

1981

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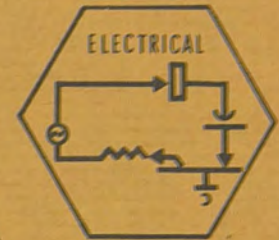
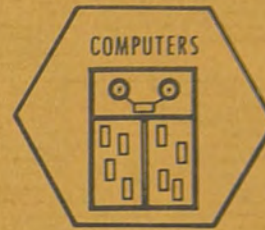
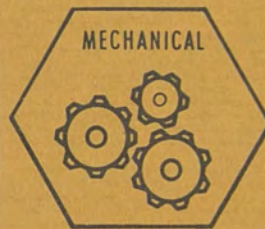
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University of Central Florida

COLLEGE OF ENGINEERING

UNIVERSITY
OF CENTRAL
FLORIDA

**RESEARCH
ACTIVITIES**



**AND
ANNUAL
REPORT**

JULY 1, 1980 - JUNE 30, 1981

UNIVERSITY OF CENTRAL FLORIDA • COLLEGE OF ENGINEERING

P. O. Box 25000 ORLANDO, FLORIDA 32816

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Table of Contents	
Introduction	ii
Dean's Office Report	1
Civil Engineering and Environmental Sciences	
Departmental Report	3
Publications and Presentations of Professional Papers	5
Conferences, Workshops, Short Courses at Which Results of Research Were Communicated	11
Resumes of Sponsored Research	12
Resumes of Un-sponsored Research	23
Abstracts of Master's Degree Research Reports & Theses	25
Electrical Engineering and Communication Sciences	
Departmental Report	31
Publications and Presentations of Professional Papers	33
Conferences, Workshops, Short Courses at Which Results of Research Were Communicated	35
Resumes of Sponsored Research	36
Resumes of Un-sponsored Research	40
Abstracts of Master's Degree Research Reports & Theses	41
Engineering Technology	
Departmental Report	45
Publications and Presentations of Professional Papers	46
Conferences, Workshops, Short Courses at Which Results of Research Were Communicated	47
Resumes of Sponsored Research	48
Resumes of Un-sponsored Research	49
Industrial Engineering and Management Systems	
Engineering Mathematics and Computer Systems	
Departmental Report	50
Publications and Presentations of Professional Papers	52
Conferences, Workshops, Short Courses at Which Results of Research Were Communicated	55
Resumes of Sponsored Research	56
Resumes of Un-sponsored Research	64
Abstracts of Master's Degree Research Reports & Theses	68
Mechanical Engineering and Aerospace Sciences	
Departmental Report	73
Publications and Presentations of Professional Papers	74
Conferences, Workshops, Short Courses at Which Results of Research Were Communicated	76
Resumes of Sponsored Research	77
Resumes of Un-sponsored Research	89
Abstracts of Master's Degree Research Reports & Theses	90
Indexes	
Investigator Index	92
Sponsor Index	94
Subject Index	96

INTRODUCTION

State leaders at all levels are committed to the industrial and economic development of Florida. The key element to development of a high-technology industrial base is a high-quality engineering educational system. While undergraduate enrollment has sky-rocketed at all Colleges of Engineering in the state over the last ten years, funding (in terms of dollars per student) has actually declined despite the enormous inflation in costs that has occurred during this period.

In a memorandum on engineering education released in March 1980, the American Society of Engineering Education (ASEE) and the American Association of Engineering Societies (AAES) concluded...(1) "that the general health of engineering education is fundamental to the general health of the national economy"...(2) "that the schools of engineering play a role in the determination of the U.S. national economic health analogous to the place of the schools of medicine in the provision of health services"...(3) "that the problems of engineering education are the problems of industrial innovation, some economists assign(ing) as much as 35% of the growth of national productivity to engineering innovation"... and (4) "that the (engineering education) system is currently stretched to (or beyond) its limit." All conclusions arrived at by ASEE and AAES apply in Florida to a greater degree than elsewhere.

Fortunately the leadership of the state perceived the nature of the problem and commissioned important "task force" studies to address the issues. At the request of Governor Graham, the Florida Board of Regents appointed a Task Force on Science, Engineering and Technology Service to Industry. The Task Force presented its report to the Board of Regents in December of 1980 and therein identified three (3) major needs:

1. "Improved continuing educational services and graduate programs."
2. "Improved quality of programs."
3. "Increased production of engineers, particularly electronic, computer and mechanical engineers, in order to help meet the statewide and nationwide shortage."

