1977

College of Engineering research activities and annual report, July 1, 1976-June 30, 1977

University of Central Florida. College of Engineering

COLLEGE OF ENGINEERING

JULY 1, 1976 - JUNE 30, 1977

Florida Technological University

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INTRODUCTION

Confronting the United States and other nations is the prospect of declining resources to satisfy the needs of an increasing population. Predictably, individual, governmental, and industrial attention turns to engineering and applied sciences for solutions to extremely complex problems. This is a compliment to the engineering profession and requires renewed "best efforts."

At stake is Florida's and this nation's ability to compete successfully in the marketplace, provide jobs, deliver health care, produce energy, provide national security, maintain quality of life, etc. Achievement of these objectives will require creative/innovative engineering services. Old designs solve yesterday's problems. The needs of today and tomorrow will require new designs which inherently must derive from current education and research.

Technological excellence has provided America with many advantages and has made more to contribute in the future; but innovation is the key, and an environment that facilitates it must be maintained and cultivated -- not eroded.

To that end the creative efforts of College of Engineering faculty and students (as reflected herein) are dedicated. Personal, professional, institutional, and governmental policies must facilitate rather than obstruct the crucial creative process.

We are pleased to present herewith the sixth Resume of Research Activities of the faculty and students of the College of Engineering. The dollar volume of "research-in-force" exceeded $700,000 for the year. The number of persons involved, the number of sponsored and unsponsored projects, and the number of publications resulting therefrom all show increases over last year.

Robert D. Kersten
Dean

FORWARD

The cultural, economic, and social stability of the peoples of the world partly depend on research. Stability with circumspect advancements is derived from the labors of research. The goals of research tend toward development of basic laws governing natural phenomena and the application of technology using existing data for more satisfying life. Results of research endeavors affect life.

The technical challenges and social demands of the early 1970's have precipitated a need for research in the areas of energy sources, environmental quality, and cost-effective resource utilization. Scarce resources and increasing demands require a precise definition of existing resource quantities and a standard of living with alternative engineering solutions. These solutions must avoid, lessen, or remove those impacts that would continue or initiate social decay. The College of Engineering Research Program was directed toward the improvement of reliable energy sources, environmental amenities, and resource distribution.

Now is the time to be an Engineer engaged in research. The opportunities for contribution in applied and basic research are developing at a rapid pace. Technical and managerial improvements for energy independence, health, welfare and environmental quality are required. Research efforts and publications in this report are focused on the applied portion of research in these areas. Practical and profitable advances are evident. When appropriate, the interdependencies of the energy and environmental areas have been recognized.

What we collectively leave for future generations depends to a great extent on our awareness and use of research. The execution of research within the constraints of existing knowledge can better our life. To accomplish this, the research must use serenity, courage, and wisdom in his work.

> *He must be granted the serenity to accept the things he cannot change, courage to change the things he can, and the wisdom to know the difference.*

The activities in this report are a credit to those researchers with creative performance that results in benefits for future generations.

Martin Paul Wanielista, PhD, P.E.
Gordon J. Barnett Professor of
Environmental Systems Management

DEAN'S OFFICE REPORT

The year 1976-77 was another excellent year for the College of Engineering. Enrollments, degrees granted, and research and service related activities all increased during the year. This report describes the more important developments of the year and summarizes research activities for the year.

This year marked the end of the third year of operation under the "professional school" concept. This step, taken by the Engineering Faculty in the Fall of 1974, places emphasis on a total engineering education program of Engineering and continues research and service responsive to the State of Florida and National needs.

COE Faculty have responded extremely well to this concept. They are going the "second mile" in guaranteeing continued professional competence, achieving professional registration, and interacting with the many professional technical and learned societies that impact on our way of life.

The College received notice of accreditation action by the Engineers' Council for Professional Development during the year. All five engineering curricula are now accredited at the basic (BSE) level and at the advanced (MSE) level.

Cooperative efforts among all SUS Engineering Colleges (FTU, USF, UF, FAU) continued and resulted in (a) favorable legislative action regarding participation in the Engineering and Industrial Experiment Station activities by all units and (b) initiation of the State Technical Assistance Centers (STAC), partially funded by NASA and Florida Department of Commerce (FTU, UF, USF).

Engineering students continue to receive a variety of scholarly and professional recognitions. James Kohler (IEMS) received the first Ernst Goldstein Scholarship, Stephen Livermore (EECS) was the first Co-op student to receive the NASA Sustained Superior Performance Award, the local Society of Women Engineers was honored as the "outstanding" new chapter in the United States, and Epsilon Chi Pi petitioning group to Tau Beta Pi was officially invited to the annual conference at Purdue University in October, 1977 where final action on their petition will be taken.

Drs. Denning, Gambrell, Kersten and Schrader served on the Engineers' Council for Professional Development and/or Southern Association for Colleges and Schools accreditation visiting committees during the year. Dr. Gambrell serves as an alternate member of the Board of Directors and as a Council Member of ECPD.

Two faculty (Drs. Carroll and Rapson) received NASA/ASEE Summer Faculty Fellowships during the year. Dr. Gambrell served on the Scientific Advisory Group of the U.S. Army Test and Evaluation Command, Dr. Schrader continued as Vice President of AIIE, and Dr. Kersten was named Vice Chairman of the Board of Trustees of the Institute for Certification of Engineering Technicians sponsored by the National Society of Professional Engineers.

The COE Board of Visitors continued active. Membership includes:

Dr. George Burnet - Iowa State University
Mr. Emory Dawkins - Dawkins and Associates, Inc.
Dr. William L. Everitt - University of Illinois

Mr. Richard Forberg - Proctor and Gamble Company
Dr. Harold B. Gotaas - Northwestern University
Dr. Richard E. Grace - Purdue University
Dr. Marvin Gustavson - Lawrence Livermore Laboratory
Dr. George J. Huebner, Jr. - Chrysler Corporation (Retired)
Mr. Donald C. Latham - Martin Marietta Aerospace
Mr. Paul D. O'Donnell - Westinghouse Electric Corporation
Dr. James Renier - Honeywell, Inc.
Mr. Miles Ross - National Aeronautics and Space Administration
Senator John Vogt - Cocoa Beach
Mr. H. L. Wilhite - Florida Gas Company

Agenda items considered during the year were (1) Economic Development, (2) Improved Productivity in Industry, (3) Technology Transfer to Developing Countries, and (4) Impact of R & D Expenditures on Productivity. The Board of Visitors has been a vital element in the development of COE programs in recent years.

Finally, the "second mile" efforts of the many faculty and students in research and service activities is acknowledged. Persons interested in any of the topics included in this report are invited to contact the appropriate Principal Investigator.

CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCES

Chairman: J. Paul Hartman

Faculty: V. H. Baldwin, D. L. Block, W. E. Carroll, C. D. Cooper, R. H. Fagan, D. R. Jenkins, R. D. Kersten, W. M. McLellon, M. P. Wanielista, and Y. A. Yousef

The Civil Engineering and Environmental Sciences Department has maintained a very active posture during the 1976-77 year. There were increased class sizes in the discipline courses at both the basic (undergraduate) and advanced (graduate) levels. The current option offered by the department is in Environmental Engineering.

Research within the department continued strong. Dr. Yousef, Director of the Environmental Systems Engineering Institute, made appreciable progress on his research on mixing in lakes due to boating activities. He also was a co-director of the highly successful SEEK 76 conference which was held at FTU in August 1976. Dr. Wanielista has been working on three research efforts- the fate of automobile related pollutants, groundwater and surface water quality from an underdrain system, and the most cost-effective method for treating stormwater. Dr. Jenkins has been working on the problem of stresses due to inclusions in materials, and is doing both experimental and analytical work (finite element) on this problem. Dr. Hartman has continued his NSF research on finite element analysis of the pressuremeter test. Dr. Carroll continues his finite element research and made a paper presentation at the International Symposium on Innovative Numerical Analysis in Applied Engineering Sciences in Versailles, France, in May 1977. Dr. Wanielista was awarded the 1977 FTU Foundation Award for Excellence in Research.

Departmental faculty have been active in technical society and professional development work and are members of local, regional, or national committees within a number of these societies. Dr. Jenkins has been the faculty advisor for the ASCE Student Chapter as well as for the College of Engineering honorary society, Epsilon Chi Pi, which had a visit this past year from Tau Beta Pi and is petitioning association with that organization. Dr. McLellon served as Vice President for Professional Affairs of the Florida Engineering Society during 1976-1977.

Statistically, the CEES department graduated 8 BSE students and 10 MS, MSE, or MSESM students (August 1976 - June 1977). The faculty had $234,000 in grants effective during the 1976-77 fiscal year. Several research proposals have been submitted for funding in 1977-78 and the faculty continue to be active in national and state professional and community service activities.

CEES students both undergraduate and graduate continue to be active on faculty research projects. CEES students, David Ponsford and Jeff Telander received College of Engineering Scholarship Awards in the Spring of 1977, David the Special Florida Engineering Society Sophomore Scholarship and Jeff the Florida Engineering Society Senior Scholarship. In addition, Jeff was selected to be a member of the President's Leadership Council for the University.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BLOCK, D. L., "A Unified Profession - Can It Be Done?," FES Journal, December, 1976.

2. CARROLL, W. E., D. R. JENKINS, and T. L. WADE, "A Cylindrical Inclusion Encased in a Soft Interlayer," Proceedings of the Fifteenth Midwestern Mechanics Conference, Vol. 8, University of Illinois at Chicago Circle, Chicago, IL, March, 1977.

3. CARROLL, W. E., "User Oriented Mesh Refinements in the Discrete Element Analysis Technique," Proceedings of the Second International Conference on Vehicle Structural Mechanics, Southfield, MI, April, 1977.

4. CARROLL, W. E., "On the Reformulation of the Finite Element Method," Proceedings of the International Symposium on Innovative Numerical Analysis in Applied Engineering Science, Versailles (France), May, 1977.

5. GOLDING, B. J., and M. P. WANIELISTA, "Loading Rates and Pollutants," Urban Hydrology Workshop, Florida Technological University/ASCE, Lake Buena Vista, FL, September 23, 1976.

6. HARTMAN, J. P., W. M. McLELLON, M. P. WANIELISTA, and Y. A. YOUSEF, "A Five Year Basic and Advanced Level Program in Environmental Engineering," ASEE Annual Conference, Knoxville, TN, June 14-17, 1976.

7. HARTMAN, J. P., "Pocket Calculators and Classroom Testing - Additional Suggestions," Journal of the Educational Research and Methods Division, American Society for Engineering Education, Vol. 9, No. 1, Fall, 1976.

8. HARTMAN, J. P., and W. M. McLELLON, Discussion of "Is Undergraduate Environmental Engineering Education Desirable?," Journal of the Environmental Engineering Division, American Society of Civil Engineers, February, 1977.

9. HARTMAN, J. P., and W. M. McLELLON, Discussion of paper by P. W. Purdom "Is Undergraduate Environmental Engineering Education Desirable?," Journal EED, Proc. ASCE, 103, EE1, 141-142, February, 1977.

10. KERSTEN, R. D., "Professional Development for Engineering Faculty," Proceedings, Specialty Conference on Ethics, Professionalism and Maintaining Competence, American Society of Civil Engineers, Ohio State University, March 10-11, 1977.

11. KERSTEN, R. D., and J. M. SNARPONIS, "Facilitating Innovation on the Part of the Engineering Team," Professional Engineer, Vol. 47, No. 6, June 1977.

12. McLELLON, W. M., "Professionalism," Preprints, Annual Meeting, Florida Section, ASCE, Orlando, FL, September 23-25, 1976.

13. WANIELISTA, M. P., 'Design Storms and the Computation of Excess Runoff," Urban Hydrology Workshop, Florida Technological University/ASCE, Lake Buena Vista, FL, September 23, 1976.

14. WANIELISTA, M. P., Y. A. YOUSEF, J. IZZO, and G. BARAGONA, "Nonpoint Effects from a Pasture and Woodland Area," 1976 Annual Meeting of the American Society of Agricultural Engineers, University of Nebraska, Lincoln, June 27-30, 1976.

15. WANIELISTA, M. P., Y. A. YOUSEF, and W. M. McLELLON, "Nonpoint Source Effects on Water Quality," Journal Water Pollution Control Federation, Vol. 49, No. 3, March, 1977, pp. 441-451.

16. WANIELISTA, M. P., Y. A. YOUSEF, and W. M. McLELLON, "Transient Water Quality Responses from Nonpoint Sources," Journal Water Pollution Control Federation, March 1977, pp. 441-451.

17. YOUSEF, Y. A., M. P. WANIELISTA, et. al., Waste Load Allocation for Tampa Bay Tributaries, Technical Report, ESEI-76-S, Florida Technological University, July, 1976.

18. YOUSEF, Y. A., and E. GLOYNA, "A Transport Model for Long Term Radionuclides Release into a Stream Ecosystem," to be published as a separate chapter in Volume 8.2 of Advances in Environmental Sciences and Technology, entitled 'Fate of Pollutants in the Air and Water Environments," to be published by John W. Wiley & Sons, Inc., the final review was made March 16, 1977.

