School of Engineering

Oregon State University

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Research Activities 1978-79

Engineering Experiment Station
Circular No. 54
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Contents

Sponsored Research*
1976-79

	Aug 1976	Feb 1977	Aug 1977	Feb 1978	Aug 1978	Feb 1979	Aug 1979
Agricultural Engr.	$ 91,427	$ 133,364	$ 93,976	$ 160,156	$ 172,156	$ 93,135	$ 65,993
Chemical Engr.	450,450	443,350	560,534	559,784	200,180	200,180	218,529
Civil Engr.	410,384	545,340	413,593	636,731	856,052	516,019	555,075
Electrical Engr.	111,011	233,268	263,334	450,257	525,165	449,744	364,461
Engr. Experiment Station	119,540	119,540	141,540	73,940	53,000	53,000	53,000
Industrial Engr.	-	8,063	8,063	-	-	-	-
Mechanical Engr.	431,980	321,821	218,083	698,881	616,437	455,990	544,438
Nuclear Engr.	124,540	143,617	143,617	136,145	192,492	304,838	172,054
W.R.R.I.	178,690	178,690	190,136	147,485	147,485	151,109	211,609
Misc.**	423,106	500,806	379,736	423,916	485,535	441,840	221,879
Total***	$2,341,128	$2,627,859	$2,412,612	$3,287,295	$3,248,502	$2,665,855	$2,407,038

* Based on data from the Office of the Dean of Research.

** Fellowships, chairs, training grants, equipment, facilities, institutes.

*** Including W.R.R.I. (Water Resources Research Institute).

Research Activities 1978-1979

Agricultural Engineering

J. R. Miner, Department Head

STRAWBERRY MECHANICAL HARVESTING, HANDLING, PROCESSING

Sponsor: Pacific Northwest Regional Commission (Oregon State Department of Agriculture)
Personnel: D. E. Booster, D. E. Kirk, Principal Investigators
Objective: Fabricate, install and monitor use of mechanical strawberry harvesting, processing and handling equipment. Equipment will be put to use in local fields and processing plants.

MINIMIZING TOTAL ENERGY REQUIREMENTS OF IRRIGATION WATER MANAGEMENT SYSTEMS

Sponsor: USDI-OWRT
Personnel: R. H. Cuenca, M. English, Principal Investigators
Objective: The objective of this study is to develop mathematical optimization models for use in designing irrigation systems that economize on total energy requirements and, at the same time, allow for the maintenance of established crop production standards. The models will include analysis of energy costs in manufacture, installation, and operation and will be tested on existing irrigation systems in Oregon.

IRRIGATION PUMP EFFICIENCY TESTING PROGRAM

Sponsor: AERF and USDI-OWRT
Personnel: H. J. Hansen, M. N. Shearer, Principal Investigators
Objective: A coordinating group has been formed of personnel involved in pump test programs in Oregon, Washington and Idaho. This group will standardize data recording and analysis procedures for field test data requisition, evaluation and reporting. A data bank of pump tests being conducted in the three-state area is being collected at Oregon State University.

FARMSTEAD UTILIZATION OF SOLAR ENERGY

Sponsor: PP&L
Personnel: M. L. Hellickson, Principal Investigator
Objective: This research project has the following specific objectives: 1) Determine the quantity and temperature of water that can be accumulated from a solar collector system under mid-Willamette Valley climatic conditions. 2) Determine the quantity and temperature of water that can be accumulated from a water cooled condenser unit installed in a typical milk refrigeration system. 3) Determine the quantity and temperature of water that can be accumulated from an in-series operation of a water cooled condenser system and a solar collector system. 4) Evaluate system cost and length of time required to recover expenditures for materials.

A solar collector system, consisting of 3 double glazed and 3 single glazed flat plate solar collector-panels, has been installed at the OSU Dairy Milking Parlor. Water is heated in the collector array and stored for use in the clean-up and sanitization operations of a dairy center. A waste heat recovery system, consisting of a water cooled condenser unit and storage tank, has been installed in place of the original air cooled condenser of the milk refrigeration unit. Water heated during milk cooling is available for clean-up operations associated with milking operations. Solar availability, electrical energy consumption for heating the preheated water to required temperatures and water consumption are being monitored.

IMPACT OF TECHNOLOGY, CROPPING PATTERNS AND CAPITAL INVESTMENT ON IRRIGATION ENERGY REQUIREMENTS IN THE PACIFIC NORTHWEST

Sponsor: USDE
Personnel: M. L. Hellickson, Principal Investigator
Objective: This was the second year of a two-year project which has the following objectives: 1) Determine present energy, water and labor requirements of irrigated agriculture in the Pacific Northwestern states of Idaho, Oregon and Washington. 2) Project, using alternative scenarios, electrical energy, water and labor requirements associated with irrigated agricultural production in 1985 and 2000 in Idaho, Oregon and Washington. 3) Assess changes in the region's crop production demands and determine the relative trade-offs between energy consumption, water utilization and labor requirements.

SOLAR GENERATED SHAFT POWER

Sponsor: AERF
Personnel: M. L. Hellickson, Principal Investigator
Objective: This investigation is concerned with the theoretical possibility and the technical feasibility of combining thermostatic bimetals with linear Fresnel lenses to develop rotational shaft power. A solar motor incorporating these materials and concepts has been developed.

WATER AND ENERGY STUDY

Sponsor: Battelle Northwest Laboratories
Personnel: M. L. Hellickson, Principal Investigator; M. J. English, L. D. King
Objective: 1) Identify and quantify water use trends in the Pacific Northwest, by state and economic subregions for the years 1950 to 1977. Iden-

tify water consumption for agricultural and non-agricultural purposes including irrigation by crop categories; domestic livestock and food processing; and water uses including hydroelectric generation; minimum stream flows for water quality, navigation, and fisheries; recreation and other purposes. 2) Identify and quantify agricultural energy use trends, during the years 1950 to 1977, by type (electricity, oil, gas, etc.), crop and livestock sector, irrigated and nonirrigated agriculture, and food system functions (production, processing, and transportation) in Oregon. 3) Evaluate water and energy conservation potentials in agriculture during the next 20 years from technical, economic and social viewpoints.

USE OF RADIANT HEAT TO PROTECT NURSERY TREE SEEDLINGS FROM FREEZE DAMAGE

Sponsor: FSL/Champion Timberlands
Personnel: D. E. Kirk, M. L. Hellickson, Principal Investigators
Objective: The objectives of the study include the development of a standby radiant heating system which can automatically protect forest tree seedlings from damage during short periods of low ambient temperature. Black metal pipes suspended over the seedlings and heated by propane burners and aided by bright metal reflectors transfer heat to the foliage and to the rooting medium. Propone is proposed as the energy source since it burns cleanly and can be stored and drawn upon as needed during cold weather periods when demands would be very high on natural gas or electricity.

DEVELOPMENT OF A WATER QUALITY MODEL FOR FEEDLOT RUNOFF CONTROL SYSTEMS

Sponsor: U.S. EPA
Personnel: J. K. Koelliker, Principal Investigator; J. R. Miner, C. Mallonee
Objective: To develop a continuous water quality model which will predict, on a daily basis, the quality of feedlot runoff.

Chemical Engineering

C. E. Wicks, Department Head

DEVELOPMENT OF A TRANSDUCER FOR OBTAINING TRANSIENT HEAT TRANSFER COEFFICIENTS IN A HOT FLUIDED BED

Sponsor: USDE
Personnel: T. Fitzgerald, J. R. Welty, C. Gosmeyer, Principal Investigators
Objective: A small copper-constantan thermocouple using a very thin constantan foil is used to measure the rapid local fluctuations in transfer which occur when a bubble passes an immersed steam tube in a fluidized bed combustor. Simultaneous capacitance and pressure measurements indicate the presence of a bubble at the heat transfer sensing device.

GAS TRANSPORT BY BUBBLES IN A LARGE PARTICLE FLUIDIZED BED

Sponsor: OSU Department of Chemical Engineering
Personnel: T. Fitzgerald, Principal Investigator; A. Stephanakis, R. Somani
Objective: This study uses motion pictures, analyzed frame-by-frame to test the assumption of potential flow of gas in the emulsion phase of a fluidized bed. Fluidized beds of large particles with and without immersed tubes are studied.

INVESTIGATION OF FLUIDIZED BEDS WITH IMMERSED HEAT EXCHANGE TUBES

Sponsor: Babcock & Wilcox, EPRI
Personnel: T. J. Fitzgerald, Principal Investigator; O. Levenspiel, T. Kennedy, D. Bushnell, S. Crane, G. Jovanovic, N. Catipovic, M. Colakyan
Objective: This project involves experimental studies of solids and gas movement in a cold scaled-model of a fluidized bed coal combustor. The problems being investigated are: 1) bypassing of coal volatiles (to burn after the bed), 2) bypassing of unburnt char fines, 3) spread of coal away from feed-points, 4) dynamics of defluidizing and re-fluidizing a portion of the fluid bed (a technique which would be useful for load following).

MEASUREMENT AND CONTROL OF CRYSTAL SIZE IN A CONTINUOUS CRYSTALLIZER

Sponsor: OSU Department of Chemical Engineering
Personnel: T. Fitzgerald, Principal Investigator; L. P. Leu, R. T. Chan (with F. Kayihan)
Objective: This is an experimental and theoretical study of the control of crystal size in a mixed-suspension, mixed-product-removal crystallizer. A small electrodynamic transducer measures the momentum of individual crystals as they collide with a thin fiber in a specially constructed rotating crystallizer. Various modes of control will be tested and evaluated.

SCALING CRITERIA FOR FLUIDIZED BED DYNAMICS

Sponsor: OSU Department of Chemical Engineering
Personnel: T. Fitzgerald, Principal Investigator; D. Morgan, R. Wood
Objective: This is an experimental study to test whether certain dimensionless groups can be used to correlate the hydrodynamic behavior of large and small, hot and cold fluidized beds. Motion pictures and statistical correlations of dynamic bed pressure drop measurements are used to determine whether two dissimilar beds have similar hydrodynamic behavior. An extensive experimental program is included to describe and catalog fluidization behavior in various regimes of fluidization.

DEVELOPMENT AND MODELING OF A SECONDARY CHAR BURNING REACTOR

Sponsor: USDE
Personnel: F. Kayihan, Advisor; D. C. Junge, Principal Investigator; R. Turton
Objective: The unburned char particles carried out of wood-fired boilers need to be collected and ei-

ther recycled or burned in a separate reactor. A transport reactor was designed and built as a pilot plant facility to test the effectiveness of a secondary burning system. Experiments were carried out successfully and a mathematical model was developed to simulate reactor performance.

DEVELOPMENT OF A LABORATORY SCALE HEAT INTEGRATED DISTILLATION COLUMN

Sponsor: Weyerhaeuser Co.
Personnel: F. Kayihan, Principal Investigator; G. Golike
Objective: A laboratory scale 10 stage distillation column with possibility of using an external heat exchanger is being constructed. The equipment will have full instrumentation for automatic control options. Column dynamics and closed loop control through the heat integrated system will be investigated.

DYNAMICS AND CONTROL OF HEAT INTEGRATED DISTILLATION COLUMNS

Sponsor: OSU Department of Chemical Engineering
Personnel: F. Kayihan, Principal Investigator; S. Patil
Objective: Distillation is one of the highest heat consuming processes in the chemical industry. Heat integration in distillation columns can potentially save energy. This project concerns the dynamics and control characteristics of a column with interstage heat exchangers.