Coincidentally, the Florida Engineering Society's Education Committee was given the charge by FES of studying engineering education in the State University System and preparing a report with recommendation for possible action by the Society. The recommendation of the report emphasized:

1. That the Florida Legislature and Florida Board of Regents, in the interest of supporting the continued industrial and economic development of the State, adopt the significant improvement of the quality of the State University System engineering education programs as one of their priority goals.

2. That the Florida Legislature and the Florida Board of Regents, as one of their priority funding goals, adopt the bringing of the State University System Colleges of Engineering to a parity with regional and national budget parameters, including emphasis on salary improvement, reduction of student/faculty ratios, engineering laboratory equipment upgrade, and enhancement of instruction resources generally (especially fixed capital outlay).
3. That the Florida Legislature and the Florida Board of Regents encourage the existing State University System Colleges of Engineering to enhance preparation for professional practice by taking steps to achieve recognition as Professional Schools of Engineering under the National Society of Professional Engineers professional schools program.

The problems of large class sizes, high student-to-faculty ratios, deteriorating physical plants, inadequate equipment, space limitations, inability to acquire equipment commensurate with technological advancement, low faculty salaries and other unfavorable demographics of engineering faculty are too widespread to be ignored. Certainly, at a time when demand for technical talent is at an all-time high and the economic welfare of Florida and the nation depends on the professional practice of engineering, these problems must be addressed in a meaningful way. They are too pervasive to be regarded as transient.

In nearly all cases, available data, tended to indicate Florida's engineering colleges now compare poorly with the better engineering colleges in the nation, and with the so-called average institutions as well, in the educational resources necessary to develop and maintain quality programs. As the year draws to a close the Florida Legislature has these matters under active consideration and is taking positive steps to redress the balance for engineering, not for the sake of competition with other institutions outside the state in terms of reputation, but simply because the economic future and well-being of Florida is strongly related to the integrity and quality of its engineering education programs. The forthcoming 1981-82 year promises to be one in which the State University System's commitment to quality engineering programs is fulfilled.

Robert D. Kersten
Dean

DEAN'S OFFICE REPORT

The College of Engineering experienced another excellent year during 1980-81. Every significant parameter (e.g. enrollments, faculty, degrees granted, research income, community service activities, extended studies activities, etc.) showed substantial increases during the year. This report describes the more important developments of the year and summarizes research activities for the year.

Cooperative efforts among all SUS Engineering Colleges (UCF, USF, UF, FAU) continued. The UCF Engineering and Industrial Experiment Station activities under a letter agreement with the University of Florida continued to show improvement. Sponsored research income again exceeded the \$1,000,000 level for the year. The State Technology Application Centers (STAC) program at UCF, USF and UF continued during the year, partially funded by NASA.

COE Faculty and Students continue to receive a variety of scholarly and professional recognition. UCF/COE faculty continue to bring national recognition to the University through many offices and committees of numerous technical and professional societies. See departments reports for additional details.

Drs. Denning, Gambrell, Hubler, Kersten, and Schrader served on the Accreditation Board for Engineering and Technology ad hoc accreditation visitation committees during the year. Dr. Denning served on Southern Association for Colleges and Schools visiting committees during the year. Dr. Gambrell serves as a member of the Board of Directors of ABET; Dr. Schrader continued as Executive Vice President of AIIE; Dr. Kersten continued as a member of the State Board of Engineers and served as Chairman of the Professional Schools of Engineering Recognition Committee of NSPE. Dr. Hartman was elected Chairman of the Professional Interest Council II and thereby joined the Board of Directors of the American Society for Engineering Education. Dr. McLellon was named Professor Emeritus during the year. Drs. Harden and Schrader served on NSF review panels during the year.

Dr. Mathews served on the Board of Directors of SOUTHCON and Orlando will host the 1982 meeting. Dr. Gambrell served on the Scientific Advisory Group of the U. S. Army Test and Evaluation Command and the Board of Trustees of Winter Park Memorial Hospital and Embry-Riddle Aeronautical University. Drs. Block and Ventre continue to serve at the Florida Solar Energy Center. Work continues with International Programs through Dr. Muiga's efforts with the World Health Organization. Dr. Hartman was selected for the ASEE Southeastern Section Western Electric Fund Award.

