
Rockefeller Foundation
Rockwell International
Rohm & Haas
SDS Computers
SRC
Salt River Project
Sand County Foundation
Sanders Associates
Sargent & Lundy
Schlumberger
Science Application International
Searle
Semiconductor Research Sepracore
Servio Logic Group
Shell
Siemens
Simmonds Precision
Simulation Sciences
Sky Computers
Sloan

Sloan Foundation
SmithKline
Software Architecture
Speakeasy Computing
Stafford
Standard Oil (Indiana)
Standard Oil (Ohio)
Stauffer Chemical
Stuart Pharmaceutical
Sun Microsystems
Sun Oil
SunTech
Sunstrand Aviation
Superior Oil
Surface Science
Syntex
System Development Foundation
TRW
Tektronix
Tennessee Eastman
Texaco
Texas Instruments
Toyo Engineering Company
Tracor
Unimation
Union Camp
Union Carbide
Union Electric
United Technologies
Unocal
Upjohn
Varian Associates
Vis Data
W. R. Grace
Weil-Caulier Trust Award
Welch Foundation
Welch/Allyn
Western Zirconium
Westinghouse
Westvaco
Weyerhauser
Whirlpool
Wideman & Singleton
Williams
Wilmad Glass
Wisconsin Power & Light
Wisconsin Public Service
World Wildlife
Worthington Industries
Xerox
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