KINETICS OF WOOD PYROLYSIS

Sponsor: NCASI, OSU Department of Chemical Engineering
Personnel: F. Kayihan, Principal Investigator; S. Bengali
Objective: The kinetic reactions and their rates of gaseous species production during the pyrolysis of wood is investigated using a captive sample apparatus. High heating rates, to 10,000°C/sec, during experiments will simulate conditions in thermal conversion processes. Results obtained will be critical in the modeling of boilers and other reactors.

SCALING CHARACTERISTICS OF COOLING TOWER WATER ON HEAT TRANSFER SURFACES

Sponsor: NSF, ASHRAE, HTRI
Personnel: J. G. Knudsen, Principal Investigator; K. Carter, K. Coates
Objective: This is an investigation of the scaling characteristics of cooling tower water. Cooling tower water contains dissolved minerals which have inverse solubility characteristics. When the water comes into contact with a hot surface, scale consisting of calcium carbonate, magnesium carbonate, or various silicates is deposited. The apparatus simulates an industrial cooling tower. The parameters being investigated are flow rate, heater surface temperature, and water quality. The various water quality parameters include total and calcium hardness, alkalinity, total dissolved solids, and pH. The goal is a systematic study of the various parameters which influence the scaling characteristics of cooling tower water in order to develop a model for the prediction of such scaling characteristics.

A MODEL FOR LARGE SCALE ATMOSPHERIC FLUIDIZED BED COMBUSTORS

Sponsor: Babcock & Wilcox, EPRI
Personnel: O. Levenspiel, D. Park, Principal Investigators
Objective: A simplified model of the atmospheric fluidized bed coal combustor is being developed to predict the carbon utilization efficiency in the unit, temperature rise above the bed, compositions throughout the bed and the sulfur captor. By identifying the special features of fluidized bed combustors and making reasonable assumptions about the order of magnitude of the rates involved, the investigators have been able to decouple many of the interacting processes and thereby develop a greatly simplified model for the combustor.

CONTROL OF CORROSION AND DETERIORATION OF TRAWL CABLES

Sponsor: NOAA-Sea Grant
Personnel: R. E. Meredith, K. Kolbe, B. Dardel, Principal Investigators
Objective: The purpose of this investigation is to demonstrate ways to increase the life of wire rope used for trawl cables. The specific objectives include the determination of how direct attachment of cables to bare steel doors, cathodic protective measures effect cable lives, to review conditions under which trawl cables must perform and to recommend design of trawl cable systems which consider cathodic protection, sizing, cost, grease, winch and pulley angles and termination.

ABSORPTION OF AMMONIA IN WATER USING A MULTIPLE STAGE CROSSCURRENT PACKED COLUMN

Sponsor: Shell Oil Company
Personnel: C. E. Wicks, Principal Investigator; G. Bayan, D. Zuehlsdorff
Objective: A multiple stage crosscurrent packed column, suitable for gas-liquid mass transfer investigations, has been constructed. Initial investigations have included pressure drop characteristics and overall mass transfer efficiency, with comparisons being made with the operation of the more conventional countercurrent packed column.

OXYGEN ABSORPTION INTO WATER USING MULTIPLE PLUNGING JETS

Sponsor: OSU Department of Chemical Engineering
Personnel: C. E. Wicks, Principal Investigator; C. Cho
Objective: This investigation is a continuing evaluation of the absorption rate of a slightly soluble gas entrained by a plunging liquid jet. Previous investigations have included the absorption of oxygen and nitrogen by water using a single plunging jet and the absorption of oxygen by an aqueous salt solution of varying hardness level. The goal is a systematic study of the parameters

which influence the aeration of aqueous pools, either in nature or in a wastewater treating facility.

Civil Engineering

F. D. Schaumburg, Department Head

AN EVALUATION OF COASTAL SAND AND GRAVEL AND MARGINAL ROCK AS CONSTRUCTION MATERIALS

Sponsor: NOAA-Sea Grant
Personnel: R. G. Hicks, Principal Investigator; G. H. Clemmons, G. L. Evans, V. Chintakovid
Objective: The overall goal of this project is to evaluate the feasibility of using coastal sands and gravels and marginal aggregates as construction materials. This will be done by: 1) evaluating promising local aggregates for construction purposes, 2) evaluating beneficiation methods for these materials, 3) develop material specifications for these aggregates and 4) establish economical limits for their use.

EVALUATION OF DUST ABATEMENT MATERIALS

Sponsor: USDA-USFS
Personnel: R. G. Hicks, Principal Investigator
Objective: 1) Review current dust abatement practices in Regions 1, 5, and 6, U.S. Forest Service. 2) Collect and test materials involved (aggregates and dust palliatives). 3) Determine what dust palliative is appropriate for a given condition. 4) Determine if existing specification for dust palliation are adequate.

TEST METHODS AND USE CRITERIA FOR FILTER FABRICS

Sponsor: FHWA/USDOT
Personnel: R. G. Hicks, J. R. Bell, Principal Investigators
Objective: This project is concerned with: 1) the identification of criteria for the engineering use of filter fabrics for subdrainage, erosion control and soil reinforcement applications, and 2) the evaluation of test methods or development of new tests to determine the properties of filter fabrics.

FORCES PRODUCED BY REGULAR AND IRREGULAR WAVES

Sponsor: Continental Oil
Personnel: R. T. Hudspeth, Principal Investigator

WAVES AND CURRENTS ON A BEACH IN THE PRESENCE OF A JETTY

Sponsor: NOAA-Sea Grant
Personnel: R. T. Hudspeth, Principal Investigator
Objective: Develop a finite element digital computer algorithm which will compute the wave-induced circulation patterns in the vicinity of a jetty in the presence of a tidal current at the entrance of a bar built estuary. The numerical algorithm will include an analytical solution to the damping of surface gravity waves over an irregular porous-elastic bottom and a numerical computer program to compute the combined effects of wave refraction and Fresnel diffraction by the jetty over a slowly varying bottom. The solution is decomposed into the following two regions: 1) a shoaling region seaward of the breaker zone in which there is a static balance between the wave induced radiation stress and the gradient of the mean water surface and 2) a surf region shoreward of the breaker zone in which an additional gradient of the water surface requires a weak alongshore current to balance the momentum flux.

A RESOURCE SURVEY OF LOW-HEAD HYDROELECTRIC POTENTIAL

Sponsor: University of Idaho Water Resource Institute
Personnel: P. C. Klingeman, Principal Investigator
Objective: A systematic, statewide investigation of stream power and energy has been made for all reaches of Oregon streams not presently having dams but capable of producing 200 kw or more at least 50 percent of the time. From available precipitation data, topographic maps and stream gaging station records, hydrologic techniques were used to generate mean discharges, discharge patterns, flow-duration curves, stream power values and stream energy values for 7626 miles of rivers in Oregon, grouped into 1443 reaches. The information was developed to inventory the theoretical developable low-head hydro power potential for Oregon. Assumptions were made to use run-of-river conditions (rather than reservoir storage) and 100 percent efficiency in generating electrical energy from streamflow.

TRANSPORT OF BED SEDIMENTS IN COARSE-BEDDED STREAMS DURING TRANSIENT FLOWS

Sponsor: NSF
Personnel: P. C. Klingeman, Principal Investigator; R. Scheidt
Objective: Improve and quantify a conceptual model for the transport of bed material as bed load and suspended load in coarse-bedded streams under transient streamflow conditions caused by storm runoff.

DEVELOPMENT OF A PRIORITY SYSTEM FOR HIGHWAY SAFETY IMPROVEMENTS

Sponsor: Oregon Traffic Safety Commission
Personnel: R. D. Layton, Principal Investigator; R. G. Hicks
Objective: This project will define and develop procedures and techniques to identify and set priorities for safety improvements in local jurisdictions.

FHWA FELLOWSHIP AND SCHOLARSHIP PROGRAM

Sponsor: USDT
Personnel: R. Layton, Principal Investigator
Objective: This scholarship is for 1 year to cover tuition, fees and living expenses for a graduate

student pursuing graduate study in Transportation Engineering. This program provides support for graduate studies of personnel in state, local and federal transportation agencies.

DISCUS BUOY STABILITY

Sponsor: USDC-NOAA
Personnel: J. H. Nath, Principal Investigator
Objective: Provide buoy simulation testing and analysis services to the NOAA Data Buoy Office. Additional funding received because of increased model testing, travel expense and wave tank usage necessary to complete the work.

DYNAMICS OF TAUT MOORINGS FOR FLOATING BREAKWATERS

Sponsor: NSF
Personnel: J. H. Nath, Principal Investigator
Objective: To experimentally investigate the fundamental problems in response of elastically moored floating breakwater to random waves as well as regular periodic waves.

LABORATORY TESTS OF DRIFTING BUOY DROGUES

Sponsor: NOAA Data Buoy Office
Personnel: J. H. Nath, Principal Investigator
Objective: Conduct a test program to determine the hydrodynamic characteristics of two types of drifting buoy drogues and develop the necessary changes to the NDBO-tether-drogue dynamics computer program.

NUMERICAL MODEL IMPROVEMENT FOR DRIFTING BUOY AND DROGUE

Sponsor: USDC-NOAA
Personnel: J. H. Nath, Principal Investigator
Objective: Analyze existing numerical model for predicting drifting buoy, drogue dynamics and lagrangian effectiveness; and identify areas where modifications can be made.

SPECIATION AND DISTRIBUTION OF HEAVY METALS IN SECONDARY EFFLUENTS

Sponsor: NSF
Personnel: P. O. Nelson, Principal Investigator

OREGON WATER SYSTEM OPERATORS CERTIFICATION PROGRAM

Sponsor: EPA
Personnel: M. E. Northcraft, Principal Investigator
Objective: Program originally put into operation in 1954 as a public service effort in cooperation with the Water Supply Section of the Oregon State Board of Health.

PROFESSIONAL TRAINING IN WATER POLLUTION CONTROL AND WATER SUPPLY

Sponsor: EPA
Personnel: W. L. Schroeder, Principal Investigator
Objective: Supports graduate training in Civil Engineering.

COOS BAY OFFSHORE DISPOSAL SITE INVESTIGATION

Sponsor: Army Corps of Engineers
Personnel: C. K. Sollitt, D. R. Hancock, P. O. Nelson, K. J. Williamson, Principal Investigators
Objective: The objective is to investigate the feasibility of at-sea disposal of dredge material from Coos Bay. The material will come from miles 12 to 15 of the Coos Bay Channel. This material has historically been considered polluted and requires special care for safe disposal. The biological, chemical and physical characteristics of the dredge material and the general offshore area around the Coos Bay entrance will be examined for the purpose of selecting the optimum ocean disposal site. Field examinations will include offshore measurements of currents due to waves and tides, sediment engineering investigations, biological surveys, solids and dissolved chemical analyses.

