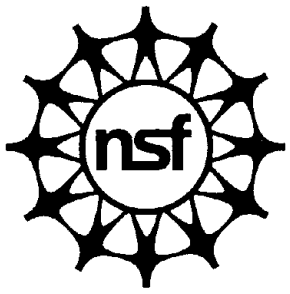


RECENT AWARDS IN ENGINEERING

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550

FIRST QUARTER FISCAL YEAR 1982

CONTENTS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. NSF/ENG-82002	2.	3. Recipient's Accession No. PB82 233065
4. Title and Subtitle: Recent Awards in Engineering, First Quarter Fiscal Year 1982			5. Report Date: 1982 6.
7. Author(s): None listed			8. Performing Organization Rept. No.: NSF 82-17
9. Performing Organization Name and Address: National Science Foundation 1800 G Street, N.W. Washington, DC 20550			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address: Directorate for Engineering (ENG) National Science Foundation 1800 G Street, N.W. Washington, DC 20550			13. Type of Report & Period Covered 14.

15. Supplementary Notes
Submitted by: Communications Program (OPRM)
National Science Foundation
Washington, DC 20550

16. Abstract (Limit: 200 words)

This publication lists and summarizes research awards granted by the National Science Foundation's Directorate for Engineering during the first quarter of fiscal year 1982. The Directorate comprises the Office of Interdisciplinary Research and four divisions: the Division of Chemical and Process Engineering, the Division of Civil and Environmental Engineering, the Division of Electrical, Computer, and Systems Engineering, and the Division of Mechanical Engineering and Applied Mechanics. Programs of each division are briefly described. Awards were made in the following areas: chemical and biochemical processes; engineering energetics; kinetics, catalysis and reaction engineering; minerals and primary materials processing; particulate and multiphase processes; separation processes; thermodynamics and transport phenomena; earthquake hazard mitigation; geotechnical engineering; water resources and environmental engineering; automation, bioengineering and sensing systems; computer engineering; electrical and optical communications; quantum electronics, waves, and beams; science and technology to aid the handicapped; solid state and microstructures engineering; systems theory and operations research; fluid mechanics; heat transfer; mechanical systems; production research; and solid mechanics. The principal investigator's name and affiliation, and the award title, amount, duration, number, and abstract are provided for each entry.

17. Document Analysis a. Descriptors

Research
Awards
Grants
Mechanical engineering
Civil engineering
Chemical engineering

b. Identifiers/Open-Ended Terms

National Science Foundation
Electrical engineering
Research and development

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
NTIS	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

NATIONAL SCIENCE FOUNDATION
DIRECTORATE FOR ENGINEERING

INTRODUCTION

The National Science Foundation's Directorate for Engineering supports basic and applied research that improves our knowledge of fundamental engineering principles and provides the knowledge needed to advance engineering technology. The Directorate also seeks to strengthen our Nation's academic engineering base by its support of research at academic institutions, and through such activities as research equipment grants and special award programs for new investigators.

The activities of the Directorate ultimately impact many important National concerns, such as the U.S.'s economic growth and competitiveness in world markets, technological innovation and industrial productivity, and National defense capabilities.

The Directorate for Engineering's budget for fiscal year 1982 is approximately $92 million, and is used chiefly to support unsolicited proposals received from the scientific and engineering community.

The Directorate consists of four Divisions and the Office of Interdisciplinary Research. These Divisions and their programs are described below.

DIVISION OF CHEMICAL AND PROCESS ENGINEERING (CPE)

Supports research on the basic mechanisms of catalysis and various chemical and biochemical processes, general theories of mass transfer and separation processes, and efficient recovery and use of resources in industrial processes. CPE's objective is to enhance basic knowledge relevant for technological innovation in the chemical, petroleum/petro-chemical, food, biochemical/pharmaceutical, mineral, and allied industries. Research efforts include development of fundamental principles, design and control strategies, mathematical models, and experimental techniques applicable to industries and processes. Fundamental phenomena and basic principles governing chemical and transport processes are studied, as are the interactive effects of these processes and phenomena. Cooperative projects between university and industry groups are encouraged. The programs of CPE are:

- **Chemical and Biochemical Processes (CBP)**
  Explores enzymatic, microbial, electrochemical, and polymeric processes in terms of both the individual reactions and the dynamics and control of the reaction system as a whole. Incorporates areas formerly contained by the Renewable Materials Engineering program (conversion and utilization of biologically based raw materials).

- **Engineering Energetics (ENE)**
  Emphasizes principles of energy conversion and material processing under high-temperature and/or energy-intensive conditions.

- **Kinetics, Catalysis, and Reaction Engineering (KCR)**
  Examines chemical reaction rates and mechanisms and their implication for reactor performance, stability, and design.

- **Minerals and Primary Materials Processing (MPM)**
  Supports research on the production and handling of essential minerals and their subsequent conversion to pure metals and related products.

- **Particulate and Multiphase Processes (PMP)**
  Studies characterization, generation, size modification, handling, and processing of systems where solid phase particulates are present.

- **Renewable Materials Engineering (RME)**
  Supports research involving engineering problems relevant to conversion and utilization of biologically based raw materials.

- **Separation Processes (SEP)**
  Emphasizes the separation of chemical species, with particular emphasis on unconventional techniques and/or combinations of processes which maximize energy efficiencies.

- **Thermodynamics and Transport Phenomena (TTP)**
  Supports theoretical and experimental research on equilibrium and transport properties to develop correlations and data bases relevant to industrially important chemical and transport processes, such as synfuels.

DIVISION OF CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

Supports research on structures and phenomena involving the earth's surface (such as near surface solids, e.g., soils, rocks, and ice, foundations and dams), the design of structures, and the flow of above- and below-ground water. Such research is fundamental to the development and building of structures and facilities, to minimize the negative impact of the natural environment on them. The programs of CEE are:

- **Earthquake Hazard Mitigation (EHM)**
  Supports research in many disciplines to develop an understanding of how earthquakes impact natural and manmade facilities in order to reduce casualties, damage, and social and economic disruption. This program consists of three subelements:

  Design Research
  Aims to develop procedures for performing dynamic analysis of proposed or existing construction under earthquake loadings, to develop an understanding of material components subjected to damaging dynamic loads, and to develop procedures for the analysis and design of nonstructural and architectural systems subject to earthquake loadings.

  Siting Research
  Seeks to determine from instrumental data the nature of strong ground shaking during earthquakes, to develop analytical procedures to predict the spatial and temporal distribution of strong ground motion at different sites, to understand the dynamic behavior of soil and rocks subject to strong shaking, and to understand the behavior of the ocean, particularly its margins, due to underwater earthquakes producing damaging tsunamis.

  Societal Response Research
  Studies and evaluates measures used to mitigate society's loss due to earthquake

(and other natural hazards) impacts, including emergency preparedness, land use planning, building codes, insurance and other economic incentives, and information and education, so as to enable communities to organize to withstand disasters with minimal impact on life and property.

- **Geotechnical Engineering (GEO)**
  Deals with the mechanical behavior of the near-surface solids of the earth, i.e., soils, rocks, and ice under conditions of pressure, temperature, size, and time scales relevant to construction, mining, drilling, and natural hazards.

- **Structural Mechanics (STM)**
  Develops engineering knowledge basic to the design and construction of safe, long-lived, economical structures. STM is concerned with construction materials, structural systems and components, and their response to loads and environmental conditions.

- **Water Resources and Environmental Engineering (WRE)**
  Seeks a better understanding of natural phenomena such as ground water flow, sediment transport, optimal design and operation of complex and multiobjective civil engineering systems, and the quality of water resources.

DIVISION OF ELECTRICAL, COMPUTER, AND SYSTEMS ENGINEERING (ECSE)

Supports basic and applied research on electronic materials and devices, sensors and imaging systems, very large-scale integrated optics and opto-electronics, information theory and communications, machine intelligence and robotics, automation, laser systems and plasmas, and control and systems design methodologies, networks, and simulation. New knowledge resulting from this research provides the basis for improvements in communications and data networks, more efficient energy generation and transmission, better computing structures and machines, and more efficient design and control of manufacturing processes, including those which would benefit from use of intelligent robots. The programs of ECSE are:

- **Automation, Bioengineering, and Sensing Systems (ABS)**
  Studies improved machine intelligence and control of industrial and non-industrial processes, with emphasis on intelligent robotic systems and cognitive systems engineering.

- **Computer Engineering (COM)**
  Broadens the understanding of principles of design and construction of computers through research to increase the payoff of Very Large Scale Integrated (VLSI) systems in new computing structures, research on Computer-Aided Design (CAD) tools, and computer hardware/software interactions.

- **Electrical and Optical Communications (EOC)**
  Studies optical communications, large-scale computer communication networks, information theory, and electronic circuit theory, all in the modern context of Very Large Scale Integrated (VLSI) microelectronic technology, to create economical, reliable communication and signal processing systems.

- **Quantum Electronics, Waves, and Beams (QWB)**
  Emphasizes lasers, plasmas, and electromagnetic and acoustic phenomena, including

new or improved coherent sources, generation of ultrashort optical pulses, non-linear optics, and basic studies of medium-temperature, medium-density plasmas.

- **Science and Technology to Aid the Handicapped (STH)**
  Supports research which develops and applies innovative engineering concepts and devices to improve opportunities for physically handicapped people.

- **Solid State and Microstructures Engineering (SSM)**
  Seeks the fundamental understanding needed to produce electronic devices with dimensions a fraction of those now used in commercial and defense applications, with emphasis on new device concepts, new electronic materials, and advanced fabrication techniques.

- **Systems Theory and Operations Research (STO)**
  Develops mathematical and computational methods for analysis, modeling, simulation, optimization, and control of natural and manmade systems and processes.

DIVISION OF MECHANICAL ENGINEERING AND APPLIED MECHANICS (MEAM)

Supports research on the transfer of heat; the problems of engineering materials under high stress and strain; questions such as lubrication and turbulence; and the synthesis of all these elements into appropriate "design" capabilities. Special emphasis is placed on applications in production research. MEAM seeks an understanding of the basic phenomena of fluid and solid mechanics and heat transfer inherent in virtually all manufacturing processes and in many industrial products in order to improve National productivity. The programs of MEAM are:

- **Fluid Mechanics (FLM)**
  Studies the dynamic behavior of liquids and gases in combustion, turbulent flow, mixing and dispersion, bioengineering, cryogenics, and other processes.

- **Heat Transfer (HET)**
  Studies conduction, convection and radiative phenomena including multiphase media, high flux heat transfer, porous media, and high temperature radiative transfer. This area develops much of the knowledge base necessary for the understanding of systems used in the generation of power.

- **Mechanical Systems (MES)**
  Studies kinematics and kinetics of machines, robotics, vibrations, acoustics, mechanical control systems, and friction, and synthesizes all these investigations in system design.

- **Production Research (PRR)**
  Generates knowledge applicable to the automation of production and improvement of manufacturing, such as computer controlled unit operations and robot-aided assembly.

- **Solid Mechanics (SOM)**
  Studies the strength of solids, continuum mechanics, fracture mechanics, plasticity, viscoelasticity, and non-linear elasticity to provide the basic framework necessary to measure and predict the deformation and mechanical strength of solids, and to determine the manner in which the strength of materials changes as a result of exposure to a given loading or environment.

OFFICE OF INTERDISCIPLINARY RESEARCH (OIR)

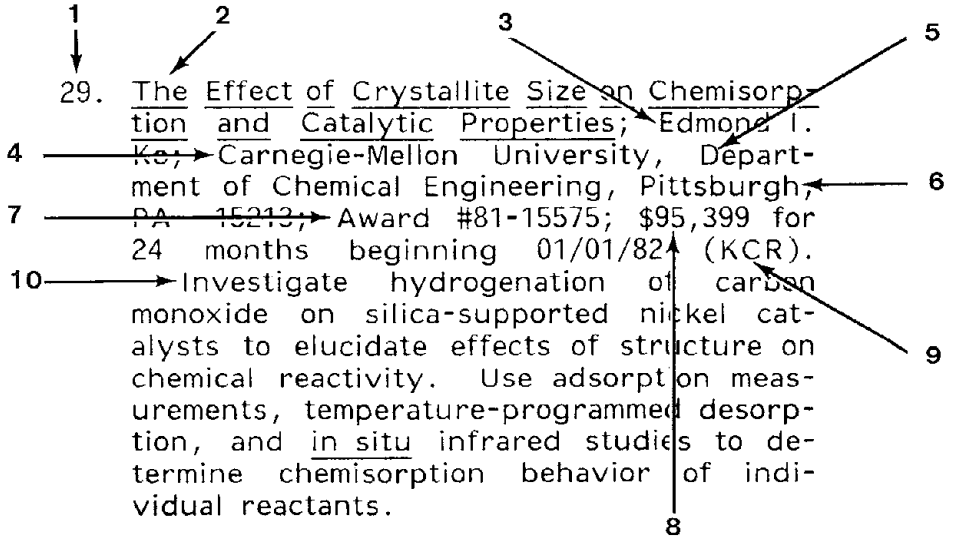
OIR was established to facilitate and coordinate the support of interdisciplinary research by the National Science Foundation. OIR undertakes activities to identify potential research areas and to stimulate quality interdisciplinary research proposals. In addition, in cooperation with Program Directors throughout the Foundation, OIR develops and supports special studies, conferences, workshops, and interdisciplinary state-of-the-art review papers. The objective of these and other activities is to identify societal or scientific and engineering problems, research gaps, and needs.

DEFINITIONS AND EXPLANATION OF FORMAT

All awards are listed under their originating (primary) Division and numbered sequentially (1-225 in this issue). Within each Division, awards are grouped by program. Within each program, awards are listed alphabetically by the Principal Investigator's surname. Split-funded awards are numbered only under their originating program.

The index at the end of this issue lists Principal Investigators in alphabetical order by surname and gives the corresponding entry number for each award.

Example #1 — This example shows an award made by the Division of Chemical and Process Engineering (CPE)



1 Entry Number: each award has been assigned a unique entry number, arranged in sequential order, and referenced in the index.

2 Title of the Award.

3 Principal Investigator: the chief scientist or administrator who is responsible for the research plan and fiscal expenditures as an NSF awardee.

4 Institution Conducting the Research: any college, university, laboratory, industry, or other organization, whether operating on a profit or non-profit basis, as well as State governments and Federal organizations.