CONFERENCES, WORKSHOPS, SHORT COURSES AT WHICH RESULTS OF RESEARCH WERE COMMUNICATED

1. ASEE Annual Conference, Knoxville, TN, June 14–17, 1976, "A Five Year Basic and Advanced Level Program in Environmental Engineering." (Hartman, McLellon, Wanielista, Yousef)

2. SEEK 76, FTU, Orlando, FL, August 1–4, 1976.
   a) "Group Dynamics Sessions on Energy and Environment." (Wanielista)
   b) "Toward Century Three: Our American Engineering Heritage." (Hartman)
   c) "General Conference." (Yousef)

3. Orange County Science Teachers Association, Rollins College, Winter Park, FL, August 24, 1976, "Toward Century Three: Our American Engineering Heritage." (Hartman)

4. Urban Hydrology Workshop, FTU and ASCE, Orlando, FL, September 23, 1976.
   a) "Design Storms and the Computation of Excess Runoff." (Wanielista)
   b) "Loading Rates and Pollutants." (Golding, Wanielista)

5. Florida Section, American Society of Civil Engineers, Annual Meeting, Orlando, FL, September 23–25, 1976.
   a) "Toward Century Three: Our American Engineering Heritage." (Hartman)
   b) "Professionalism." (McLellon)

6. Florida Pollution Control Association and Florida Section American Water Works Association, Joint Annual Meeting, Tampa, FL, October 24–27, 1976, "Phosphorus Profiles within the Sediments of Selected Florida Lakes." (Yousef, Stewart)

7. Civil Engineering Department Seminar, North Carolina State University, Raleigh, NC, December 2, 1976, "Our American Civil Engineering Heritage." (Hartman)

8. East Central Branch, Florida Section, American Society of Civil Engineers, Orlando, FL, December 14, 1976, "Hellenistic and Roman Engineering." (Hartman)

9. State of Florida 208 Project Directors Meeting, January 20, 1977 and April 6, 1977, "Runoff Quality and Quantity from Urban Lake Uses." (Wanielista)

10. Senior Seminar, University of South Florida, Tampa, FL, February 22, 1977, "Toward Century Three: Our American Engineering Heritage." (Hartman)

11. U.S. EPA Symposium on Rate Constants, Coefficients, and Kinetics Formulation in Surface Water Modeling, Concord, CA, February 22–25, 1977, "Seasonal Variations of Rate Coefficients from a Stream in Florida." (Yousef)

12. Zero Population Growth, College of Humanities and Fine Arts and Florida Endowment for the Humanities Conference on "Will My Child Have a House of His Own?" "Can Technology Help to Solve Present and Future Problems Related to Home Ownership?" FTU, Orlando, FL, February 24-25, 1977. (McLellon)

13. American Society of Civil Engineers, Specialty Conference on Ethics, Professionalism and Maintaining Competence, Ohio State University, March 10-11, 1977.
    a) "Professional Development for Engineering Faculty." (Kersten)
    b) "Driving Forces for Demonstration of Proficiency." (Kersten)
    c) "Certificate of Continued Professional Development." (Block)

14. Fifteenth Midwestern Mechanics Conference, University of Illinois at Chicago Circle, March 25, 1977, "A Cylindrical Inclusion Encased in a Soft Interlayer." (Jenkins, Carroll, Wade)

15. ASEE Southeastern Section Annual Meeting, Civil Engineering Division, Tampa, FL, April 5, 1977, "Our American Civil Engineering Heritage." (Hartman)

16. Second International Conference on Vehicle Structural Mechanics, Southfield, MI, April 1977, "User Oriented Mesh Refinements in the Discrete Element Analysis Technique." (Carroll)

17. International Symposium on Innovative Numerical Analysis in Applied Engineering Science, Versailles (France), May 1977, "On the Reformulation of the Finite Element Method." (Carroll)

18. ASCE Workshop on Florida Water Problems, University of South Florida, Tampa, FL, June 9-10, 1977, "Direct Use of Wastewater - The Case For." (Wanielista)

RESUMES OF SPONSORED RESEARCH

TITLE: Finite Element Analysis of the Presuremeter Test in Cohesive Materials

PRINCIPAL INVESTIGATOR: Dr. J. P. Hartman, P.E.

SPONSORING AGENCY: National Science Foundation

GRANT NUMBER: NSF ENG 75-05331

A B S T R A C T

The objective of this research is to extend analytic capability for interpreting presuremeter test data from the one dimensional to the three dimensional case. This will be accomplished by utilizing existing data in conjunction with a recently developed finite element program. Parametric studies of a nonlinear cohesive model will include: borehole disturbance and unloading, cohesion, limit pressure and failure criteria.

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TITLE: Inclusion Stresses

PRINCIPAL INVESTIGATOR: Dr. D. R. Jenkins, P.E.

SPONSORING AGENCY: FIU In-House Research Project

GRANT NUMBER: 18-20000-046

A B S T R A C T

The three-dimensional state of stress in a polyester resin matrix containing a single glass rod reinforcement element is being determined by scattered light photoelasticity. Primary interest is in the region near the tip of the inclusion. The experimental work on this research is well along since both the laser-optical system for making measurements and the scanning photometer system for interpreting measurements have been developed. In addition, analysis of the stresses in a specimen of this type is being done by a finite element technique using the SAP IV program. Part of the work has already been reported in a paper titled, "A Cylindrical Inclusion Encased in a Soft Interlayer", by D. R. Jenkins, T. L. Wade, and W. E. Carroll which was presented at the 15th Midwest Mechanics Conference in March, 1977.

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TITLE: Water Quality From an Underdrain System in Seminole County, Florida

PRINCIPAL INVESTIGATOR: Dr. M. P. Wanielista, P.E.

SPONSORING AGENCY: Seminole County Planning Division

GRANT NUMBER: FTU # 111620004

A B S T R A C T

Relative to non-drained environments, drained areas provide environments which reduce the probability of disease transmission. Drainage of land areas will also improve economic value and recreation activities. When land is drained, increases in water volume, peak discharge, and pollutants are possible. However, an underdrain (french drain) system would slowly release water, thus peak discharges may be less than pre-drainage conditions, and the soil acts to filter pollutants.

Water quality and flow estimates are made on a bi-monthly basis. Sampling is done for nutrients, bacteriological, organics, and physicochemical parameters.

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TITLE: Best Management Practices for Nonpoint Sources

PRINCIPAL INVESTIGATOR: Dr. M. P. Wanielista, P.E.

SPONSORING AGENCY: Environmental Protection Agency

GRANT NUMBER: Orlando Area 208

A B S T R A C T

The research duration is for 15 months. This abstract reports on the first 12 months of the research.

Nonpoint source effects in terms of loading rates (mass) and concentration for selected pollutants have been documented for the State of Florida, but are not complete. Missing are data related to specific land uses. In addition, there is little hydrologic and water quality data for the efficiencies of land intensive management practices for the abatement of nonpoint source effects.

Reasons for the choice of management methods must be documented and existing data gathered for evaluation. From this data, best engineering and economic judgements must be made to develop generalized cost-effective design and operating management practices. In the Central Florida region, management practices are being utilized.

Hydrologic and water quality data has been collected for at least 6 storm events on 9 management practices. The practices are (1) diversion to

percolation, (2) percolation, (3) swales with percolation, (4) swales, (5) cypress strand, (6) sedimentation basin, (7) underdrains, (8) fabric bag, and (9) vacuum sweeping. The cost and efficiency of these basins have been estimated from field collected data.

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TITLE: Roadside Deposition of Automobile Related Pollutants

PRINCIPAL INVESTIGATORS: Dr. M. P. Wanielista, P.E., Dr. R. Gennaro and Mr. R. Fagan

SPONSORING AGENCIES: State Board of Regents and State Department of Transportation

GRANT NUMBER: STAR 76-7093

A B S T R A C T

This is a preliminary report for a 15 month research project. The report is for the first 9 months.

Transportation right-of-ways have and will continue to be vital in our American social and economic system. Efforts to minimize the environmental impact of the activities within these right-of-ways are consistent with primary concerns related to our natural resources and secondary concerns related to health and general environmental management.

Because of the need for safety, transportation systems (especially highways) are elevated above water levels. Therefore, drainage for storm-water runoff must be provided. However, this drainage carries roadway pollutants (oil, nutrients, and organics) into the shallow-water roadside ditches and environments adjacent to the roadways. Information received from the Florida Department of Transportation (DOT) indicates that over 58 square miles of land, in Florida, are committed to roadside ditching.

The eventual disposition of the pollutants in the environment is relatively unknown. Questions regarding the concentrations of these pollutants in the plants, animals, soil, and water with their ultimate levels of concentrations should be documented to determine ultimate environmental management practices of the shallow-water roadside ditch. Field collected samples for metals and hydrocarbons are being evaluated. Preliminary results indicate that the metals are being stored in the soils immediately adjacent to the roadway.

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TITLE: Waste Load Allocations for Tampa Bay Tributaries

PRINCIPAL INVESTIGATORS: Dr. Y. A. Yousef, P.E. and Dr. M. P. Wanielista, P.E.

SPONSORING AGENCY: Department of Environmental Regulations

GRANT NUMBER: FTU # 111620002

A B S T R A C T

Streams and estuaries are utilized as carriers of treated wastewater and those who deal in water management will have to decide on the degree of treatment necessary before the discharge takes place. Wastewater treatment facilities discharging their effluent into Tampa Bay Tributaries located in Hillsborough, Manatee, Pinellas, Polk, and Sarasota counties were investigated. Estimates for their acceptable wasteloads were developed through the use of River and Estry mathematical models. Effluent limitations, in terms of carbonaceous and nitrogenous biochemical oxygen demand that should not depress the dissolved oxygen in the receiving stream during dry weather conditions below 5 mg/l, were determined. Analyses during wet weather conditions and limiting nutrients were beyond the scope of this study.

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TITLE: Mixing Effects Due to Boating Activities in Shallow Lakes

PRINCIPAL INVESTIGATORS: Dr. Y. A. Yousef, P.E., Dr. W. M. McLellon, P.E., and Mr. R. Fagan

SPONSORING AGENCY: U.S. Department of Interior, Office of Water Research and Technology

GRANT NUMBER: 13-34-0001-6203

A B S T R A C T

The proposed research plan involves laboratory and field investigations to determine mixing effects due to boating activities on shallow lakes. The main approach in the investigation is to quantify physical, chemical, and biological changes in selected shallow lakes due to agitation from limited boating activities. Relationships between agitation and resuspension of sediments will be developed. Various horse power motors will be mounted on boats and different lakes will be tested. Initiation of a predictive model to determine the allowable boating traffic on a particular lake will be attempted.

Laboratory and field data will be correlated for possible application in setting up guidelines by interested agencies and local groups.

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RESUMES OF UNSPONSORED RESEARCH

TITLE: Engineering Enrollment and Degree Data

PRINCIPAL INVESTIGATOR: Dr. D. L. Block, P.E.

A B S T R A C T

Computer program is written and currently is being debugged. Once completed, parametric studies of engineering enrollment and degree data will be conducted.

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TITLE: Finite Element Methods

PRINCIPAL INVESTIGATOR: Dr. W. E. Carroll, P.E.

A B S T R A C T

Two papers were written this quarter. One of these papers is being considered for presentation at "The Second National Symposium on Vehicle Structural Mechanics" in Detroit, Michigan. The second paper will be presented at the "International Symposium on Innovative Numerical Analysis in Applied Engineering Science" in Versailles, France. The author also implemented the computer programs DESAP I, DESAP II, and SAP IV on the FTU computer system.

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TITLE: Historic American Engineering Record

PRINCIPAL INVESTIGATOR: Dr. J. P. Hartman, P.E.

A B S T R A C T

Informal inventory of historic engineering works in Florida has continued. Several more sites have been located and inventory cards will be forwarded to Washington in 1977-78. Historic talks on "Our American Engineering Heritage" and "Our American Civil Engineering Heritage" have been given at local and regional meetings, including the Florida Section of the ASCE and the Southeastern Region of the ASEE. These presentations have also been made at the University of South Florida and North Carolina State University. A joint proposal to develop a course on American Engineering Transportation History with Princeton University has been submitted to the National Endowment for the Humanities.

PUBLICATIONS: Hartman, J.P. "Civil Engineering Landmarks: State of Florida," Florida Section, American Society of Civil Engineers, Bicentennial Project 1975-76.

Hartman, J.P. "Toward Century Three: Our American Civil Engineering Heritage," American Society of Civil Engineers, Florida Section Annual Meeting, September 23, 1976, Orlando, Florida.

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TITLE: Glass Rod Inclusion

PRINCIPAL INVESTIGATOR: Dr. D. R. Jenkins, P.E.

A B S T R A C T

A finite element analysis was carried out to determine stresses near an elastic inclusion embedded in a polymer matrix. The problem was treated as an axisymmetric one so that loading in the direction of the axis of the inclusion only was considered. The effect of a low-modulus interlayer between the inclusion and the matrix was investigated. Preliminary work done here eventually became part of a paper presented at the 15th Midwestern Mechanics Conference under the title, "A Cylindrical Inclusion Encased in a Soft Interlayer," by D. R. Jenkins, T. L. Wade, and W. E. Carroll.

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TITLE: Engineering Education and Economic Development (Parameters for Public Policy in Florida)

PRINCIPAL INVESTIGATOR: Dr. R. D. Kersten, P.E.

A B S T R A C T

Review of information relative to engineering and engineering education as a major force for economic growth. Determination of statistical parameters such as population, per capita income, degree productivity, Federal R & D support, university research, and college age enrollments. Analysis of parameters comparing Florida and the United States as a whole are presented.

PUBLICATION: Kersten, R.D. "Engineering Education and Economic Development," FTU/COE Institutional Research Report, March 1977.

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TITLE: Professional Development for Engineering Faculty

PRINCIPAL INVESTIGATOR: Dr. R. D. Kersten, P.E.

A B S T R A C T

A review of pertinent information related to engineering faculty activities and need for some measure of maintenance of competence. Such factors as formal study, training/continuing education, summer work experience, student evaluation of teaching, research acquisition, publications, presentations, society activities, professional registration, community service efforts, ad hoc consulting, etc. are considered.

A case study review of a faculty situation before and after the faculty imposed (1) professional registration, (2) evidence of maintenance of competence, and (3) evidence of professional service activities with ECPD type participating bodies as added criteria for promotion and tenure over and above university-wide criteria.

PUBLICATION: Kersten, R.D. "Professional Development for Engineering Faculty," Proceedings, Specialty Conference on Ethics, Professionalism and Maintaining Competence, Ohio State University, March 10-11, 1977.

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ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: Infiltration in Stormwater Detention/Percolation Basin Design

CANDIDATE: Robert D. Beaver

FACULTY ADVISOR: Dr. J. Paul Hartman

A B S T R A C T

Investigations of soil parameters, infiltration testing, and storm observations are used to determine the infiltration characteristics for three Central Florida stormwater holding basins. Basic soil parameters are investigated and a value for available soil water storage is computed from these data.

In-situ permeability and infiltration tests are used to obtain field permeability and infiltration rates. Infiltration test results may be applied to infiltration theory. Data from infiltration tests may be verified using available soil water storage computed from soil parameters. The effect of soil cover conditions is noted and investigated using the drum infiltrometer.

Storm observations are used to confirm infiltration models. Infrequency of rainfall activity limited the number and reliability of observations. The effects of precipitation frequency and input intensity to the pond are also noted in storm observations.

A design procedure incorporating infiltration in stormwater retention basins is presented. This design procedure is based on infiltration theory and observed pond operation.

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TITLE: Solid Waste Resource Recovery Plan for Dekalb County Georgia

CANDIDATE: Ivan Ray Dory

FACULTY ADVISOR: Dr. Yousef A. Yousef

A B S T R A C T

A study was made of the feasibility of implementing a system of Resource Recovery from the solid wastes of an urban county in Georgia. A review was made of the existing solid waste management practices and present generation rates. A projection of future waste quantities and composition was made. A review of the present state of the art of recovering resources from solid waste was made to determine what systems could be developed for the County. An analysis of the estimated costs during a test year for three alternative systems for disposal was made to determine a least cost alternative. In that no markets for a refuse derived fuel exist in the County and

all costs which may be applicable to the landfill alternative cannot be defined in terms of current costs, the cost of Resource Recovery excedes the costs of conventional landfilling. Recommendations are for the County to develop markets and make provisions for future development of a system to recover resources from their wastes. In the meantime they should pursue their present plan of disposing of their wastes in a Sanitary Landfill.