UMPQUA OFFSHORE ARTIFICIAL REEF STUDY

Sponsor: Douglas County
Personnel: C. K. Sollitt, D. Hancock, Principal Investigators
Objective: The Port of Umpqua has proposed to construct an artificial reef at the 27 fathom contour, two miles north of the whistler buoy at the mouth of the Umpqua River. The reef is to be constructed of used automobile tire rosettes scattered along the ocean bottom in a 1200' by 2400' area, along with 72-tire columns extending to a height of 30 to 40 feet above the ocean floor. The intended purpose of the reef is to restore recreational bottom fishing to this coastal area by providing habitats for bottom and reef fishes. It is the objective of this study to investigate fundamental questions required to minimize construction costs and environmental risks while maximizing reef fishery production. The activities associated with the study correspond to four major objectives. First, Background Studies will collect available current, wave and meteorological data to establish appropriate design wave conditions. Also, available biological information will be examined to select tire unit configurations and reef locations which maximize fish attraction capacity for local species of interest. Secondly, Field Studies will examine in-situ current, wave and sand conditions as input to the laboratory experiments. In addition, tire unit burial on sand bottoms will be investigated. Third, Engineering Laboratory Studies will evaluate wave and current loading on various tire units and will determine the ability of bottom friction to resist these loads. Fourth, Performance Studies will synthesize the results of the previous three study areas to assess the biological and engineering behavior of various tire unit configurations located at several appropriate depths.

WAVE REFLECTION AND ATTENUATION AT PILE SUPPORTED HARBOR FACILITIES

Sponsor: NOAA-Sea Grant
Personnel: C. K. Sollitt, Principal Investigator; J. Dummer
Objective: Harbor facilities are constructed to aid waterborne commerce and shelter marine activities from wave and current interference. Few harbors are adequately protected from all sources of wave expo-

sure and the resulting wave activity may be magnified if harbor structures reflect waves without dissipation, causing a superposition of incident and reflected waves. Resulting waves can produce conditions which interfere with vessel loading, navigation and mooring. The overall objective of this study is to develop an analytical procedure for predicting the behavior of wave reflection and attenuation with the most common type of harbor facility -- pile supported structures. Immediate goals are: 1) to derive and document a potential flow, eigenseries solution for two-dimensional, monochromatic wave interaction with an arbitrary framework; 2) to validate the theory by comparing predicted reflection and attenuation results with available experimental data; 3) to present the solution in a format amenable to design use; 4) to examine several types of structure and develop optimum pile configurations; 5) to disseminate results via professional journal publications.

DYNAMIC PROPERTIES OF NATURALLY FROZEN SOILS

Sponsor: NSF
Personnel: T. S. Vinson, Principal Investigator
Objective: The proposed research will evaluate the dynamic properties of naturally frozen soils over a very great range of material and test conditions associated with frozen ground wave propagation problems. Specimens cored from undisturbed samples taken in situ from Alaska will be tested with both resonant column and cyclic triaxial equipment. Parameters that might influence the dynamic properties of naturally frozen soils such as soil type, soil density, nature of the ice phase, anisotropy, temperature, confining pressure, and amplitude and frequency of dynamic loading will be investigated. Design equations or curves to evaluate the dynamic properties of frozen soil based on a knowledge of index and classification parameters will be developed.

BACTERIAL BIOASSAY FOR LEVEL I TOXICITY ASSESSMENT

Sponsor: EPA
Personnel: K. J. Williamson, Principal Investigator
Objective: The general objective of this study is to develop a toxicity test using freeze-dried bacteria which could be used to assess toxicity of aqueous solutions. Specific objectives include: 1) Determine the toxic concentrations of a wide range of known toxicants to freeze-dried Nitrobacter. 2) Compare these concentrations to known toxic levels for other health and ecology bioassay tests presently used by the EPA and other regulatory agencies. 3) Develop methods to successfully freeze-dry Nitrosomonas. 4) Upon successful completion of 3, complete Objectives 1 and 2 using freeze-dried Nitrosomonas.

EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON ATP VIABILITY OF ACTIVATED SLUDGE

Sponsor: NSF
Personnel: K. J. Williamson, Principal Investigator
Objective: Differences in operational characteristics and sludge production have been observed for many oxygen activated sludge systems as compared to air systems. These results cannot be explained by present models of the activated sludge process nor have they been duplicated under laboratory conditions. Three theories are proposed to explain differences in ATP viability as a function of dissolved oxygen concentrations. These include oxygen limitation inside floc particles (anoxic core model), changes in dominant cytochrome systems, and changes in kinetics of oxidative phosphorylation. Experiments will be conducted in completely-mixed bench scale reactors with three variables systematically controlled: solids retention time, mixing energy and dissolved oxygen concentrations. Measurements of ATP viability, Monod coefficients, and yield coefficients with these three variables controlled will be used to determine which of the three proposed or other alternate theories is most plausible.

FIELD EVALUATION OF ROCK FILTERS FOR REMOVAL OF ALGAE IN LAGOON EFFLUENTS

Sponsor: EPA
Personnel: K. J. Williamson, Principal Investigator
Objective: Determination of operational characteristics of a rock filter for up-grading lagoon effluents at Veneta, Oregon.

UPTAKE OF HEAVY METALS BY ESTUARINE INFAUNA

Sponsor: USDI-OWRT
Personnel: K. J. Williamson, Principal Investigator
Objective: The potential of uptake of heavy metal by estuarine infauna from adsorbed metal in clays, hydrous oxides, and humic acids, is being measured and modeled for laboratory-scale systems.

Electrical & Computer Engineering

S. J. T. Owen, Department Head

IDENTIFICATION OF SYNCHRONOUS MACHINE PARAMETERS

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: G. C. Alexander, Principal Investigator
Objective: Preliminary work is being done to better define the requirements for application of state estimator techniques to test data obtainable from a synchronous machine. The ultimate objective is to be able to estimate directly the parameters of a dynamic Park-domain model of a synchronous machine. Only indirect methods are presently in use for defining the constants of dynamic synchronous machine models.

STUDY OF TOWER TO CONDUCTOR CAPACITANCE

Sponsor: BPA
Personnel: G. C. Alexander, Principal Investigator
Objective: This project has the development of a design procedure for predicting the effective capacitance between the conductors and the metallic towers of power lines as its major goal. Verification us-

ing a small-scale tower model and tests on a full-scale transmission line are included as part of the project.

DEVELOPMENT AND TESTING OF A MICROPROCESSOR BASED SYSTEM FOR MONITORING RESPIRATION AND CONTROLLING OXYGEN IN THE NEONATE AND FETUS

Sponsor: UO Health Sciences Center
Personnel: R. Bucolo, Principal Investigator
Objective: To develop necessary hardware and computer software for a reliable noninvasive and economical system of respiratory monitoring based upon microcomputer technology. To develop a control system to provide accurate and responsive control of oxygen delivered to neonates.

PHYSIOLOGICAL SYSTEM MODELING

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: R. J. Bucolo, Principal Investigator
Objective: Simulation studies using a steady state model of insulin metabolism in humans are currently being conducted to examine the relationship between obesity, hyperinsulinemia and diabetes. Further efforts include extending this steady state model of insulin metabolism to a dynamical model and incorporating interactions with glucose metabolism. Studies will then be undertaken to determine optimal control algorithms for exogenous insulin infusion in the treatment of juvenile diabetes. The results of these studies should provide useful guidelines for the design of an "artificial pancreas."

COST OF CONTROLS FOR "SMALL" HYDROELECTRIC PLANTS ON RIVER SYSTEMS

Sponsor: USDE
Personnel: P. A. Frick, Principal Investigator
Objective: Various aspects of the automatic control of small (low head) hydroelectric generating plants are being investigated.

LOAD MODELING METHODOLOGY USING AN INSTANTANEOUS PARAMETRIC STOCHASTIC REPRESENTATION

Sponsor: USDE
Personnel: P. A. Frick, Principal Investigator
Objective: Consumer behavior is depicted as the sample functions of one or more parametric stochastic process in representing the instantaneous electrical power load in distribution networks.

FEATURE EXTRACTION AND PATTERN RECOGNITION FOR CHANGE DETECTION IN REMOTE SENSING

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: J. H. Herzog, Principal Investigator
Objective: This research is investigating metrics and algorithms for comparing large data bases such as provided by satellite imagery. The goal of the research is to develop techniques capable of detecting regions which have undergone significant changes in land usage in the interim between repetitive satellite coverage.

Techniques are currently under investigation in which the entire LANDSAT imagery is segmented into Land Analysis Units of 1024 pixels. Spatial and statistical features are extracted from the Land Analysis Unit and are analyzed by a classifier to determine if there is a significant difference from comparable features obtained at other dates.

Currently, data bases and computer programs are being prepared for data analysis and data handling. Spectral signatures of typical forest land uses will be investigated. Extensive use will be made of forest test sites in Western Oregon for evaluation of techniques.

While this research is presently unsponsored, it was formulated from previously sponsored (NASA) research and a NASA proposal is pending.

INVESTIGATION OF THE METHODOLOGY FOR THE NON-DESTRUCTIVE TESTING OF WALL INSULATION

Sponsor: PP&L
Personnel: J. H. Herzog, Principal Investigator
Objective: This research investigates and evaluates techniques and devices currently available for on-site determination of home insulation properties. The goal of the research is to develop a technique in which a single technician equipped with highly specialized detector equipment and computer processing can evaluate the thermal integrity of a dwelling.

MEDICAL APPLICATION OF ULTRASONICS

Sponsor: General Research Fund
Personnel: L. C. Jensen, Principal Investigator
Objective: The goal of this research is to investigate the feasibility of using a tone-burst rather than a single pulse in medical applications with the ultimate goal of utilizing ultrasound for tissue classification.

EXTENSION OF THE MODELING CAPABILITIES OF THE ELECTRO-MAGNETIC TRANSIENTS PROGRAM

Sponsor: USDE-BPA
Personnel: H. K. Lauw, Principal Investigator
Objective: This research deals with the development of a universal machine model and its interface with the well-known Electromagnetic Transients Program. This program is a widely used state-of-the-art digital program to analyze the transients in electric power systems, ranging from load change impacts on the associated swings of generating units up to atmospheric discharges on exposed transmission lines and abrupt structural network changes. The universal machine model is aimed at capturing the description of the three major classes of rotating electric machines; synchronous machines, induction machines and direct current machines.

MULTI-PHASE FLASHOVERS ON TRANSMISSION TOWERS DUE TO LIGHTNING STROKES

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: P. C. Magnusson, Principal Investigator
Objective: This is an investigation in connection with summer employment at Bonneville Power Adminis-

tration, Portland, Oregon. This project is a continuation of work which was started in 1976, and involves measurements at the High Voltage Laboratory at Ross Substation, Vancouver, Washington.

PIEZOELECTRIC FORCE TRANSDUCER

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: R. R. Michael, Principal Investigator
Objective: A low cost force transducer and conditioning amplifier is being investigated for use at the Health Sciences Center in ballistic monitoring of infants. A holding fixture for piezoelectric crystals and a variable frequency forcer have been assembled for sensitivity, noise and bandwidth measurements. Preliminary data indicate possible frequency response below 0.1 Hz, but spurious mechanical resonances preclude tests above a few hundred Hz. Mechanical redesign, as well as amplifier optimization is continuing.

BILINEAR CONTROL PROCESSES

Sponsor: NSF
Personnel: R. R. Mohler, Principal Investigator
Objective: This project represents the base of an extensive international program of research on a significant class of nonlinear systems which are linear in state, linear in control, but not jointly linear in both. While past research emphasized optimal control, controllability of bilinear systems, and modeling application to such biological processes as water balance, the present work includes parameter identification, stochastic control along with applications to socio-economics, biology, and energy. The program includes international cooperation and exchange with the University of Rome.