5 Department or section of the institution conducting the research with which the Principal Investigator is affiliated.

6 Institution's Mailing Address.

7 Award Number: the award number, and amendment number, if applicable.

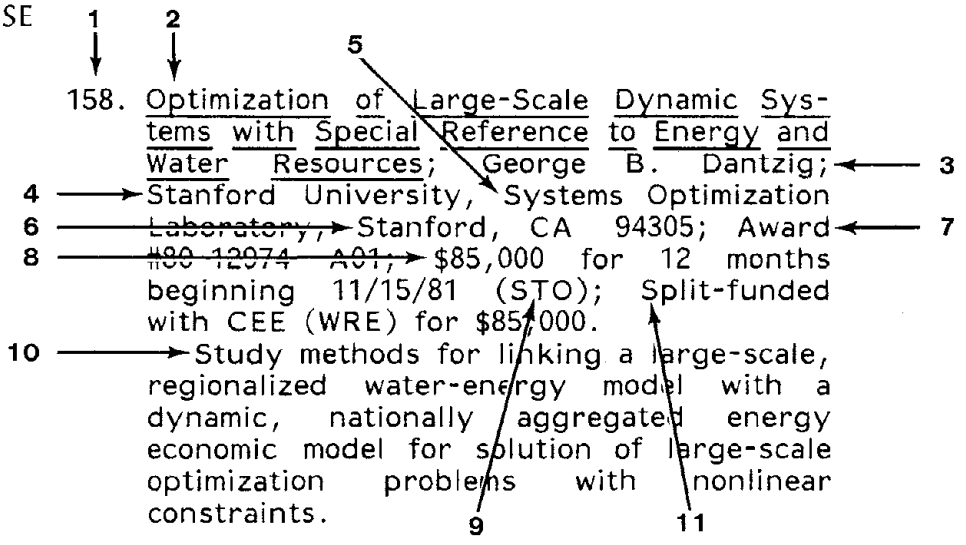
8 Award Amount, Duration, and Starting Date of the Award.

9 Program Abbreviation: this 3-letter abbreviation indicates the program which has funded the award. Directorate for Engineering programs and corresponding abbreviations are described in the Introduction.

10 Abstract: a brief summary highlighting important aspects of the project to be undertaken.

Example #2—This example shows a split-funded award made by the Division of Electrical, Computer, and Systems Engineering (ECSE) and the Division of Civil and Environmental Engineering (CEE)

Under ECSE



Under CEE

12 ⟶ xxDantzig, George B., see ECSE(STO).

1 - 10 Same as above.

11 Split-Funded Award: a split-funded award is one which has received funds from two or more programs within the same Division of the Directorate for Engineering, or from two programs housed in different Divisions of the Directorate for Engineering. Complete award information is listed under the originating or primary program, and a cross reference is given under the co-funding or secondary program. As shown above, the primary program is STO (Systems Theory and Operations Research within the Division of Electrical, Computer, and Systems Engineering). The secondary or co-funding program is Water Resources and Environmental Engineering (WRE) within the Division of Civil and Environmental Engineering (CEE).

12 Cross References to Split-Funded Awards: a cross reference such as the one shown above can be found in alphabetical order by the Principal Investigator's surname under the secondary or co-funding Division/program for each split-funded award. In example #2, therefore, the cross reference for George B. Dantzig can be found under the Water Resources and Environmental Engineering (WRE) program of the Division of Civil and Environmental Engineering, while complete award information can be found under the Systems Theory and Operations Research (STO) program of the Division of Electrical, Computer, and Systems Engineering (ECSE).

The data have been reconciled with the NSF's Management Information System.

Recent Awards in Engineering is a new publication. It provides information on the research awards made in each fiscal year quarter by the Directorate for Engineering, and is aimed at those researchers, educators, administrators, and users who wish to keep abreast of the research being supported in various technical areas. We feel that the brief project summaries included for each award will provide the reader with a better understanding of the Directorate's program objectives and emphases.

If you would like to be placed on our mailing list to receive future issues of RECENT AWARDS IN ENGINEERING, please return the post card in the back cover of this issue.

DIVISION OF CHEMICAL AND PROCESS ENGINEERING (CPE)

Chemical and Biochemical Processes (CBP)

xxBrosilow, Coleman B., see ECSE(STO).

1. Development of an Analytical Melting Model for Polymer Extrusion; Chan I. Chung; Rensselaer Polytechnic Institute, Materials Engineering Department, Troy, NY 12181; Award #80-02023 A01; $65,721 for 12 months beginning 10/01/81 (CBP).

   Develop equations for predicting shear stress required in melting molded block samples. Modify analytical equations applicable for predicting melting rate and shear stress for polymer pellets and powders so results can be utilized directly by polymer processing industry.

2. The Flow of Polymer Melts and Solutions in Twin Screw Extruders; Costel D. Denson; University of Delaware, Department of Chemical Engineering, Newark, DE 19711; Award #81-09997; $63,760 for 12 months beginning 01/15/82 (CBP).

   Investigate flow of viscous Newtonian solutions and non-Newtonian polymer melts to develop a quantitative understanding of how volumetric flow rate and required energy are related to process conditions, rheological properties of the materials being processed, and geometry of screws.

3. Kinetics of Electroless Copper Plating; Francis M. Donahue; University of Michigan, Chemical Engineering Department, Ann Arbor, MI 48109; Award #79-09745 A02; $41,774 for 12 months beginning 12/15/81 (CBP).

   Perform electrochemical and chemical measurements to determine complexed cupric ion chemistry in solution. Elucidate the reaction mechanism of partial reactions occurring in electroless plating.

4. Advanced Control Strategies for Distillation Columns; Thomas F. Edgar; University of Texas, Department of Chemical Engineering, Austin, TX 78712; Award #81-11613; $47,322 for 12 months beginning 12/15/81 (CBP).

   Develop methods to screen proposed designs for control difficulties. Investigate multivariable interaction analysis and control, and adaptive control for highly nonlinear and interactive high purity columns by experiments and computer simulation.

5. Synthesis of Optimal Tower Fermentors for Viscous Fermentations; Larry E. Erickson; Kansas State University, Department of Chemical Engineering, Manhattan, KS 66506; Award #81-08799; $40,813 for 24 months beginning 11/01/81 (CBP).

   Conduct research on multiphase flow, mass transfer, bubble breakup, and size distributions in airlift fermentors. Investigate oxygen transfer rates and efficiencies in single and multistage airlift columns. Develop optimal designs for high viscosity fermentation broths.

6. Workshop on Prospects for Biotechnology; Elmer L. Gaden; University of Virginia, Department of Chemical Engineering, Charlottesville, VA 22903; Award #81-20590; $24,512 for 6 months beginning 11/01/81 (CBP).

   Convene chemical engineers, biochemical engineers, and microbiologists from industry, government, and academia to discuss and assess prospects for biotechnology. Present recommendations regarding "national centers" for research and development.

7. Prediction, Simulation and Optimization of Nutrient Content of Processed Foods; Marcus Karel; Massachusetts Institute of Technology, Nutrition and Food Science Department, Cambridge, MA 02139; Award #81-04582; $81,900 for 12 months beginning 12/01/81 (CBP).

   Develop mathematical models to rationally estimate nutrient content of processed foods at the time of their consumption. Determine optimum processing and storage conditions to ensure eating quality and nutrient content through computer simulation of food behavior.

8. Food-Quality Factors in Spray Drying; C. Judson King; University of California, Department of Chemical Engineering, Berkeley, CA 94720; Award #80-06786 A01; $59,141 for 12 months beginning 10/01/81 (CBP).

   Investigate loss of food quality (flavor, aroma, density, etc.) during spray drying by sampling within a convectively heated spray chamber with chromatographic measurements of volatiles retention, and by observing particles generated under controlled conditions in a wall-heated column.

9. Predicting the Rheology and Texture of Viscoelastic Fluid Food Materials; Jozef L. Kokini; Rutgers University, Department of Food Science, New Brunswick, NJ 08903; $28,456 for 12 months beginning 11/01/81 (CBP).

   Develop a model to explain texture from general rheological and lubrication concepts; account for transient behavior characteristic on non-linear viscoelastic food materials; and, develop guidelines for texture design.

10. Mass Transfer Effects with Highly Flocculating Yeast; Roger A. Korus; University of Idaho, Chemical Engineering Department, Moscow, ID 83843; Award #81-04709; $74,757 for 24 months beginning 11/01/81 (CBP).

Evaluate effects of mass transfer on yeast growth and product synthesis in continuous fermentation systems. Study and model continuous flocculating bed fermentors.

11. Kinetics of Glucoamylase-Catalyzed Transfer Reactions; Peter J. Reilly; Iowa State University, Chemical Engineering Department, Ames, IA 50011; Award #81-01102; $34,590 for 24 months beginning 10/15/81 (CBP).

Investigate ability of two glucoamylase isozymes produced by Aspergillus niger to catalyze reversible reactions between glucose and maltose, isomaltose, and nigerose. Obtain rate parameters and equilibrium constants at varying temperatures, pHs, and initial concentrations; calculate activation energies, standard enthalpies and entropies for each isozyme. Obtain rate parameters for trisaccharides.

12. Industry/University Cooperative Research Activity: Model Algorithmic Control of Chemical Processes; Neil L. Ricker; University of Washington, Department of Chemical Engineering, Seattle, WA 98195; Award #81-13056; $34,286 for 12 months beginning 01/15/82 (CBP).

Develop improved methods for multivariable control of chemical processes by investigating techniques of Model Algorithmic Control (MAC). Theoretically examine the basic MAC method, test potential improvements, and compare MAC to other control methods.

13. Computer Modeling of Rheological Behavior of Entangled Polymers; David S. Soong; University of California, Chemical Engineering Department, Berkeley, CA 94720; Award #78-26870 A03; $46,780 for 12 months beginning 10/01/81 (CBP).

Construct a molecular model to predict viscoelastic properties of entangled polymer melts and concentrated solutions. Study effect of polydispersity on nonlinear flow properties via behavior of binary, ternary, and multi-component blends for incorporation into model.

14. Immobilized Flavin Co-Factor Electrodes; Lemuel B. Wingard, Jr.; University of Pittsburgh, Department of Pharmacology, Pittsburgh, PA 15260; Award #81-07715; $53,934 for 12 months beginning 12/01/81 (CBP).

Examine fundamental engineering aspects of enzyme catalyzed direct electron transfer from an enzyme substrate in solution onto a solid electrode surface by covalently attaching the cofactor to the electrode surface. Characterize immobilized flavins electrochemically and enzymatically in order to define factors limiting rates of transfer.

Engineering Energetics (ENE)

15. Stochastic Data Analysis System; Robert W. Albrecht; University of Washington, Department of Nuclear and Electrical Engineering, Seattle, WA 98195; Award #81-05161; $40,573 for 12 months beginning 10/15/81 (ENE).

Develop capability and hardware to update existing data analysis system for processing multisource random data; use with three nuclear reactors for data on induced neutron field fluctuations, special measurements, and for instrument failure detection by functional redundancy.

16. Nitric Oxide Reduction by Ammonia Addition to Post Flame Gases; Melvyn C. Branch; University of Colorado, Department of Mechanical Engineering, Boulder, CO 80390; Award #81-05300; $52,669 for 18 months beginning 01/15/82 (ENE).

Study chemistry of an ammonia/nitric oxide/oxygen reaction system by measuring and modeling stable species and radical intermediates in a reaction using gas chromatography and absorption spectroscopy.

17. Interactive Multiuser Laboratory Data System; Richard S. Cohen; Drexel University, Department of Mechanical Engineering, Philadelphia, PA 19104; Award #80-23880; $38,812 for 12 months beginning 10/15/81 (ENE).

Develop a system for automation and control of engineering research laboratory experiments in combustion kinetics, ultrasonics, engine research, and fluid and heat transfer.

18. Analytical Instrumentation for Combustion Research; Thomas W. Lester; Kansas State University, Department of Nuclear Engineering, Manhattan, KS 66506; Award #81-04749; $23,200 for 12 months beginning 11/01/81 (ENE).

Develop a gas chromatograph with flame photometric and thermionic detectors to measure nitrogen and sulfur species from devolatization of coal, from combustion of coal and agricultural residue in a laboratory furnace, and from pyrolysis of heteroaromatic compounds.

19. Nonuniformities Studies in MHD Flows; Jean F. Louis; Massachusetts Institute of Technology, Department of Aeronautics and Astronautics, Cambridge, MA 02139; Award #81-02902, $79,660 for 12 months beginning 10/15/81 (ENE).

Study effects of isotropic nonuniformities on equilibrium and nonequilibrium plasmas. Characterize nonuniformities driven by electrothermal ionization instabilities. Determine effective Hall coefficients and levels of fluctuations in the electron/ion density.

20. Laser Photochemistry and Diagnostics with Aligned Molecules; Erhard W. Rothe; Wayne State University, Department of Chemical/Metallurgical Engineering, Detroit, MI 48202; Award #81-06325; $80,000 for 12 months beginning 01/15/82 (ENE).

Examine the use of laser spectroscopy and molecular beams to gain insight into collision dynamics and to characterize the state distribution and alignment of the reaction products of simple three- and four-center reactions.

Kinetics, Catalysis, and Reaction Engineering (KCR)

21. Porous Electrodes, Shape Change, and Optimization; Richard C. Alkire; University of Illinois, Department of Chemical Engineering, Urbana, IL 61801; Award #80-08947 A01; $58,553 for 12 months beginning 10/15/81 (KCR).

Use linear programming techniques to model large assemblies of electrolytic cells and predict optimum operating conditions for energy-intensive processes.

22. Dynamic Behavior of Catalytic Reactions and Reactors; Rutherford Aris; University of Minnesota, Department of Chemical Engineering and Materials Science, Minneapolis, MN 55455; Award #81-12292; $125,509 for 24 months beginning 11/01/81 (KCR).

Examine relations between surface reaction kinetics and reactor behavior under pressures and temperatures approaching those of industrial processes for static and dynamic reaction systems. Model kinetic parameters into reactor equations.

23. Process Dynamic Models for Heterogeneous Catalysts; James E. Bailey; California Institute of Technology, Department of Chemical Engineering, Pasadena, CA 91104; Award #81-11607; $85,180 for 12 months beginning 11/01/81 (KCR).

Develop identification strategies for models of catalytic kinetics based upon open and closed loop transient measurements of catalyst responses and guided by modern methods of dynamic system theory and bifurcation analysis. Study dynamics of interactions between fluid phase and catalyst surface, and chemical reactions on catalyst surface.

24. International Symposium of Chemical Reaction Engineering, October 4-6, 1982, Boston, Massachusetts; James M. Douglas; University of Massachusetts, Department of Chemical Engineering, Amherst, MA 01003; Award #81-20647; $14,500 for 12 months beginning 01/01/82 (KCR).

Symposium includes invited plenary review papers and parallel sessions of contributed papers. Proceedings will be published.

25. High Pressure Kinetic Measurements of the Methanol Synthesis Reaction on Well-Characterized CU/ZNO Surfaces; Gregory L. Griffin; University of Minnesota, Department of Chemical Engineering and Materials Science, Minneapolis-St. Paul, MN 55455; Award #81-10754; $79,459 for 24 months beginning 12/01/81 (KCR).

Measure rate of methanol synthesis reaction on a zinc-oxide single-crystal surface coated with a copper monolayer. Determine structure and composition of the active site and influences such as electronic structure, site geometry, poisons, and promotors.