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TITLE: Sewer System Design for Camp Challenge and Determination of Per Capita Flows from Vacation Facilities

CANDIDATE: William C. Goucher

FACULTY ADVISOR: Dr. Martin P. Wanielista

A B S T R A C T

A sewer system was designed for Camp Challenge of the Florida Easter Seal Society, in Mount Plymouth, Florida, of polyvinyl chloride piping. Invert elevations were tabulized and necessary fittings determined for the system. Cost estimates were also included. The sewers were designed on a per fixture basis so as not to overdesign using per capita flow rates. A literature and records search was conducted to obtain design and actual wastewater flow quantities in gallons per capita per day (gpcd). Actual flows determined from 4 camps and 11 travel trailer parks gave average values of 39 and 33 gpcd, respectively, and can be used as design parameters for wastewater treatment facilities. However, further investigations and intensive flow monitoring are deemed necessary to provide a wider, more accurate data base with less variability.

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TITLE: Factors in Modeling Floridan Aquifer Recharge

CANDIDATE: Harlan A. Hannah

FACULTY ADVISOR: Dr. J. Paul Hartman

A B S T R A C T

The problems associated with formulation of a recharge model of the Floridan aquifer are examined. Alternate modeling techniques are discussed and their application to identification of recharge rates and possible recharge areas of the Floridan aquifer are considered. The more significant geological and hydrological characteristics of the Floridan aquifer are reviewed, and analog modeling along with finite difference modeling techniques are discussed. Each of these techniques are outlined and their advantages

considered. Recommendations are made in regard to subsequent steps to be taken in development of the model.

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TITLE: Removal of Hydrogen Sulfide from Ground Water in Central Florida

CANDIDATE: Thomas Gene Lochrane

FACULTY ADVISOR: Dr. Waldron M. McLellon

A B S T R A C T

The presence of hydrogen sulfide in a ground water source is noted by its rather obnoxious odor, similar to a "rotten egg." Concentrations as low as 0.05 ppm are noticeable, therefore, almost its entire removal is demanded prior to potable consumption. Hydrogen sulfide is formed primarily by the decomposition of organic matter in anaerobic conditions. Removal of this gas has been accomplished by means of aeration, detention, and chlorination over the years. The mechanisms behind each of these processes are complex and discussed in this paper.

During the course of this investigation, a literature survey concerning the nature and sources of hydrogen sulfide, its removal by aeration and detention, and the experimental methodology has been conducted. Samples were collected from two ground water locations in Central Florida; namely, City of Apopka Terrace Plant, and the City of Maitland Thistle Plant. These samples were taken before and after aeration and detained in containers similar to the storage tank dimensions. These samples were tested for Hydrogen Sulfide and pH with respect to time.

The aerators were determined to remove 13 to 15 percent H_2S, respectively. The pH values ranged between 7 - 8 prior to detention and rose slowly during H_2S ionization to 8 - 8.6.

Both locations were evaluated to determine the most economic operating conditions. Ideally, Apopka should be removing between 30 - 40 percent by means of aeration, and Maitland, between 40 - 50 percent. Chlorination will remove the remaining H_2S.

Although the existing aerators were operating less than their optimum removal range, they should remain in service. This is based on deducting the aerator "sunk costs" from the economic evaluation.

Efforts should be encouraged to improve aerator efficiencies by increased agitation, contact time, and weir overflow rates in the aerator trays. These measures should increase the H_2S reaction rate and improve its removal.

Detention only removes the odor problem, but the chlorine demand still remains, as exerted by the forms HS^- and $S^=$.

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TITLE: Seminole County, Florida Solid Waste Management Plan

CANDIDATE: Paul A. Magnant

FACULTY ADVISOR: Dr. Martin P. Wanielista

A B S T R A C T

The Seminole County, Florida solid waste transportation network was examined to determine alternate locations of transfer stations. The scope of this study is limited to transportation and assumed disposal costs. Collection costs are not included. Review of past generation records was conducted and a per capita generation rate of 4 lbs/day was determined. This compared favorably to 4.06 lbs/day for Orange and Brevard County.

The cost per ton for the present solid waste management system was computed and compared to alternative systems. The present system was compared to several alternatives by altering the number and changing the locations of transfer stations to arrive at an optimum cost configuration.

Recommended alternate plans are provided which are dependent upon the waste generating districts participating as well as transfer station location in the overall solid waste management system.

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TITLE: Dynamic and Stability Characteristics of an Articulated Frame Railway Passenger Truck

CANDIDATE: David Kenneth Platner

FACULTY ADVISOR: Dr. Wayne E. Carroll

A B S T R A C T

Mass transit vehicles in normal rail service frequently attain speeds which can excite carbody oscillations (primary hunting), as well as sustained lateral oscillations of the trucks (secondary hunting). The carbody motions have been shown to generate passenger discomfort and sustained truck hunting can lead to derailment. This thesis develops approximate equations which predict the carbody hunting frequencies, as well as the hunting speed of an articulated frame truck. The linear equations of motion are derived from a simplified model of a railway vehicle. A comparison indicates the results obtained using the approximate truck hunting equation presented here are within ten percent of the results obtained from more rigorous approaches reported by others.

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TITLE: Evaluation and Use of Dynamic Analysis Capabilities of ICES STRUDL II

CANDIDATE: Hugh M. Roberts

FACULTY ADVISOR: Dr. David L. Block

A B S T R A C T

The objective of this report is to evaluate and to provide detailed documentation for using the structural dynamic analyses capabilities of the ICES STRUDL II program at the FTU Central Florida Regional Data Center.

Documentation of the use of STRUDL in dynamic analysis is provided by the explanation of the STRUDL commands and by examples of each command. Subtleties and pitfalls involved in the use of the commands are documented. In addition a detailed flow chart is presented showing those STRUDL commands which are required and optional and showing the command sequence. Use of this report is meant to supplement the ICES STRUDL I Users Manual.

The report also presents actual computer command input and resulting sample output for a plane frame example problem. For the example frame, dynamic analyses are presented illustrating the determination of eigenvalues and eigenvectors of the frame by three different methods, the frame structural response for a sinusoidal joint loading at three different frequencies and the frame structural response for the El Centro Earthquake loading in the form of joint accelerations and in the form of joint acceleration response spectrum. Comparative results are discussed for the example dynamic analyses.

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TITLE: A Study of Differences in Vertical Phosphorus Profiles Within the Sediments of Selected Florida Lakes as Related to Trophic Dynamics

CANDIDATE: E. Allen Stewart, III

FACULTY ADVISOR: Dr. Yousef A. Yousef

A B S T R A C T

Several Florida lakes with different documented trophic state indices were selected for sediment analysis. Vertical sections of the sediment were taken at depths of .1, .5, 1, 2, 3, 4, 5, 6, 10 and 15 centimeters below the surface of the sediment-water interface. Total Phosphorus analysis was done on each section. The profile presented was then evaluated and was found that the profiles best fit the equation $Y = X/A + BX$, where Y is the Phosphorus Concentration in ppm and X is the sediment depth in cm. Correlation between the trophic state and the profiles characteristics are presented.

A hypothesis as to how the sediment profile changes as the lake experiences increased Phosphorus loading is presented, and is used to evaluate

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. PETRASKO, B. E., "MILES Code Structure and Decoding Scheme," NATO Panel of Laser Direct Fire Training Simulators, Brussels, Belgium, October 13, 1976.

2. PETRASKO, B. E., R. L. PHILLIPS, J. CORMACK, A. CANNON, "Simulation of a Weapons Fire Simulator Modeled as an Optical Communication Channel," Ninth NAVTRAEQUIPCEN/Industry Conference, Orlando, FL, Nov 9-11, 1976.

3. PETRASKO, B. E., and D. L. TRIMBLE, "Simulation of Microprocessor Operation for Program Development and Checkout," Ninth NAVTRAEQUIPCEN/Industry Conference, Orlando, FL, Nov 9-11, 1976.

4. PETRASKO, B. E., and R. L. PHILLIPS, "A Computer Simulation of an Optical Communication Channel and Laser Pulse Detector Electronics," SOUTHEASTCON 77, Williamsburg, VA, April 4, 1977.

5. PHILLIPS, R. L., and R. D. EVANS, "A New Flat-Plate Collector Using Total Internal Reflection for Light Trapping," Flat-Plate Solar Collector Conference, Orlando, Feb 28-Mar 2, 1977.

6. PHILLIPS, R. L., "Scintillation Effects on a Binary Optical Communication System," April, 1977, Williamsburg, VA.

7. SIMONS, F. O. JR., and R. C. HARDEN, "An Efficient Mag-Card Pocket Calculator Interrelated Program for Stability Checks, Relative Stability, and Response Time for Up to 20th Order H(s) Systems," Proceedings of the Ninth Annual Southeastern Symposium on System Theory, Charlotte, N.C., March 7-8, 1977.

8. SIMONS, F. O. JR., and R. C. HARDEN, "What Is and What Should Be the Impact of Scientific Pocket Calculators on Engineering Education," Proceedings of the IEEE Southeastcon 77, Williamsburg, VA, April 4-6,1977.

9. SIMONS, F. O. JR., and R. C. HARDEN, "Design Specifications Checks for up to 20th Order H(z) Discrete Systems Using New Mag-Card Pocket Calculator Programs," Proceedings of the Eighth Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, April 21-22, 1977.

CONFERENCES, WORKSHOPS, SHORT COURSES AT WHICH RESULTS OF RESEARCH WERE COMMUNICATED

1. U.S. Army PM TRADE Seminar on "Laser Communication", NTEC, Orlando, FL, July 1976. (Phillips)

2. XEOS in Los Angeles, CA, Summer 1976, "Impact of Coding for an Optical Communication Channel." (Petrasko)

3. IEEE Computer Society, Orlando Public Library, September 1976, "FTU Microprocessor Laboratory." (Patz)

4. NATO Panel of Laser Direct Fire Training Simulators, Brussels, Belgium, October 13, 1976, "MILES Code Structure and Decoding Scheme." (Petrasko, Phillips)

5. NTEC Conference, Orlando, FL, Fall 1976, "A Computer Simulation of an Optical Communications Channel." (Petrasko, Phillips)

6. Ninth NAVTRAEQUIPCEN/Industry Conference, Orlando, FL, November 9-11, 1976.
   a) "Simulation of a Weapons Fire Simulator Modeled as an Optical Communication Channel." (Petrasko, Phillips, Cormack, Cannon)
   b) "Simulation of Microprocessor Operation for Program Development and Checkout." (Petrasko, Trimble)

7. SCEEE Seminar on Technology and Technological Change, Collective Bargaining and Technology, Collective Bargaining and Professionalism, FTU/SORC, Orlando, FL, February 2, 1977. (Mathews)

8. Flat-Plate Solar Collector Conference, Orlando, FL, February 28-March 2, 1977, "A New Flat-Plate Collector Using Total Internal Reflection for Light Trapping." (Phillips, Evans)

9. AIIE and IEEE Minicomputers and Microcomputers in Industry Conference, FTU, Orlando, FL, March 26, 1977. (Patz, Bauer)

10. Ninth Annual Southeastern Symposium on System Theory, Charlotte, NC, March 7-8, 1977, "An Efficient Mag-Card Pocket Calculator Interrelated Program for Stability Checks, Relative Stability, and Response Time for Up to 20th Order H(s) Systems." (Simons, Harden)

11. SOUTHEASTCON 77, IEEE Region III Conference, Williamsburg, VA, April, 1977.
    a) "Solar Energy Education - Mapping The Territory." (Walker)
    b) "A Computer Simulation of an Optical Communication Channel and Laser Pulse Detector Electronics." (Petrasko, Phillips)
    c) "Scintillation Effects on a Binary Optical Communication System." (Phillips)
    d) "What Is and What Should Be the Impact of Scientific Pocket Calculators on Engineering Education." (Simons, Harden)

12. Eighth Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, April 21-22, 1977, "Design Specifications Checks for up to 20th Order H(z) Discrete Systems Using New Mag-Card Pocket Calculator Programs." (Simons, Harden)

13. Florida Optical Society of America, May, 1977, Orlando, FL, "Optical Communication Through a Turbulent Atmosphere." (Phillips)

14. IEEE Computer Society, Dutch Pantry, Orlando, June, 1977, "Microcomputer Controller for a Ham Radio/Telephone System." (Patz)

RESUMES OF SPONSORED RESEARCH

TITLE: Three Dimensional Sonar

PRINCIPAL INVESTIGATOR: Dr. E. R. McCarter, P.E.

SPONSORING AGENCY: FTU Office of Graduate Studies and Research

A B S T R A C T

The project consists of first, a theoretical investigation into the various methods for achieving the desired results and secondly, the most feasible method resulting from this investigation will then be carried through to the conceptual design stage. Depending on the progress, a limited amount of experimental work will be conducted to verify some of the design concepts. It is hopeful that this preliminary work will lead to further research in this area with some marine group.

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TITLE: NTEC Grant

PRINCIPAL INVESTIGATOR: Dr. B. W. Patz, P.E.

SPONSORING AGENCY: NTEC

GRANT NUMBER: 033502071

A B S T R A C T

This grant involved primarily two endeavors:

(1) An evaluation of computer programming for an A7E HUD simulator
(2) A study of the GETS computer-aided instruction system

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TITLE: NTEC Course 76-77: Computer Engineering

PRINCIPAL INVESTIGATORS: Dr. B. W. Patz, P.E. and Dr. R. C. Rapson, Jr., P.E.

SPONSORING AGENCY: NTEC

GRANT NUMBER: 033502008

A B S T R A C T

Course II - Software Programming Problems and Solutions focused on practical applications. It emphasized programming basic philosophy (machine

language, assembly language, compiler), Fortran programming and engineering applications, numerical solution to difference equations, programming errors, etc.

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TITLE: Army "MILES"

PRINCIPAL INVESTIGATORS: Dr. R. L. Phillips and Dr. B. E. Petrasko

SPONSORING AGENCY: U.S. Army

A B S T R A C T

This paper presents a method of simulating various noise sources in a Weapons Fire Simulator System which has been modeled as an Optical Communications Channel. This Weapons Fire Simulator System is composed of laser transmitters mounted on weapons that fire blank cartridges, and laser receivers mounted on targets. The laser transmitter sends out "kill" beam pulses to the target whenever blank cartridges are fired. Detection of these pulses at the target signifies a "hit". The entire system along with the optical communication channel is simulated in a general purpose computer program called SCEPTRE.

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TITLE: PM Trade NATO

PRINCIPAL INVESTIGATORS: Dr. R. L. Phillips and Dr. B. E. Petrasko

SPONSORING AGENCY: U.S. Army

A B S T R A C T

This project is the development of a new integrated laser system which could be used in laser engagement simulators.

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TITLE: New Plate Collector

PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips

SPONSORING AGENCY: Florida Solar Energy Center

A B S T R A C T

The phenomenon of optical total internal reflection (TIR) is due to an abrupt decrease of the index of refraction of a material. This physical prin-

ciple is used to trap and contain light in optical fibers. Using the TIR principle a small 2 ft x 3 ft prototype solar collector panel was designed. The collector was constructed from 1/16 inch colorless plexiglass (ultraviolet transmitting) plastic consisting of triangular corrugated channels mounted on a plexiglass surface. The corrugated triangular rows were constructed so as to provide a conduit for the fluid and to provide the desired light trapping effect. Headers were fabricated from the same material and integrated into the collector panel. Three prototype collectors were fabricated.