ENGINEERING SYSTEMS APPROACH TO CELL KINETICS, IMMUNOLOGICAL MODELING AND DISEASE CONTROL

Sponsor: NSF
Personnel: R. R. Mohler, Principal Investigator; P. Peterson
Objective: Engineering system analysis is applied to the development of a model which simulates the antibody production and the cell division in the immune response. The objective is to investigate the regulating action exerted by a class of cells, i.e., T-cells on the B-cells, another class of cells which initiate cell differentiation and antibody production. The understanding of this regulatory system is one of the bases of disease control and immunotherapy.

The logistic approach to the study is the following: 1) Development of a mathematical model based on cell division theory and immune reactions. 2) Parameter identification and system optimization by control theory analysis of the model. 3) Digital simulation of the model with experimental data from current research conducted at the Oregon Primate Research Center and elsewhere. 4) Cooperative program active with the University of Rome and with the USSR.

ACQUISITION OF EQUIPMENT TO PERFORM DEEP LEVEL TRANSIENT SPECTROSCOPY OF LASER ANNEALED SEMICONDUCTORS AND INTERFACES

Sponsor: NSF
Personnel: S. J. T. Owen, Principal Investigator
Objective: The Deep Level Transient Spectroscopy (DLTS) method of studying the deeper non-radiative traps in semiconductors is a high frequency junction capacitance measurement, in which distinction is made between majority and minority traps, and information about concentrations, energy levels and capture rates is readily available. For example, DLTS measurements may be used for measurements of concentration profiling, activation energy analysis and thermal emission rates. The comparison of DLTS measurements with other capacitance techniques, especially those which involve thermal scanning, such as thermally stimulated capacitance TSCAP has been made. DLTS measurements are shown to be the most sensitive, most convenient to use and analyze, and to give the widest coverage in range of traps depths. In the present investigation the aim is to establish DLTS equipment, and to use the technique to study laser annealed semiconductors and interfaces. The equipment consists of a low temperature Dewar for temperature control from 4.2°K to 300°K and the associated electronic instrumentation for DLTS measurement.

HETEROJUNCTIONS IN SEMICONDUCTORS

Sponsor: Office of Naval Research
Personnel: S. J. T. Owen, Principal Investigator; H. K. Choi, J. Ku
Objective: The resolution of the physical processes involved in interface electron transport across a semiconductor heterojunction requires comprehensive measurements and the preparations of structures repeatedly and repeatably. The project is concerned with the Ge-GaAs structure which will be prepared by various means, including liquid phase epitaxy. This project is part of a consortium effort linking several universities and industrial firms. The aim of the project is to contribute to a comprehensive examination of the Ge-GaAs heterojunction by structural, optical, electrical and physical measurements on devices.

INSTRUCTIONAL SCIENTIFIC EQUIPMENT

Sponsor: NSF
Personnel: S. J. T. Owen, Principal Investigator
Objective: This proposal is concerned with the purchase of equipment for improvement of the facilities of the solid state electronics laboratory. The provision of facilities for measuring current/voltage and capacitance/voltage characteristics of devices and materials will substantially improve the undergraduate program. Other vital supporting equipment for this project include metalization facilities, film thickness measurement, laminar flow benches and additional tubular furnace facilities. Each piece of equipment will be used extensively in undergraduate coursework and in research projects.

INVESTIGATIONS OF SILICON-PHOSPHOR INTERFACES

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: S. J. T. Owen, Principal Investigator
Objective: This project is concerned with investigations of producing a light emissive material on a silicon substrate. If a phosphor can be excited by electrons injected directly from a silicon integratedcircuit, then address and control circuitry may be directly integrated with the emissive layer. Zinc oxide and zinc ortho-silicate layers are being investigated as likely phosphors, and simple planar circuits have been produced to study electron injection into wide gap materials.

STUDY OF DEEP LEVELS IN ION-IMPLATED GALLIUM ARSENIDE

Sponsor: NSF
Personnel: T. K. Plant, Principal Investigator
Objective: This work is concerned with identifying and electrically characterizing the deep level traps in ion-implanted GaAs. Although much data is available on deep level in bulk-grown or expitaxial GaAs, no work has been done on the implanted material. Implants of O, Cr, and Mn in high purity GaAs substrates will be electrically characterized using C-V, I-V, Hall effect and deep level transient spectroscopy measurements for temperatures from 4.2°K-300°. Effects of thermal and laser annealing of the implanted layers will also be studied. Information on the changes in deep level trap concentrations, energy levels and capture cross sections with annealing should be useful in identifying sources of degradation in ion implanted GaAs FETs and other devices based on GaAs technology.

COMPUTER SCIENCE AND COMPUTER ENGINEERING RESEARCH EQUIPMENT

Sponsor: NSF
Personnel: V. M. Powers, Principal Investigator
Objective: Acquisition of a bit-slice microprocessor development system to support research such as: 1) Top-down, bit-slice firmware engineering. 2) New loop protocol development. 3) Bandlimited acoustic data processing.

STOCHASTIC CONTROL WITH AEROSPACE APPLICATION

Sponsor: NASA
Personnel: J. Ruzicka, Principal Investigator
Objective: Mathematical problems associated with the design of a control system for an aerospace vehicle operating under realistic complications of uncertainty (predicting the vehicle's dynamic characteristics, the stochastic nature of the measurement process, and random external disturbances (turbulence)).

Particular attention is being aimed at: 1) "Separation theorems" for certain continuous-time optimal stochastic control problems with non-linearities. 2) Non-Lipschitzian stochastic differential equations: weak solutions versus strong solutions. 3) Statistical description of turbulence and its impact on the stochastic control problem (see 1). 4) Numerical aspects. The above problems are of importance in their own right in the general field of system theory and the theory of stochastic processes.

DEVELOPMENT AND TESTING OF MACRO-MODELS OF OCEANOGRAPHIC ACOUSTIC SIGNAL SYSTEMS

Sponsor: U.S. Navy
Personnel: J. L. Saugen, Principal Investigator; R. C. Rathja
Objective: Computer processing of acoustic signals and others arising during undersea system testing is being studied. Currently being investigated is the applicability of the array processor as a means of prescreening data so as to reduce the storage required for analysis. Because of the vast amount of data, it is essential that effective and fast data storage reduction algorithms be developed and incorporated into the data collection system. Analysis procedures and display methods (including color graphics) for the examination of test data are being developed.

ADVANCED FORWARD AREA TACTICAL RADAR NETWORK

Sponsor: Air Force Office of Scientific Research
Personnel: J. D. Spragins, Principal Investigator; C. J. Warner
Objective: This work is focused on development and analysis of communications protocols for a radar network being studied by the Air Force for development in the mid-to late 1980's. The network will consist of a fairly large number of short range radars, each with sophisticated data processing facilities, which are interconnected by communication links to provide integrated surveillance of a large geographical area. The network is a specialized surveillance of a large geographical area. The network is a specialized type of computer communications network, so some techniques developed for computer communications networks are being applied.

COMMUNICATION SATELLITE STUDIES

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: J. D. Spragins, V. K. Tripathi, Principal Investigators; R. S. Engelbrecht
Objective: A variety of studies associated with communication satellites are being conducted. These include implementation of a communications satellite receiving station (and, at a later date, a transmitting station), examining the effects of rain on propagation of signals between communication satellites and earth stations, studying a new type of planar microwave integrated circuit antenna for satellite communications, and looking at various types of architectures for systems for dissemination of earth resources data obtained from satellites and other monitoring systems. Related work is being done cooperatively with personnel at the OSU Air Resources Center who hope to use some of the technology developed to monitor rainfall in a geographical area.

DEVELOPMENT OF MORE USABLE TECHNIQUES FOR ANALYZING PERFORMANCE OF COMPLEX SYSTEMS

Sponsor: NSF
Personnel: J. D. Spragins, Principal Investigator; R. Maneshi

Objective: This project is exploring approximate techniques for analyzing and predicting the performance of complex systems such as computer networks. The aim is that the techniques developed be readily usable by persons responsible for the design, development, selection or tuning of such systems. The approach being pursued is to explore the relationships between the various approaches already documented and others being developed with particular emphasis on the advantages and limitations of the various approaches. Experimental verification is planned.

NEW ARCHITECTURES FOR DISTRIBUTED COMPUTER NETWORKS

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: J. D. Spragins, V. M. Powers, Principal Investigators
Objective: A new form of communications architecture for distributed computer networks has been developed and studied via simulation and analytic techniques. The architecture is based on a dual loop configuration with one loop used for control and one (or more) used for data communications. Studies to date indicate that the architecture significantly outperforms any of the competing architectures in the current literature, and it is also more flexible than its competitors. Approaches to implementing a computer communications network at OSU and/or a statewide computer communications network based on this architecture are being explored.

REALISTIC RELIABILITY MODELS FOR DATA COMMUNICATIONS NETWORKS

Sponsor: NSF
Personnel: J. D. Spragins, Principal Investigator
Objective: This research program is concerned with reliability of data communication networks. The work focuses on two important problems: 1) The tendency of different communications lines to fail in a dependent manner, and 2) the variability in important reliability parameters, such as percentage downtime, between different lines. Initial, rather simple mathematical models are available for each of these problems. Better models are being explored to apply to more general types of data communication networks including distributed networks. Better techniques for designing reliable communication networks are sought and the impact of communications reliability on network design is assessed.

CORONA PRODUCED AUDIBLE NOISE ON EHV AND UHV TRANSMISSION LINES

Sponsor: BPA
Personnel: L. N. Stone, Principal Investigator
Objective: A theoretical and experimental investigation of phenomena associated with generation of audible noise caused by corona discharges on EHV transmission line conductors.

INTEGRATED CIRCUITS FOR mmWAVE AND OPTICAL FREQUENCIES

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: V. K. Tripathi, Principal Investigator
Objective: The purpose of this work is to formulate analytical and experimental procedures to push MIC techniques to mmWave frequencies. These include tapered and non-uniformly coupled microstrip lines on suitable substrates and dielectric guides. Planar circuits at optical frequencies are also being investigated by utilizing the normal mode analysis of these systems.

INTERACTION OF ELECTROMAGNETIC WAVES WITH BIOLOGICAL OBJECTS

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: V. K. Tripathi, Principal Investigator
Objective: The interaction of nonionizing electromagnetic radiation with biological objects are being investigated. The absorption characteristics of uniform prolate spheroidal model of man and animals when radiated with plane waves at and near the resonance frequencies are being evaluated by utilizing point matching techniques and potential function expansion methods. Interaction of objects having different geometries with waves in a class of guided-wave systems are also being investigated for EMI emission and susceptibility testing, biological exposures and other measurements.

MICROWAVE INTEGRATED CIRCUITS

Sponsor: OSU Department of Electrical & Computer Engineering
Personnel: V. K. Tripathi, Principal Investigator
Objective: Analytical techniques required for the investigation of the properties and applications of multiple uniformly-coupled line structures in an inhomogenous medium are being formulated. In particular, the properties of and design procedures for various multi-section structures for applications as useful circuit elements with improved and novel characteristics at microwave frequencies are being studied. These circuits include filters, directional couplers, and impedance matching networks. Physical realization of these circuits to yield desired normal mode parameters are also being investigated with a special emphasis on microstrip structures.