26. Detection of Vibrationally Excited, Surface Catalyzed Reaction Products by Infra-red Emission; Bret L. Halpern; Yale University, Department of Engineering & Applied Science, New Haven, CT 06520; Award #81-14348; $24,812 for 12 months beginning 1/15/82; (KCR); Split-funded with ENE for $24,812.

Measure infrared emission spectra of vibrationally excited molecules generated by surface catalyzed reactions. Interpret spectra in terms of surface reaction dynamics and mechanisms.

27. Transient Isotopic Tracing of Catalytic Methanation; John Happel; Columbia University, Department of Chemical Engineering and Applied Chemistry; New York, NY 10027; Award #78-04055 A02; $5,809 for 6 months beginning 10/01/81 (KCR).

Explore effects of temperature, pressure, and composition on reaction mechanisms, velocity of reaction steps, and variations in catalyst formation using transient isotope tracing with carbon-13, oxygen-18, and deuterium.

28. Transient Isotope Tracing of Catalytic Methanation Over Molybdenum Sulfide; John Happel; Columbia University, Department of Chemical Engineering and Applied Chemistry, New York, NY 10027; Award #81-16015; $119,246 for 24 months beginning 12/15/81 (KCR).

Investigate composition of the working catalyst (species actually participating in methanation), the nature of the rate-controlling process, and the sensitivity of mechanistic parameters to operating conditions, using isotopically marked species in a gradientless recirculating reactor.

29. The Effect of Crystallite Size on Chemisorption and Catalytic Properties; Edmond I. Ko; Carnegie-Mellon University, Department of Chemical Engineering, Pittsburgh, PA 15213; Award #81-15575; $95,399 for 24 months beginning 01/01/82 (KCR).

Investigate hydrogenation of carbon monoxide on silica-supported nickel catalysts to elucidate effects of structure on chemical reactivity. Use adsorption

measurements, temperature-programmed desorption, and in situ infrared studies to determine chemisorption behavior of individual reactants.

30. Solid-Electrolyte Aided Study of Catalytic and Electrocatalytic Oxidations; Costas G. Vayenas; Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, MA 02139; Award #80-09436 A01; $83,320 for 12 months beginning 10/15/81 (KCR).

Use oxygen-ion-conducting solid electrolytes to directly measure thermodynamic activity of oxygen on catalytic metal surfaces during reactions. Study oxidation of carbon monoxide on platinum and propylene on platinum and silver, in conjunction with kinetic measurements and in situ infrared spectroscopy. Explore product distributions and power output of solid electrolyte fuel cells; examine possibility of cogenerating electric energy and sulfur trioxide, formaldehyde, butadiene, and ethylene oxide.

31. Rates of Equilibrium Reactions in the Presence of a Selective Adsorbent; Imre Zwiebel; Arizona State University, Department of Chemical and Biochemical Engineering, Tempe, AZ 85281; Award #81-11288; $98,128 for 24 months beginning 11/01/81 (KCR).

Investigate kinetics of equilibrium reactions in the presence of an adsorbent specific toward one of the reaction products to evaluate enhancement of reaction rates and to facilitate product separation.

Minerals and Primary Materials Processing (MPM)

32. Industry/University Cooperative Research Activity: Electrochemical Kinetics of Hydrometallurgical Processes; Denny A. Jones; University of Nevada, Department of Chemical and Metallurgical Engineering, Reno, NV 89557; Award #81-10020; $63,838 for 12 months beginning 12/15/81 (MPM).

Examine the kinetics and mechanisms of selected leaching reactions relevant to hydrometallurgical extraction of ores. Establish a galvanic series of representative oxide and sulfide mineral compounds; conduct a polarization study of chalcopyrite to demonstrate leaching reactions; and, demonstrate the feasibility of an electrolytic leach process for chalcopyrite.

33. Selective Magnetic Mineral Component Separation; David R. Kelland; Massachusetts Institute of Technology, Francis Bitter National Magnet Laboratory, Cambridge, MA 02139; Award #81-20442; $60,000 for 12 months beginning 01/15/82 (MPM).

Separate weakly paramagnetic and diamagnetic species of particles on the basis of their magnetic susceptibilities under ideal experimental conditions to better understand the capture mechanism of mineral component particles, capture forces for computed matrix designs, and mineral separation under harsh conditions.

34. Refining of Liquid Metals by Injection of Gas-Particle Jets; Michael McNallan; University of Illinois, Department of Materials Engineering, Chicago, IL 60680; Award #81-15342; $37,714 for 12 months beginning 11/01/81 (MPM).

Investigate the hydrodynamics of gas-particle jets by using high speed chromatography in a high temperature liquid model system. Develop a general model of flow transitions in submerged gas-particle jet behavior.

35. Hydration Reaction Mechanisms and Their Effects Upon Properties of Cements with Mineral Waste Substituents; Della M. Roy; Pennsylvania State University, Materials Research Laboratory, University Park, PA 16802; Award #81-12821; $43,145 for 12 months beginning 11/15/81 (MPM).

Develop information on relationship of hydration mechanisms rates, characteristics, and properties in hydraulic cements containing different pozzolanic additives.

36. High Purity Manganese By Fused Chloride Electrolysis; Donald R. Sadoway; Massachusetts Institute of Technology, Materials Processing Center, Cambridge, MA 02139; Award #81-16641; $54,403 for 12 months beginning 11/15/81 (MPM).

Examine effects of fluid flow in molten salt electrolyte cells on the electrodeposition of manganese using digital signal analysis by fast Fourier transform. Model electrolyte flow behavior as a function of cell design.

37. Minerals, Coal and Metal Extraction with Minimum Water Usage and Pollution Conference; Ponisseri Somasundaran; Columbia University, Henry Krumb School of Mines, New York, NY 10027; Award #81-18187; $5,000 for 6 months beginning 12/15/81, (MPM).

Exchange information on recent developments in water treatment and recycling in the United States and abroad. Discuss problems and identify research and development opportunities.

38. The Kinetics of Flash Reaction of Metal Sulfides in Oxygen Streams; Nickolas J. Themelis; Columbia University, Henry Krumb School of Mines, New York, NY 10027; Award #81-10526; $68,607 for 12 months beginning 11/01/81 (MPM).

Study weight and temperature of sulfide particles suspended against time of reaction, and measure heat and mass transfer rates.

39. Collectorless Flotation of Chalcopyrite and Sphalerite Ores; Roe Hoan Yoon; Virginia Polytechnic Institute, Department of Mining and Mineral Engineering, Blacksburg, VA 24061; Award #80-11456 A01; $46,313 for 12 months beginning 11/15/81 (MPM).

Perform electrochemical measurements, calorimetry, ESCA studies, and flotation kinetic studies on the phenomenon of collectorless flotation under slightly oxidizing conditions.

Particulate and Multiphase Processes (PMP)

40. Industry/University Cooperative Research Activity: Resonant Scattering for Characterization of Dielectric Particulates and Multicomponent Systems; Peter W. Barber; University of Utah, Bioengineering Department, Salt Lake City, UT 84112; Award #81-16087; $24,210 for 24 months beginning 1/15/82 (PMP).

Investigate an optically-based method to provide noninvasive measure of particle size, shape, index of refraction and distribution function for multicomponent particulate systems. Use signal processing techniques to optimize characterization processes.

41. Particle Analysis by Mass Spectrometry (PAMS); Sheldon K. Friedlander; University of California, Department of Chemical Engineering, Los Angeles, CA 90024; Award #80-08686 A01; $73,000 for 12 months beginning 11/01/81 (PMP).

Apply techniques of particle beam generation and focal plane mass spectrometry to study and measure the chemical composition of single aerosol particles on a continuous, real-time basis. Stress efficiency of ionization as a function of particle size and composition.

42. Separation of Particles from Non-Aqueous Media Based on Electrokinetic Phenomena; D. Gidaspow; Department of Chemical Engineering, Illinois Institute of Technology, Chicago, IL 60616; Award #79-19189 A02; $57,916 for 12 months beginning 01/01/82 (PMP).

Analyze operation of cross-flow electrofilters to yield predictive design methods and test theories using synthetic slurries. Develop and test a comprehensive settling theory using non-equilibrium thermodynamics and non-aqueous slurries.

43. Physicochemical Effects upon the Particle Size Distribution in Coagulation; Larry A. Glasgow; Kansas State University, Department of Chemical Engineering, Manhattan, KS 66506; Award #81-12533; $35,703 for 24 months beginning 11/01/81 (PMP).

Examine effects of macromolecular conformation upon clay-polymer floc properties and develop a chain-length model capable of describing the variation of floc density with pH. Determine critical frequency components of flow fields and study particle size distribution behavior in batch deaggregation of lean suspensions.

44. Homogeneous Nucleation Rate Investigations Using a Diffusion Cloud Chamber; Richard H. Heist; University of Rochester, Department of Chemical Engineering, Rochester, NY 14627; Award #81-19892; $78,366 for 24 months beginning 01/01/82 (PMP).

Employ a thermal diffusion cloud chamber to make homogeneous nucleation rate measurements as functions ofsupersaturation, temperature, vapor depletion, and latent heat generation on both nonreacting and reacting chemical systems. Examine fundamental nucleation and phase transition theories.

45. Industry/University Cooperative Research Activity: Soot Formation and Burnout in Flames; Jack B. Howard; Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, MA 02139; Award #80-08071 A01; $22,495 for 12 months beginning 12/01/81 (PMP).

Study effects of soot history on burnout kinetics. Measure and model effects of quantity, size, specific surface area, and composition on soot entering the burnout stage.

46. Relationships Between Cyclone Performance and Dimensions; David Leith; Harvard University, Department of Environmental Health Sciences, Boston, MA 02115; Award #80-12968 A01; $34,025 for 12 months beginning 11/01/81 (PMP).

Develop theory for dimensioning and sizing cyclone equipment. Determine inadequacies in efficiency or pressure drop theories; demonstrate usefulness of cyclone design procedures to optimize cyclone performance; and, provide a base for measuring future improvements in cyclone performance.

47. Interactions in Multiple Colloidal Systems; Egon Matijevic; Clarkson College of Technology, Department of Chemistry, Potsdam, NY 13676; Award #81-11612; $47,425 for 12 months beginning 11/01/81 (PMP).

Perform theoretical and experimental analyses of well-defined mixtures of solids of different geometries. Investigate adhesion and interactions of particles of different morphologies, particle removal from an uneven surface, and detachment of colloidal particles from surfaces exposed to turbulent hydraulic shear.

48. Effects of Physicochemical Parameters on Adsorption of Submicron Species; Raj Rajagopalan; Rensselaer Polytechnic Institute, Department of Chemical and Environmental Engineering, Troy, NY 12181; Award #81-16224; $106,081 for 24 months beginning 01/01/82 (PMP).

Develop simple closed-form solutions for stability ratios and rates of deposition of small species on simple complex substrates. Identify the most important features of interaction forces.

49. Industry/University Cooperative Research Activity: Jetting and Bubbling Phenomena in a Hot Fluidized Bed; C. Y. Wen; West Virginia University, Department of Chemical Engineering; Morgantown, WV 26506; Award #81-12948; $57,532 for 12 months beginning 01/01/82 (PMP).

Verify validity to hot beds of correlations obtained on cold beds; modify correlations of jet height and bubble size as necessary.

Renewable Materials Engineering (RME)

50. Biological and Synthetic Systems for Production of Hydrogen from Water; Alvin I. Krasna; Columbia University, College of Physicians and Surgeons, Biochemistry Department, New York, NY 10023; Award #79-27221 A01; $125,451 for 12 months beginning 10/01/81 (RME).

Produce hydrogen by using hydrogenase-containing algae to catalyze the biophotolysis of water, or by using a synthetic system to catalyze photoproduction of hydrogen from a variety of organic compounds. Methods include reversible absorption and desorption of oxygen by oxygen-carrying proteins, synthetic heme analogues, transition metal complexes, and perfluoro compounds.

Separation Processes (SEP)

51. Supercritical Fluid Extraction; Robert C. Reid; Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, MA 02139; Award #81-10019; $74,524 for 12 months beginning 12/15/81 (SEP); Split-funded with TTP for $18,631.

Conduct studies to provide a basis for optimum design of supercritical fluid (SCF) extractors. Measure mass transfer coefficients for packed beds of pure solute contacted by SCF and diffusion coefficients to facilitate correlations of mass transfer coefficients. Enhance solvent power of an SCF by addition of trace quantities of a second component; develop predictive correlation to allow a priori choice of optimal type (and amount) of trace component.

Thermodynamics and Transport Phenomena (TTP)

xxBerg, John C., see MEAM(FLM).

52. Macromolecular Hydrodynamics; R. Byron Bird; University of Wisconsin, Chemical Engineering Department, Madison, WI 53706; Award #81-04705; $111,580 for 12 months beginning 11/01/81 (TTP).

Develop methods for solving transport phenomena problems using rheological measurements and molecular constitution. Study kinetic theory and rheology of polymer melts, viscoelastic flow problems, flows of concentrated suspensions of spheres, and numerical molecular dynamics.

53. Restricted Transport of Solutes in Fine Pores; William M. Deen; Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, MA 02139; Award #81-11279; $58,725 for 12 months beginning 11/01/81 (TTP).

Study diffusion and convection of macromolecular solutes including electrostatic effects on diffusion, solute rejection coefficients in ultrafiltration, and solute-solute interactions involving membranes formed by track-etch processes.

54. Vaporization Chemistry and Thermodynamics of Ternary Chalcogenides by Computer-Automated Methods; Jimmie G. Edwards; University of Toledo, Department of Chemistry, Toledo, OH 43606; Award #81-03676; $110,408 for 24 months beginning 10/15/81 (TTP).

Investigate high temperature thermodynamics and vaporization chemistry in binary systems PbS/Ga_2S_3, MnS/In_2S_3, $CdSe/Ga_2Se_3$, and $CdSe/In_2Se_3$ using a computer-automated simultaneous Knudsen-effusion and torsion-effusion high-temperature vapor-pressure analysis.

55. Vapor-Liquid Equilibria in Solvent/Polymer/Solvent Systems by Gas Chromatography; Charles J. Glover; Texas A&M University, Chemical Engineering Department, College Station, TX 77843; Award #81-11272; $93,277 for 24 months beginning 11/01/81 (TTP).

Develop perturbation gas chromatography as an accurate method for the determination of vapor-liquid or vapor-solid equilibria involving multiple interacting components.

56. Spectroscopic Investigations of Structure, Transport, and Thermodynamic Properties of Nonideal Liquid Solutions; Erdogan Gulari; University of Michigan, Chemical Engineering Department, Ann Arbor, MI 48109; Award #81-07724; $65,000 for 12 months beginning 10/15/81 (TTP).

Determine structure and transport properties of nonideal solutions of associating solutes by nonintrusive spectroscopic techniques of Quasielastic Light Scattering,

Fourier Transform Infrared Spectroscopy, and Small Angle X-ray Scattering. Use results to test existing theories and develop correlations for predicting mutual diffusion coefficients.