The Florida Legislature revised the Professional Engineer Registration Law (Chapter 471 F.S.) during 1979. Engineering faculty teaching "principles and methods of design" are now required to be registered in Florida. At the end of the year 82 percent of the UCF Engineering Faculty were registered.

The COE Board of Visitors continued its active support during the year. Special efforts were made to increase the readiness of UCF/COE to initiate doctoral programs. A special consulting team (including Dr. Joseph Pettit, President of Georgia Institute of Technology; Dr. Joseph Malina, University of Texas; Dr. Russell O'Neill, UCLA; Alan Pritsker, President of Pritsker and Associates; and Dr. William Smith, North Carolina State University) completed a visitation and report during the year. Six additional faculty were honored for ten or more years of service to the College and UCF.

The COE remained active with 16 other major engineering colleges in the Southeastern Consortium for Minorities in Engineering (partially funded by the Sloan Foundation) during the year. Minority enrollments have increased significantly in the last four years. The College was the recipient of a challenge grant from the National Action Council for Minorities in Engineering. Twenty eight minority student scholars will enroll in engineering departments during Fall Semester 1981 as a result.

Persons interested in any of the topics included in this report are invited to contact the Dean's Office or the appropriate Principal Investigator.

CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCES DEPARTMENTAL REPORT

Chairman: M. P. Wanielista

Faculty: D. L. Block, W. E. Carroll, C. D. Cooper, H. H. Harper,
J. P. Hartman, D. R. Jenkins, R. D. Kersten,
W. M. McLellon, J. N. Seaman, R. Smith, M. I. Muiga,
B. R. Snyder, J. S. Taylor, and Y. A. Yousef

The Civil Engineering and Environmental Sciences Department consisted of a fifteen-member faculty during the 1980-81 year. Options offered by the Department are in Civil Engineering and Environmental Engineering. Dr. Block is resident with the Florida Solar Energy Center on the Florida East Coast. Dr. Muiga is on leave-of-absence to serve with the World Health Organization in Africa. Dr. Cooper rejoined the faculty after two years of study at Clemson, after which he earned a Ph.D. Professors Seaman and Smith joined the faculty in the Spring quarter. Dr. McLellon was appointed Professor Emeritus. He retires from the University this year.

The CEES Department graduation count was 43 BSE and 10 MS, MSE or MSESM students. The faculty had \$570,000 of research grants and contracts effective during the 1979-80 fiscal year. During the year, external funding was approximately \$182,000. In addition, Department faculty attracted \$467,000 in federal and state monies to be used for construction on Lake Eola, a eutrophic urban lake. Research supported approximately three full-time faculty positions during the year.

Again, a focused research program for the development of faculty and students was one of the primary goals achieved by the faculty. Dr. Yousef, Director of the Environmental Systems Engineering Institute, continued his work on bridge runoff effects on fresh water resources. Of national significance was his work on bottom mud inactivation using chemical sludges. He also conducted research in heavy metals in water distribution systems. Dr. Yousef holds the Gordon J. Barnett chair which enhances the transfer of technical information. Information transfer through short courses and workshops were accomplished in the mini-computer, stormwater impacts, and statistical analysis of highway construction and maintenance. The Faculty continue to remain active in all types of continuing education activities. Of note was the Florida Federation of Garden Clubs' Environmental Workshop for high schools and a Mini-computer Applications in Civil Engineering Workshop. Dr. Taylor is continuing studies in suspect carcinogens in potable water supplies. His work is receiving national attention. Dr. Jenkins returned from leave-of-absence with the National Bureau of Standards and immediately started research on wind loadings on solar collectors and building designs for vertical evacuation during hurricanes. Dr. Carroll continues his work in finite elements applying his concepts to most areas in Civil Engineering. Also, he is an editor of a column in the Civil Engineering Magazine. Dr. Cooper was initiated research in dual-fired power plants. Economic

and environmental impacts are being investigated. Harvey Harper is continuing work on lake impacts from stormwater. He is a frequent speaker among local government organizations. Bruce Snyder continues his research in the potable water and lake impacts areas. A manual with basic computer programs was developed for the State Department of Environmental Regulation. Drs. Yousef and Wanielista developed the Manual and are conducting workshops around the State. Lake Eola related stormwater management continues to provide many research results and opportunities.