TEMPORAL VARIABILITY IN STREAM ECOSYSTEMS

Sponsor: EPA
Personnel: J. Van Sickle, Principal Investigator; R. Hanlen
Objective: This project studies the predictability and variability of stream flow and suspended sediment transport in small Pacific Northwest streams. Stochastic systems identification techniques are used to build predictive models of sediment yield as a function of storm flows or monthly average flows in streams. The ultimate goal is to be able to detect changes in the habitat (streambed) of aquatic insects or fish caused by logging or other radical changes in the watershed.

Industrial & General Engineering

J. L. Riggs, Department Head

ANALYSIS OF MARINE CONTAINER TERMINAL MATERIAL FLOW PATTERNS AND YARD LAYOUT

Sponsor: NOAA-Sea Grant
Personnel: E. D. McDowell, T. M. West, Principal Investigators
Objective: The primary objective of this project is to study the layout and material handling methods in public marine container terminals. The study's objective is to determine yard layouts; material handling methods; and material management methods which will be optimal and allow the prediction of terminal capacity. The current study is concentrating on yard storage plans, but future activities involving ship load planning are within the scope of the study. Digital simulations and analytical models are being used in the current phase to model container movements through the yard.

DEVELOPMENT OF A MANUFACTURING ENGINEERING OPTION AS A COOPERATIVE VENTURE

Sponsor: NSF
Personnel: J. L. Riggs, Principal Investigator
Objective: To develop a manufacturing engineering option within an accredited industrial engineering curriculum. The option is in response to a national drive for practical education to prepare engineers for careers in manufacturing. Oregon industries feel strongly enough about the need for such a program to fund a teaching position, participate in internships, and supply instructors and facilities for on-site instruction if an acceptable program can be developed. Immediate objectives are to design a curriculum, new courses, demonstration labs and self-teaching modules to conserve teaching resources, procedures for a credit-earning co-op program, arrangements to use industrial facilities for course instruction, and means to publicize availability of the new option. The outcome should be a new curriculum offered by the University, improved service courses in manufacturing subjects currently required by other departments, partially developed laboratory demonstration equipment and self-teaching modules on manufacturing engineering topics, and improved University relationships as typified by an active Manufacturing Engineering Advisory Board.

Mechanical Engineering

J. R. Welty, Department Head

ELECTRICAL GENERATION POTENTIAL AT INDUSTRIAL COGENERATION INSTALLATIONS

Sponsor: Rocket Research
Personnel: D. J. Bushnell, Principal Investigator
Objective: The overall objective of this study is to determine the potential electrical/process-steam cogeneration capacity within 35 industrial plants in the State of Oregon. These plants are currently being surveyed for waste heat availability under Pacific Northwest Regional Commission (PNRC) Project No. 784. The structure of this program is based upon integrating this effort with Task II of the PNRC project. Specifically, Phases I and III of this study will develop information on: 1) Potential cogeneration capacity of individual plants through: a) Identification and evaluation of existing and planned (announced) process heat requirements, equipment capacities, and waste heat availability. b) Identification of new equipment required for cogeneration. 2) Industry willingness to participate in developing cogeneration capability within existing plant installations and constraints for development. 3) Preliminary engineering requirements and the economics of cogeneration installations for a limited number of plants with greatest possibilities for cogeneration. (Phase III)

INDUSTRIAL WASTE HEAT FOR ADJACENT COMMUNITIES AND INDUSTRIAL APPLICATIONS

Sponsor: Rocket Research
Personnel: D. J. Bushnell, Principal Investigator
Objective: Task II will be the on-site survey of 35 industrial plants within the State of Oregon. The survey will assess the quantity of waste heat available in each plant, the quality of waste heat, the percentage recoverable and the equipment necessary for each type of process studied. Potential applications will be identified for each surrounding community. The applications will be judged according to population density, neighboring industries, and ability to use the waste heat which is available. At the conclusion of Task II, twenty industrial plant-community complexes will be selected for in-depth study. During Task III, social-economic and detailed engineering problems will be analyzed. Task II will run from March 1, 1978 to October 17, 1978.

FIELD STUDY OF COOLING TOWER PLUMES

Sponsor: PP&L
Personnel: L. R. Davis, Principal Investigator
Objective: The object of this study was to measure temperature and humidity data using a tethered ballon-radiosonde-ground station system within the plumes of the mechanical draft cooling towers at the Centrailia Steam Power Plant in Centrailia, Washington. From these data the trajectory and

dilution characteristics of the plumes from these cooling towers were determined for various weather conditions. The information gathered was used to help tune a mathematical model developed for plume prediction. It will also be used to help assess the environmental impact of future power plant cooling towers and aid in power plant siting.

IDENTIFICATION OF MODAL PARAMETERS IN DYNAMIC STRUCTURAL MODELS

Sponsor: NSF
Personnel: W. E. Holley, Principal Investigator
Objective: In order to predict the effects of dynamic wind, wave, or earthquake loads, an accurate dynamic model of the structure is required. Often, it is desired to identify an appropriate model from test data. One technique which has been successful is the maximum likelihood method. Using this technique, optimal, least-squares, estimates of the modal parameters of the dynamic system are computed. A modified Newton, non-linear, least-squares algorithm is utilized in the computation, and the data is assumed to be in the form of accelerations with additive noise errors. The technique is applied to the problem of identifying the modal parameters of a suspended cable subjected to random and known excitations.

INVESTIGATION OF THE RATE OF COMBUSTION OF WOOD RESIDUE FUELS

Sponsor: USDE
Personnel: D. C. Junge, Principal Investigator; J. G. Mingle, F. Kayihan
Objective: This investigation of the combustion characteristics of wood residue fuels was undertaken to provide a data base which could be used to optimize the combustion of such fuels. Optimization of the combustion process in industrial boilers serves to improve combustion efficiency and to reduce air pollutant emissions generated in the combustion process. Technical reports present data on the combustion characteristics of: Douglas Fir bark, Douglas Fir planer shavings, Red Alder bark, Red Alder sawdust, Ponderosa Pine bark, Hemlock bark, and Eastern White Pine bark. The data were obtained in a pilot scale combustion test facility at Oregon State University. An Executive Summary Report is also available which compares the combustion characteristics of the various fuel species.

ANALYSIS OF SYSTEM PERFORMANCE OF THE PROTOTYPE ENERGY RETRIEVAL SYSTEM

Sponsor: USDE-BPA
Personnel: G. M. Reistad, Principal Investigator
Objective: In this project, OSU personnel are evaluating the performance of two systems for conventional energy conservation; a solar air conditioning system and a heat recovery system. In the solar system, about 90 square meters of solar collectors are used to drive a new design of absorption refrigeration system for cooling. In the heat recovery system a heat pump is being used to recover part of the energy normally rejected to the air in large electric transformers.

EVALUATION AND DESIGN OF DOWNHOLE EXCHANGERS FOR DIRECT APPLICATION

Sponsor: OIT
Personnel: G. M. Reistad, Principal Investigator
Objective: This project was a cooperative effort with the Oregon Institute of Technology, in which downhole heat exchangers used in geothermal energy recovery were studied. The project involved the testing of wells typically used with downhole heat exchangers, analytical modelling of the heat exchanger and well system, and testing of wells with installed heat exchangers of both new and old design. Also, economic evaluations of the use of energy from such systems were made.

FEASIBILITY FOR HARNESSING THE HEAT GENERATED BY CONVERTER VALVES AT CELILO STATION

Sponsor: USDE-BPA
Personnel: G. M. Reistad, E. Schmisseur, Principal Investigators
Objective: The BPA AC-DC converter station near the Dalles, Oregon rejects substantial quantities of heat as warm water. This study is investigation uses for this energy. Because the rejected energy is not continuously available, storage of the energy is an important aspect of the study.

HEAT PUMPS FOR GEOTHERMAL APPLICATIONS, AVAILABILITY AND PERFORMANCE

Sponsor: USDE
Personnel: G. M. Reistad, Principal Investigator
Objective: In this study, the performance and availability of water source heat pumps for use in geothermal applications is to be evaluated. Of particular concern, is the performance of units as a function of the water source temperature. Overall, the research intends to provide information on the present status and projected performance of water source heat pumps that may be used in geothermal applications.

PERFORMANCE AND FEASIBILITY OF FORCED GEOHEAT RECOVERY FOR LOW TEMPERATURE APPLICATIONS

Sponsor: USDE
Personnel: G. M. Reistad, G. Bodvarsson, Principal Investigators
Objective: Forced geoheat recovery (FGR) involves the application of various types of stimulation techniques to extract geoheat from non-convecting and non-hydrothermal resources. Possible heat resources are permeable horizons in deep sedimentary basins, lava-bed contacts in flood basalt areas, mafic dikes and fracture zones. The project involves a study of reservoir and production mechanics for sources of this type. A second phase of the project involves a technoeconomical study of the feasibility of using thermal water produced by FGR system for building heating and other low-temperature purposes. Design of distribution and terminal units is being studied and a detailed investigation of FGR economics is being carried out.

TECHNICAL PROBLEM REVIEW OF NEW WIND SYSTEMS

Sponsor: USDE
Personnel: R. W. Thresher, Principal Investigator
Objective: The intent of this work is to identify common technical issues which are problems in each area of wind turbine design. This work spands the range from very small wind turbines of 1 kw or less up to 25,000 kw.

HEAT TRANSFER IN HIGH TEMPERATURE FLUIDIZED BEDS WITH IMMERSED TUBES FOR COAL COMBUSTION SERVICE

Sponsor: USDE
Personnel: J. R. Welty, Principal Investigator
Objective: This research has two objectives, both dealing with heat transfer between a high-temperature (~1100 K) gas fluidized bed and immersed tubes. The first objective is to develop an analytical model which will predict the local heat transfer rates and tube-surface temperatures as functions of bed operating parameters. The second objective is to perform experiments with an operational high-temperature bed to support the analytical model and to provide data on high-temperature operation.

APPLIED AERODYNAMIC OF WIND TURBINES

Sponsor: USDE
Personnel: R. E. Wilson, Principal Investigator
Objective: The objective of the project is to develop simplified, yet significant engineering analysis techniques for estimating aerodynamic performance, structural loads, and response of wind turbines.

GRADUATE TRAINING PROGRAM IN SOLAR ENERGY

Sponsor: USDE
Personnel: R. E. Wilson, Principal Investigator; E. M. Patton
Objective: Energy traineeship.

Nuclear Engineering

C. H. Wang, Department Head

DEVELOPMENT OF NUCLEAR TECHNIQUES FOR THE NUCLEAR METALS INDUSTRY

Sponsor: Teledyne Wah Chang Albany
Personnel: S. E. Binney, Principal Investigator
Objective: Development of nuclear techniques to aid in solving problems that arise in the nuclear metals industry, including uranium and thorium material balances on a zirconium separations plant and determinations of solubilities of certain zirconium fluoride salts.

EXTRACTION OF URANIUM FROM SEAWATER - PHASE I

Sponsor: Exxon Nuclear
Personnel: S. E. Binney, Principal Investigator; C. Wicks, W. Slabaugh
Objective: Experiments were conducted to test the capability of certain materials to preferentially adsorb uranium from seawater under ambient conditions. The work was performed at the Marine Science Center, the Radiation Center, and the Chemistry and Chemical Engineering laboratories.