57. Ion Exchange Kinetics - Anions of Polybasic Acids; Friedrich G. Helfferich; Pennsylvania State University, Chemical Engineering Department, University Park, PA 16802; Award #81-07472; $74,232 for 24 months beginning 11/01/81 (TTP).

Theoretically extend existing model of ion exchange kinetics, based on Nernst-Planck equations for ionic diffusion and transference, to anions of polybasic acids by inclusion of dissociation equilibria, with emphasis on phosphate and carbonate.

58. Blood Flow and Macromolecular Transport in a Tumor Capillary Bed During Normo- and Hyperthermia; Rakesh K. Jain; Carnegie-Mellon University, Department of Chemical Engineering, Pittsburgh, PA 15213; Award #81-11626; $71,382 for 12 months beginning 11/01/81 (TTP).

Characterize microcirculatory response to heat through noninvasive in vivo measurement of changes in capillary diameter, capillary blood flow, and macromolecular transport in normal and neoplastic tissues during various degrees of hyperthermia.

59. The Study of Phase Equilibrium in Fluid-Hydrate Systems; Riki Kobayashi; Rice University, Chemical Engineering Department, Houston, TX 77001; Award #81-10853; $60,000 for 12 months beginning 11/01/81 (TTP).

Provide additional constraints with which to fit a theoretical Langmuir Absorption Isotherm model presently used to predict occupation number of hydrate formers in various cases and proper phase compositions in fluid phases.

60. Transport Theory for Fluids in Membranes; Edward A. Mason; Brown University, Division of Engineering, Providence, RI 02912; Award #81-07269; $55,000 for 12 months beginning 10/15/81 (TTP).

Develop a mathematical description of transport across membranes based on statistical-mechanical equations, analysis of relation between membrane structure and transport, molecular limitation on boundary conditions and integration procedures, and molecular theories of fluid properties.

61. The Solubility of Pure Gases and Gas Mixtures in Liquids at Pressures up to 30,000 PSIA; Edward McLaughlin; Louisiana State University, Chemical Engineering Department, Baton Rouge, LA 70803; Award #81-11287; $53,202 for 12 months beginning 10/15/81 (TTP).

Determine solubility of selected pure gases and binary gas mixtures in liquids at 30k psia and temperatures up to 450°F. Examine validity of various solubility theories to determine which best matches the data.

62. Further Application of Statistical Mechanics to Thermodynamic Properties of Liquid Solutions; John P. O'Connell; University of Florida, Department of Chemical Engineering, Gainesville, FL 32611; Award #80-07395 A01; $52,191 for 12 months beginning 10/15/81 (TTP).

Develop correlations, using a two-computer corresponding states method, which can be applied to electrolyte and non-electrolyte solutions at pressures up to several thousand bar.

63. Vapor-Liquid Equilibria of High Temperatures: Mixtures of Heavy (Polar) Components from Fossil-Fuel Sources; John M. Prausnitz; University of California, Chemical Engineering Department, Berkeley, CA 94720; Award #81-07274; $56,085 for 12 months beginning 11/15/81 (TTP).

Perform vapor-liquid equilibrium measurements for mixtures of high-boiling organic liquids found in coal-liquefaction and similar synfuel processes. Use data to compute activity coefficients, expressed with various molar Gibbs excess energy functions.

64. Phase Equilibrium Experiments in Fluid Systems at High Pressures; William B. Streett; Cornell University, School of Chemical Engineering, Ithaca, NY 14853; Award #81-04708; $70,000 for 12 months beginning 11/01/81 (TTP).

Examine pressure-temperature-composition phase diagrams for binary fluid mixtures that exhibit nonideal behavior. Emphasize mixtures containing polar liquids (HCl, H_2S, CH_3OH, CH_3Cl, SO_2). Use data in testing and refining molecular theories of dense fluids and for the design of industrial processes.

65. Industry/University Cooperative Research Activity: Adsorption of Polymer-Surfactant Complexes on Solid Surfaces; Paul F. Waters; American University, Department of Chemistry, Washington, DC 20016; Award #80-10687 A01; $4,750 for 6 months beginning 12/15/81 (TTP).

Assess effects of solution compositions and surface properties to determine physiological mechanisms governing simultaneous adsorption of polymer-surfactant complexes on solid surfaces. Measure complex formation equilibria, adsorption isotherms, and solid surface and solution properties.

DIVISION OF CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

Earthquake Hazard Mitigation (EHM)

66. Seismic Behavior of Cellular Cofferdams; Paul P. Christiano; Carnegie-Mellon University, Department of Civil Engineering, Pittsburgh, PA 15213; Award #80-06781 A01;$69,580 for 12 months beginning 10/15/81 (EHM).

Determine the stress and displacement distributions in shell and fill under the action of earthquakes of a single cellular cofferdam bearing on a rigid base in the absence of surrounding soil or water under drained and undrained conditions.

67. Post-Event Investigations to Maximize Learning From Destructive Natural Disasters; O. Allen Israelsen; National Academy of Sciences, Washington, DC 20418; Award #78-10631 A03; $158,286 for 12 months beginning 12/15/81 (EHM).

Collect perishable information on damage to constructed facilities and disruptions of populations due to natural hazards (earthquakes, winds, landslides, and floods) to gain a better understanding of each particular phenomenon and its effect upon constructed works.

68. U.S.-People's Republic of China Cooperative Strong-Motion Array; Wilfred D. Iwan; California Institute of Technology, Pasadena, CA 91104; Award #80-18271 A01; $149,511 for 12 months beginning 11/15/81 (EHM).

Deploy fixed and mobile array strong-motion measuring instruments in China; provide China with U.S. strong-motion accelerographs, technical support, and travel support; provide for U.S. salaries, site investigation, preparation, and installation, operation, and maintenance of instruments.

69. Natural Hazard Risk Evaluation for Major Industrial Facilities; Anne S. Kiremidjian; Stanford University, Department of Civil Engineering, Stanford, CA 94305; Award #81-16997; $99,630 for 24 months beginning 10/01/82 (EHM).

Develop methodology for evaluating hazard from future earthquakes near major industrial facilities; determine potential failures of each facility when subjected to seismic ground motion; and, estimate losses resulting from failures. Test validity of methods developed by application to a generic oil refinery.

70. Statistical Investigation of Engineering Seismology; Leon Knopoff; University of California, Institute of Geophysics, Los Angeles, CA 90024; Award #80-08588 A01; $112,117 for 12 months beginning 11/15/81 (EHM).

Continue research into statistical and stochastic character of earthquake sequences and seismic risk by studying reliable earthquake catalogs and properties of source-time functions for complex sources. Analyze stochastic properties of earthquake catalogs and seek correlations between seismicity patterns and physical parameters.

71. Dynamic Characteristics of Steel Fibrous Reinforced Concrete as Related to Aseismic Design; Levon Minnetyan; Clarkson College of Technology, Department of Civil and Environmental Engineering, Potsdam, NY 13676; Award #81-117904; $131,268 for 24 months beginning 01/01/82 (EHM).

Construct mathematical models for inelastic dynamic properties of steel fibrous reinforced concrete members via standard time-history system identification techniques using load-displacement data from forced vibration experiements. Identify contribution of steel fibers to dynamic stiffness and strength of members under high-intensity seismic loads.

72. Investigation of Seismic Response and Field Performance of Prototype Earth Dams; H. Bolton Seed; University of California, Department of Civil Engineering, Berkeley, CA 94720; Award #81-10734; $180,609 for 24 months beginning 12/15/81 (EHM).

Check applicability of available analytical procedures for predicting performance of two- and three-dimensional embankment configurations. Extend design and analysis procedures to evaluate post-earthquake stability. Investigate seismic stability of earth embankment dams.

73. Hydraulic Transients in Liquid-Filled Pipelines During Earthquakes; Fred M. Young; Lamar University, Mechanical Engineering Department, Beaumont, TX 77710; Award #81-07292; $49,446 for 24 months beginning 12/15/81 (EHM).

Investigate pipeline damage due to hydraulic transients induced in liquid-filled pipelines by earthquake motion; examine peak overpressures and values of damping; and, verify models for boundary conditions. This is a joint U.S.-Japan research project.

Geotechnical Engineering (GEO)

74. Nonlinear Consolidation Analyses Around Pile Shafts; Mohsen M. Baligh; Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, MA 02139; Award #81-10003; $62,870 for 12 months beginning 12/15/81 (GEO).

Study soil consolidation around friction pile shafts due to dissipation of excess pore pressures developed during pile installation. Conduct consolidation analyses of changes in effective stresses at or close

to pile-soil interface and develop an improved model of soil stresses and properties after installation in soft clays.

75. Collaborative Research: Determination of Soil Properties With the Self-Boring Pressuremeter; G. Wayne Clough; Stanford University, Department of Civil Engineering, Stanford, CA 94305-2179; Award #80-11594 A01; $57,179 for 12 months beginning 01/01/82 (GEO).

Study stresses induced in soil by insertion of a self-boring pressuremeter and inflation of its membrane. Investigate effects of full or partial drainage on these measurements. Use results to improve pressuremeter analysis techniques and better determine soil behavior.

76. Development of Improved Procedures for Simulation of Excavation and Application; C. S. Desai; University of Arizona; Department of Civil Engineering and Engineering Mechanics, Tucson, AZ 85721; Award #81-16950; $34,989 for 12 months beginning 10/15/81 (GEO).

Develop improved procedures based on the finite element method for simulation of underground and surface excavations. Analyze stresses and displacements, allowing for strain-softening, loading and unloading, anisotrophy and joints, and effects of stages of excavations and existing structures.

77. Mechanics of Soil-Tool Interaction in Tillage; C. S. Desai; University of Arizona, Department of Civil Engineering and Engineering Mechanics, Tucson, AZ 85721; Award #81-16949; $24,998 for 12 months beginning 10/15/81 (GEO).

Based on conventional triaxial, direct shear and true triaxial test results, develop and expand a mathematical model and three-dimensional finite element procedure capable of handling geometrical and material nonlinearities for analysis of soil-structure interaction effects related to tillage.

78. A Centrifuge Facility for Research In Geotechnical Engineering; Angelo Giovannetti; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA 94035; Award #78-26122 A06; $284,186 for 12 months beginning 11/01/81 (GEO).

Support conversion of existing NASA-Ames Research Center centrifuge, which is used in geomechanics research for modeling natural and man-made systems, under a spectrum of artificially-induced loads representing normal and rare events.

79. The Formation and Mechanical Properties of Naturally Occurring Ice Systems Within the Context of Civil Engineering Interests; John F. Kennedy; University of Iowa, Institute of Hydraulic Research, Iowa City, IA 52242; Award #81-09252; $52,656 for 12 months beginning 12/15/81 (GEO); Split-funded with MEAM(SOM) for $10,000.

Analyze ground and river icings to predict vertical plane profiles and occurrence of incised channels and/or ice ripples; experiment with a refrigerated flume and a towing tank for two and three dimensional developments; and examine time-dependent shear strength of freezing ice rubble.

80. A Continuum Theory of Rock Damage and Fracture; Dusan Krajcinovic; University of Illinois, Department of Materials Engineering, Chicago, IL 60680; Award #81-05270; $47,492 for 12 months beginning 12/15/81 (GEO).

Establish a continuum theory based on a minimum number of parameters with direct application to rock mechanics. Qualify and quantify levels of damage by means of hidden internal variables, and consider rock fracture as a process continuous in time and space.

81. Static and Dynamic Behavior of Anisotropic Cohesionless Soils Under Combined Stresses; Adel S. Saada; Case Western Reserve University, Department of Civil Engineering; University Circle, Cleveland, OH 44106; Award #81-12070; $69,856 for 12 months beginning 01/01/82 (GEO).

Study response of sands to both static and dynamic combined stresses, taking into consideration the nature, magnitude, direction, void ratio, and fabric of the stress.

82. Nonmonotonic Consolidation of Soil; Robert L. Schiffman; University of Colorado at Boulder; Department of Civil, Environmental and Architectural Engineering, Boulder, CO 80309; Award #81-15615; $7,000 for 24 months beginning 01/01/82 (GEO).

Develop and test new theories of soil consolidation under cyclic loading to provide methods for accelerating the consolidation process of field installations.

83. Experimental and Analytical Validation of Constitutive Models for Soils; Stein Sture; University of Colorado; Department of Civil, Environmental, and Architectural Engineering, Boulder, CO 80309; Award #80-25806 A01; $67,785 for 12 months beginning 11/15/81 (GEO).

Investigate behavior of cohesive and cohesionless soils subjected to proportional, nonproportional, and cyclic monotonic loading in conjunction with a rotating principal stress field; demonstrate influence of such features on stress-strain-strength behavior of soil.

Structural Mechanics (STM)

84. Efficient Methods for Optimal Design of Large Complex Structural Systems; Jasbir S. Arora; University of Iowa, Department of Civil Engineering, Iowa City, IA 52242; Award #80-08102 A01; $41,024 for 12 months beginning 10/15/81 (STM).

Improve analytical/numerical methods for optimization of design of complex structural systems by reformulation of stress and displacement constraints to reduce the number of parameters involved. Study implicit design constraints in nonlinear programming methods relative to structural mechanics problems.

85. Inelasticity and Failure of Concrete; Zdenek P. Bazant; Northwestern University, Department of Civil Engineering, Evanston, IL 60201; Award #80-09050 A01; $146,448 for 12 months beginning 10/15/81 (STM).

Improve mathematical models of inelasticity and failure needed for structural analysis criteria of concrete stability including anisotropic stiffness degradation due to microcracking. Formulate total strain theory including failure and post-peak response and determine variability of fracture energy due to heterogeneity effects.

86. Verification of Constitutive Relations for Silage Through Full-Scale Silo Measurements; Alfred G. Bishara; Ohio State University, Department of Civil Engineering, Columbus, Ohio 43210; Award #79-08408 A02; $20,500 for 12 months beginning 01/01/82 (STM).

Correlate field behavior of drained and undrained circular silos sequentially loaded and unloaded with natural silage materials, with predicitons based on previously developed constitutive models and finite element formulations.

87. Role of Cement Paste in Deformation and Cracking of Plain Concrete; David Darwin; University of Kansas, Department of Civil Engineering, Lawrence, KS 66045; Award #81-16349; $101,399 for 24 months beginning 01/01/82 (STM).

Study structural changes as a function of stress and correlated with stress-strain behaviors of cement paste, mortar, and concrete. Provide information on mechanisms controling nonlinear softening microcracking and submicrocracking and the degree to which cement paste controls the behavior of concrete.

88. Shear Strength of High Strength Concrete; Gregory C. Frantz; University of Connecticut, Department of Civil Engineering, Storrs, CT 06268; Award #81-19386; $86,173 for 24 months beginning 01/15/82 (STM).

Study effects of compressive strengths from 3,000 to 15,000 psi on diagonal cracking capacity and ultimate shear capacity of reinforced concrete beams without and with web reinforcement; examine shear transfer mechanism of aggregate interlock.

89. Non-Stationary Solutions To Structural Optimization Problems; Ernest F. Masur; University of Illinois, Department of Materials Engineering, Chicago, IL 60680; Award #81-10784; $95,158 for 24 months beginning 12/15/81 (STM).