Dr. Jenkins is active with Minority Programs in the local high schools. Other faculty have contributed to an outreach program for minorities. This remains a high Department priority. Faculty also are active with International Programs. Evidence is the work of Dr. Muiga with the World Health Organization and efforts at the University.

Department faculty have been active in technical society and professional development work and are members of local, regional or national committees within the American Society of Civil Engineers, Florida Engineering Society, National Society of Professional Engineers, American Society for Metals, American Society for Engineering Education, Water Pollution Control Federation, American Water Works Association, American Academy of Environmental Engineers and the Association of Environmental Engineering Professors. International and national review of professional journal articles and national level research proposals were done by seven faculty members. A total of twelve publications and six research proposals were reviewed. Dr. Carroll has been the faculty advisor for the ASCE Student Chapter. Dr. McLellon served on various task committees for the Florida Engineering Society and is their Past-President. In the awards area, Dr. Hartman was selected for the ASEE Southeastern Section Western Electric Fund Award; a first of this type for the Department.

Public relations activities to inform the local community were evident. Engineering week activities provided opportunities for students and faculty to display their research projects and education materials. Two displays for both civil and environmental engineering were among prize winners at the University.

CEES students, both undergraduate and graduate, continue to be active on faculty research projects. The ASCE student chapter was very active this year and participated in the concrete canoe competition and bridge building contests. Of national significance was the AISC Steel Fellowship Award to John Gladwell, one of our new graduate students. Dr. Carroll worked with the national organization to foster the award.

The faculty remain active and show sustained involvement in many education and research areas. Sixteen proposals were generated of which twelve were for external funding. In the area of publications, about fifty-five of sixty-eight were considered of professional quality with thirty-six being refereed journal types. Twenty professional presentations were given while the faculty were attending forty-three separate meetings. This quality and quantity of work reflect credit upon the Faculty and the University. We are ready for the opportunities of the eighties.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. CARROLL, W. E. "An Interactive Program for Structural Analysis." Civil Engineering-ASCE, Volume 51, No. 3, May, 1981.
2. CARROLL, W. E. "Applications of the Boundary Integral Analysis Technique to Practical Problems." Presented to the Alcoa Aluminum Corporation to stimulate mutual area of research. Alcoa Research Center, Pittsburg, PA, May, 1981.
3. CARROLL, W. E. "Boundary Integral Analysis." SAE Transactions, Volume 88, August, 1981.
4. CARROLL, W. E. "Design of Light and Heavy Industry Buildings." AISC Seminar Series to Local Professional Engineers. Orlando, FL, October, 1980.
5. CARROLL, W. E. "The Basics of Buying Microcomputer." Civil Engineering-ASCE, Volume 51, No. 2, February, 1981.
6. COOPER, C. D. and ALLEY, F. C. "Kinetic Analysis of Non-Isothermal Reactor." Accepted for publication by AICHE Journal.
7. COOPER, C. D. and MANDERSON, M. C. "Sulfur Supply and Demand and Its Relationship to New Energy Sources." 181st National Meeting of American Chemical Society, Atlanta, GA, March 30-April 3, 1981.
8. COOPER, C. D. "Treatment and Disposal of Hazardous Wastes." 13th Annual Industrial Pollution Control Seminar, Clemson, SC, June, 1980.
9. HARPER, H. H. and WANIELISTA, M. P. "Retention/Detention Stormwater Designs." 1980 Annual Civil Engineering Conference, Hollywood, FL, October 31 - November 1, 1980.
10. HARPER, H. H., WANIELISTA, M. P. and YOUSEF, Y. A. "Stormwater Treatment by Diversion to Underground Systems." Proceedings of 1981 National Conference on Environmental Engineering, Atlanta, GA, July 10, 1981.
11. HARPER, H. H., YOUSEF, Y. A. and WANIELISTA, M. P. "Productivity Responses of Lake Eola Water to Urban Runoff." Proceedings of Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies Conference, pp. 341-370, EPA 600/9-80-056, December, 1980.
12. HARTMAN, J. P. "An Overview of Courses and Programs." (Technically related for non-technical students.) CUTHA M.I.T. Workshop, June 26, 1980.