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TITLE: PM Trade Optics

PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips

SPONSORING AGENCY: U.S. Army

A B S T R A C T

This project was to asertain the characteristics required by the laser engagement system used for training by the U.S. Army to allow joint NATO training exercises.

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TITLE: Laser Crystals

PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips

SPONSORING AGENCY: International Laser Systems

A B S T R A C T

This project is to measure the absorption of light in crystals which are used in lasers for modulators.

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TITLE: Laser Training Device

PRINCIPAL INVESTIGATOR: Dr. H. C. Towle

SPONSORING AGENCY: NTEC

A B S T R A C T

This is a project using lasers for determining the circuit position and

microprocessors for processing of data.

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TITLE: Investigation of Optimal Control for Solar Water Heaters

PRINCIPAL INVESTIGATOR: Dr. H. C. Towle

SPONSORING AGENCY: Florida Solar Energy Center

GRANT NUMBER: 111622001

A B S T R A C T

Since January, a control test facility has been designed and components purchased for two duplicate systems. Components include 18 square foot Sol-Ray commercial solar water heaters, 40 gallon tanks, pumps, flow meters, and controls as described in the initial proposal. Copper tubing and commercial fittings have also been obtained.

The solar panels have been installed on the roof of the Engineering Building at Florida Technological University. The next step will be to connect the components and check out the system.

The program was completed in January 1977. It provides two essentially duplicate systems for comparison tests of solar water heater control systems or other system features. FTU Engineering faculty are welcome to use the facility.

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RESUMES OF UNSPONSORED RESEARCH

TITLE: Dielectric Measurements

PRINCIPAL INVESTIGATOR: Dr. E. E. Erickson, P.E.

A B S T R A C T

A microwave waveguide coupler system for the measurement of the complex permittivity of dielectric materials was developed and tested. Results of the tests show that the new technique is feasible for the measurement of small values of dielectric permittivity. The project produced an MSE research report.

Literature research on the subject of complex permittivity measurements on dielectrics was conducted.

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TITLE: Study Impact of Scientific Hand Calculators on Engineering Education

PRINCIPAL INVESTIGATORS: Dr. R. C. Harden, P.E. and Dr. F. O. Simons, Jr., P.E.

A B S T R A C T

Actual contributions of scientific pocket calculators to engineering and education have been minimal. The authors review past uses and propose desirable future utilization.

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TITLE: Prepare publication for a mag-card program for stability of 20th order systems

PRINCIPAL INVESTIGATORS: Dr. R. C. Harden, P.E. and Dr. F. O. Simons, Jr., P.E.

A B S T R A C T

The algorithms covered in the title are based on Routh's criterion, roots in an s-plane sector and a polynomial translational routine.

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TITLE: Prepare publication on mag-card programs for 20th order H(z) system checks

PRINCIPAL INVESTIGATORS: Dr. R. C. Harden, P.E. and Dr. F. O. Simons, Jr., P.E.

A B S T R A C T

The items covered in the title are provided by a unique minimum memory algorithm for a z- to s-plane transformation plus a subprogram to account for difficulties with the constant z-plane damping contours.

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TITLE: Computer Generated Auditory Training

PRINCIPAL INVESTIGATOR: Dr. B. E. Mathews, P.E.

A B S T R A C T

The equipment for generating vowel sounds with two format frequencies has been completed. The next step is to develop methods for measuring the acoustic energy in the test signals.

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TITLE: Microprocessor based decoding for MILES

PRINCIPAL INVESTIGATOR: Dr. B. E. Petrasko

A B S T R A C T

A PIM decoding scheme was applied to the MILES code in an effort to minimize dead time loss and provide for an increase in noise rejection characteristics. A ping-pong input buffer scheme was analyzed for the former effort and a list structured data base was investigated for the latter. There appears to be sufficient time and space for both efforts, and the investigation is continuing.

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TITLE: Optical Communications Channel Analysis

PRINCIPAL INVESTIGATOR: Dr. B. E. Petrasko

A B S T R A C T

Previous sponsored efforts in this area were extended and the developed software was examined for portability and transferral to a large mini-computer system.

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TITLE: Optical Fiber Communication Networks

PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips

A B S T R A C T

This work is the computer modeling of an optical fiber communication network. With this model we will be able to determine optimum techniques for optical communication.

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TITLE: Laser Hydraphone

PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips

A B S T R A C T

The laser hydraphone is an application of the principles of total internal reflection to the problem of sound detection in water.

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TITLE: The Design and Testing of an Optical Solar Energy Collector

PRINCIPAL INVESTIGATORS: Dr. R. L. Phillips and Dr. R. D. Evans, P.E.

A B S T R A C T

A 2 ft. x 3 ft. laboratory prototype plexiglass optical trap (index of refraction u=1.5) was designed and built to be used as a solar energy collector. The optical trap works on the principle that all the incoming solar radiation passing through a transparent surface of index of refraction u_1 will be trapped inside a triangular channel filled with a fluid of index of refraction u_2 provided $u_2 > u_1$. Preliminary data indicates the collector will provide temperatures of 140° F when water (u=1.33) is the collector fluid. However, extensive testing of the collector will be conducted utilizing working fluids with much higher indexes of refraction.

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TITLE: Power Plant Simulation

PRINCIPAL INVESTIGATOR: Dr. F. O. Simons, Jr., P.E.

A B S T R A C T

Explore the possibility of sponsored research in power plant simulation by the hybrid computer. Dr. Simons received university permission to serve as a consultant with Martin Marietta Aerospace in the Hybrid Simulation Laboratory. In this capacity the opportunity was afforded whereby Dr. Simons could seek research on behalf of FIU at the expense of the Hybrid Laboratory as long as that research would utilize these hybrid facilities. Therefore, one trip was made to Houston, Texas and brief exploratory simulation modeling studies were made for the purpose of obtaining research money to construct meaningful large-scale hybrid computer simulation studies.

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TITLE: Scientific Calculations in Education

PRINCIPAL INVESTIGATOR: Dr. F. O. Simons, Jr., P.E.

A B S T R A C T

Dr. Simons' research efforts in 1976-77 were devoted to preliminary research studies designed to determine "What is and What Should be the Impact of Scientific Calculators on Engineering Education." This effort culminated in research proposals to HEW and NSF - the latter of which is still pending.

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TITLE: Solar Water Heater

PRINCIPAL INVESTIGATOR: Dr. H. C. Towle, P.E.

A B S T R A C T

Following a careful evaluation of gains to be expected through the use of an optimal solar water heater control, it was decided to abandon further efforts on optimality studies. Effort was redirected toward completing the roof facility which will be available for comparative tests of solar water heater controls.

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TITLE: Solar Energy Education

PRINCIPAL INVESTIGATOR: Dr. R. L. Walker, P.E.

A B S T R A C T

Solar energy will be used by more and more people for water heating, space cooling, and other applications in Florida. To educate Floridians in this field educational materials must be prepared, aimed at various levels of audience. This project first mapped out the material to be presented and the clientele to be served, and then proceeded to prepare some of the modules in the complete system of materials. A paper was presented at the Region 3 Conference of the Institute of Electrical and Electronic Engineers, Williamsburg, Virginia in April 1977.

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TITLE: Power Pole Lightning Protection

PRINCIPAL INVESTIGATOR: Dr. R. L. Walker, P.E.

A B S T R A C T

Conferences were held with Mr. Bob Kolar and his associates with the Florida Department of Transportation to better understand the problems experienced with lightning. Several suggestions for research to be performed were made to the Department and a final statement of work has been received from D.O.T. We will propose a contract to begin in September 1977 for about 30,000 dollars on this project.

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ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: A Computer Simulation of a Weapons Fire Simulator Modeled by Sceptre as an Optical Communication Channel

CANDIDATE: John James Cormack

FACULTY ADVISOR: Dr. Ronald L. Phillips

A B S T R A C T

This paper presents a method of simulating various noise sources in a Weapons Fire Simulator System which has been modeled as an Optical Communication Channel. This Weapons Fire Simulator System is composed of laser transmitters mounted on weapons that fire blank cartridges, and laser receivers mounted on targets. The laser transmitter sends out 'kill' beam pulses to the target whenever blank cartridges are fired. Detection of these pulses at the target signifies a 'hit'. The entire system along with the optical communication channel is simulated in a general purpose computer program called SCEPTRE. This analysis package is an efficient means of modeling the communication channel characteristics and determining signal to noise ratios as functions of various electrical and physical parameters. Also the SCEPTRE program is a versatile tool for circuit noise calculations. The main advantage is a single SCEPTRE run computes the total noise output from a large number of noise sources distributed throughout the circuit.

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TITLE: Implementing Multiple-Linked Lists in the Minicomputer-Microcomputer String Processor, C. String

CANDIDATE: John H. Firestone

FACULTY ADVISOR: Dr. Brian Petrasko

A B S T R A C T

This report will demonstrate how to implement a basic linked-list data structure in RAM for C. STRING. The result of this implementation is Memory Allocation or Data Management which obtains or releases memory space as required in C. STRING.

The basic concepts of data structures such as strings, lists and stacks are discussed and the algorithm for allocation of space is developed. The C. STRING user language TOSCL, and the TOSCL parse algorithm with Data Management is described. Finally, the INTEL's Schottky Bipolar LSI microprocessor is microcoded to implement Data Management.

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TITLE: The Design and Analysis of a Rare Earth Iron Magnetostrictive Underwater Sound Transducer

CANDIDATE: Steven Wayne Meeks

FACULTY ADVISOR: Dr. Richard C. Harden

A B S T R A C T

The design and analysis of a low-frequency, resonant, tonpilz type, rare earth iron underwater sound transducer using rods of $Tb_{.27}Dy_{.73}Fe_{1.95}$ are described. An equivalent circuit is presented which predicts the performance of the transducer in the presence of eddy currents and demagnetization. The effect of eddy currents on the impedance of a rod is discussed. The predicted performance of a laminated transducer is compared with that of an unlaminated transducer. The performance of the rare earth iron transducer is compared with the performance of the same transducer with identical ceramic active elements. Data on transmitting current response, transmitting voltage response, free field voltage sensitivity, coupling coefficient, efficiency, and linearity are presented. Advantages, disadvantages, and possible uses of rare earth iron material are discussed.

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TITLE: The Silicon Solar Cell as an Optical Detector

CANDIDATE: Stephen O. Saltsman

FACULTY ADVISOR: Dr. Ronald L. Phillips

A B S T R A C T

The optical detector characteristics of a silicon solar cell are examined. A general equivalent circuit model is developed and typical parameter values are determined. A comparison is made between the photovoltaic and short circuit operating modes and the short circuit mode is shown to be preferable in terms of linearity, extended frequency response, and temperature stability. A method is developed to determine the noise characteristics of the amplifier-detector system used in the short circuit mode. The silicon solar cell is shown to be an economical alternative to standard photodiodes in low to medium data rate systems.

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TITLE: Hardware and Software Considerations for Improving the Throughput of Scientific Computation Computers

CANDIDATE: Glenn Allen Sullivan

FACULTY ADVISOR: Dr. Benjamin W. Patz

A B S T R A C T

In this paper, hardware and software techniques are presented for improving the Throughput (defined as Computations per dollar) of computing systems which are oriented towards high-precision floating point computations. The various improvements are referenced to a baseline of the PDP 11/20, the NOVA 1200, and the TI 960A, all 16 bit minicomputers. The most beneficial hardware improvement is the inclusion of a Floating Point Processor, which yields up to 200X Throughput increase over a software floating point package. The inclusion of a cache high speed local memory and the availability of Polish Notation format instructions are shown to provide less than a 5X increase each. The use of 48 bit data paths, numerous registers devoted to various processor functions, instruction lookahead, a system I/O controller which frees the processor from I/O work, and partitioned main memory, result in a combined Throughput increase of 5.9X.

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TITLE: Plotting Frequency Response with the Hybrid Computer

CANDIDATE: David Kenneth Swartwood

FACULTY ADVISOR: Dr. Fred O. Simons, Jr.

A B S T R A C T

This paper describes a hybrid computer microprogram which plots frequency domain responses for linear systems. The microprogram computes the real and imaginary parts of the system output and displays either Bode or Nyquist plots.

Various approaches are discussed and a detailed explanation of the one selected is presented. The major areas of discussion are the sinewave generator, the computation of real and imaginary parts of the system output, the logarithm computation and the digital control logic.

The conclusion gives a comparison of a Nyquist plot made with the microprogram with one calculated by a digital computer. Possible improvements for the microprogram are also discussed.

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TITLE: Techniques for Determination of Complex Permittivity of Dielectric Materials at Microwave Frequencies

CANDIDATE: Witold J. Trett

FACULTY ADVISOR: Dr. Ernest E. Erickson

A B S T R A C T

This report reviews several methods of measurement of the dielectric properties of materials. The properties of dielectric materials vary greatly, and no one method of measurement is applicable to all cases. The choice of a method depends not only on the dielectric parameters but also on the physical form of the material. Most methods can be used with solid materials, but gases and aerosols require equipment with special design features.

A new method for the measurement of the complex permittivity of dielectric materials, which would be applicable to aerosols, is presented in this report. The method is based on the comparison of signals applied from two microwave couplers in a secondary waveguide section which contains the dielectric material under test. The results of laboratory experiments, using nylon and plexiglass as test materials, show the validity of this technique for the measurement of complex permittivity.

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TITLE: Load Forecasting for an Electrical Utility

CANDIDATE: Thomas E. Washburn

FACULTY ADVISOR: Dr. Benjamin W. Lin

A B S T R A C T

This paper will attempt to present different needs for electric load forecasting and some methods by which these needs can be satisfied. Short-term, intermediate-term and long-term forecasting will be discussed in general. Then this paper will present a complete long-term forecast using data from an actual electric utility. For this forecast the selection of the independent variables, the statistical significance of the model, and an analysis of elasticity or sensitivity of the load due to changes in the independent variable will be addressed. Finally, there is a subjective analysis of the developed mathematical model.

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INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

Chairman: G. F. Schrader

Faculty: C. S. Bauer, R. D. Doering, K. A. Ehlert, C. B. Gambrell, Y. A. Hosni, H. I. Klee, B. W. Lin

The Department of Industrial Engineering and Management Systems continued to expand and improve the scope of its activities during the 1976-77 academic year. In the fall of 1976, authorization was given for the joint operation of the Engineering Computer Systems Laboratory by the Department of Industrial Engineering and Management Systems and the Department of Electrical Engineering and Communications Sciences. Equipping of that laboratory has progressed rapidly and currently includes a Data General "NOVA" 1220 Minicomputer with 28K core memory, 256K disk storage capacity and A/D, D/A, D/D interfacing hardware; a Digital Equipment Corporation PDP 11/34 Minicomputer with 32K core memory, two 1.2 million word storage capacity disks, and a 30 c.p.s. Decwriter input terminal; an IBM 1050 interactive remote terminal to the IBM 360/75 computer at the Regional Computer Center in Tampa; an Intecolor color graphics terminal with floppy tape and floppy disk drives; a Tektronix 4051 computer graphics terminal with data communications interface option; a Motorola M6800 microprocessor evaluation system with a hardwired monitor system to facilitate operator communication with the hardware; and an ATC-510J flight simulator made by Analog Training Computers.