Optimize stationarity conditions of the calculus of variations pertaining to structural stress for a structure of given volume; study buckling load, deflection, flutter, and stress; and, seek solutions through perturbation expansions.

90. Theoretical and Computational Aspects of Nonlinear Shell Theory: Closing the Gap; James G. Simmonds; University of Virginia; Department of Applied Mathematics and Computer Science, Charlottesville, VA 22903; Award #81-17103; $75,843 for 27 months beginning 01/15/82 (STM).

Develop solutions to a set of benchmark problems in nonlinear shell theory to test efficacy of large, commercially available finite element codes. Investigate application of Sanders' path-independent, energy-release rate integrals in both linear and nonlinear shell problems.

91. Active Control in Structural Engineering; Tsu T. Soong; State University of New York, Department of Civil Engineering, Buffalo, NY 14260; Award #80-10891 A01; $51,092 for 12 months beginning 10/15/81 (STM).

Develop an active control methodology for flexible structures which considers, in integrated fashion, use of low-order discretized systems, control and observation spillovers, optimal placement of limited number of sensors and controls, and control design under practical constraints.

92. Control and Reliability of Civil Engineering Structures; James T. Yao; Purdue University, School of Civil Engineering; West Lafayette, IN 47907; Award #80-18963 A01; $65,358 for 12 months beginning 01/01/82 (STM).

Study the interrelationship between active control and structural reliability of civil engineering structures and examine the applicability of various control mechanisms for safety considerations.

Water Resources and Environmental Engineering (WRE)

93. Transportation Analysis Methods; Carlos F. Daganzo; University of California, Institute of Transport Studies, Berkeley, CA 94720; Award #81-11681; $153,992 for 36 months beginning 12/15/81 (WRE).

Improve equilibrium analysis, demand analysis, and supply analysis using transportation equilibrium theory to improve transportation performance prediction methods.

xxDantzig, George B., see ECSE(STO).

94. Rheology of Biological Wastewater Suspensions; Richard I. Dick; Cornell University, Department of Environmental Engineering, Ithaca, NY 14853; Award #81-11249; $64,250 for 12 months beginning 01/01/82 (WRE).

Determine effect of design and operational variables including concentration, residence time, shear rate, and duration of anaerobiosis in biological wastewater treatment processes on the rheological properties of biological solids synthesized. Study relationships between rheological properties of biologically active suspensions and performance of selected treatment processes.

95. Modern Stability and Numerical Concepts in Water Resource Management; Lucien Duckstein; University of Arizona, Department of Systems and Industrial Engineering, Tucson, AZ 85721; Award #81-10778; $85,345 for 12 months beginning 12/01/81 (WRE).

Evaluate methodologies such as polyhedral dynamics, bifurcation theory, differential dynamic programming, and nonparametric regression used to investigate lake eutrophication and ecosystems, multi-reservior control, aquifer identification, floodwater control in mines, and saltwater intrusion into aquifers for use in forecasting and management.

96. Microbial Production of Nitrous Oxide in Nitrogen-Rich River Sediments; Harold F. Hemond; Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, MA 02139; Award #81-08184; $116,457 for 24 months beginning 12/15/81 (WRE).

Identify roles of ammonium oxidation and dissimilatory nitrate reduction in bacterial nitrogen transformations for producing nitrous oxide at the sediment-water interface. Assess mechanisms responsible for increasing concentrations of N_2O in the troposphere and nitrogen cycling of polluted river sediments.

97. Field Testing of Mathematical Models Describing Soil-Water-Solute Dynamics; Daniel I. Hillel; University of Massachusetts, Department of Plant and Soil Sciences, Amherst, MA 01003; Award #81-05807; $167,333 for 24 months beginning 12/15/81 (WRE).

Test computer-based theoretical models of hydrological processes such as infiltration, surface runoff, root-zone soil moisture changes, evapotranspiration, water-table fluctuations, and lateral groundwater drainage against full-scale experimental data to verify the theoretical models.

98. Chemical Interactions Between Complexed Heavy Metals and Hydrous Solids. The Effects of Complex Formation on Interfacial Reactions; Chin-Pao Huang; University of Delaware, Department of Civil Engineering, Newark, DE 19711; Award #81-04728; $103,744 for 24 months beginning 12/01/81 (WRE).

Determine how chemical interactions between complexed heavy metals and finely divided particles affect adsorption of heavy metals at the hydrous solid surface, and the stability of dispersions. Study effects of complexed heavy metal adsorption on thickening and dewatering characteristics of coagulated solids.

99. Structured Models for Biological Waste Treatment Systems; Robert L. Irvine; University of Notre Dame, Department of Civil Engineering, Notre Dame, IN 46556; Award #81-12530; $143,849 for 12 months beginning 12/15/81 (WRE).

Determine relationships between rate of substrate removal and population dynamics of microorganisms in biological reactors, staged systems for biological treatment of wastes. Construct model for potential application of findings to design and study operation of waste treatment systems.

100. A Methodological Foundation for Performance and Accountability Evaluations of Water Resource Systems; Roman Krzysztofowicz; Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, MA 02139; Award #81-07204; $94,480 for 12 months beginning 12/01/81 (WRE).

Develop methodology for making performance and accountability evaluations of large-scale, complex man/machine, and engineering/societal systems; apply methodology to evaluation of performance and accountability of storage management systems of water resources.

101. Establishment of Mathematical Modeling of Shoreline Evolution; Bernard LeMehaute; University of Miami, Department of Ocean Engineering, Miami, FL; Award #79-11930 A03; $44,577 for 12 months beginning 12/01/81 (WRE).

Develop a three-dimensional mathematical model of shoreline evolution as a result of man-made structures. Use functional relationships which express alongshore and onshore-offshore movement of sediment based on laboratory and field investigations.

102. Mechanics of Turbulent Buoyant Plumes; E. John List; California Institute of Technology, Division of Engineering and Applied Science, Pasadena, CA 91104; Award #81-17272; $126,988 for 12 months beginning 01/15/82 (WRE).

Investigate the motion of axisymmetric turbulent buoyent jets using a laser-doppler velocimeter. Study intensity of turbulent fluctuations in velocity and concentration; flux of tracer within the flow; turbulent kinetic energy balance; and influence of ambient fluid turbulence levels on rate of dilution.

103. Hydrodynamic Roughness of Marine Growths on Cylinders; John H. Nath; Oregon State University, Department of Civil Engineering, Corvallis, OR 97331; Award #79-11787 A02; $57,961 for 12 months beginning 11/15/81 (WRE).

Perform laboratory and field investigations to advance knowledge of hydrodynamic effects from naturally-occurring roughnesses such as barnacles, rock scallops, mussels, grasses, and kelp, which cannot be modeled, by uniformly coating the exterior of a model with various sizes of sand grains.

104. Simulation of Multi-Phase Flow Phenomenon Via Catastrophe Theory; George F. Pinder; Princeton University, Department of Civil Engineering, Princeton, NJ 08540; Award #81-11240; $63,381 for 12 months beginning 12/15/81 (WRE).

Use catastrophe theory to extend collocation techniques to transport problems in fluid mixtures characterized by sudden changes in thermodynamic variables. Investigate isothermal flow of multicomponent, multiphase fluid mixtures in porous media in the absence of chemical reactions.

105. The Kinematic Properties of Breaking Waves and Their Interaction with Bottom Pavements; Fredric Raichlen; California Institute of Technology, Department of Hydraulics and Water Resources, Pasadena, CA 91104; Award #79-12434 A02; $103,070 for 12 months beginning 01/01/82 (WRE).

Determine stability of offshore and coastal structures in relation to the water particle velocity and the acceleration field of incident waves. Advance understanding of the kinematics and dynamics of near-breaking and breaking waves.

106. Baroclinic Response of Wide, Deep Estuaries to Offshore Atmospheric Forcing -- With Application to the Strait of Juan De Fuca; Maurice Rattray; University of Washington, Department of Oceanography, Seattle, WA 98195; Award #81-10708; $18,397 for 12 months beginning 11/01/81 (WRE).

Develop a model for time-dependent responses of wide-mouthed estuaries to changes in coastal winds. Couple frictional wave upwelling response to a wave diffraction model to give the phase and amplitudes of diffracted waves into the estuary and adjacent ocean region.

107. Stochastic Modeling of Geophysical Time Series; Jose D. Salas; Colorado State University, Civil Engineering and Statistics Department, Fort Collins, CO 80523; Award #81-10782; $62,265 for 12 months beginning 12/15/81 (WRE).

Investigate characteristics of time series of geophysical processes which exhibit changes due to man-made or physical processes, and study properties of stochastic models capable of reproducing such changes.

108. Effects of Activated Carbon on Reactions of Chlorine-Containing Disinfectants With Organic Compounds; Vernon L. Snoeyink; University of Illinois, Department of Civil Engineering, Urbana, IL 61801; Award #81-10024; $88,288 for 12 months beginning 12/15/81 (WRE).

Characterize reactions between disinfectants containing chlorine and organic compounds that become adsorbed on activated carbon during treatment of water. Emphasize determining reaction products and characterizing mechanisms of reactions.

DIVISION OF ELECTRICAL, COMPUTER, AND SYSTEMS ENGINEERING (ECSE)

Automation, Bioengineering, and Sensing Systems (ABS)

109. Volume and Surface Area Algorithms; Larry T. Cook; University of Kansas Medical Center, Department of Diagnostic Radiology, Kansas City, KS 66103; Award #81-08810; $36,683 for 24 months beginning 12/01/81 (ABS).

Study mathematical models to explicitly state geometric assumptions of associated algorithms and delineate sources of error. Perform experimental trials on test objects using CT scanners and sonography scanners to establish experimental error ranges.

110. Image Recognition of Curved Objects; Ernest L. Hall; University of Tennessee, Department of Electrical Engineering, Knoxville, TN 37916; Award #81-12074; $46,732 for 12 months beginning 01/01/82 (ABS).

Develop techniques and algorithms for three-dimensional location of curved objects and surfaces using a computer vision approach. Study dependence of algorithms on number of views, noise sensitivity, and error analysis.

111. Data Adaptive Wideband Array Processing; Mostafa Kaveh; University of Minnesota, Department of Electrical Engineering, Minneapolis, MN 55455; Award #81-05962; $78,907 for 24 months beginning 12/01/81 (ABS).

Study use of spectral contents of appropriate wideband signals to improve accuracy and reliability of spatial spectral estimates. Emphasize receiver-processor configurations that use distributed processing for computational efficiency.

112. Advanced Control for Multirobot Assembly Systems; C.S. Georg Lee; University of Michigan, Department of Electrical and Computer Engineering, Ann Arbor, MI 48109; Award #81-06954; $75,000 for 24 months beginning 01/01/82 (ABS); Split-funded with MEAM(PRR) for $75,000.

Develop methodologies for control and coordination of multirobot batch assembly systems using distributed computer-based control to improve dynamic performance of robot systems in areas of real-time control, higher motion speed, and efficient runtime control and codes.

113. Microwave Induced Resting Potential Shifts in Chara; William F. Pickard; Washington University, Department of Electrical Engineering, St. Louis, MO 63130; Award #81-05485; $99,953 for 24 months beginning 11/15/81 (ABS).

Examine single giant cells from Characean algae for responses to microwave irradiation. Observe cell resting potential as an indicator of interaction between electromagnetic energy and the biological tissue.

Computer Engineering (COM)

114. Efficient Representation Schemes for Line-Drawing Data; Herbert Freeman; Rensselaer Polytechnic Institute, Department of Electrical, Computer and Systems Engineering, Troy, NY 12181; Award #81-11619; $78,000 for 18 months beginning 01/01/82 (COM).

Investigate generalized chain coding and polycurve coding schemes for representing line-drawing data for computer storage, analysis, and manipulation. Establish quantitative measures for criteria examined to judge effectiveness for verification of predicted results.

115. Conference on Advanced Research in VLSI, January 1982; Paul Penfield; Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, Cambridge, MA 02139; Award #81-18430; $14,350 for 9 months beginning 11/01/81 (COM).

Discuss Very Large Scale Integrated (VLSI) circuits, including submicron lithography, semiconductor devices and circuits, VLSI design automation, and system architecture.

Electrical and Optical Communications (EOC)

116. Digital Filter Structures; Casper W. Barnes; University of California, Department of Electrical Engineering, Irvine, CA 92717; Award #81-09239; $49,045 for 12 months beginning 12/01/81 (EOC).

Discover digital filter structures that provide optimal tradeoffs between filter complexity and finite word effects for implementation in very large scale integrated circuits. Emphasize finite word effects in multi-input, multi-output digital filters.

117. Specialized Research Equipment: Electron Beam Evaporation System for Research in Solid State Electronic and Optical Devices and Circuits; Joe T. Boyd, University of Cincinnati, Department of Electrical and Computer Engineering, Cincinnati, OH 45221; Award #80-14976 A01; $10,000 for 6 months beginning 12/01/81 (EOC).

Develop an electron beam evaporation system which provides higher quality metalization with respect to contamination, adhesion, and strength than present filament evaporator systems.

118. Hybrid Cavity Waveguide Lasers; William S. Chang; University of California-San Diego, Department of Electrical Engineering and Computer Science, La Jolla, CA 92093; Award #79-22933 A02; $110,000 for 24 months beginning 11/01/81 (EOC).

Investigate the Hybrid Cavity Waveguide laser which operates existing commercially available diode lasers in an external cavity. Analyze laser oscillation mode, frequency stability, spontaneous emission reduction, mode locking, stabilization of laser output, oscillation in lithium niobate waveguides, and intra-cavity modulation.

119. Low Pressure Chemical Vapor Deposition Equipment; Richard C. Jaeger; Auburn University, Department of Electrical Engineering, Auburn, AL 36849; Award #81-12294; $30,300 for 12 months beginning 01/01/81 (EOC).

Help acquire Low Pressure Chemical Vapor Deposition (LPCVD) equipment for the Microelectronics Laboratory at Auburn for use in support of metal oxide semiconductor integrated circuit research.

120. Adaptive Digital Filter Algorithms; C. Richard Johnson; Cornell University, Department of Electrical Engineering, Ithaca, NY 14853; Award #81-20998; $16,486 for 10 months beginning 12/01/81 (EOC).

Study infinite-impulse response digital filters used in communications, array processing, speech analysis, and bioengineering. Investigate convergence rates, reduced modeling, and noise effects.

121. Two-Dimensional Recursive Estimation with Application to Real-Time Filtering of Images; Howard Kaufman; Rensselaer Polytechnic Institute, Department of Electrical and Systems Engineering, Troy, NY 12181; Award #80-12569 A01; $51,000 for 12 months beginning 12/15/81 (EOC); Split-funded with STO for $12,000.

Develop methods for 2-D recursive filtering of image data corrupted by distortion and noise using Kalman recursive estimation techniques.