13. HARTMAN, J. P. "Inventories, Surveys, and Historic Preservation." Annual Meeting of American Society of Civil Engineers, Hollywood, FL, October, 1980.
14. HARTMAN, J. P. "Some Interesting Historical Devices and Machines." Solar Technology Assessment Conference, Orlando, FL, January 29, 1981.
15. HARTMAN, J. P. "Word Processor Academic Applications for the Professor." Proceedings of the 47th Annual Meeting of the Southeastern Section of the American Society for Engineering Education, Chattanooga, TN, April 7, 1981.
16. HARTMAN, J. P. and MESSENGER, R. A. "Environmental Considerations in Energy Education." Proceedings, ASEE Annual Conference, Amherst, MA, June, 1980.
17. HARTMAN, J. P., WHEELER, R., HAZELTINE, B. and TRILLING, L. "Summary Report: Technology For the Liberal Arts Major." Workshop, M.I.T., Cambridge, MA, June, 1980.
18. HARTMAN, J. P., HOSLER, E. R., MILLER, R. N. and DEBO, J. C. "Energy and Man: A University Course For Non-Engineers." Proceedings, Third International Conference on Alternative Energy Sources, Miami Beach, FL.
19. JENKINS, D. R. "What Can Be Learned From Simple Mechanical Tests?" Lecture National Review of Standards Building Composites Group, Seminar, August 26, 1980.
20. JENKINS, D. R. and MATHEY, R. G. "Hail Impact Testing of Solar Collectors." National Bureau of Standards NBSIR, Washington, DC, 1981.
21. JENKINS, D. R., KNAB, L. J. and MATHEY, R. G. "Infrared Thermography in Roofing Moisture Detection." A.S.T.M. Symposium Moisture Migration in Buildings: The Need for Standards, Philadelphia, PA, October 6, 1980.
22. JENKINS, D. R., KNAB, L. I. and MATHEY, R. G. "Laboratory Evaluation of Nondestructive Methods to Measure Moisture In Built-Up Roofing Systems." National Bureau of Standards, Center for Building Technology, Building Science Series, No 131, January, 1981.
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24. KERSTEN, R. D. and HARTMAN, J. P. "Engineering Course Work for Non-Engineers - A Decade of Experience." Engineering Education, December, 1980.

25. MCLELLON, W. M. "What is the Animal?" Paper submitted to ASEE for possible publication in Engineering Education, 1980.
26. MUIGA, M. I. "Drinking Water Supply and Sanitation Decade in Africa: Water for all by the year 1990." (Appeared in December 1980 issue of AFRO Newsletter as a regional contribution to the launching of the UN Water Decade).
27. MUIGA, M. I. "Planning of Environmental Health Training in the African Region."
28. MUIGA, M. I. "Environmental Health Training Manual for Village Health Inspectors."
29. MUIGA, M. I. "Environmental Health Training Modules for Health Inspectors."
30. MUIGA, M. I. "Environmental Health Training Modules for Medical Assistants."
31. MUIGA, M. I. "Environmental Health Training Modules for Sanitary Engineers."
32. MUIGA, M. I. "Environmental Health Training Modules for Village Health Workers."
33. SEAMAN, J. N. "The Analysis and Design of Shock Absorbers with Constant Deceleration for Variable Loadings." Ph.D. Dissertation, University of Florida, December, 1980.
34. SMITH, R. "Fundamental Measurements Needed for Modeling the Aerated Composting Process." January 16, 1981.
35. SMITH, R. and EILERS, R. G. "Numerical Simulation of Aerated Sludge Composting."
36. SMITH, R. and EILERS, R. G. "Numerical Simulation of Combustion and Gastification of Wet Carbon and Sludge under Equilibrium and Adiabatic Conditions." August 26, 1980.
37. SMITH, R. and EILERS, R. G. "Numerical Simulation of Sludge Combustion and Drying in the Multiple Hearth Furnace." June, 1980.
38. SNYDER, B. R., TAYLOR, J. S., GODLEWSKI, V. J. and MOORE, P. A. "Coagulation and Detention of Stormwater Runoff." Preprint of ASCE Convention and Exposition, October, 1980.
39. TAYLOR, J. S. "Environmental Challenges of the Eighties." Florida Environmental Health Annual Education Conference, Orlando, FL, May, 1981.
40. TAYLOR, J. S. "1980 Conference Highlights." Overflow, January - February, 1981.