The scale of activities of the departmental student group continued to increase during the 1976-77 academic year. For the third year in a row, the student chapter of the American Institute of Industrial Engineers (AIIE) won first place for the group competition in the annual Engineers Fair. The FTU chapter of Alpha Pi Mu, an industrial engineering honor society initiated 15 new members during the year.

Recent new adidtions to the I.E. faculty include Ms. Karen W. Ehlert and Dr. Yasser A. Hosni. Ms. Ehlert received her Master of Science degree in Computer Systems from FTU in 1976 and has been teaching in the area of engineering mathematics and computer systems. Dr. Hosni received his Ph.D. from the University of Arkansas in 1976 and has had extensive production engineering background in Egypt.

In addition to their instructional assignments at both the undergraduate and graduate levels, the IEMS faculty were quite active in research and public service projects. During the year, Dr. Bauer and Dr. Klee completed a project for the Florida Department of Transportation on the computerized "Green Band" freeway ramp merge control system facility located in Tampa, Florida. Dr. Bauer served as president of the Central Florida Chapter of AIIE and also as chairman of the Regional Planning Committee for the Florida State Energy office. Dr. Doering worked on a research project for the Florida State University System on solar hot water heating applications for state buildings. He also served as a Regional Director for Alpha Pi Mu and treasurer for the Central Florida Chapter of the Florida Engineering Society. Dr. Schrader served as chairman of the Council of Industrial Engineering Academic Department Heads and also as vice president for Region IV of AIIE.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BAUER, C. S., and T. A. RISHER, "A Simulation Analysis of A Computer-Controlled Freeway Merging System," Proceedings of the 27th Annual Conference of the IEEE Vehicular Technology Group, Orlando, FL., March, 1977.

2. DOERING, R. D., "A Strategic Approach To Energy Management Shows Positive $ Results," The Consultant, Vol. X, No. 2, International Society of Food Service Consultants, Oct, 1976.

3. DOERING, R. D., C. S. BAUER, and B. W. LIN, "Minimizing Operating Cost For a Central Energy Plant," National Joint Meeting, ORSA/TIMS, Miami, FL, Nov. 3-5, 1976.

4. DOERING, R. D., "Special Demand Control System Design Proves Cost Effective in Restaurant Application," The Consultant, Vol. X, No. 3, International Society of Food Consultants, Jan, 1977.

5. DOERING, R. D., "The Economics of Retrofit," Retrofit Profit for All, Proceedings of 26th Annual Air Conditioning Conference, Gainesville, FL, Feb 24-25, 1977.

6. DOERING, R. D., "Communications Center Personnel Training Simulator," Journal of Police Science and Administration, Vol. 5, No. 1, March, 1977.

7. HOSNI, Y., "Multipurpose Computer System for Plant Layout Design," Computers and Industrial Engineering, PERGAMON PRESS, 5th edition, Aug, 1977.

8. HUTCHINS, P. F., R. D. DOERING, B. W. LIN, and C. S. BAUER, "Minimization of Operational Costs for a Central Energy Plant: An Optimization Approach Using Linear Integer Programming," AIIE Transactions, (in press)

9. LIN, B. W., "A Controlled Experimental Design for Comparison of Integer Programming Algorithms," National Joint Meeting, ORSA/TIMS, Miami, FL, Nov 3-5, 1976.

10. SCHRADER, G., "Productivity and the Factors of Production," Proceedings of the Symposium on Metal Cutting and Manufacturing, University of Illinois, April 28, 1977.

CONFERENCES, WORKSHOPS, SHORT COURSES AT WHICH RESULTS OF RESEARCH WERE COMMUNICATED

1. FTU/AIA Workshop, "Energy as Design Criteria," June 1976. (Doering)

2. FES/FTU Professional Engineer Review Course, Fall 1976. (Doering)

3. ORSA/TIMS Joint National Meeting, Miami, FL, November 1976.
   a) Minimization of Operational Costs for Central Energy Plant." (Bauer, Doering, Lin, Hutchins)
   b) "Controlled Experimental Designs for Comparison of Integer Programming Algorithms." (Lin)

4. AIIE Jacksonville Chapter, Jacksonville, FL, November 3, 1976, "Productivity and the Factors of Production." (Schrader)

5. Twenty-sixth Annual Air Conditioning Conference, University of Florida, Gainesville, FL, February 1977, "The Economics of Retrofit." (Doering)

6. Annual Conference of the Management Division of AIIE, Huntsville, AL, March 4, 1977, "Productivity and the Factors of Production." (Schrader)

7. AIIE and IEEE Minicomputers and Microcomputers in Industry Conference, FTU, Orlando, FL, March 26, 1977. (Bauer, Patz)

8. Twenty-seventh Annual Conference of the IEEE Vehicular Technology Group, Orlando, FL, March 1977, "A Simulation Analysis of a Computer-Controlled Freeway Merging System." (Bauer, Risher)

9. FTU/AIA Workshop "Energy as a Design Criteria," April 1977. (Doering)

10. Orlando Section of ASQC Meeting, Orlando, FL, April 20, 1977, "Training and Certification of Quality Engineers." (Doering)

11. Symposium on Metal Cutting and Manufacturing, University of Illinois, Urbana, IL, April 28, 1977, "Productivity in the Private Sector." (Schrader)

12. AIIE Orlando Chapter, Orlando, FL, May 1977, "Computerized Job-Shop Layout Design." (Hosni)

13. ORSA/TIMS Joint National Meeting, San Francisco, CA, May 1977, "What Makes Integer Programming Problems Hard to Solve." (Lin, Rardin)

RESUMES OF SPONSORED RESEARCH

TITLE: Improvements for A Moving Merge Control System

PRINCIPAL INVESTIGATORS: Dr. C. S. Bauer, P.E. and Dr. H. I. Klee, P.E.

SPONSORING AGENCY: Florida Department of Transportation, Office of Traffic Operations

A B S T R A C T

This project included analyses of system operations at the computer-controlled freeway entrance ramp to I-75 from Ashley Street in Tampa, Florida. Computer-generated motion pictures of display operation were used in conjunction with computer simulation of control system functions to identify improved algorithms for running the system.

All project software modifications were completed in the first quarter of 1977. Systems acceptance tests were held at the Tampa ramp location in April and May and public operation with the new system was initiated. An evaluation of the system improvements will be conducted by the Florida Department of Transportation.

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TITLE: Correlation of Biorhythm Theory with Industrial Accident Occurrences

PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E.

SPONSORING AGENCY: FTU Office of Graduate Studies and Research

A B S T R A C T

The purpose of this research was to investigate the validity of Biorhythm Theory in predicting industrial accidents. If a significant correlation could be established, the theory might be used to counsel the workers such that accidents could be avoided.

Safety Division files from Walt Disney World were used to identify 119 single occurrence events during 1977. Incidents were screened to select those which required a careless act on the part of the worker. The worker's Biorhythm profile then was correlated against the accident date to identify occurrences on critical days, and ± 24 or ± 48 hours of a critical day. For control purposes, a random day was selected within the cycle time and again correlated with the Biorhythm profile.

The results showed that the Biorhythm Theory was not able to distinguish between the random day and the accident day. It was concluded that Biorhythm Theory could not be used to predict accident times. It was noted that in instances where the system has been instituted, there was a dramatic drop in the accident rate. On the basis of this study, however, it is believed that

this is more of a psychological reaction to the attention such a program affords the worker. This was dramatically illustrated in the classic Hawthorne works study at Western Electric in which both the control and experimental groups of workers responded identically in work output, although the experimental group was given better lighting conditions.

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TITLE: Waste Water Plant Operator Training Simulator Pilot Development

PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E.

SPONSORING AGENCY: FTU Office of Graduate Studies and Research

A B S T R A C T

The Simulator concept utilizes a control board which is equipped to display a selected plant flow process and key operating parameters such that the operator trainee can select and implement his operating decisions. A control board for a typical activated sludge type WW plant was completed and interfaced to the Nova minicomputer in the computer laboratory. The minicomputer will now be programmed with equations which describe the plant process such that it will respond to the trainee's decisions by displaying the new plant conditions on the control board. In application the Instructor would select the plant model, initiate its starting parameters and operational scenario and the trainee would "operate" the plant. The computer will also record the trainee's decisions and the degree of their success so that the trainee can be classified and a permanent record of each test maintained. A proposal has been prepared for submittal as soon as an agency can be identified which might fund the development of prototype Simulator.

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TITLE: Manpower Analysis in Transportation Safety

PRINCIPAL INVESTIGATOR: Dr. G. F. Schrader, P.E.

SPONSORING AGENCY: U. S. Department of Transportation

A B S T R A C T

This project provided a manpower review of national, state and local needs for safety skills, and projected future manning levels for transportation safety personnel in both the public and private sectors. Survey information revealed that there are currently approximately 121,000 persons employed directly in transportation safety occupations within the air carrier, highway and traffic safety, motor carrier, pipeline, rail carrier, and marine carrier transportation industry groups. The projected need for 1980 is over 145,000 of which over 80% will be in highway safety.

An analysis of transportation tasks is included, and shows ten general categories about which the majority of safety activities are focused. A

skills analysis shows a generally high level of educational background and several years of experience are required for most transportation safety jobs.

A published report(DOT-TST-77-40) is available on this project from the National Technical Information Service, Springfield, Virginia 22161.

RESUMES OF UNSPONSORED RESEARCH

TITLE: Moving Merge Control System

PRINCIPAL INVESTIGATOR: Dr. C. S. Bauer, P.E.

A B S T R A C T

The final report for the project was completed during the spring quarter of 1977. It is now under review by the sponsoring organizations(Florida DOT and Federal Highway Administration).

Software modifications comprising the final phase of the work product of the contract have been accepted, and the improved ramp control system is now in public operation.

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TITLE: Development of Digital Computer Laboratory

PRINCIPAL INVESTIGATOR: Dr. C. S. Bauer, P.E.

A B S T R A C T

During the 1976-1977 period, several new computer systems and associated display peripherals were acquired to extend the capabilities of the College of Engineering Computer Laboratory for instructional and research use. The new equipment includes the following items:

1. Digital Equipment Corporation PDP-11/34 minicomputer with 32k of core memory, 2 1.2 million word disk drives, 2 floppy disk drives, and a 30 character 1 second I/O terminal. Available software includes the RT-11 operating system with the optional FORTRAN compiler.
2. A Motorola 6800 microcomputer system "designer's kit" board was constructed and interfaced with an 8k RAM memory and locally designed buffer circuitry and power supplies to provide a portable computer system for system monitoring and control applications.
3. A Tektronix 4051 graphics terminal with 8k of RAM memory and the optional Data Communications Interface and Matrix operations ROM. This system has a built-in microprocessor for standalone operation, or may be used in conjunction with external computer systems.
4. A Compucolor 8001 color graphics terminal with associated floppy tape and floppy disk drives. This system also includes a built-in microcomputer for standalone operation, and may also be used with external computers in a terminal mode.

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TITLE: Development of Methodologies to Improve Productivity of Police Patrol Operations

PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E.

A B S T R A C T

Today local governments are faced with the challenge of providing more police services in a period of increasing inflation and cost escalation which severely limits their ability to raise the added revenues. The answer to this dilemma lies in increasing the productivity of available resources.

Measuring productivity in the police department, however, requires ingenuity. The process is not as simple as a manufacturing operation where the amount of canned goods or desks produced can be counted over a given period of time. The technique for measuring productivity in the police department must be considered in a different manner since the product is service oriented.

The primary objective of this research is to develop a productivity model of the Orlando Police Department patrol operations such that the impact on efficiency/productivity of new administrative procedures, operational techniques, and equipment can be evaluated. The operations of a typical patrol district will be selected to provide the data base for the model. Using this data, productivity measures can be identified for assessing the field activities. When the initial productivity measures have been formulated, the model will be validated. This will be done by comparing the model against actual data during a test period. Relative weighting will be assigned to major objectives and then reevaluated in conjunction with the trial period data. The model can then be adjusted and placed in an operational status.

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TITLE: Crime Busters

PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E.

A B S T R A C T

There are many unsolved crimes in the files of all police departments. Typically, when a case is not solved within a reasonable length of time, the leads diminish, the trail becomes cold, and it becomes increasingly more difficult to solve. A method is then needed which will reawaken public awareness of the incident and rekindle the help of the citizens to provide the needed "break" in the case.

It has been observed that many times citizens have witnessed a crime without being aware of it and consequently may possess key information toward its solution. The citizen can be made aware of the importance of his role by having the incident recalled to his attention and noting what information is needed. Sometimes also the citizen may not contact the authorities because he fears it would expose him to reprisal. He must be provided

anonymity. In other instances, the citizen may lack the knowledge of how and whom to contact in the police organization. It is much easier to converse with someone you "know" who is interested and you feel will get results.

The Crime Busters Project will promote a method of overcoming these limitations and involve the citizen in solving crimes. A continuing program is visualized, one which will take fullest advantage of all media to integrate the power of the citizenry to solve unsolved cases.

The Orlando Police Department will open its unsolved case files and tell the public about the problems they are having solving these crimes and ask for help. A reward (up to $1000) would be awarded to the citizen whose information led to indictment if he chose. The reward would be doubled if he would appear in court. The amounts would vary for different crimes.

The local media would be involved. A short 3-4 minute dramatization of a selected case would be presented each week on TV. On the same day, the pertinent information on the case would also be printed in the newspaper. One officer from O.P.D. would be designated to handle all calls and narrate the case on TV so that the citizenry would relate him with the program. If the citizen who called in wished to be anonymous, he would be assigned a number and could provide information in this manner.

FTU would provide the personnel and facilities to script and tape the case. Drama majors will be used and the take would be in the FTU studio and on the actual crime location where possible.

Local TV and news media have expressed interest in presenting the programs.

This program has proceeded to the point of incorporation under the name, Central Florida Crimewatch and the initial case will be presented the week of July 7, 1977.

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TITLE: Computerized Plant Layout

PRINCIPAL INVESTIGATOR: Dr. Y. A. Hosni

A B S T R A C T

A computer system was developed for the production of plant layout design. The system includes three components. One component builds a relationship between the production departments. The criteria considered in creating these relationships include: production volume, material flow, product design, and processing operations.

Another component of the system uses the departmental relationships to produce three unique design alternatives, each of which is generated by different techniques. A third component evaluates each of the suggested designs with respect to manufacturing the product. The software is formulated to initiate a new layout design or to analyze an existing layout.

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TITLE: Mathematical programming of time Study

PRINCIPAL INVESTIGATOR: Dr. Y. A. Hosni

A B S T R A C T

An optimization model was built to minimize the time consumed in performing a task. The task is to be analyzed and translated mathematically before applying the model. Optimization is done through eliminating unnecessary movements, simultaneity between operations, and rearranging the working place. The model is heuristic in nature which complies with the laws of motion economy used in motion and time study.