122. Optimization and Control of Large-Scale Networks; James S. Meditch; University of Washington, Department of Electrical Engineering, Seattle, WA 98195; Award #80-11262 A01; $19,996 for 12 months beginning 10/15/81 (EOC); Split-funded with STO for $19,996.

Develop a basic theoretical understanding of the structure and operation of large-scale networks and provide algorithms for optimal performance for use in automated industrial processes and terrestrial, satellite, and ground-radio computer-communications networks.

123. Gradient Index Optical Systems; Duncan T. Moore; University of Rochester, Institute of Optics, Rochester, NY 14627; Award #81-06941; $72,240 for 12 months beginning 11/01/81 (EOC).

Design anamorphic gradient systems for coupling light from laser diodes to fibers; design anamorphic camera systems and lenses for optical computing; implement chromatic aberrations in lens and quantify gradient index materials; measure mechanical and thermal properties of gradient index materials; investigate gradient index glass; and, design gradient index optical systems.

124. Chaotic Resistors and Turing-Smale Systems; Robert W. Newcomb; University of Maryland, Department of Electrical Engineering, College Park, MD 20742; Award #81-05507; $46,673 for 18 months beginning 11/01/81 (EOC).

Study simple, degree-two realizations of Turing-Smale cells using hysteresis effects to obtain practical electronic realizations.

125. Research in Source-Channel Coding and Communication Networks; Jim K. Omura; University of California, Department of System Science, Los Angeles, CA 90024; Award #80-12568 A01; $67,000 for 12 months beginning 12/01/81 (EOC).

Examine information theory and queuing/ network theory with regard to digital communication for efficient utilization of networks accessed by a large number of users. Evaluate delay-throughput stability and operating point characteristics of Markovian channels.

126. Research in Multi-Dimensional Signal Processing; Alan V. Oppenheim; Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, Cambridge, MA 02139; Award #80-07102 A01; $80,000 for 12 months beginning 12/15/81 (EOC).

Develop algorithms and hardware for multi-dimensional signal processing. Research multi-dimensional signal reconstruction and noise reduction in multi-dimensional signals.

127. Problems in Integrated Digital Networks; Mischa Schwartz; Columbia University, Department of Electrical Engineering, New York, NY 10027; Award #81-08776; $95,649 for 12 months beginning 11/01/81 (EOC).

Study multiplexing of digital traffic (voice, data, and image) over terrestrial and satellite integrated digital networks. Study routing problems, congestion control and performance over interconnected integrated networks of differing characteristics.

128. 2-D Image Restoration: Adaptive and Recursive Approaches; Leonard M. Silverman; University of Southern California, Department of Electrical Engineering, Los Angeles, CA 90007; Award #80-11911 A01; $42,500 for 12 months beginning 12/01/81 (EOC).

Develop procedure for nonlinear restoration of images degraded by additive noise. Enable human observer to optimize parameters.

129. Estimation and Decision for Random Point Processes; Donald L. Snyder; Washington University, Department of Electrical Engineering, St. Louis, MO 63130; Award #81-13266; $86,996 for 24 months beginning 01/01/82 (EOC).

Formulate random point process models for phenomena encountered in optical communications to identify receiver processing; recover information bearing signals; and develop coordinated tranmitter and receiver designs. Investigate coordinated design of modulation and coding for multiple-user optical communication systems, and receiver system design and performance for randomly dispersive channels.

130. Short-Pulse Optical And Opto-Electronic Devices; John R. Whinnery; University of California, Electronics Research Laboratory, Berkeley, CA 94720; Award #81-14526; $99,300 for 12 months beginning 10/01/81 (EOC).

Study a double mode-locked dye laser stressing pulses of one pulse train and between two trains of different frequency. Compare correlation for commercial synchronously-pumped system with other mode-locked configurations.

131. Two-Dimensional Recursive Digital Filtering; John W. Woods; Rensselaer Polytechnic Institute, Department of Electrical, Computer, and Systems Engineering, Troy, NY 12181; Award #81-08806; $43,000 for 12 months beginning 11/01/81 (EOC).

Develop a spectral factorization-based design algorithm; study quality of approximation afforded by various classes of filter specifications; develop 2-D liner shift-invariant operator factorization, and use to design two-pass recursive filters.

Quantum Electronics, Waves, and Beams (QWB)

132. Continuation of Lower Hybrid Wave Research on the Encore Tokamak; Paul M. Bellan; California Institute of Technology, Department of Engineering and Applied Sciences, Pasadena, CA 91104; Award #81-13533; $79,919 for 12 months beginning 11/01/81 (QWB).

Conduct hybrid wave research with emphasis given to rf generation of dc currents, wave propagation, and plasma heating. Collect data on electrostatic and magnetic probes.

133. Molecular Beam CARS Spectroscopy; Robert L. Byer; Stanford University, Department of Applied Physics, Stanford, CA 94305; Award #79-12673 A02; $63,275 for 12 months beginning 12/15/81 (QWB).

Study pulsed molecular beams to enhance spectral and structural details for molecular systems such as methane and sulfur hexafluoride. Combine high vaccum technology with laser systems to further develop coherent anti-Stokes Raman spectroscopy. Improve the precision of measured Raman vibrational frequencies and verify isotopic shift of molecular vibration.

134. Investigation of New Experimental Techniques with Subpicosecond Pulses; Jean-Claude Diels, North Texas State University, Department of Physics, Denton, TX 76203; Award #81-19568; $66,350 for 12 months beginning 12/01/81 (QWB).

Investigate gain and loss kinetics in a subpicosecond dye laser medium; apply nonlinear optical techniques to high-resolution measurements relevant to picosecond pulse propagation.

135. Nonlinear Optical Microscopy; Robert W. Hellwarth; University of Southern California, Department of Electrical Engineering-Electrophysics, Los Angeles, CA 90007; Award #81-14828; $68,195 for 12 months beginning 11/15/81 (QWB).

Develop nonlinear optical techniques for applications in microscopy. Study optical wave mixing at surfaces; calculate mixing between two to four optical waves reflected by a surface; and, study mechanisms underlying photorefraction in optical imaging.

136. Achromatic Interferometry Using Holographic Optical Elements; Emmet N. Leith; University of Michigan, Department of Electrical and Computer Engineering; Ann Arbor, MI 48109; Award #79-01647 A02; $50,962 for 12 months beginning 11/01/81 (QWB).

Design achromatic holographic interferometers based on interference of two beams that have each been twice diffracted by gratings; attempt to fabricate matched gratings that couple equal transmitted light into both arms of the interferometer.

137. Nonlinear Interaction of Light at Optical Surfaces; Gail A. Massey; San Diego State University, Department of Electrical and Computer Engineering, San Diego, CA 92182; Award #81-19737; $60,737 for 12 months beginning 11/01/81 (QWB).

Construct an electron microscope utilizing multiphoton photoemission; use it to examine optical waveguide surfaces and investigate optical damage mechanisms.

138. Interaction of Strong Electromagnetic Waves with Plasmas; Z.A. Pietrzyk, University of Washington, Department of Nuclear Engineering, Seattle, WA 98195; Award #80-12997 A01; $92,935 for 12 months beginning 12/01/81 (QWB).

Study absorption of CO_2 laser beam by a stationary plasma. Examine collision of two radiation-driven plasma wavefronts and Raman and Brillouin scattering processes.

139. Ion Cyclotron Harmonic and Nonlinear Electron Cyclotron Plasma Wave Studies; John E. Scharer; University of Wisconsin, Department of Electrical and Computer Engineering, Madison, WI 53706; Award #79-20153 A02; $41,140 for 12 months beginning 01/15/82 (QWB).

Investigate plasma wave coupling, propagation, and heating in and near ion cyclotron frequency range. Apply ray tracing techniques to ion cyclotron wave characterization, generation, and parametric conversion.

140. Trapped Particle Instabilities and Plasma Transport; Amiya K. Sen; Columbia University, Department of Electrical Engineering and Applied Physics, and Nuclear Engineering, New York, NY 10027; Award #81-13183; $112,830 for 12 months beginning 12/01/81 (QWB).

Study linear wave properties of the trapped ion mode, effects of magnetic field gradients on the mode, feedback control of the trapped ion instability, nonlinear saturation, and wave-induced transport of particles and energy.

141. Asymptotic Theory of Surface Acoustic Wave Interactions; S.R. Seshadri; University of Wisconsin, Department of Electrical and Computer Engineering, Madison, WI 53706; Award #81-06727; $30,000 for 12 months beginning 11/15/81 (QWB).

Develop ray techniques and perturbation procedures for problems of wave interactions in lower microwave frequency regimes to better understand phenomena relevant to applications and physical mechanisms of wave processes.

142. High Absorption of Electromagnetic Radiation by Structures; Theodor Tamir; Polytechnic Institute of New York, Department of Electrical Engineering, Brooklyn, NY 11201; Award #79-02879 A02; $51,554 for 12 months beginning 10/15/81 (QWB).

Analyze significant beam displacement properties and absorptive materials with extinction lengths long compared with film thickness; conduct experiments at both optical and microwave wavelengths.

143. The Study of Surface Generated Bulk Waves in Quartz for Applications Requiring High Temperature Stability; John F. Vetelino; University of Maine, Electrical Engineering and Lab Surface Science, Orono, ME 04473; Award #81-13429; $105,477 for 24 months beginning 12/01/81 (QWB).

Study quartz crystal orientations, propagating modes and transducer geometrics to improve temperature stability of acoustic wave devices emphasizing surface skimming and reflected bulk waves.

Science and Technology to Aid the Handicapped (STH)

144. Tactile Perception of Speech; James C. Craig; Indiana University, Department of Psychology, Bloomington, IN 47401; Award #80-17178 A01; $76,338 for 12 months beginning 12/15/81 (STH).

Examine using tactile sense as an alternate modality for perception of speech and understanding of spoken language. Determine distinctive elements of acoustic speech to be transformed to tactile patterns; develop training procedure for perceptual learning; and evaluate natural and synthetic speech tokens presented to the skin of the finger.

145. Electrical Stimulation of Skin as a Basis for Sensory Prostheses; William H. Dobelle; Columbia University, Department of Surgery, New York, NY 10027; Award #79-17634 A02; $45,000 for 12 months beginning 10/15/81 (STH).

Investigate electrocutaneous display methods using psychophysical techniques to provide information about the ability of human observers to perceive complex, dynamic patterns of input imposed on their skin (for use in the future design of non-invasive prosthetic devices).

Solid State and Microstructures Engineering (SSM)

146. Investigation of Excess ("1/F") Noise and Dielectric Response of Non-Crystalline Structures Preceding First Nuleation in Thin Film Systems; Robert W. Bene; University of Texas, Department of Electrical Engineering, Austin, TX 78712; Award #81-11616; $44,073 for 12 months beginning 11/15/81 (SSM).

Study nucleation of thin metal films reacting at low temperatures with emphasis on reaction paths. Analyze in order to predict and control initial nucleation of metal films on silicon substrates.

147. Electrical Properties of Annealed and Implanted Gallium Arsenide; P.K. Bhattacharya; Oregon State University, Department of Electrical and Computer Engineering, Corvallis, OR 97331; Award #80-11917 A01; $47,219 for 12 months beginning 11/15/81 (SSM).

Identify origin of dominant traps in vapor phase epitaxial and ion implanted gallium arsenide by studying laser annealing characteristics. Determine optimum trade-off between annealing and creation of traps.

148. Josephson Tunnel Junctions Using Hard Superconductors; James E. Nordman; University of Wisconsin, Electrical and Computer Science Department, Madison, WI 53706; Award #79-22050 A01; $9,500 for 12 months beginning 10/15/81 (SSM).

Investigate fabrication limitations and device properties of Josephson junctions using niobium and niobium compounds, focusing on oxidation. Analyze results through Auger and x-ray photoelectron spectroscopy.

149. Integrated Sensing Devices Based on the Charge-Flow Transistor; Stephen D. Senturia; Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, Cambridge, MA 02139; Award #81-14781; $72,000 for 12 months beginning 01/01/82 (SSM).

Develop a Fourier transform analysis system to measure and evaluate device transients; emphasize on-chip functionality techniques for sub-femte amp measurement of interelectrode corrosion currents and moisture uptake.

150. Investigation on Interface Reactions of Transition-Metal/SI Structures Induced By Ion Implantation; Kang L. Wang; University of California, School of Engineering and Applied Science, Los Angeles, CA 90024. Award #80-11037 A01; $42,989 for 12 months beginning 10/15/81 (SSM).

Study reaction mechanisms and applications of transition-metal silicides followed by laser annealing. Study film and interface stability after annealing and oxidation using furnaces and laser beams.

151. Magnetic Reversal Processes with Application To Core Materials; J. Kenneth Watson; University of Florida, Department of Electrical Engineering, Gainesville, FL 32611; Award #81-11623; $92,159 for 24 months beginning 10/15/81 (SSM).

Investigate processes in magnetic elements applicable to inductors and transformers. Analyze selected core materials to distinguish different modes of magnetic reversal.

Systems Theory and Operations Research (STO)

152. Parameter Estimation and Adaptive Control of Large Scale and Distributed Parameter Systems; Mark Balas; Rensselaer Polytechnic Institute, Department of Electrical and Systems Engineering, Troy, NY 12181; Award #80-16173 A01; $63,550 for 12 months beginning 12/15/82 (STO).

Develop methodology to synthesize implementable, on-line parameter estimation and adaptive feedback control algorithms for large-scale distributed parameter systems. Analyze convergence and closed-loop stability of resulting algorithms.

153. Multi-Level Programming; Jonathan F. Bard; Northeastern University, Department of Management Science, Boston, MA 02115; Award #81-18185; $7,826 for 8 months beginning 01/01/82; (STO).

Characterize overall feasible regions and develop iterative solution procedures for bi-level programming in which a higher level decisionmaker sets policy for a lower level decisionmaker, who then reacts within promulgated guidelines to meet objectives.

154. Computational Methods for Nonlinear Programming and Optimal Control; Dimitri P. Bertsekas, Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, Cambridge, MA 02139; Award #79-20834 A02; $61,565 for 12 months beginning 03/01/82 (STO).

Study non-convex optimization in the presence of equality constraints; analyze proximal point algorithms; solve multi-commodity network flow problems; and research subgradient algorithms.

155. Development and Analysis of Coordination Algorithms for the Simulation of Integrated Dynamic Systems; Coleman B. Brosilow; Case Western Reserve University, Department of Chemical Engineering, Cleveland, OH 44106; Award #81-10040; $46,014 for 24 months beginning 10/15/81 (STO); Split-funded with CPE (CBP) for $36,000.

Investigate and analyze a modular simulation technique for dynamic integrated systems. For each subsystem, use a module with its integration algorithm controlled by internal error criteria and linked by a coordinator. Emphasize algorithms used by the coordinator. Consider explicit and implicit extrapolation methods.

156. Computational Methods for Identification and Optimal Control of Hereditary Systems; John A. Burns; Virginia Polytechnic Institute, Department of Mathematics, Blacksburg, VA 24061; Award #81-09245; $18,386 for 12 months beginning 10/15/81 (STO).