41. TAYLOR, J. S. and FERRARO, C. "TTHM, TOC and Color Removal From A Potable Water Using Recycled Magnesium Carbonate." Florida Academy of Sciences, April, 1980.
42. TAYLOR, J. S. and GILL, K. O. "TTHM, TOC and Color Removal From Recycled Magnesium Carbonate by GAC." Florida Academy of Science, April, 1980.
43. TAYLOR, J. S. and HATCHER, E. "Treatment Process Variations to Reduce TTHM Residuals." AWWA 1980 Annual Conference Proceedings, Atlanta, GA, June, 1980.
44. TAYLOR, J. S. and KIMES, J. K. "The Effect of Ozone on Trihalomethane Precursors in a Highly Colored Surface Water." AWWA 1980 Annual Conference Proceedings, Atlanta, GA, June, 1980.
45. WANIELISTA, M. P. "An Example of Urban Watershed Management for Improving Lake Water Quality." 1980 International Conference on Lake Protection and Restoration, Portland, ME, September 8-12.
46. WANIELISTA, M. P. "Mixing Zone Models." FDOT Environmental Seminar, Hayden Burns Building, Tallahassee, FL, March 17-18, 1981.
47. WANIELISTA, M. P. "Stormwater Management for Urban Lakes." American Geophysical Union Spring Meeting, Baltimore, MD, May 26, 1981.
48. WANIELISTA, M. P. (contributor) "Urban Stormwater Management and Technology, Case Histories" by Lynard, et al. U.S. EPA 600-8-80-035, 20 pages in a 329 page publication, August, 1980.
49. WANIELISTA, M. P. and CURRAN, T. M. "SMADA-Stormwater Management and Design Aid." ASCE 1980 Annual Meeting, Hollywood, FL, October 29, 1980.
50. WANIELISTA, M. P. and YOUSEF, Y. A. "An Example of Urban Watershed Management for Improving Lake Water Quality." Proceedings of the 1980 International Conference on Lake Management Protection and Restoration, Portland, ME, September 8-12, 1980.
51. WANIELISTA, M. P., YOUSEF, Y. A. and CHRISTOPHER, J. E. "Management of Runoff From Highway Bridges." A final report submitted to Florida Department of Transportation, Tallahassee, Fl, Contract #99700-7198, 140 pages, October, 1980.
52. WANIELISTA, M. P., YOUSEF, Y. A., HARPER, H. H. and CASSAGNOL, C. L. "Detention With Effluent Filtration for Stormwater Management." Second International Conference on Urban Storm Drainage, Urbana, IL, June 14-19, 1981.
53. WANIELISTA, M. P., YOUSEF, Y. A. and TAYLOR, J. S. "Lake Eola Restoration." Florida Specifier, 1980.

54. WANIELISTA, M. P., YOUSEF, Y. A. and TAYLOR, J. S. "Lake Eola Stormwater Management to Improve Lake Water Quality." The Engineering News, Winter, 1981.
55. WANIELISTA, M. P., YOUSEF, Y. A. and TAYLOR, J. S. "Project Summary - Stormwater Management to Improve Lake Quality." NTIS report, January, 1981.
56. WANIELISTA, M. P., YOUSEF, Y. A. and TAYLOR, J. S. "Stormwater Management to Improve Lake Water Quality." Final report to U.S. EPA, January, 1981.
57. YOUSEF, Y. A. "Effects of Bridging on Biological Productivity and Diversity in the Floodplain." Florida Department of Transportation Annual Seminar, Hayden Burns Building, Tallahassee, FL, March 17-18, 1981.
58. YOUSEF, Y. A. "Environmental Constraints for Energy Consumption." Seventh Annual Youth Environmental Conference, SEEK 80, University of Central Florida, August 3-7, 1980.
59. YOUSEF, Y. A. "Environmental Engineering Education - Needs and Objectives." Institute of Civil Engineering, University of Aalborg, Denmark, September 11, 1980.
60. YOUSEF, Y. A. "Impact of Point Sources on Shingle Creek and Lake Tohopekaliga." Lake Tohopekaliga Task Force Meeting, October 8, 1980.
61. YOUSEF, Y. A. "Impact of Urban Stormwater Runoff on Receiving Water Bodies." Institute of Civil Engineering, University of Aalborg, Denmark, September 9, 1980.
62. YOUSEF, Y. A., HARPER, H. H. and JELLERSON, D. "Impact of Water Treatment Sludges on Benthic Organisms in Shallow Lakes." Florida Academy of Sciences, Orlando, FL, May 1, 1981.
63. YOUSEF, Y. A., HARPER, H. H. and JELLERSON, D. "Inactivation of Lake Sediment Release of Phosphorus." A final report to UCF-EIES, Grant #11-1699-034, 77 pages, December, 1980.
64. YOUSEF, Y. A., HARPER, H. H. and WALSH, T. "Changes in Water due to Stormwater Runoff in Lake Eola." Florida Academy of Sciences, Orlando, FL, May 1, 1981.
65. YOUSEF, Y. A., MCLELLON, W. M. and ZEBUTH, H. H. "Changes in Phosphorus Concentrations Due to Mixing by Motorboats in Shallow Lakes." Water Research, Great Britain, Vol. 14, pp. 841-852, July, 1980.
66. YOUSEF, Y. A., WANIELISTA, M. P., HARPER, H. H. and JELLERSON, D. B. "Inactivation of Anaerobic Release of Phosphorous by Water Treatment Sludges." 13th Annual Mid-Atlantic Industrial Waste Conference, Newark, DE, June 13, 1981.