LOW-GRADE URANIUM RESOURCES - SEAWATER

Sponsor: USDE/Exxon Nuclear
Personnel: S. E. Binney, Principal Investigator; L. Gordon, A. Chen, M. Rodman, M. Rivera
Objective: A major assessment was made of the uranium resources in seawater. All U.S. coastal waters were considered to determine a typical potential site for location of a uranium extraction plant. Various methods of moving the seawater and extracting the uranium were reviewed. A uranium extraction plant was conceptually designed. Economic and environmental considerations were also addressed. Extensive bibliographies were compiled.

REVIEW AND DEVELOPMENT OF BWR MODELS FOR THE ANALYSIS OF OPERATIONAL TRANSIENTS

Sponsor: EPRI
Personnel: K. Hornyik, Principal Investigator
Objective: Safety analyses as required for power plant licensing are based on predicted behavior under a set of postulated accident condition. These analyses are based on analytic models which are cast into computer codes. Recent tests performed at a BWR have provided transient records of many process parameters of interest. They are to be compared with best estimate results produced by the RETRAN code. Eventual discrepancies are to be identified and point the way to eliminating coding errors, inadequate numerical methods, and/or overly simplistic model assumptions. This work involves: neutronics (feedback), thermal hydraulics, control systems, component characteristics, numerical methods, stability theory.

HEAT TRANSFER IN SPHERE PAC REACTOR FUEL PINS

Sponsor: Swiss Federal Institute for Reactor Research
Personnel: K. L. Peddicord, Principal Investigator; M. E. Cunningham, M. Ades
Objective: The project seeks to calculate the effective conductivity of an array of regularly packed ceramic fuel spheres. This is done by making a set of consistent two dimensional and three dimensional calculations of heat conduction through a sphere of one material located within a region of a second material. Both analytical and numerical studies are utilized and the results compared. Parameters such as variable conductivities of the two regions, variation of cell size and consideration of the contact between spheres is incorporated. The project also investigates the effect of porosity on thermal conductivities for ceramic nuclear fuels and the modeling for temperature calculations of carbide fuel in a power reactor environment.

PREDICTION OF THE PERFORMANCE OF SPHERE PAC MIXED CARBIDE FUEL PINS

Sponsor: EIR
Personnel: K. L. Peddicord, Principal Investigator; M. J. Ades, C. A. Robinson
Objective: This project deals with the modeling of the behavior of sphere pac mixed carbide fuel in a power reactor under irradiation conditions. A code entitled SPECKLE-I is under development which will account for the thermal and mechanical behavior of a sphere pac fuel pin during its lifetime. The important thermal components are the heat source and temperature distribution, thermal conductivity, initial stage restructuring, porosity redistribution, fuel swelling, and gas release. This phase of the code is currently completed and is undergoing evaluation and testing. The mechanical modeling will seek to calculate pin stresses, fuel clad mechanical interaction and overall pin strains. Sources of loading within the pin will be fuel swelling, thermal expansion, and creep. The code is being evaluated against data provided by the Swiss Federal Institute for Reactor Research from irradiations of advanced fuel pins carried on by the Institute.

THERMAL HYDRAULIC ANALYSIS OF THE TROJAN CORE WITH THE COBRA CODE

Sponsor: PGE
Personnel: K. L. Peddicord, Principal Investigator
Objective: The core of a pressurized water reactor (PWR) consists of fuel rods in a square array surrounded by cooling water. In this project, a detailed study of principal thermal hydraulic parameters for the Trojan PWR is performed using the COBRA codes. The fuel rods in the core are modelled and the hot channel analyzed with the COBRA-IIIC/MIT Code. The value of the departure from nucleate boiling ratio (DNBR) reported in the Final Safety Analysis Report is assessed for the Trojan core.

TRANSIENT FUEL PIN TEMPERATURE ALGORITHMS BASED ON TRANSFER FUNCTION

Sponsor: EPRI
Personnel: K. L. Peddicord, Principal Investigator; T. E. Guidotti
Objective: The project concerns the calculation of transient fuel pin temperatures for typical light water reactor situations. In contrast to current techniques which usually employ variations of the finite difference approach, the main technique used to account for the time dependent behavior is generalized transfer functions. The transfer function technique is being extended to account for the nonlinear properties of the fuel, principally thermal conductivity and heat capacity. In addition, the method will incorporate the effect of gap conductance between the fuel pellet and the clad. The technique may be used in transient fuel performance codes under development by the Electric Power Research Institute.

NEUTRON RADIOGRAPHY STUDIES OF LIQUID PROPELLANTS

Sponsor: Army
Personnel: A. H. Robinson, Principal Investigator

STUDIES OF ACTINIDE WASTE BURNUP AND USE IN FAST REACTOR SPECTRA

Sponsor: USDE
Personnel: A. H. Robinson, Principal Investigator

EVALUATION OF FISSION-PRODUCT AFTERHEAT

Sponsor: U.S. Nuclear Regulatory Commission
Personnel: B. I. Spinrad, Principal Investigator; S. M. Baker, T. J. Trapp, C. H. Wu, B. M. K. Wong
Objective: Analytical studies of power delivered by fission products after a power reactor has been shut down. These are the source of the heat which must be removed by an Emergency Core Cooling System (ECCS) after a Loss of Coolant Accident (LOCA). Studies include: evaluation of fission product (FP) yields and decay parameters; evaluation of uncertainties in these data, and determination of the corresponding uncertainties in decay power inferred from them; evaluation of increases and decreases in decay power due to neutron capture in FP; evaluation of effects of reactor history, including fuel burnup, operating time, and fissile nuclide depletion and buildup; input to preparation of decay power standards; and analytical assistance to, and interpretation of decay power measurements.

TRAINING PROGRAM FOR LIBYAN UNDERGRADUATE STUDENTS IN NUCLEAR ENGINEERING

Sponsor: Libya
Personnel: C. H. Wang, Principal Investigator

Grants & Contracts Received 1978-79

Investigator	Department	Agency	Duration	Amount
Hellickson, M. L.	Agricultural Engr.	PP&L	179-1279	10,000
Farmstead Utilization of Solar Energy				
Hellickson, M. L.	Agricultural Engr.	Battelle	1078-1079	21,263
Water and Energy Study				
Fitzgerald, T. J.	Chemical Engr.	Babcock & Wilcox	478-179	32,757
Investigation of Fluidized Beds with Immersed Heat Exchange Tubes (Supplement)				
Fitzgerald, T. J.	Chemical Engr.	Babcock & Wilcox	179-1279	218,529
Investigation of Fluidized Beds with Immersed Heat Exchange Tubes				
Hicks, R. G.	Civil Engr.	USDA-USFS	1078-1279	24,088
Evaluation of Dust Abatement Materials				
Layton, R.	Civil Engr.	USDT	778-679	6,000
FHWA Fellowship and Scholarship Program (Hutson)				
Nath, J. H.	Civil Engr.	USDC-NOAA	1277-179	20,534
Discus Buoy Stability (Supplement)				
Nath, J. H.	Civil Engr.	USDC-NOAA	877-1278	1,493
Numerical Model Improvement for Drifting Buoy and Drogue (Supplement)				
Nath, J. H.	Civil Engr.	USDC-NOAA	179-979	7,111
Numerical Model Improvement for Drifting Buoy and Drogue (Supplement)				
Northcraft, M. E.	Civil Engr.	EPA	978-879	4,000
Oregon Water System Operators Certification Program				
Schroeder, W. L.	Civil Engr.	EPA	1078-979	20,150
Professional Training in Water Pollution Control and Water Supply				

Investigator	Department	Agency	Duration	Amount
Hancock, D. Sollitt, C. K.	Oceanography Civil Engr.	Army	179-1279	249,979
Coos Bay Offshore Disposal Site Investigation				
Hancock, D. Sollitt, C. K.	Oceanography Civil Engr.	Army	179-1279	2,533
Coos Bay Offshore Disposal Site Investigation (Supplement)				
Hancock, D. Sollitt, C. K.	Oceanography Civil Engr.	Umpqua	1178-979	43,931
Umpqua Offshore Artificial Reef Study				
Williamson, K. J.	Civil Engr.	EPA	479-480	25,493
Bacterial Bioassay for Level I Toxicity Assessment				
Williamson, K. J.	Civil Engr.	NSF	679-181	62,203
Effect of Dissolved Oxygen Concentration on ATP Viability of Activated Sludge				
Bucolo, R.	Electrical Engr.	UO	978-879	10,413
Development and Testing of a Microprocessor Based System for Monitoring Respirati				
Frick, P. A.	Electrical Engr.	USDE	977-978	1,502
Cost of Controls for "Small" Hydroelectric Plants on River Systems (Supplement)				
Lauw, H. K.	Electrical Engr.	USDE-BPA	479-480	27,498
Extend the Modeling Capabilities of the Electromagnetic Transients Program				
Owen, S. J. T.	Electrical Engr.	NSF	978-880	20,000
Instructional Scientific Equipment				
Plant, T. K.	Electrical Engr.	NSF	479-381	54,626
Study of Deep Levels in Ion-Implanted Gallium Arsenide				
Powers, V. M.	Electrical Engr.	NSF	479-380	18,220
Computer Science and Computer Engineering Research Equipment				
Saugen, J. L.	Electrical Engr.	Navy	878-779	95,000
Development and Testing of Macro-Models of Oceanographic Acoustic Signal Systems				

Investigator	Department	Agency	Duration	Amount
Sigmon, T. W. Owen, S. J. T. Acquisition of Equipment to Perform Deep Level Transient Spectroscopy of Laser Annealed Semiconductors and Interfaces	Electrical Engr.	NSF	878-779	17,119
Spragins, J. D. Development of More Usable Techniques for Analyzing Performance of Complex Systems	Electrical Engr.	NSF	978-980	51,385
Spragins, J. D. Realistic Reliability Models for Data Communications Networks	Electrical Engr.	NSF	778-780	52,947
Van Sickle, J. Temporal Variability in Stream Ecosystems	Electrical Engr.	EPA	1078-1079	35,911
Riggs, J. L. Development of a Manufacturing Engineering Option as a Cooperative Venture	Industrial Engr.	NSF	479-381	24,611
Bushnell, D. J. Electrical Generation Potential at Industrial Cogeneration Installations	Mechanical Engr.	Rocket Research	678-1078	5,562
Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels	Mechanical Engr.	USDE	978-879	188,333
Junge, D. C. Investigation of the Rate of Combustion of Wood Residue Fuels (Supplement)	Mechanical Engr.	USDE	978-879	38,000
Reistad, G. M. Analysis of System Performance of the Prototype Energy Retrieval System (Supplement)	Mechanical Engr.	USDE-BPA	377-979	8,000
Reistad, G. M. Schmisseur, E. Feasibility for Harnessing the Heat Generated by Converter Valves at Celilo Station	Mechanical Engr. Ag. Economics	USDE-BPA	179-1279	31,937
Reistad, G. M. Heat Pumps for Geothermal Applications, Availability and Performance	Mechanical Engr.	USDE	679-180	20,448
Thresher, R. W. Technical Problem Review of New Wind Systems	Mechanical Engr.	USDE	1178-1079	9,900