Use functional differential equations, augmented hyperbolic partial differential equations, and integro-differential equations to develop computational methods for parameter estimation and optimal control of dynamical systems.

157. Large-Scale Systems; Jose B. Cruz, Jr.; University of Illinois, Coordinated Science Laboratory, Urbana, IL 61801; Award #7919396 A02; $140,000 for 12 months beginning 11/15/81 (STO).

Investigate modeling, analysis, and control of interconnected multiperson dynamic systems. Introduce multimodeling and develop an analytical framework for studying iterative properties (convergence, etc.) of these modeling processes.

158. Optimization of Large-Scale Dynamic Systems with Special Reference to Energy and Water Resources; George B. Dantzig; Stanford University, Systems Optimization Laboratory, Stanford, CA 94305; Award #80-12974 A01; $85,000 for 12 months beginning 11/15/81 (STO); Split-funded with CEE (WRE) for $85,000.

Study methods for linking a large-scale, regionalized water-energy model with a dynamic, nationally aggregated energy economic model for solution of large-scale optimization problems with nonlinear constraints.

159. Hybrid Adaptive Control of Multivariable Systems; Howard O. Elliot; Colorado State University, Department of Electrical Engineering, Fort Collins, CO 80523; Award #81-10042; $69,947 for 24 months beginning 11/01/81 (STO).

Perform convergence and stability analyses of hybrid adjustment schemes for controlling minimum phase continuous time processes. Complete stability analysis of adaptive control structures for single-input, single-output nonminimum phase plants and generalize multivariable control schemes.

160. Homotopy and Pivotal Methods; Floyd J. Gould, University of Chicago, Graduate School of Business, Chicago, IL 60637; Award #79-20177 A02; $47,119 for 12 months beginning 11/15/81 (STO).

Explore approaches to selection of homotopy paths (continuous line curves in space) that lead to strong convergence for solving highly nonlinear systems of equations. Investigate relationship between homotopy and pivotal methods.

161. Research on Stochastic Systems and Stability Theory and Applications; Harold J. Kushner; Applied Mathematics; Brown University, Division of Applied Mathematics, Providence, RI 02912; Award #77-12946 A04; $32,652 for 12 months beginning 02/01/82 (STO).

Develop theory of diffusion approximation and its applications. Investigate approximation procedures with and without constraints, with coefficients approaching zero and nonzero limits, and random and non-random coefficients.

162. Research in Model Reference Adaptive Control of Continuous Time Systems; Richard V. Monopoli; University of Massachusetts, Electrical and Computer Engineering Department, Amherst, MA 01003; Award #81-11255; $36,886 for 12 months beginning 11/01/81 (STO).

Derive adaptive control algorithms that do not require a priori knowledge of plant structure, parameters, and measurement noise; apply to non-minimum phase plants.

163. Multi-Attribute and Multiple Criteria Approaches for Determining Bayesian Acceptance Plans in Quality Control and Auditing; Arunachal A. Ravindran; Purdue University, School of Industrial Engineering, Lafayette, IN 47907; Award #80-07103 A01; $65,000 for 24 months beginning 01/01/81 (STO).

Incorporate inspector errors, multiple defects, multiple criteria, and risk preference into Bayesian acceptance sampling plans in quality control and auditing such as goal programming, compromise programming, and interactive methods.

164. Decentralized Control of Large-Scale Systems; Dragoslav D. Siljak, University of Santa Clara,. Department of Electrical Engineering and Computer Science, Santa Clara, CA 95053; Award #80-11210 A01; $56,110 for 12 months beginning 02/01/82 (STO).

Formulate decentralized control strategies based upon overlapping information sets to reduce dimensionality due to local processing; obtain robustness in tolerance of imprecision and nonlinearities; and ensure reliability with respect to failure of interconnections for use in traffic regulation, power systems, economics and computer control in steelmaking.

165. Non-Gaussian Self-Similar Processes; Murad S. Taqqu; Cornell University, Department of Operations Research and Industrial Engineering, Ithaca, NY 14853; Award #80-15585 A01; $37,504 for 12 months beginning 11/01/81 (STO).

Extend processes to processes with infinite variance. Provide models for random phenomena that exhibit long-range dependence and high variability; study asymptotic processes.

166. Investigations in Discrete Optimization; Leslie E. Trotter; Cornell University, Department of Operations Research and Industrial Engineering, Ithaca, NY 14853; Award #81-13534; $38,331 for 12 months beginning 12/15/81 (STO).

Classify optimization of network flow, job and machine scheduling, and routing problems by their linear programming counterparts. Consider integral packing and covering models, integer rounding, and matching type models.

167. Self-Organization in Dissipative Systems: A Perturbed Optimization Model; Robert E. Ulanowicz; Chesapeake Research Consortium, Inc., 1419 Forest Drive, Suite 207, Annapolis, MD 21403; Award #81-10035; $55,123 for 12 months beginning 10/15/81 (STO).

Develop an optimization oriented model for self-organizing dissipative systems applicable to ecosystems, economic communities, developing organisms, social hierarchies, and political structures. Qualify flow network using process variables.

168. Estimation and Statistical Analysis of Spatially-Distributed Random Processes; Alan S. Willsky; Massachusetts Institute of Technology, Department of Electrical Engineering, Cambridge, MA 02139; Award #80-12668 A01; $34,741 for 12 months beginning 11/01/81 (STO); Split-funded with EOC for $23,160 and ABS for $19,300.

Study random processes such as image processing, geophysical data processing, and gravitational mapping; develop algorithms for efficient combination and processing of spatially-distributed data. Study geometry of random objects and contours.

DIVISION OF MECHANICAL ENGINEERING AND APPLIED MECHANICS (MEAM)

Fluid Mechanics (FLM)

169. The Correlation Between Cavitation and Pressure Fluctuation in Turbulent Shear Flow; Roger E. A. Arndt; University of Minnesota, Department of Civil and Mineral Engineering, Minneapolis, MN 55455; Award #81-13562; $55,058 for 12 months beginning 11/15/81 (FLM).

Obtain a quantitative relationship between the pressure field and dynamic response of cavitation nuclei in confined jet flows. Examine effects of turbulence and gas content.

170. Spreading of Oil Films on Water in the Surface Tension Regime; John C. Berg; University of Washington, Department of Chemical Engineering, Seattle, WA 98195; Award #81-09226; $53,200 for 12 months beginning 01/01/82 (FLM); Split-funded with CPE (TTP) for $22,881.

Examine effects of surfactant type and concentration on spreading, surface fractionation, and evaporation. Analyze quasi-steady model of spreading.

171. Industry/University Cooperative Research: Particle Motion in a Turbulent Boundary Layer; Frederick K. Browand; University of Southern California, Department of Aerospace Engineerng, Los Angeles, CA 90007; Award #79-10730 A01; $42,132 for 12 months beginning 11/01/81 (FLM).

Refine design and construction of a closed-return type free surface water channel to smooth out its flow.

172. Unsteady Aerodynamics; Hsien-Kei Cheng; University of Southern California, Department of Aerospace Engineering, Los Angeles, CA 90007; Award #79-26003 A01; $107,624 for 12 months beginning 10/15/81 (FLM).

Study fluid dynamics of animal swimming, flying and hovering, emphasizing lunate-tail swimming propulsion and the hovering flight of insects. Extract new fundamental principles by which man-made systems can be designed more intelligently.

173. Large Eddies in Turbulent Shear Flow; Donald Coles; California Institute of Technology, Guggenheim Aeronautics Lab, Pasadena, CA 91125; Award #77-23541 A05; $57,900 for 12 months beginning 10/15/81 (FLM).

Experimentally study nature and role of large coherent vortex structures, taking into consideration shape, evolution, and transport properties; formation and interaction of vortex rings; free-convection boundary layer processes; and flow processes.

174. Experimental and Theoretical Research in Fluid Dynamics; Russell J. Donnelly; University of Oregon, Department of Physics, Eugene, OR 97403; Award #81-17569; $68,956 for 12 months beginning 11/01/81 (FLM).

Study stability and transition in Couette flow with focus on dislocations and boundary effects on transitions and time-dependent effects induced by modulation of rotation speed. Construct Benard convection cell for visual studies.

175. Cardio-Pulmonary Dynamics; Y. C. Fung; University of California-San Diego, Department of Applied Mechanics and Engineering Science, La Jolla, CA 92093; Award #79-10560 A01; $86,087 for 12 months beginning 11/01/81 (FLM).

Establish a constitutive basic mathematical description of heart muscle. Study mechanics of the heart, including stress and strain distribution, coupling of heart muscle contraction and blood flow, and coupling of heart and lung so that functions of the organ can be predicted.

176. Some Basic Investigation in Turbulent Shear Flows; A. K. M. Fazle Hussain; University of Houston, Department of Mechanical Engineering, Houston, TX 77004; Award #81-11676; $100,513 for 12 months beginning 11/15/81 (FLM).

Study coherent structure properties in detail, understand their physics, determine their dynamic significance and incorporate findings in a viable turbulence theory.

177. Stability of a Rotating Fluid Flow; Roger F. Gans; University of Rochester, Department of Mechanical and Aerospace Sciences, Rochester, NY 14627; Award #81-00451; $99,500 for 24 months beginning 11/01/81 (FLM).

Study the influence of rotation rate, viscosity, surface tension, void fraction, and container geometry on flow states in a horizontal partially-filled rotating cylinder, and investigate the influence of surface viscosity on transition mechanisms.

178. Problems in Low-Reynolds-Number Hydrodynamics; Robert E. Johnson; University of Illinois, Department of Theoretical and Applied Mechanics, Urbana, IL 61801; Award #81-07564; $87,295 for 24 months beginning 11/01/81 (FLM).

Determine to what extent a fluid coating on a solid particle alters its hydrodynamics; solve coupled hydrodynamic problems involving porous material and a cavity of specified shape; and determine flow behavior of a viscous fluid injected into a fracture embedded in a porous material.

179. Structure of Reattaching Turbulent Shear Flows; James P. Johnston; Stanford University, Department of Mechanical Engineering, Stanford, CA 94305; Award #80-17860 A01; $82,587 for 12 months beginning 01/01/82 (FLM).

Investigate large-scale structure of a separated, turbulent shear layer using a thermal tuft and pulsed-wall probe to map out velocity distribution near the wall in an unsteady reversing flow.

180. Studies of Shear Flow Instabilities; Joseph T. Liu; Brown University, Division of Engineering, Providence, RI 02912; Award #78-22127 A03; $5,520 for 6 months beginning 10/01/81 (FLM).

Perform analytical studies on instabilities due to large-scale motions (the dominant noise source in aerodynamic sound from a free turbulent jet) in combustors.

181. Statistical Physics of Turbulence; Mark S. Nelkin; Cornell University, School of Applied and Engineering Physics, Ithaca, NY 14853; Award #79-02942 A02; $33,152 for 12 months beginning 11/15/81 (FLM).

Study physics of turbulence emphasizing intermittent small scale fluctuations in very high Reynolds number flows.

182. Studies of Ship Hydrodynamics and Water Waves; John N. Newman; Massachusetts Institute of Technology, Department of Ocean Engineering, Cambridge, MA 02139; Award #77-17817 A04; $193,456 for 12 months beginning 11/15/81 (FLM).

Examine shallow and/or restricted water ship hydrodynamics, critical phenomena in water waves, and slender-body theories for ship maneuvering.

183. Turbulence and Deterministic Evolution Models: Theory and Experiment; Larry G. Redekopp; University of Southern California, Department of Aerospace Engineering, Los Angeles, CA 90007; Award #81-14780; $67,985 for 18 months beginning 01/15/82 (FLM).

Study effect on turbulent flows of attractors and analyze existing data of baroclinic instability, Taylor-Couette flow, and free shear flows.

184. Vortex-Leading Edge Interactions; Donald O. Rockwell; Lehigh University, Department of Mechanical Engineering and Mechanics, Bethlehem, PA 18015; Award #81-14352; $79,165 for 12 months beginning 03/01/82 (FLM).

Examine vortex-leading edge interaction for stationary and oscillating edges for various edges and "linear" and nonlinear amplitudes, and a range of reduced frequencies; In second phase, study trailing edge also.

185. Convection in Containers; Simon Rosenblat; Illinois Institute of Technology, Department of Mathematics, Chicago, IL 60616; Award #80-26808; $47,267 for 12 months beginning 11/01/81 (FLM).

Analyze nonlinear buoyancy-driven flows in closed containers to determine how

preferred wave number is selected and how convection develops as the Rayleigh number is increased.

186. Microcirculatory Flow: A Study of Fluid Movement in Complex Porous Structures; Eric P. Salathe; Lehigh University, Center for the Application of Mathematics, Bethlehem, PA 18015; Award #80-06782 A02; $50,935 for 12 months beginning 12/15/81 (FLM).

Theoretically study convection and diffusion in microcirculation by constructing a mathematical model in order to better understand flow in porous media including living tissue.

187. Flow Through Heart Valves and Large Vessels; Lawrence Talbot; University of California, Department of Mechanical Engineering, Berkeley, CA 94720; Award #81-16360; $94,349 for 12 months beginning 11/01/81 (FLM).

Study entry flow in aortic arch, specifically the boundary-layer interaction and the relationship between heart murmurs and blood turbulence produced by stenotic valves.

188. Periodic Flow in Curved Tubes; John M. Tarbell; Pennsylvania State University, Department of Chemical Engineering, University Park, PA 16802; Award #80-10878 A01; $47,149 for 12 months beginning 11/01/81 (FLM).

Study laminar periodic flow in curved tubes with emphasis on heat and mass transfer using Method of Weighted Residuals. Factors include curvature ratio, flow reversal, flow development length, pulse shape, and tube wall elasticity.

189. Experimental Studies of Coherent Structure and Spectral Dynamics of Scalar and Velocity Fields in Turbulent Flows; Charles W. Van Atta; University of California - San Diego, Department of Applied Mechanics and Engineering Sciences, La Jolla, CA 92093; Award #81-00431; $101,730 for 12 months beginning 11/01/81 (FLM).

Study role of identifiable large-scale coherent flow regions in diffusion and entrainment of scalar and vector fields and shear flows. Develop criteria and techniques for isolating effects of structure on measured statistical properties.

190. Experiments on Mixing and Transport of Scalars in Turbulent Flows; Zellman Warhaft; Cornell University, Sibley School of Mechanical and Aerospace Engineering, Ithaca, NY 14853; Award #81-04733; $90,795 for 24 months beginning 11/01/81 (FLM).

Study mixing and transport of passive scalars in decaying grid turbulence across a linear scalar gradient and in isotropic turbulence. Conduct experiments relevant to atmospheric phenomena and fast chemical reactions.

191. Hydrodynamics of Deformable Bodies; William C. Webster; University of California, Department of Naval Architecture, Berkeley, CA 94720; Award #79-21244 A01; $66,013 for 12 months beginning 11/01/81 (FLM).