67. YOUSEF, Y. A., WANIELISTA, M. P., MCLELLON, W. M. and TAYLOR, J. S. (Editors). "Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies." EPA 600-9-28-056.
68. YOUSEF, Y. A., WANIELISTA, M. P., TRAVER, R. P., HARPER, H. H. and WALSH, T. "Impact of Stormwater Runoff on Lake Eola Water Quality." Proceedings of the Second International Conference on Urban Stormwater Drainage, University of Illinois - Urbana, IL, June, 1981.
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78. YOUSEF, Y. A., HARPER, H. H. and JELLISSON, B. "Inactivation of Ammonia Release of Phosphorus by Water Treatment Sludges." 13th Annual Mid-Atlantic Industrial Waste Conference, Newark, DE, June 13, 1981.
79. YOUSEF, Y. A., HARPER, H. H. and JELLISSON, B. "Inactivation of Ammonia Release of Phosphorus by Water Treatment Sludges." 13th Annual Mid-Atlantic Industrial Waste Conference, Newark, DE, June 13, 1981.
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90. YOUSEF, Y. A., HARPER, H. H. and JELLISSON, B. "Inactivation of Ammonia Release of Phosphorus by Water Treatment Sludges." 13th Annual Mid-Atlantic Industrial Waste Conference, Newark, DE, June 13, 1981.

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

1. Workshop on "Statistical Quality Control," under a Florida Department of Transportation Grant. (Carroll/Wanielista)
2. Workshop on "Application of Microprocessor to Civil Engineering," March, 1981. (Carroll)
3. Coping with Hazardous Wastes under RCRA, UCF, December 2, 1980. (Cooper)
4. Annual Youth Environmental Conference, Florida Federation of Garden Clubs, UCF, August, 1980. (Harper/Yousef)
5. Review Course for Professional Engineering Exam, Orlando, FL, February 2, 1981. (Jenkins/Hartman)
6. "Application of Microcomputers in Civil Engineering", March 1981. (Wanielista)
7. Video tapes/workshops on Stormwater for FDER. (Wanielista)
8. 5th Annual Environmental Engineering and Science Student Conference, FIT, Melbourne, FL, May 16, 1981. (Yousef)

TITLE: Water Resources
PRINCIPAL INVESTIGATOR: Dr. W. E. Carroll, P.E.
SPONSORING AGENCY: UCF - E1E3
GRANT NUMBER: 21-2699-006

A B S T R A C T

An interactive code to aid in the pre and post processing of Finite Element Models is being supported by this grant.

This code features extensive graphics and is currently in the demonstration phase.

RESUMES OF SPONSORED RESEARCH

TITLE: Boundary Integral Study

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

SPONSORING AGENCIES: NASA and UCF - EIES

GRANT NUMBERS: 10-1620-003 and 11-1699-009

A B S T R A C T

A General Boundary Integral Program is given for the linear elastic static analysis of a two-dimensional anisotropic continuum. Special kernel functions described by Cruse have been used in the development of the computer code and allow the user to easily model through type cracks. The use of these functions also allows for the direct calculation of the MODE I and MODE II Stress Intensity factors. Provision for the calculation of internal stresses and/or displacements once the boundary solution has been found have been included.