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TITLE: Optimum location for training centers in rural areas

PRINCIPAL INVESTIGATOR: Dr. Y. A. Hosni

A B S T R A C T

A study is conducted to define the factors that affect the location choice of training and employment centers in rural areas. Analytical model is to be built using the assignment of weights to the factors. A choice between alternative locations is to be applied to optimize the factors. The methodology has been outlined and a proposal is submitted to the State of Florida for data collections and the model application.

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TITLE: Computerized project planning
(Graphics Network plotting)

PRINCIPAL INVESTIGATOR: Dr. Y. A. Hosni

A B S T R A C T

The FTU package for Network Analysis was studied for further development to suit the needs of the Bureau of Construction (Florida State). A proposal is submitted for development of the package to be used with the graphic capabilities of the FTU Computer Center.

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TITLE: Investigation of a new method for computing rate of return

PRINCIPAL INVESTIGATOR: Dr. H. I. Klee, P.E.

A B S T R A C T

A simulation was developed to compute the expected rate of return for a bond with face value \$1 initial cost \$$\beta$, bond interest i_B, years to maturity n, and selling cost \$$\alpha(K)$, K = 1,2 . . ., n. The discount β and selling price $\alpha(K)$ are treated as a random variable and stochastic process, respectively. An interesting aspect of the simulation is the non-iterative nature of the calculations involving rate of return.

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TITLE: An Analysis of the Average Yearly Fraction of the Hot Water Energy Demand Supplied by Solar Heating

PRINCIPAL INVESTIGATOR: Dr. H. I. Klee, P.E.

A B S T R A C T

The Florida Solar Energy Center has outlined a procedure for sizing the components of a solar water heating system to supply a given daily demand of hot water. The percentage of solar heating is treated as an input thereby enabling the consumer to trade-off the monthly savings in utility bills expected against the initial cost of the system. From a systems viewpoint, however, the percent solar heating is a derived output of the system subject to controllable inputs, namely hot water temperature and daily consumption of hot water, and the uncontrollable input, i.e. solar radiation. This study will attempt to correlate these variables and ascertain the reliability of the FSEC procedure to size a system yielding the desired percentage of solar heating. The solar system is to be simulated with the aid of the TRSYNS Program developed at the University of Wisconsin. Central Florida Solar radiation data from the FSEC will be used as input.

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TITLE: Optimum Design of a Solar Heating and Cooling System

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

This project, funded by the Division of Sponsored Research, was to determine an optimum design of solar heating and cooling residential houses at various localities in Florida. The computer model for simulating solar houses developed by the University of Wisconsin Solar Research Group was studied and

an attempt was made at running a heating/cooling system. Difficulties with program errors were encountered. Dr. S. Chandra of Florida Solar Energy Center indicated that other research teams had experienced similar difficulties. An effort is being made to run a solar hot water system, which will seemingly become economically feasible.

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TITLE: What Makes Integer Programming Problems Hard

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

A joint paper entitled "What Makes Integer Programming Problems Hard to Solve" was written with Dr. R. L. Rardin, Industrial and Systems Engineering, Georgia Tech. The paper was presented by the coauthor at the TIMS/ORSA San Francisco National Meeting, May 9-11, 1977. Some 100 copies of the paper were requested. This paper was submitted to Journal of Operations Research for publication.

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TITLE: Generation of Random Integer Programming Test Problems with Known Optimal Solutions

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

Dr. Ric Jackson of National Bureau of Standards had indicated to us that the Bureau had interest in the comparison of integer programming procedures. He also suggested to us to submit a pre-proposal related to the subject to the Applied Mathematics Division of NBS. A pre-proposal jointly written with Dr. R. L. Rardin of Georgia Tech had been sent to the Division. We maintain close contact with Dr. Jackson about the funding of the project.

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TITLE: Feasibility of Hydrogen as a Fuel for Automobiles in Florida

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

The original intent of this project was to look at the feasibility of hydrogen as a possible fuel substitute for transportation, and then prepare

a research proposal to the Florida State Energy Office, for this issue was rated first order of research priority in a Compendium of State Related Research Project Abstracts: 1973-1976. Studies indicated while hydrogen is abundant and economically competitive with respect to gasoline, problems such as storage and safety need be resolved. Thus, this investigator felt that a comparison study should not be made until these critical problems are resolved.

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TITLE: Minimizing Operating Cost for a Central Energy Plant

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

A research paper entitled "Minimizing Operating Cost for a Central Energy Plant" was prepared and presented at the National Joint Meeting of ORSA/TIMS at Miami, Florida on November 3-5, 1976. It was submitted to AIIE Transactions for Publication.

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TITLE: A Controlled Experimental Design for Comparison of Integer Programming Algorithms

PRINCIPAL INVESTIGATOR: Dr. B. W. Lin

A B S T R A C T

A research paper entitled "A Controlled Experimental Design for Comparison of Integer Programming Algorithms" was prepared and presented at the National Joint Meeting of ORSA/TIMS at Miami, Florida on November 3-5, 1976. It was submitted to Management Science for Publication. A revision is in preparation in accordance with referees' comments and suggestions.

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TITLE: Analysis of Productivity in the Private Sector

PRINCIPAL INVESTIGATOR: Dr. G. F. Schrader, P.E.

A B S T R A C T

The purpose of this project was to review the trends in industrial productivity and focus attention on those factors of production which appear to contribute to improvement in such productivity within various industrial sectors. A number of anomalies were found to exist between the factors of

production and productivity. However, there appears to be a strong relationship between process research activity and labor productivity within certain industry sectors.

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TITLE: Analysis of the Degree Programs in Industrial Engineering and Industrial Engineering Technology

PRINCIPAL INVESTIGATOR: Dr. G. F. Schrader, P.E.

A B S T R A C T

An analysis of the ECPD accredited programs in Industrial Engineering and Industrial Engineering Technology was presented at the annual meeting of the Council of Industrial Engineering Academic Department Heads (CIEADH) in Dallas on May 24, 1977. This study revealed that, during 1976-1977 there were 70 four-year accredited baccalaureate degree programs in Industrial Engineering, 4 four-year programs in Industrial Engineering Technology, and 14 two-year programs in Industrial Engineering Technology.

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ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: A Comparison of a GASP and a GPSS Simulation of an AVL Operational System

CANDIDATE: Barry Walden DuPuis

FACULTY ADVISOR: Dr. Robert D. Doering

A B S T R A C T

The purpose of this research report is to compare two simulation languages; GASP and GPSS. An economical comparison was performed by simulating the same system in each language and examining parameters such as run time, core size, program time, and debug time. A statistical comparison of the results of the system simulation was also performed using a 90% confidence level testing procedure. The system simulated was the proposed Orlando Police Department Automatic Vehicle Locator (AVL) Operational System.

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TITLE: An Interactive Income Tax Preparation System

CANDIDATE: Karen W. Ehlert

FACULTY ADVISOR: Dr. Christian S. Bauer

A B S T R A C T

The system described in this research report computes 1975 Federal income tax for those who itemize deductions. The system user calls the program, written in FORTRAN IV, from a computer terminal, and then types answers to questions asked by the program. The user is given the opportunity to make corrections in the answers, and then the system calculates and prints out information necessary to complete the IRS Form 1040 and Schedule A. The paper contains a description of the system, an explanation of the program, recommendations for future revision, and suggestions for expansion of the system. Four appendices contain IRM Form 1040 and Schedule A, sample cases, a complete program listing, and the gas tax and sales tax tables and tax rate schedules X, Y, and Z in which the tax is found.

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TITLE: An Interactive Information System for Tracking Student Academic Progress and for Projecting Quarterly Course Enrollments

CANDIDATE: Marilyn S. Khorsandi

FACULTY ADVISOR: Dr. Christian S. Bauer

A B S T R A C T

An interactive information system has been developed for the College of Engineering to promote faster and more accurate trial advisement interviews between professors and the students they advise. This system also provides departmental administrative personnel with information to guide course scheduling. The system has the capability of providing the following information concerning undergraduate students enrolled in the College of Engineering:

1. A student's academic progress toward graduation.
2. A projection for four quarters of enrollments in engineering core courses.
3. The current status of any course offered as a requirement for obtaining a Bachelor's Degree in one of the Engineering disciplines.
4. The current status of any program leading to a Bachelor's Degree in any of the Engineering disciplines.

The system provides the user with the additional capabilities to:

1. Update the database containing information pertaining to students enrolled in the College of Engineering.
2. Update the database containing information concerning courses offered as a requirement for obtaining a Bachelor's Degree in one of the Engineering disciplines.
3. Update the database containing information concerning the degree programs offered by the College of Engineering.

The system is user oriented and operation does not require any knowledge of computer programming. Complete documentation is available to facilitate trouble-free user operation and programming any desirable additional capabilities in the future.

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TITLE: Energy Resource Allocation Optimization a Mixed Integer Programming Fixed Charge Model

CANDIDATE: Mashaallah Khorsandi

FACULTY ADVISOR: Dr. Benjamin W. Lin

A B S T R A C T

A fixed charge model has been developed for a case study of a total energy power plant involving energy demands for chilled water, high temperature

hot water, and electrical power. Using a FORTRAN computer program, which employs the Land and Doig branch and bound algorithm, the system model is solved for different sets of system demands for multiple energy users, and the following set of information is obtained to guide the decisions of operations personnel:

1. Recommended on/off status for each piece of equipment in the system.
2. Recommended rate of operation for each piece of machinery.
3. Required amounts of different types of fuel to satisfy system demands.
4. A preferred path of flow through the system for each type of energy purchased or produced within the system.

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TITLE: Aggregate Production Planning: Techniques and Comparison

CANDIDATE: Fariborz Mazaheri-Meybodi

FACULTY ADVISOR: Dr. Benjamin W. Lin

A B S T R A C T

Aggregate production planning models are of the greatest importance to operations management, since these plans enable management to utilize the major resources at its command. In this report the structure of the aggregate planning problem and a number of different approaches are reviewed and presented. Approaches are classified in three categories: a) smoothing models, b) production smoothing models, and c) production and workforce models. The models are compared with respect to the cost structure, parameters estimation, forecast requirement, decision variables, computability and optimization techniques.

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TITLE: Work Sampling and Methods Improvements in Shipment Preparation

CANDIDATE: Michael P. McCann

FACULTY ADVISOR: Dr. Christian S. Bauer

A B S T R A C T

A study was undertaken in the Shipping Center of Rohm and Haas Chemical Company in Philadelphia, Pennsylvania to determine what course of action should be taken to reduce overall costs in a labor oriented shipment preparation operation. This activity, which currently utilizes a complement of twenty-seven people, involves the preshipment labeling and stenciling of

product and customer information to metal drums and pails plus various other preparation requirements. A work sampling was performed to determine manpower requirements by work category and this information was used to direct the methods improvements study into the most lucrative areas. By transferring the responsibility of label and stencil preparation from the Shipment Preparers, who work on the Shipping platforms, to Shipping Office personnel, and by changing stencil cutting and label storage methods, a net reduction of five people is projected.

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TITLE: Management Systems Design and Development

CANDIDATE: William F. Morwood

FACULTY ADVISOR: Dr. Robert D. Doering

A B S T R A C T

A Management Information System (MIS) is an information network of operations, practices, and procedures designed to meet the goals and objectives of management. The purpose of MIS is to convert information into management action.

Management Information Systems are frequently criticized for not meeting management objectives, as well as for being too costly and non-responsive to management's information needs.

This paper addresses this problem by researching the methods used to design and develop Management Information Systems. Section I presents the MIS project approach. It discusses the project phases, their objectives, the methods used and the project documentation. Section II is an analysis of the MIS project, pointing out the weaknesses and the reasons why the project itself is a success but often the end product quickly becomes unmanageable. Section III presents the changes that are required in the project objectives, the methods used, the personnel assigned and the documentation. These changes will reduce the management risk of failure of the MIS project and increase the probability of the end product meeting management needs.

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TITLE: Analytical and Experimental Investigation of Pumped Solar Hot Water Systems

CANDIDATE: Jeffrey B. Pearce

FACULTY ADVISOR: Dr. Ronald D. Evans

A B S T R A C T

A transient computer model of a forced circulation solar hot water system has been developed. The model allows for capacitance effects by solving

the energy balances on a four node model of the solar collector. The tank model is designed to include the presence of an auxiliary heater and to allow for the nonideal condition of load drawoff.

Five tests were done to validate the computer model. These tests include a comparison of the computer simulation with experimental data and a model available in the literature. The results of these tests indicate that the computer model is able to predict the collector inlet and outlet temperatures within 10% for typical operating conditions.

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TITLE: A Computer Graphics Analysis of a Freeway Merge Control System

CANDIDATE: Thomas A. Risher

FACULTY ADVISOR: Dr. Christian S. Bauer

A B S T R A C T

In 1975, C.S. Bauer completed a doctoral dissertation at the University of Florida which treated the Green Band Merging Control System on I-75 in Tampa, Florida. In this work, Bauer suggested the possibility for the use of computer graphics as a tool for analysis of the bands generated by the Green Band Control System Simulation developed in his dissertation. The use of computer generated movies of the bands displayed to ramp drivers by the system allows the comparison of various band control strategies without the need for field implementation and testing. With the goal of producing such films in mind, the research topic discussed in this paper was undertaken.

The report introduces the reader to some of the basic aspects of computer graphics and presents specialized computer software and interface hardware for producing automated computer graphics movies from a Tektronix 4010 storage display.

A brief discussion of the Tampa System and its associated simulation program is presented, and representative frames from the movies of the Tampa System produced in the research are discussed. Suggestions for additional work that could be undertaken in this research area conclude the report.

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TITLE: An Optimization Model for Modular Incineration and Transfer Station Location in Municipal Solid Waste Systems

CANDIDATE: Ali Sajjadian

FACULTY ADVISOR: Dr. Robert D. Doering

A B S T R A C T

Facility location models presently available in solid waste management are reviewed. From these models, one is adapted and modified to optimally

locate the modular incinerator plants and transfer stations for a typical municipal solid waste system. The criteria for optimization is developed in terms of minimum total operating and capital costs of the system.

Recommendations are made for the use of the optimization model for locating modular incinerator plants and transfer stations by municipal solid waste managers.

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TITLE: Distributed Computing Systems: An Overview

CANDIDATE: Haim (Jimmy) Schwarzkopf

FACULTY ADVISOR: Dr. Christian S. Bauer

A B S T R A C T

Associative processors, parallel processors, content addressable parallel processors, networks, and other architectures have been around the computing scene as "Distributed Processing" for some time now. Several hundred papers have been written discussing their use and design but so far no academic work has tried to summarize the field called "Distributed Processing" using a systems approach.

This research report attempts to remedy this lack. It attempts to gather into one place information that existed as of late 1976 in a format easily understandable by managers and systems engineers. The report deals also with certain issues of centralization and decentralization of EDP (Electronic Data Processing) facilities, created by the introduction of distributed computing systems into industries and businesses.