Develop a three-dimensional hydrodynamic theory for deformable bodies and response in a single mode of motion to wave-energy absorption devices.

Heat Transfer (HET)

192. The Optical Path Length Approach to Radiation Heat Transfer With Conduction and Convection; Richard O. Buckius; University of Illinois, Department of Mechanical and Industrial Engineering, Urbana, IL 61801; Award #81-09250; $86,792 for 24 months beginning 12/01/81 (HET).

Study energy transport in a planar medium which scatters anisotropically and absorbs spectrally; determine photon path length distributions; compare different solutions used in the energy transport analyses.

193. Fundamental Studies of Heat and Mass Transfer in Porous Media; Ping Cheng; University of Hawaii - Manoa, Department of Mechanical Engineering, 2444 Dole Street, Honolulu, HI 96822; Award #81-00437 A01; $89,000 for 19 months beginning 01/01/82 (HET).

Examine higher-order approximatations associated with eigenfunctions and leading edge effects on global heat transfer rate; obtain a quantitative description of the heat transfer process in film boiling and condensation; and, investigate wave and vortex instabilities.

194. Heat Transfer in a Separated and Reattaching Flow; John K. Eaton; Stanford University, Department of Mechanical Engineering, Stanford, CA 94305; Award #81-08189, $85,000 for 24 months beginning 11/15/81 (HET).

Investigate heat transfer using backward-facing step formed by expansion in a channel through which a low-speed air flow passes. Measure heat transfer as a function of upstream boundary layer thickness and channel expansion ratio.

195. Optical Properties of Soot Particles in Propane and Synthetic Fuel Flames; James D. Felske; State University of New York, Department of Mechanical and Aerospace Engineering, Buffalo, NY 14222; Award #81-12539; $102,121 for 24 months beginning 12/15/81 (HET).

Compare burning a conventional fuel with two synthetic fuels using two optical methods and light scattering techniques in situ; determine carbon formation and growth in flames using laser diagnostics.

196. Hydrodynamic and Thermal Conditions in Irradiated Liquid Suspensions; Frank P. Incropera; Purdue University, School of Mechanical Engineering, West Lafayette, IN 47907; Award #80-09034 A01; $69,913 for 12 months beginning 11/01/81 (HET).

Study radiative transfer and buoyancy forces in quiescent and moving liquid layers. Determine the radiation field in irradiated liquid suspensions and study radiation absorption and stabilizing salt concentration gradients in quiescent liquids heated from below and/or cooled from above.

197. Multidimensional Radiative Heat Transfer in Participating Media; M. Necati Ozisik; North Carolina State University, Department of Mechanical and Aerospace Engineering, Raleigh, NC 27607; Award #81-10705; $83,402 for 24 months beginning 12/15/81 (HET).

Study source function expansion method for multidimensional radiative transfer including multidimensional radiation transfer; radiation transfer in one-dimensional multilayer media; multidimensional radiation in finite media; and radiative equilibrium in the picket fence model.

198. Fundamental Studies of Unsteady Turbulent Boundary Layer Heat Transfer; William C. Reynolds; Stanford University, Department of Mechanical Engineering, Stanford, CA 94305; Award #81-07205; $63,600 for 12 months beginning 12/01/81 (HET).

Develop new technique for determination of instantaneous local heat transfer rate from an isothermal surface. Study heat transfer at imposed oscillation frequencies, from quasi-steady to "bursting frequency."

199. Corrosion Fouling: The Effect of Corrosion on Heat Transfer; Euan F. C. Somerscales; Rensselaer Polytechnic Institute, Department of Mechanical Engineering, Troy, NY 12181; Award #81-06429; $80,000 for 24 months beginning 11/15/81 (HET).

Determine magnitude of thermal resistance of corrosion products formed on heat transfer equipment surfaces in contact with natural waters.

200. Diffusion Flame Spread; James S. T'ien; Case Western Reserve University, Department of Mechanical and Aerospace Engineering, Cleveland, OH 44106; Award #81-15339; $46,200 for 12 months beginning 12/15/81 (HET).

Develop theoretical analysis of flame spread over condensed-phase fuels in opposed flow to better understand flame spread mechanisms and the interactive effect of flames with pressure fields.

201. Stabilization of Superconducting Magnets in HE II - Heat Transfer Aspects; Steven W. Van Sciver; University of Wisconsin, Department of Nuclear Engineering, Madison, WI 53706; Award #80-11583 A01; $62,315 for 12 months beginning 11/01/81 (HET).

Investigate steady-state and transient heat transfer characteristics of a composite superconductor to increase knowledge of fundamental heat transfer properties of He II for new geometries, temperatures, and pressure ranges. Study interaction between composite conductors and He II.

Mechanical Systems (MES)

202. Inverse Perturbation in Finite Element Dynamic Analysis; William J. Anderson; University of Michigan, Department of Aerospace Engineering, Ann Arbor, MI 48109; Award #80-19642 A01; $72,399 for 12 months beginning 12/01/81 (MES).

Modify a first-order inverse perturbation method developed by Stetson to conform to standard finite element form and determine the feasibility of using the method for large structural systems.

203. Specialized Acoustical Research Equipment; Alan Cummings; University of Missouri, Department of Mechanical and Aerospace Engineering, Rolla, MO 65401; Award #81-12330; $28,624 for 12 months beginning 10/15/81 (MES).

Analyze energy dissipation mechanisms in perforated materials; study acoustic behavior of singly perforated orifice plates; apply results to structures such as perforated tubes; and formulate methods for estimating noise reduction by attenuating devices.

204. Methods of Global Analysis for Nonlinear Dynamical Systems; Chieh S. Hsu; University of California, Department of Mechanical Engineering, Berkeley, CA 94720; Award #80-19274 A01; $75,000 for 12 months beginning 12/01/81 (MES).

Develop cell-to-cell mappings and the unravelling method of global analysis. Find effective methods to implement a generalized theory of index for dynamical systems of orders higher than two, and apply these techniques to nonlinear mechanical systems under parametric and forcing excitation.

205. Analysis of Rigid Body Displacement Parameters from Imprecise Data; Alan J. Laub; University of Southern California, Department of Electrical Engineering, Los Angeles, CA 90007; Award #81-16696; $113,852 for 24 months beginning 11/01/81 (MES).

Investigate the effect of random measurement errors on determining the position of a rigid body, and subsequent effects on system modeling.

206. High Level Diagnostics in Machinery; Richard H. Lyon; Massachusetts Institute of Technology, Department of Mechanical Engineering, Cambridge, MA 02139; Award #81-11283; $120,230 for 24 months beginning 12/01/81 (MES).

Study signal processing methods for identification of valve/valve seat diesel engine and armshaft sewing machine component failures.

207. Workshop on the State-of-the-Art and Future Areas of Need in Mechanical Engineering Research; Karl N. Reid; American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017; Award #81-19616; $44,780 for 12 months beginning 11/15/81 (MES).

Determine long-range research priorities for mechanical engineering and enhance viability of mechanical engineering research within the greater engineering research community.

208. Multiaxial Fatigue Design Methods; Darrell F. Socie; University of Illinois, Department of Mechanical and Industrial Engineering, Urbana, IL 61801; Award #81-11282; $93,975 for 36 months beginning 11/01/81 (MES); Split-funded with HET for $15,838.

Develop design methods for structures and components subjected to bending-torsion and tension-torsion multi-axial stresses, and evaluate analytical models subjected to these types of loadings.

209. Three-Dimensional Kinematic Analysis and Synthesis of Tangent Plane Motion; A. H. Soni; Oklahoma State University, Department of Mechanical and Aerospace Engineering, Stillwater, OK 74074; Award #81-19133; $44,290 for 12 months beginning 11/01/81 (MES).

Develop a one-parameter, tangent-plane curvature theory by derivation of the characteristic equations of a tangent-plane envelope up to second order, analysis of characteristic equations, and formulation of a general synthesis procedure for a developable surface.

210. Investigation of Load-Induced Rotordynamic Instabilities in Turbomachinery; John M. Vance; Texas A & M University, Department of Mechanical Engineering, College Station, TX 77843; Award #81-15330; $118,622 for 24 months beginning 11/01/81, (MES).

Develop improved computerized stability analysis methods for rotor-bearing systems with load-induced destabilizing forces. Experimentally verify, modify and analytically extend "Torquewhirl" theory.

211. Computer Aided Design Sensitivity Analysis and Optimization of Dynamic Mechanical Systems; Roger A. Wehage; University of Iowa, Department of Mechanical Engineering, Iowa City, IA 52242; Award #81-12947; $69,544 for 24 months beginning 11/01/81 (MES).

Develop algorithms that establish equations of motion for constrained mechanical systems; employ variable methods of design sensitivity analysis to determine cost and design constraints; and, apply nonlinear programming to optimize design.

212. Lubrication in Steel Cold Rolling; William R. Wilson; Northwestern University, Department of Mechanical and Nuclear Engineering, Evanston, IL 60201; Award #81-22106; $88,916 for 12 months beginning 12/15/81 (MES).

Investigate theoretical and experimental mechanics of lubrication by liquid lubricants. Study film thickness, friction levels, and surface roughness.

Production Research (PRR)

xxLee, C.S. Georg, see ECSE (ABS).

213. Parts Mating Theory for Compliant Parts; Daniel E. Whitney; The Charles Stark Draper Laboratory, Inc., Department of Automation/Man-Machine Systems, Cambridge, MA 02139; Award #79-10341 A02; $124,997 for 12 months beginning 09/01/81 (PRR).

Continue research on mating problems for rigid parts; develop design guidelines for compliant parts to aid assembly; estimate influence of surface effects on mating; and develop models to monitor assembly process.

214. Ninth Production Research Conference; Richard C. Wilson, University of Michigan, Department of Industrial and Operations Engineering, Ann Arbor, MI 48109; Award #81-19727 A01; $2,555 for 6 months beginning 11/10/81 (PRR).

Plan and conduct conference of Production Research Program at which grantees will present reports on their work.

Solid Mechanics (SOM)

215. Development of Constitutive Relations for Porous, Ductile Metals; Donald R. Curran; SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025; Award #81-08186; $68,602 for 12 months beginning 01/01/82 (SOM).

Investigate nucleation growth and coalescence of microstructural voids governing ductile failure of metals; focus on improved computational models for void growth and coalescence. Test model for void growth combining high temperature diffusion processes with plastic flow processes.

216. Research on Nonlinear Theories of Solids; J. L. Ericksen; Johns Hopkins University, Department of Mechanical Engineering, Baltimore, MD 21218; Award #79-11112 A02; $66,685 for 12 months beginning 12/15/81 (SOM).

Study instability in solids, considering the theory for martensitic transformations in metals and St. Venant's principle.

217. Application of Qualitative Methods in Nonlinear Elasticity; Cornelius O. Horgan; Michigan State University, Department of Metallurgy, Mechanics and Materials Science, East Lansing, MI 48824; Award #78-26071 A02; $80,790 for 24 months beginning 11/15/81 (SOM).

Analyze nonlinear problems of elasticity using the theory of nonlinear elliptic partial differential equations. Highlight finite anti-plane shear cases, stress concentration problems, and St. Venant's Principle.

218. Study of the Acoustoelastic Effect in Elastic-Plastic Materials; George C. Johnson; University of California, Department of Mechanical Engineering, Berkeley, CA 94720; Award #81-16376; $95,837 for 24 months beginning 01/01/82 (SOM).

Determine states of stress by measuring stress waves through structural components. Extend the scope of acoustoelastic theory to encompass elastic-plastic deformations.

xxKennedy, John F., see CEE (GEO).

219. Contact Problems with Friction: Analysis and Computation; Noboru Kikuchi; University of Michigan, Department of Mechanical Engineering and Applied Mechanics, Ann Arbor, MI 48109; Award #81-09221; $81,518 for 24 months beginning 01/01/82 (SOM).

Couple local (analytical) and global (finite element) approaches. Study the convergence of algorithms used in finite element analysis, the connection between quasi-variational inequalities and the incremental formulation, and variation principles for contact problems with friction.

220. Mechanical Failure of Cancellous Bone/PMMA Interface; Jack L. Lewis; Northwestern University, Department of Civil Engineering, Evanston, IL 60201; Award #81-17106; $69,436 for 12 months beginning 02/01/82 (SOM).

Investigate failure processes in vivo at the bone/bone cement (PMMA) interface in artificial human joints.

221. Extension of Moire Interferometry Techniques for Engineering Measurements; Daniel Post; Virginia Polytechnic Institute and State University, Engineering Science and Mechanics Department, Blacksburg, VA 24061; Award #81-09230; $120,000 for 24 months beginning 11/01/81 (SOM).

Develop moire interferometry as a tool of experimental mechanics for high sensitivity in-plane and out-of-plane displacement measurements.

222. Stability Aspects of Large Inelastic Deformation of Metals; Nicolas Triantafyllidis; University of Michigan, Department of Aerospace Engineering, Ann Arbor, MI 48109; Award #81-16449; $78,986 for 24 months beginning 01/01/82 (SOM).

Investigate stability of structures with emphasis on unloading, formation of vertex in yield surface, and rate sensitivity. Examine bifurcation, post bifurcation, and imperfection sensitivity. Solve boundary value and stability problems for vertex materials.

223. Rational Thermomechanics of Materials; Clifford A. Truesdell; Johns Hopkins University, Department of Computer Science, Baltimore, MD 21281; Award #80-15791 A01; $36,801 for 12 months beginning 12/15/81 (SOM).

Investigate foundations and interconnections of continuum mechanics, thermodynamics, statistical mechanics, and the kinetic theory of gases through conceptual analysis and mathematical arguments. Specifically, study continuum thermomechanics of open systems and establish quantitative parallels between kinetic theory of gases and continuum mechanics of materials.

224. Using Photoelasticity to Determine Orthotropic Stress Intensity Factors; Loren W. Zachary; Iowa State University, Department of Engineering Science and Mechanics, Iowa State University, Ames, Iowa 50011; Award #81-13535; $54,315 for 24 months beginning 01/01/82 (SOM).

Develop technique for obtaining orthotropic stress intensity factors for fiber reinforced photoelastic models. Determine pure mode and mixed mode cases. Analyze tension specimens and compare to numerical computations.

OFFICE OF INTERDISCIPLINARY RESEARCH (OIR)

225. Determining Flood Hazard Mitigation Policy and Research Priorities; Robert L. Kaplan; The Rumson Corporation, 6739 Baron Road, McLean, VA 22101; Award #81-19817; $3,931 for 1 month beginning 11/30/81 (OIR).

Develop a set of priorities, at the request of Congress, from among the thirty recommendations for flood hazard mitigation research published in NSF's Flood Hazard Mitigation Report in 1979.

PRINCIPAL INVESTIGATOR INDEX

References Denote Entry Numbers

PRINCIPAL INVESTIGATOR INDEX

References Denote Entry Numbers

PRINCIPAL INVESTIGATOR INDEX

References Denote Entry Numbers

PRINCIPAL INVESTIGATOR INDEX

References Denote Entry Numbers