Investigator	Department	Agency	Duration	Amount
Wilson, R. E.	Mechanical Engr.	USDE	878-879	7,400
Graduate Training Program in Solar Energy				
Binney, S. E.	Nuclear Engr.	Exxon	978-280	86,183
Low-Grade Uranium Resources--Seawater				
Hornyik, K.	Nuclear Engr.	EPRI	778-779	30,000
Review and Development of BWR Models for the Analysis of Operational Transients				
Peddicord, K. L.	Nuclear Engr.	EIR	179-1279	47,494
Evaluation Models for the Prediction of the Performance of Sphere Pac Fuel Pins				
Peddicord, K. L.	Nuclear Engr.	EPRI	978-879	25,000
Transient Fuel Pin Temperature Algorithms Based on Transfer Function				
Robinson, A. H.	Nuclear Engr.	Army	878-1079	99,560
Neutron Radiography Studies of Liquid Propellants				
Spinrad, B. I.	Nuclear Engr.	NRC	1077-978	2,000
Evaluation of Fission-Product After Heat (Supplement)				
Wang, C. H.	Nuclear Engr.	Libya	175-679	42,805
Training Program for Libyan Undergraduate Students in Nuclear Engineering (Suppl				

Proposals Submitted 1978-79

Investigator	Department	Grant Agency	Amount	Term
Cuenca, R. H.	Agricultural Engr.	USDI-OWRT	79,765	3 yr
Crop Production Functions for Irrigated Agriculture in the Willamette Valley				
English, M. J.	Agricultural Engr.	USDI-OWRT	65,600	3 yr
Applied Optimization of Irrigation				
Hansen, H. J.	Agricultural Engr.	USDI-OWRT	75,000	3 yr
Shearer, M. H.				
Efficiency Performance Criteria for Irrigation Systems				
Hellickson, M. L.	Agricultural Engr.	Battelle	24,445	13 mo
Agricultural Energy and Water Use in the Pacific Northwest - Past, Present and Future				
Hellickson, M. L.	Agricultural Engr.	Battelle	21,263	13 mo
Agricultural Energy and Water Use in the Pacific Northwest (Revision)				
Hellickson, M. L.	Agricultural Engr.	PP&L, PGE	10,000	1 yr
Farmstead Utilization of Solar Energy (Revision)				
Fitzgerald, T. J.	Chemical Engr.	USDE	78,585	2 yr
Fluidized Bed Solids Sampling				
Fitzgerald, T. J.	Chemical Engr.	Babcock & Wilcox	314,494	1 yr
Junge, D. C.	Mechanical Engr.			
Investigation of Fluidized Beds with Immersed Heat Exchange Tubes				
Fitzgerald, T. G.	Chemical Engr.	USDE	394,072	2 yr
Mrazek, R.				
Measuring and Modeling Solids Movement in a Large, Cold Fluidized Bed Test Facility				
Kayihan, F.	Chemical Engr.	Wheelabrator Corp.	73,700	11 mo
McDowell, E. D.	Industrial Engr.			
Data Analysis and Interpretation, Reactor Modeling and Experimental Design				

Investigator	Department	Grant Agency	Amount	Term
Kayihan, F.	Chemical Engr.	Weyerhaeuser	21,768	
Pyrolysis Kinetics of Wood Under High Heating Rates				
Knudsen, J. G.	Chemical Engr.	NSF	189,428	2 yr
Fouling Characteristics of Cooling Tower Water				
Hicks, R. G.	Civil Engr.	OTSC	105,108	2 yr
Development of a Maintenance Management System for Oregon Counties				
Hicks, R. G.	Civil Engr.	OSDT	35,707	2 yr
Evaluation of Construction Problems on Reduced Life of Asphalt Pavements				
Hudspeth, R. T.	Civil Engr.	USDC-NOAA	77,641	1 yr
Hydrodynamic Characteristics of the OTEC Cold Water Pipe				
Hudspeth, R. T. Garrison, C. J.	Civil Engr.	NSF	109,555	1 yr
Hydrodynamic Damping of Offshore Structures				
Hudspeth, R. T. Borgman, L. E.	Civil Engr.	NSF	151,045	2 yr
Simulation and Measurement of Nonlinear Random Waves by Poly-Spectral Methods				
Hudspeth, R. T.	Civil Engr.	CH2M	108,785	
Swoop Diffuser Model Tests				
Layton, R. D.	Civil Engr.	USDT	169,812	2 yr
Transportation System Constraints on the Mobility, Accessibility and Health of El				
Leonard, J. W.	Civil Engr.	NSF	51,798	18 mo
Stochastic Analysis of Cable Systems and Cable-Reinforced Membranes				
Nath, J. H.	Civil Engr.	API	44,765	1 yr
Hydrodynamic Coefficients for Cylinders with Pronounced Marine Growths				
Nath, J. H.	Civil Engr.	NSF	304,664	3 yr
Hydrodynamic Roughness of Marine Growths on Cylinders				

Investigator	Department	Grant Agency	Amount	Term
Nath, J. H.	Civil Engr.	NSF	244,314	2 yr
Predicting Physical Events from Wave Flume Tests				
Nath, J. H.	Civil Engr.	API	39,726	1 yr
Wave Forces on Sloping Cylinders				
Northcraft, M. E.	Civil Engr.	EPA	5,000	1 yr
Oregon Water System Operators' Certification Program				
Schaumburg, F. D.	Civil Engr.	NSF	95,381	15 mo
An Alternative Strategy for Potable Water Supply in the United States				
Schroeder, W. L.	Civil Engr.	USDA-USFS	33,452	1 yr
Engineering Properties of Coastal Range Soils				
Schroeder, W. L.	Civil Engr.	EPA	7,931	1 yr
Professional Training Program (Supplement)				
Schultz, R. J.	Civil Engr.	DGMI	824,960	5 yr
Couch, R.	Oceanography			
Seaders, J.	Civil Engr.			
Geodetic Investigations of Earth Crustal Movements				
Hancock, D. R.	Oceanography	Umpqua	43,931	10 mo
Sollitt, C. K.	Civil Engr.			
Umpqua Offshore Artificial Reef Study (Revision)				
Hancock, D. R.	Oceanography	Army	2,533	6 mo
Sollitt, C. K.	Civil Engr.			
Coos Bay Offshore Disposal Site Investigation (Supplement)				
Vinson, T. S.	Civil Engr.	R&M Consultants	38,886	1 yr
Consolidation and Shear Strength Characteristics of Offshore Permafrost				
Vinson, T. S.	Civil Engr.	NSF	83,264	2 yr
Dynamic Properties of Naturally Frozen Soils				
Williamson, K. J.	Civil Engr.	NSF	62,203	20 mo
Effect of Dissolved Oxygen Concentration of ATP Viability of Activated Sludge				

Investigator	Department	Grant Agency	Amount	Term
Bhattacharya, P. K. Owen, S. J. T. Determination of the Characteristics of Deep Levels and Electronic Transport Prop	Electrical Engr.	NSF	161,864	2 yr
Bhattacharya, P. K. Plant, T. K. Growth and Characterization of GaInAsP/InP Liquid Phase Epitaxial Layers	Electrical Engr.	Army	222,197	3 yr
Bucolo, R. J. Modeling of Metabolic System in Obesity and Diabetes	Electrical Engr.	PHS	104,250	3 yr
Engle, J. F. The Spark Ignition of Fuel-Air Mixtures	Electrical Engr.	USDE-BPA	36,898	1 yr
Frick, P. A. Lauw, H. K. A New Approach to Optimal Automatic Generation Control	Electrical Engr.	EPRI	158,096	2 yr
Frick, P. A. Optimal Regulation of Two or More Low Head Hydroelectric Plants	Electrical Engr.	USDE	95,485	29 mo
Lauw, H. K. Macroscopic Modeling of the Electromechanical Dynamics in Large-Scale Power Syste	Electrical Engr.	NSF	69,539	2 yr
Lauw, H. K. Modeling of University Machine for EMTP	Electrical Engr.	USDE-BPA	27,475	1 yr
Lewis, T. G. A Microprocessor Development Laboratory	Electrical Engr.	Zilog Corp.	12,565	
Mohler, R. R. Engineering Systems Approach to Cell Kinetics, Immunological Modeling	Electrical Engr.	NSF	136,250	2 yr
Mohler, R. R. Modeling, Control and Identification of Bilinear Systems	Electrical Engr.	NSF	124,337	2 yr
Owen, S. J. T. Investigations of Ge/GaAs Heterojunctions	Electrical Engr.	ONR	17,768	1 yr

Investigator	Department	Grant Agency	Amount	Term
Plant, T. K.	Electrical Engr.	NSF	55,758	2 yr
A Study of Deep Levels in Ion-Implanted GaAs				
Powers, V. M.	Electrical Engr.	NSF	18,220	1 yr
Computer Science and Computer Engineering Research Equipment				
Van Sickle, J.	Electrical Engr.	EPA	35,911	1 yr
Temporal Variability in Stream Ecosystems (Revision)				
Campbell, J. C.	Industrial Engr.	USDT	20,000	1 yr
Evaluation of Comfort Criteria and Design Recommendations for Individual Seating				
Fichter, E.	Industrial Engr.	NSF	31,967	2 yr
Assembly Method for a New Design of Leaf Cutter Bee Nesting Site				
Knudsen, J. G.	Engineering Exp. Sta.	Wheelabrator Corp.	13,751	10 mo
McDowell, E. D.	Industrial Engr.			
Experimental Design Related to the Biomass Liquefaction Facility				
Riggs, J. L.	Industrial Engr.	NSF	49,312	2 yr
Development of Supplementary Criteria for Benefit-Cost Analyses				
Riggs, J. L.	Industrial Engr.	NSF	22,091	18 mo
LOCI: Development of a Manufacturing Engineering Option as a Cooperative Venture				
Bushnell, D.	Mechanical Engr.	NSF	232,611	2 yr
Systems Analysis, Heat Transfer Studies and Component Design				
Holley, W. E.	Mechanical Engr.	USDE	15,651	1 yr
A New Method for Wood Stove Performance Testing				
Larson, M. B.	Mechanical Engr.	NSF	166,180	30 mo
Reistad, G. M.				
Experimental Evaluation of Natural Convection in Vertical Circular Cylinders				
Larson, M. B.	Mechanical Engr.	NSF	30,300	
Laser Doppler Anemometer System				

Investigator	Department	Grant Agency	Amount	Term
Larson, M. B.	Mechanical Engr.	USDE	39,435	1 yr
Use of Unglazed Collectors with Water Source Heat Pumps in the Pacific Northwest				
Mingle, J. G.	Mechanical Engr.	Oregon	71,415	1 yr
Determine the Impacts of Using Blends of Gasoline and Alcohol				
Reistad, G. M.	Mechanical Engr.	USDE	17,309	8 mo
Heat Pumps for Geothermal Applications; Availability and Performance				
Thornburgh, G. E. Junge, D. C.	Mechanical Engr.	USDE	139,090	1 yr
Investigation of the Rate of Combustion of Wood Residue Fuels				
Thresher, R. W.	Mechanical Engr.	USDE	175,470	18 mo
Wind Response Characteristics of Horizontal Axis Turbines				
Thresher, R. W.	Mechanical Engr.	USDE	34,376	1 yr
Wind Turbine Design Parameters and Related Economic Trends				
Wilson, R. E.	Mechanical Engr.	USDE	29,999	1 yr
Darrieus Rotor Aerodynamics				
Binney, S. E.	Nuclear Engr.	Exxon	87,539	18 mo
Effects of Moisture on Radon Emanation				
Binney, S. E.	Nuclear Engr.	Exxon	86,183	6 mo
Low-Grade Uranium Resources - Seawater				
Dodd, B.	Nuclear Engr.	USDE	112,654	27 mo
Determinations of Dose Equivalent Index				
Dodd, B.	Nuclear Engr.	USDE, EPRI, PGE	74,287	2 yr
Operational Health Physics Computer Code				
Peddicord, K. L.	Nuclear Engr.	EIR	47,534	1 yr
Evaluation of Models for the Prediction of the Performance of Sphere Pac Mixed Carbide Fuel Pins				