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TITLE: Applications of Fire Protection Models in Urban Planning

CANDIDATE: Ronald George Thomas

FACULTY ADVISOR: Dr. Robert D. Doering

A B S T R A C T

Providing fire protection service can be handled in a number of ways. With respect to urban planning, a number of varied techniques which can be applied to determining fire protection service have been developed in recent years; these include mathematical modeling, computer simulation, and systems analysis.

This research report presents a reveiw of the factors associated with urban planning and fire protection; the results of the investigations into

the fire protection service provided by Orange County, Florida, and Fairfax County, Virginia; and a survey of techniques which can be used to determine the level of fire protection service needed in a given area.

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TITLE: A Comparative Study of Forecasting Techniques for the U.S. Air Force Medical Material Management System

CANDIDATE: Philip John Van Ess

FACULTY ADVISOR: Dr. Benjamin W. Lin

A B S T R A C T

A computer simulation experiment was conducted to evaluate and compare five individual forecasting models across nine different demand patterns. The models were based on the Medical Material Management System used by the U.S. Air Force hospitals. Results indicated the best model varied depending on the demand pattern, the safety stock level, the noise level of the demand pattern, and the measure of forecast error. Across all demand patterns, exponential smoothing and 12-month moving average were best for the short term forecast used by the system, regardless of noise level in the demand patterns. Analysis of models within a single demand pattern showed, in most cases, several models as ranking equally well. When overall system requirements were considered, the exponential smoothing method was by far the best choice.

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MECHANICAL ENGINEERING AND AEROSPACE SCIENCES

Chairman: R. D. Evans

Faculty: J. R. Beck, A. H. Hagedoorn, B. G. Nimmo, C. Nuckolls, K. Prouty, R. Rapson, W. F. Smith, M. A. Varney, G. G. Ventre D. B. Wall

The faculty of the Mechanical Engineering and Aerospace Sciences Department continued a high level of productivity during the 1976-77 year. The increased work load brought on by increasing enrollments and decreasing available resources continues to be a problem. During the year Ms. Kathleen Prouty and Dr. Michael Varney joined the faculty and Dr. Bruce G. Nimmo went on leave of absence to the University of Petroleum and Minerals, Dahran, Saudia Arabia for a two year period to help them develop a viable solar energy research program.

The faculty continued to be active in creative, sponsored research, professional development and public service activities. A total of 37 publications, reports and presentations at technical meetings were produced by the faculty. Twenty two research proposals were prepared and submitted to outside funding agencies. In addition the faculty of the department supported short course activities for the Naval Training Equipment Center, a series of energy seminars throughout the State of Florida under the sponsorship of the Energy Research and Development Administration and continued contract work with the Florida Department of Pollution Control and Orlando Utilities Commission for the calibration of stack gas pitot tubes. These activities brought the department's total new funded activities for the 1976-77 year to $118,600 and total funded activities in force to $62,300. Drs. Evans and Smith were selected to serve on the Technical Advisory Committee to the Florida Solar Energy Center.

The faculty continued their active involvement in technical and professional activities such as ASME, AIAA, ASCE, ASM, ASEE, ACS, FES, NSPE, ISES, and ASA. Of the 10 current faculty in the department, 8 are now registered professional engineers in the State of Florida. Five faculty hold a P.E. license in more than one state. The faculty also participated in numerous civic, educational and community activities at the local, state, and national level.

The ASME Student Chapter under the leadership of Dr. Nuckolls was a highlight during the year. The students designed and built a small 8 horsepower single passenger vehicle and placed third overall in the National Mini-Baja Competition at Lafayette, Louisiana. A total of 15 Universities were involved in the competition.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. EVANS, R. D., and J. K. BECK, "Solubility Studies of Refrigerant-Absorbent Fluid Pairs for Solar Powered Air Conditioning Applications," Florida Scientist, Vol. 39, No. 3, Summer, 1976.

2. EVANS, R. D., "Energy Conservation in Building Designs," American Society of Civil Engineers (Florida Section), Annual Meeting, Lake Buena Vista, FL, September 23-25, 1976.

3. EVANS, R. D., and J. K. BECK, "Alternate Working Fluids for Solar Air Conditioning Applications," Proceedings of the ERDA Solar Heating and Cooling Forum, Miami, FL, December 13-15, 1976.

4. PHILLIPS, R. L., and R. D. EVANS, "A New Flat Plate Solar Collector Using Total Internal Reflection (TIR) for Light Trapping," Proceedings of the Flat Plate Solar Collector Conference, Orlando, FL, February 28 - March 2, 1977.

5. EVANS, R. D., and D. N. GREELEY, "A Preliminary Assessment of a Heat Pipe Flat Plate Collector," Proceedings of the Flat Plate Solar Collector Conference, Orlando, FL, February 28 - March 2, 1977.

6. EVANS, R. D., and D. N. GREELEY, "The Analysis, Design and Thermal Performance of a Heat Pipe Flat Plate Collector," Proceedings of the International Solar Energy Society - American Section, Vol. 1, Sec. 1-13, Orlando, FL, June 6-10, 1977.

7. HAGEDOORN, A. H., "Solar Energy Home Design and the Programmable Calculator," First International Conference on Mathematical Modeling, St. Louis, Missouri, May 16, 1977.

8. NUCKOLLS, C. E., and R. F. DOMINGUEZ, "Large Displacement Mooring Dynamics," Offshore Technology Conference, Houston, TX, May 2-5, 1977.

9. RAPSON, R. C. JR., "The Metric System as it Applies to the Citrus Industry," Trans. 1977 Citrus Engineering Conference, ASME, Lakeland, FL, March, 1977.

10. SMITH, W. F., "Performance of Sun-Lite-I (Premium) as compared to Ordinary Glass as a Glazing Material for Flat-Plate Collector," Flat-Plate Solar Collector Conference and Workshop, Orlando, FL, February 28 - March, 1977.

11. SMITH, W. F., "Performance of Lexan as Compared to Ordinary Glass as a Glazing Material for Flat-Plate Solar Collectors," International Solar Energy Society Solar World Proceedings Conference, Orlando, FL, June 6-9, 1977.

12. VARNEY, A. M., et. al., "Liquid Propellant Burning Rate Measurement Techniques," CPIA Publication No. 138, January, 1977.

13. VARNEY, A. M., et. al., "Erosion of Powder Metallurgy Aluminum Alloys by Hot Propellant Gases," ASME J of Engineering Materials and Technology, February, 1977.

14. VENTRE, G. G., "Environmental Acoustics Newsletter," Coordinating Committee on Environmental Acoustics, Acoustical Society of America, Orlando, FL, Summer, 1976.

CONFERENCES, WORKSHOPS, SHORT COURSES AT WHICH RESULTS OF RESEARCH WERE COMMUNICATED

1. Southeastern Seminar of Thermal Sciences, University of Virginia, Charlottesville, VA, June 8, 1976, "Solubility Studies of Refrigerant-Absorbent Fluid Pairs for Solar Powered Air Conditioning Applications." (Beck, Evans)

2. FTU/AIA Workshop, "Energy as a Design Criteria," Summer 1976. (Evans)

3. American Society of Civil Engineers - Florida Section Annual Meeting, Lake Buena Vista, FL, September 23-25, 1976, "Energy Conservation in Building Designs." (Evans)

4. Thirteenth JANNAF Propulsion Meeting, U.S. Naval Post Graduate School, Monterey, CA, September 1976, "Liquid Propellant Burning Rate Measurement Technique." (Varney)

5. FTU Seminar, October 13, 1976, "Developing Noise Awareness Programs." (Ventre)

6. Florida Chapter of the Acoustical Society of America, Gainesville, FL, October 15, 1976, "Aeroacoustics." (Ventre)

7. Florida Chapter of the Acoustical Society of America, Gainesville, FL, October 15, 1976, "The Concorde." (Ventre)

8. FES/FTU Professional Engineer Review Course, Fall 1976. (Evans, Rapson)

9. Fourth Annual Meeting on FAE, Eglin Air Force Base, FL, December 1976, "Deflagration to Detonation Transition Using Pyrophonic Initiators." (Varney, Summerfield)

10. Zero Population Growth, College of Humanities and Fine Arts and Florida Endowment for the Humanities Conference on "Will My Child Have a House of His Own?" "Can Technology Help to Solve Present and Future Problems Related to Home Ownership?" FTU, Orlando, FL, February 24-25, 1977. (Evans)

11. ERDA Flat Plate Solar Collector Conference, Orlando, FL, February 28-March 2, 1977.
    a) "A Preliminary Assessment of a Heat Pipe Flat Plate Collector." (Evans, Greeley)
    b) "A New Flat Plate Solar Collector Using Total Internal Reflection (TIR) for Light Trapping." (Evans, Phillips)
    c) "Performance of Sun-Lite I (Premium) as Compared to Ordinary Glass as a Glazing Material for Solar Collectors." (Smith)

12. Citrus Engineering Conference, ASME, Lakeland, FL, March 1977, "The Metric System as it Applies to the Citrus Industry." (Rapson)

13. AIME National Meeting, Atlanta, GA, April 7, 1977, "The Effect of a 0.57 Ag Collector as the Age Strengthener of an Al-4.57 Cu-1.57 Mg Alloy." (Smith, White, Sulouff)

14. Offshore Technology Conference, Houston, TX, May 3, 1977, "Lurge Displacement Mooring Dynamics." (Nuckolls)

15. American Chemical Society, Pensacola, FL, May 13, 1977, "The Real Story on the Energy Crisis." (Ventre)

16. The National Swimming Pool Institute, Region VII, Orlando, FL, May 19-20, 1977, "System Sizing and Economics of Solar Pool Heaters." (Evans)

17. The International Solar Energy Society - American Section, Orlando, FL, June 6-10, 1977.
    a) "The Analysis, Design and Thermal Performance of a Heat Pipe Flat Plate Collector." (Evans, Greeley)
    b) "Performance of Lexan as Compared to Ordinary Glass as a Glazing Material for Solar Collectors." (Smith)
    c) "Energy Resources and the Future, Solar Energy and the Classroom." (Ventre)

RESUMES OF SPONSORED RESEARCH

TITLE: Calibration of Stack Gas Pitot Tubes

PRINCIPAL INVESTIGATOR: Mr. J. K. Beck, P.E.

SPONSORING AGENCY: Orlando Utilities Commission

A B S T R A C T

A continuing program is underway to calibrate various pitot tubes for use in making air pollution measurements in stack gases. The calibrations are carried out over a range of flow conditions utilizing the FTU subsonic wind tunnel.

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TITLE: A Preliminary Evaluation of Solar-Activated Dessiccant Systems for Supplementary Comfort Conditioning of Residential Environments

PRINCIPAL INVESTIGATOR: Mr. J. K. Beck, P.E.

SPONSORING AGENCY: FTU Office of Graduate Studies and Research

A B S T R A C T

This effort has been directed toward the lowering of the humidity ratio utilizing dessiccants which may be reactivated by solar energy. Both solid and liquid dessiccants have been evaluated.

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TITLE: The Application of Heat Pipes for Solar Space Heating

PRINCIPAL INVESTIGATOR: Dr. R. D. Evans, P.E.

SPONSORING AGENCY: Florida Solar Energy Center

A B S T R A C T

A project has been initiated to assess the feasibility of utilizing a combination solar collector - heat pipe system for space heating. An analysis of such a system is underway to determine the best method of several alternatives which offers the most potential for achieving a workable space heating system. An experimental system will be designed and tested in the laboratory to determine the thermal performance characteristics of the system.

PUBLICATIONS: Evans, R. D., and D. N. Greeley, "A Preliminary Assessment of a Heat Pipe Flat Plate Solar Collector," Proceedings of the ERDA Flat Plate Solar Collector Conference, Orlando, Florida, February 28-March 2, 1977.

Evans, R. D., and D. N. Greeley, "The Analysis, Design and Thermal Performance of a Heat Pipe Flat Plate Collector," Proceedings of the International Solar Energy Society, annual meeting of the American Section, Orlando, Florida, June 6-10, 1977.

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TITLE: STAR 76-021, Solar Heating in State Buildings

PRINCIPAL INVESTIGATOR: Dr. R. D. Evans, P.E.

SPONSORING AGENCY: Florida State Energy Office - Department of Administration

A B S T R A C T

An analysis is being carried out to identify state buildings which offer the highest potential for the installation of a solar water heating system. A solar system is sized for each building identified and a cost estimate for the system is made. A life cycle cost analysis is being conducted for each solar system to predict the net life time energy savings and payback period.

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TITLE: Solar Energy Home Design

PRINCIPAL INVESTIGATOR: Dr. A. H. Hagedoorn, P.E.

SPONSORING AGENCY: FIU Office of Graduate Studies and Research

GRANT NUMBER: 182000044

A B S T R A C T

The application of the hand calculator to solar energy home design.

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TITLE: Solar System Survey II

PRINCIPAL INVESTIGATORS: Dr. B. G. Nimmo and Dr. R. D. Evans, P.E.

SPONSORING AGENCY: Florida Solar Energy Center

A B S T R A C T

This project involves the completion of the mobile solar testing and recording system and its use in testing installed domestic hot water systems in the State of Florida.

PUBLICATION: Nimmo, B. G., "Testing of Flat Plate Solar Collectors and Solar Hot Water Systems," Florida Academy of Sciences Solar Symposium Volume, In Press.

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TITLE: Monitoring and Evaluation of Residential Solar Water Heaters

PRINCIPAL INVESTIGATORS: Dr. B. G. Nimmo and Dr. R. D. Evans, P.E.

SPONSORING AGENCY: Department of the Navy - Naval Training Center, Facilities Command

A B S T R A C T

Three residential size solar water heaters were monitored over a period of 21 days to determine the overall thermal performance of the three systems. The monitoring program was carried out with the FTU Mobile Solar Laboratory (STAR). The raw data was received by a computer program and instantaneous efficiencies and average daily efficiencies calculated for each solar water heater.

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TITLE: State Technology Applications Center (STAC)

PRINCIPAL INVESTIGATOR: Dr. C. E. Nuckolls, P.E.

SPONSORING AGENCIES: NASA/SUS STAR/Florida Department of Commerce

A B S T R A C T

A joint project of the State University System, NASA, and the Florida Department of Commerce, STAC is a computer based information retrieval system which offers users rapid access to NASA and other data bases storing data on more than ten million published articles related to virtually every

field of human endeavor. This service to business and industry is available through field offices of the Department of Commerce and the Engineering Colleges at FTU, USF, and UF.

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TITLE: Instruction in Control Systems Analysis

PRINCIPAL INVESTIGATOR: Dr. R. C. Rapson, P.E.

SPONSORING AGENCY: NTEC

A B S T R A C T

A one quarter short course was developed and presented at the NTEC on the subject of Control Systems Analysis.

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TITLE: NTEC Course 76-77 - Computer Engineering

PRINCIPAL INVESTIGATORS: Dr. R. C. Rapson, P.E. and Dr. B. W. Patz, P.E.