Investigator	Department	Grant Agency	Amount	Term
Peddicord, K. L.	Nuclear Engr.	NSF	72,811	2 yr
Heat Conduction in Eccentric Annuli				
Peddicord, K. L.	Nuclear Engr.	USDE	2,390	1 yr
Nuclear Techology Workshops				
Peddicord, K. L.	Nuclear Engr.	EPRI	24,920	1 yr
Transient Fuel Pin Temperature Algorithms Based on Describing Functions				
Robinson, A. H.	Nuclear Engr.	USDE	39,419	1 yr
Methods of Utilizing and Burning Actinide Wastes in a Very Fast Spectrum Reactor				
Robinson, A. H.	Nuclear Engr.	Army	99,560	14 mo
Neutron Radiographic Evaluation of Liquid Propellants (Revision)				
Spinrad, B. I.	Nuclear Engr.	EPRI & EIR	44,274	1 yr
Sphere Pac Ceramic Fuel in a Safeguarded Fuel Cycle				

Ph.D. Theses
June 1979

Maurice Ades
Nuclear Engineering
"Modeling of the Thermal Behavior of Irradiated Sphere-Pac Mixed Carbide Fuel"

Nikola Milivoj Catipovic
Chemical Engineering
"Heat Transfer to Horizontal Tubes in Fluidized Beds: Experiment and Theory"

Ramamurti Chandramouli
Electrical & Computer Engineering
"Multiple Fault Detection in Iterative Arrays"

Chia-Mao Chang
Industrial & General Engineering
"Multiperiod Multiple-Item Dynamic Lot Sizing Problem When Discounts are Available"

Ching-Shung Hsu
Electrical & Computer Engineering
"Bilinear Control Processes with Application to Immunology"

Goran Jovanovic
Chemical Engineering
"Gas Glow in Fluidized Beds of Large Particles: Experiment and Theory"

Perng-Yi Ma
Electrical & Computer Engineering
"Optimizing the Microcode Produced by a High Level Microprogramming Language"

Robert William McVicar Jr.
Industrial & General Engineering
"The Sinking Fund Problem: Optimal Timing of Bond Purchases"

Eldon Dale Olsen
Industrial & General Engineering
"Manpower Pattern Prediction for Multi-Project Situations"

James C. Rawers
Mechanical Engineering
"Fracture Energies of Some Zirconium Alloys"

In Kyu Ro
Industrial & General Engineering
"Development of an Information Processing Capacity Estimation Method for Managing a Project Subjected to Disruptions"

Ajit Govind Rode
Electrical & Computer Engineering
"Injection of Electrons into Silicon Dioxide from Planar Silicon Structures"

Turner Japhet Trapp
Nuclear Engineering
"The Effects of the Depletion and Buildup of Fissile Nuclides and of 238U Fast Fissions on Fission Product Decay Power"

Chi Hung Wu
Nuclear Engineering
"Average Beta and Gamma Decay Energies of the Fission Products"

M.S. Theses
June 1979

Mujib Ahmed
Civil Engineering
Non-Thesis Option

Severino Terence Andrade
Electrical & Computer Engineering
Non-Thesis Option

Jonathan Russell Axt
Mechanical Engineering
Non-Thesis Option

Mohsen Bahrami
Mechanical Engineering
Non-Thesis Option

Ravindranath B. Baliga
Civil Engineering
"Sand Waves in a Pristine Estuary"

Tim Robert Brandenburg
Civil Engineering
Non-Thesis Option

Somsak Chaiyapinunt
Mechanical Engineering
Non-Thesis Option

Srikumar Rama Chandran
Electrical & Computer Engineering
Non-Thesis Option

Hsiao-Hwa Chao
Mechanical Engineering
"An Investigation of Slumping Behavior in Cold-Phase Fluidized Bed"

Vanit Chintakovid
Civil Engineering
Non-Thesis Option

Binfu Chuang
Electrical & Computer Engineering
Non-Thesis Option

William W. Y. Chung
Mechanical Engineering
Non-Thesis Option

Jean-Jacques Lucien Cogne
Civil Engineering
Non-Thesis Option

Muhammad Abdul-Rahman Da'ous
Chemical Engineering
Non-Thesis Option

Sankar De
Electrical & Computer Engineering
Non-Thesis Option

Stephen Craig Downs
Civil Engineering
Non-Thesis Option

Bruce Jackson Duffe
Civil Engineering
Non-Thesis Option

Russell Stewart East
Civil Engineering
Non-Thesis Option

William Clarence Eberlein
Mechanical Engineering
Non-Thesis Option

Timothy Robert Emery
Electrical & Computer Engineering
"Nonsymmetrical Coupled Microstrip Lines for Applications as Ideal Directional Couples"

Charles Joseph English, Jr.
Civil Engineering
"Determination of the Equilibrium Partial Pressure of Ammonia Gas Above Anaerobically Digested Sewage Sludge"

Greg Bryan Frandsen
Mechanical Engineering
Non-Thesis Option

Stephen Frank Gaines
Mechanical Engineering
"Single Rod Wetting With Simulated Fuel-Cladding Gap"

Douglas Drake Gransberg
Civil Engineering
Non-Thesis Option

Miroslav Gregoric
Mechanical Engineering
"Experimental Investigation of Merging Buoyant Jets in a Crossflow"

Richard John Guenther
Nuclear Engineering
"The Applicability of Sintering Mechanisms in the Initial Stage Restructuring and Preferential Pore Migration of Irradiated $(U_{0.85}Pu_{0.15})C$ Sphere-Pac Fuel"

Paul Stephen Hamer
Electrical & Computer Engineering
Non-Thesis Option

Robert M. Hansen
Civil Engineering
"Optimizing Intake Screens for Ocean Thermal Energy Conversion Plants"

Michael Carl Hartley
Civil Engineering
Non-Thesis Option

David Delvin Hostetler
Mechanical Engineering
Non-Thesis Option

Kitty Ai-ping Hsieh
Nuclear Engineering
"Evaluation of the Economic Risk from Nuclear Power"

Robert Edward Jensen
Civil Engineering
"Finite Amplitude Deep Water Waves
A Comparison of Theoretical and
Experimental Kinematics and Dynam

John Richard Joiner
Electrical & Computer Engineering
Non-Thesis Option

Yong Joong Kang
Electrical & Computer Engineering
Non-Thesis Option

Goutama Sai Kantamaneni
Electrical & Computer Engineering
Non-Thesis Option

Richard Hoeffner Kehr
Civil Engineering
"A Procedure to Identify and Eval
ate Forest Arterial and Collecto
Road Networks"

Sharad Shantaram Khamkar
Electrical & Computer Engineering
Non-Thesis Option

David Roy Koberstein
Civil Engineering
Non-Thesis Option

Jimmy Arnold Kooiman
Civil Engineering
Non-Thesis Option

Sudhir Sitaram Krishna
Mechanical Engineering
"Computer Simulation and Evalua-
tion of Solar Cooling Systems
With Hot and Cold Storage Optior

Joseph Weiyeh Ku
Electrical & Computer Engineering
Non-Thesis Option

Dennis Lawrence Lambright
Civil Engineering
Non-Thesis Option

Daniel Tak Ling Lau
Electrical & Computer Engineering
Non-Thesis Option

Hon-Keung Lau
Electrical & Computer Engineering
Non-Thesis Option

Sai Heep Lee
Chemical Engineering
"Deposition Characteristics of Magnesium Silicate and Calcium Carbonate in Cooling Tower Water"

Louis Arthur Licht
Agricultural Engineering
"A Prototype Wet Packed Bed Scrubber for Controlling Odor Emission from a Confinement Livestock Building"

Jorge Fco Martinez-Carballido
Electrical & Computer Engineering
Non-Thesis Option

Robert Leonard Merritt
Mechanical Engineering
Non-Thesis Option

Charles Ray Miles
Mechanical Engineering
"Modelling and Flow Measurement of Shallow Geothermal Systems with Downhole Heat Exchangers"

Yoshihiro Miyakawa
Industrial Engineering
"Development of Network Location Algorithm for Resource Planning and Management"

Mohammad Ali Mobarhan
Electrical & Computer Engineering
Non-Thesis Option

Seung-Chai Nam
Electrical & Computer Engineering
Non-Thesis Option

Patat Natjumnong
Electrical & Computer Engineering
Non-Thesis Option

Kevin Scott Nichols
Civil Engineering
"Safety Analysis Technique for Evaluation of Highway Geometrics"

Frans C. Nurtanio
Electrical & Computer Engineering
Non-Thesis Option

Richard Charles Oksness
Civil Engineering
Non-Thesis Option

John W. Olsen
Electrical & Computer Engineering
Non-Thesis Option

Melrose Charles Olson
Chemical Engineering
Non-Thesis Option

Tyler Barnett Parsons
Civil Engineering
Non-Thesis Option

David Floyd Perkins
Electrical & Computer Engineering
Non-Thesis Option

Jonathan Woodrome Pote
Civil Engineering
"Modeling of Ammonia Losses in Sprinkley Application of Animal Wastes"

Ramachandran Radhakrishnan
Industrial Engineering
Non-Thesis Option

Haseeb Abid Rana
Electrical & Computer Engineering
Non-Thesis Option

Subrahmaniam Rathnam
Electrical & Computer Engineering
Non-Thesis Option

Robert Irvin Scherpelz
Nuclear Engineering
"The Measurement of Uranium Concentrations by the Delayed Neutron Counting Technique"

Pravin R. Shah
Electrical & Computer Engineering
Non-Thesis Option

Chien-Fu Shih
Electrical & Computer Engineering
Non-Thesis Option

Ajay Prakash Shingal
Electrical & Computer Engineering
Non-Thesis Option

Kenneth Basil Simons
Civil Engineering
Non-Thesis Option

David Charles Squire
Electrical & Computer Engineering
"A Simulation Study of a Heuristic Technique for Approximating Availability Percentiles for Cascaded Independent Systems"

Leslie A. Stout
Chemical Engineering
Non-Thesis Option

Amitabh Tripathi
Nuclear Engineering
Non-Thesis Option

Joseph Edward Vecera
Mechanical Engineering
Non-Thesis Option

Bright Marn Kong Wong
Nuclear Engineering
"Correlation Analysis of Decay Hea
Experiments and Summation Calcula
tions"

Richard Thai Wang Kuo Yang
Mechanical Engineering
Non-Thesis Option

Christopher Si Young
Civil Engineering
Non-Thesis Option

DuWayne Aaron Zuehlsdorff
Chemical Engineering
"Absorption of Ammonia in Water Using a Multiple Stage Cross-current Packed Column"