SPONSORING AGENCY: NTEC

GRANT NUMBER: 033502008

A B S T R A C T

Course II - Software Programming Problems and Solutions focused on practical applications. It emphasized programming basic philosophy(machine language, assembly language, compiler), Fortran programming and engineering applications, numerical solution to difference equations, programming errors, etc.

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TITLE: Performance of Glazing Materials for Solar Water Heaters

PRINCIPAL INVESTIGATOR: Dr. W. F. Smith, P.E.

SPONSORING AGENCY: Florida Solar Energy Center

A B S T R A C T

An evaluation was made of the performance of Kalwall Company's Sun-Lite-I (premium), 0.040 in. sheet, as a glazing material for flat plate solar

collectors. Two identical flat-plate solar hot water heating systems were set up side-by-side, one with a Sun-Lite cover and the other with ordinary 3/16 in. glass. On the basis of the hot water produced over 6-hr. test periods, the Sun-Lite glazing material was found to be 80-85% as efficient as the ordinary glass.

PUBLICATION: Smith, W. F., "Performance of Sun-Lite-I (Premium) vs. Ordinary Glass as Glazing Materials for Flat-Plate Solar Collectors," Proceedings of the Flat-Plate Solar Collector Conference, Orlando, Florida, February 28-March 2, 1977.

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TITLE: Coal Combustor Design

PRINCIPAL INVESTIGATOR: Dr. A. M. Varney

SPONSORING AGENCY: FTU Office of Graduate Studies and Research

GRANT NUMBER: 182000058

A B S T R A C T

The DSR project proposes to develop a practical analytical model simulating pulverized coal combustion in a volume limited system and to parametrically explore the effects of coal particle size, particle residence time, and coal combustion kinetics on combustion intensity and heat recovery efficiency. Further, the proposed in-house project would conduct preliminary planning and cost assessment for an FTU Coal Combustion Laboratory and prepare a document which would be presented to the Energy Research and Development Administration (ERDA) as a proposal in an effort to obtain grant support for a continuing project housed at FTU.

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TITLE: Support of Local Governments in Central Florida in Developing or Updating Noise Ordinances

PRINCIPAL INVESTIGATOR: Dr. G. G. Ventre

SPONSORING AGENCY: State of Florida Department of Pollution Control

A B S T R A C T

This continuing project involves assisting local governments in Central Florida in updating or developing noise ordinances. Efforts include research into the various approaches available, monitoring of existing noise levels at selected locations, recommending levels for various zoning categories and for

various products, assistance in selecting measuring and recording instrumentation, training of enforcement personnel, public education, etc.

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RESUMES OF UNSPONSORED RESEARCH

TITLE: The Design and Testing of an Optical Solar Energy Collector

PRINCIPAL INVESTIGATORS: Dr. R. D. Evans, P.E. and Dr. R. L. Phillips

A B S T R A C T

A 2 ft x 3 ft laboratory prototype plexiglass optical trap (index of refraction u = 1.5) was designed and built to be used as a solar energy collector. The optical trap works on the principle that all the incoming solar radiation passing through a transparent surface of index of refraction u_1 will be trapped inside a triangular channel filled with a fluid of index of refraction u_2 provided $u_2 > u_1$. Preliminary data indicates the collector will provide temperatures of 140°F when water (u = 1.33) is the collector fluid. However, extensive testing of the collector will be conducted utilizing working fluids with much higher indexes of refraction.

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TITLE: Design of a Calibration Device for Piezoelectric Pressure Transducers

PRINCIPAL INVESTIGATOR: Dr. R. C. Rapson, P.E.

A B S T R A C T

Analysis and preliminary design of a calibration device for piezoelectric pressure transducers for measurement of solar energy collection and usage hours developed. Further work is necessary to fabricate and test the device.

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TITLE: Performance of Glazing Materials for Solar Water Heaters

PRINCIPAL INVESTIGATOR: Dr. W. F. Smith, P.E.

A B S T R A C T

An evaluation has been made of the performance of General Electric Company's Lexan, 0.060 in. sheet, as a glazing material for single-glazed flat-plate solar collectors. Results showed that for clear sky conditions Lexan was slightly superior to ordinary glass. However, under intermittent cloud conditions, the efficiency of Lexan covers decreased to 95% of glass.

PUBLICATION: Smith, W. F. "Performance of Lexan vs. Ordinary Glass as Glazing Materials for Flat-Plate Solar Collectors," Proceedings of the 1977 Annual Meeting of the American Section of the International Solar Energy Society, Orlando, Florida, June 6-10, 1977.

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TITLE: An Evaluation of Selected Vegetable Oils as Possible Fuels for IC Engines

PRINCIPAL INVESTIGATOR: Dr. D. B. Wall, P.E.

A B S T R A C T

An examination of selected vegetable oils as fuel sources for small internal combustion engines has been initiated. A library research will be conducted with initial experiments to follow.

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ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: Nose Tip Recession Measuring System for Hypersonic Test Vehicles

CANDIDATE: James Anthony Brown

FACULTY ADVISOR: Dr. Ronald D. Evans

A B S T R A C T

A method is presented which permits the measure of nose tip recession of re-entry vehicles and advanced terminal interceptors by employing a double choked flow coolant gas system. Recession of the tip results in an increased exit flow area which reduces the total pressure of the gas in the blast tube. Measurement of the blast tube pressure and gas generator (chamber) pressure will produce an effective measurement of the nose tip recession as long as choked flow (i.e., sonic velocity) is maintained in both the tip exit area and the gas generator throat area.

Governing flow equations documented in the literature are developed for double choked flow. Hypersonic wind tunnel test data are presented to verify the developed flow equations and to identify the mass flow ratios necessary to sustain double choked flow.

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TITLE: Analytical and Experimental Investigation of Thermosyphon Solar Hot Water Systems

CANDIDATE: William E. Clark

FACULTY ADVISOR: Dr. Ronald D. Evans

A B S T R A C T

A computer simulation of a thermosyphon system allowing load drawoff and non-ideal weather conditions has been developed. The model is restricted to the more common single cover, flat plate collector system. Using an analysis based on the present literature, this model calculates the energy absorbed by the collector, the temperature distribution through the system, and the corresponding flow rate.

Experimental data for a non-ideal day is compared to the computer simulation. Results of this comparison indicate that the desired parameters, flow rate, collector inlet and outlet temperatures, and the mean tank temperature can be predicted by this model to within 10 percent.

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TITLE: Selection Considerations for a Servovalve

CANDIDATE: Frank J. Niemas, Jr.

FACULTY ADVISOR: Dr. Richard C. Rapson, Jr.

A B S T R A C T

Servovalves are a key factor in determining the performance characteristics of an electrohydraulic position servo. This paper examines the interrelationships between servovalve parameters and system requirements.

A brief description of the configuration and operation of a typical servovalve is presented. Key servovalve parameters are identified, defined, and discussed. System performance considerations are identified, and the interrelationships between system requirements and servovalve parameters are examined. Examples of servovalve parameters for missile, aircraft and industrial systems are given to illustrate the effect of system requirements on a servovalve. Finally, general guidelines for selecting and specifying servovalve parameters are given.

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TITLE: Aging Characteristics of an Aluminum-4.5% Copper-1.5% Magnesium Alloy

CANDIDATE: Robert Earl Sulouff, Jr.

FACULTY ADVISOR: Dr. William F. Smith

A B S T R A C T

The effects of quenching conditions, single-step and two-step aging treatments on the tensile properties of an Al-4.5% Cu-1.5% Mg alloy has been investigated. Results indicate that two distinctly different precipitates of GPB and S' form during aging. Single-step aging at 140°C, 160°C and 190°C indicated that 24 hours at 160°C produced optimum strength (67 ksi UTS). Two-step aging for 3 days at 140°C plus 190°C resulted in a slight increase in strength over single-step aging at 190°C. Slow (oil) quenching as well as direct quenching improved the tensile properties when aged at 190°C. Reversion occurred slowly over the temperature range 250°C to 350°C.

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ENGINEERING TECHNOLOGY

Chairman: R. G. Denning

Faculty: H. L. Griffith, J. W. Hubler, and K. W. Osborne

The Engineering Technology Department made significant progress during 1976-77. The number of full-time faculty was doubled as Dr. Denning was appointed as Chairman and J. W. Hubler was changed from adjunct to Visiting Professor. The rapid growth in student enrollment of the early years of the ENT program appears to have ended and will be followed by a period of stability and gradual increase. In the Winter Quarter of 1977, 237 students were enrolled compared to 225 in Winter of 1976. Summer enrollment was 141 in 1977 and 144 in the summer of 1976. The productivity of the department remained high during 1976-77.

During 1976-77, 65 BET Degrees were awarded increasing the total number of graduates to over 100 since the program began. Those graduating in the Spring of 1977 included a number of students who completed the majority of the ENT program at the FTU Brevard Resident Center.

The ENT Program at the Brevard Resident Center continued during the year with approximately 55 active students. An adequate number of ENT curriculum courses were offered during the evening, usually three courses per quarter, and class enrollments indicated continued student interest in the BET program. At least two evening courses per quarter are scheduled at BRC for 1977-78 and the program is expected to continue to be an important part of FTU's ENT Department.

The Department continued to offer evening courses during 1976-77, averaging three courses per quarter. During 1977-78 at least three courses per quarter will be offered during the evenings on the main campus to provide working students in the Orlando area the opportunity to earn the BET while holding full-time jobs.

Efforts to maintain and promote articulation with the community/junior colleges were increased during 1976-77. The additional full-time faculty provided some relief for the heavy student advisement load and allowed more time for visits with faculty and students at the two-year colleges in the State. Academic advisement remains a major task as almost all ENT students have transfer credit to be petitioned, but most student records are now up to date due to the extra effort of the faculty during 1976-77.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. GRIFFITH, H., "Sample Problems and Solutions for Industrial Engineering Technology Examination," NSPE Institute for Certification of Engineering Technicians, 1977.

2. OSBORNE, K., "Wanted: Challenging Assignments," Electronics Engineering Times, May, 1977.

3. OSBORNE, K., "Digital Laboratory Workbook," Florida Technological University - Engineering Technology Department, 36 pages, Spring 1977.

CONFERENCES, WORKSHOPS, SHORT COURSES AT WHICH RESULTS OF RESEARCH WERE COMMUNICATED

1. Continuing Education Department at Southern Technical Institute, January and August, 1976, Conducted Mathematics and Thermodynamics sections of Engineer in Training Exam preparation course. (Denning)

2. Florida Technical Education Association, Orlando, FL, August 10, 1976, "Engineering Technology Articulation Accomplishments over the Past Four Years." (Griffith)

3. Florida Organization for Recruiting Minorities, FTU, Orlando, FL, Fall Meeting 1976. (Denning)

4. Management Seminar, Luria Brothers, Burns Harbor, Indiana, October 9, 1976. (Hubler)

5. Seminar for Counselors and Administration at Brevard CC, October 14, 1976, "Engineering Technology Articulation." (Griffith)

6. Seminar for Faculty, Administration and Counselors at Broward CC, Ft. Lauderdale, FL, February 4, 1977, "Engineering Technology Articulation." (Griffith)

RESUMES OF UNSPONSORED RESEARCH

TITLE: Study of Lower Level Industrial Engineering Technology

PRINCIPAL INVESTIGATOR: Mr. H. L. Griffith, P.E.

A B S T R A C T

Three Community Colleges in Florida (Manatee, Seminole, and Brevard) have Industrial Engineering two year Technology programs. I now have the course content of each program and plan to determine the common courses and credits required. From this information I hope to establish a common two year Industrial Technology program for the State of Florida and evaluate how the curriculum articulates into the FTU Engineering Technology program.

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TITLE: Lower Division Requirements for Environmental Technology

PRINCIPAL INVESTIGATOR: Mr. H. L. Griffith, P.E.

A B S T R A C T

Activities were limited to evaluating the potential of our Environmental Technology program. Our state has only one lower level Environmental Technology program (Brevard Community College). The Brevard program is strong and provides us with 8 to 10 students per year. In the past we have had 6 to 8 additional students per year from out of state and other sources. This did not happen in the Fall of 1976, probably due to out-of-state student restrictions. The lower level Environmental Technology programs in the United States are varied. Some are health allied, with emphasis on microbiology. Students with microbiology backgrounds apparently make good Environmental Technology students.

Fortunately, our Environmental courses are compatible for students interested in Construction, Design, and Industrial Technologies. Our Environmental Technology courses have averaged 15 to 25 students due to Operations and Design students who need electives or have an interest. My overall conclusions are that we should make no Environmental Module changes at this time because:

a. All of our Environmental graduates appear to find appropriate employment in the environmental field.
b. We need the courses as electives for Operations and Design Module majors.
c. If out-of-state students are now being accepted, we may increase our enrollment.
d. There are few four year Environmental programs in the United States.

e. We could at some future date start a Construction Technology Module with minimal effort. The waste water and hydraulics courses are compatible in the Construction Module with no modification. This could further increase class enrollment.

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TITLE: Lower Division Mathematics Requirements for Engineering Technology

PRINCIPAL INVESTIGATOR: Mr. H. L. Griffith, P.E.

A B S T R A C T

In the context of the technology program, there are at least two methods of viewing mathematical requirements. The first method is to take the view that all technologies should have the same mathematics education and training regardless of module. The second, a more sophisticated approach, is to allow variations, allowing the student to take the minimum mathematics needed to accomplish his or her module. One individual module, electronics, appears to require a more complex mathematics training than the normal. In general, I am leaning toward the approach that students in the community colleges complete algebra, trigonometry, and a minimum of five credits of applied calculus. I would like to see this made standard for Florida.

With the above in mind, our Technology department will run two sections of ENT 303 during the fall quarter, one group for the electronics majors, the other for environmental, design, and operations. The two courses will vary slightly depending upon needs at this institution. As an example, the electronics students will concentrate on mathematics needed to solve applied electronics problems whereas the other group will concentrate on mathematics needed to solve various problems including statistics. Mr. Osborne will teach the two classes, keep a record of their progress, and make a short written report concerning the outcome. We then hope to follow the students through their formal math sequence to see if the practice is of value.

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TITLE: Determine Lower and Upper Level Course Requirements for Engineering Technology Electronics

PRINCIPAL INVESTIGATOR: Mr. K. W. Osborne, P.E.

A B S T R A C T

It was determined that we need to expose students to more integrated circuit building blocks. Many community college programs are deficient in this area. Numerous manufacturers' data books and application manuals were ordered for the library.

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TITLE: Digital Circuit Laboratory Improvement

PRINCIPAL INVESTIGATOR: Mr. K. W. Osborne, P.E.

A B S T R A C T

A 35 page lab manual containing tests for 20 integrated circuits was prepared. CMOS logic was introduced.

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TITLE: Power Transmission Course Development

PRINCIPAL INVESTIGATOR: Mr. K. W. Osborne, P.E.

A B S T R A C T

The course content of our new power course was determined. Three visits to Florida Power facilities were made. Literature was obtained from Florida Power and pertinent reference books were ordered for the library.

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1976-77 Academic Year

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