In the formulation of this computer program parabolic variations of displacements and surface stresses are assumed on the boundary of the problem. Example problems are given which illustrate the accuracy of the parabolic integral program.

* * * * *

TITLE: Water Resources

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-006

A B S T R A C T

An interactive code to aid in the pre and post processing of Finite Element Models is being supported by this grant.

This code features extensive graphics and is currently in the demonstration phase.

* * * * *

TITLE: Waste Incinerator
PRINCIPAL INVESTIGATOR: Dr. C. D. Cooper, P.E.
SPONSORING AGENCY: City of Kissimmee and UCF - EIES
GRANT NUMBERS: 28-1620-001 and 21-1699-022

A B S T R A C T

An economic study for the City of Kissimmee is underway to evaluate the feasibility of a coal-fired electricity generating plant which will also serve as a municipal solid waste incinerator. The study will consider growth in population and the need for services in the Kissimmee area, as well as capital costs, fuel costs, and operating and maintenance costs of each of several alternative projects. Power plant sizes of 100, 200 and 400 MW will be considered. At this stage, population growth has been projected, mass and energy balances have been developed, and five major alternatives have been defined. A literature survey is being conducted to determine representative capital and operating costs for the different alternatives. Additionally, in this regard, a survey of several large power companies in Florida will be conducted to obtain cost data specifically for this state.

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TITLE: Field Determination of Wind Loading on Solar Collectors
PRINCIPAL INVESTIGATOR: Dr. D. R. Jenkins, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-012

A B S T R A C T

Instrumentation is being prepared to measure wind loadings on a solar collector mounted on a Test Shack at the Florida Solar Energy Center. A support system incorporating strain gauges to measure the reactive loads on the solar collector is being designed and will be installed during the summer. Recording equipment is available at FSEC.

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TITLE: Hail Impact on Solar Collector Covers
PRINCIPAL INVESTIGATOR: Dr. D. R. Jenkins, P.E.
SPONSORING AGENCY: National Bureau of Standards
GRANT NUMBER: IPA 10-1620-005

A B S T R A C T

A report was written summarizing the experimental data obtained on three solar collector cover materials impacted by ice balls of various sizes and fired at various terminal velocities. This report has been reviewed at NBS and final corrections are being made. This document should provide the basis for a new or modified ASTM recommended procedure for testing solar collector covers.

* * * * *

TITLE: Roofing Systems Research
PRINCIPAL INVESTIGATOR: Dr. D. R. Jenkins, P.E.
SPONSORING AGENCY: National Bureau of Standards
GRANT NUMBER: IPA 10-1620-005

A B S T R A C T

A state of the art report on nondestructive evaluation techniques for determining moisture in roofing systems was completed. Both a report and a paper summarizing the experimental measurements on the infrared response of roofing specimens with various moisture contents were also completed. Contributions were made to the summary report on the total laboratory program on nondestructive methods to measure moisture in roofing systems.

PUBLICATIONS: JENKINS, D. R., KNAB, L. I., and MATHEY, R. G. "Infrared Thermography in Roofing Moisture Detection", Symposium on Moisture Migration in Buildings: The Need for Standards, American Society for Testing and Materials, Committee E-6, Philadelphia, PA, October, 1980. Under review for publication.

KNAB, L. I., MATHEY, R. G., and JENKINS, D. R. "Laboratory Evaluation of Nondestructive Methods to Measure Moisture in Roofing Systems", National Bureau of Standards, Center for Building Technology, Building Science Series No. 131, Washington, D.C., January, 1981.

JENKINS, D. R., MATHEY, R. G., and KNAB, L. I. "Moisture Detection in Roofing by Nondestructive Means: A State-of-the-Art Survey", National Bureau of Standards, Center for Building Technology, Technical Note, 1981. Approved for publication.

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TITLE: The Floccil Process

PRINCIPAL INVESTIGATOR: Dr. W. M. McLellon, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-033

A B S T R A C T

Subsequent to completion of grant work, one graduate student, David Jansen, extended the scope with experiments involving different fabric filters, including thin felt. In this work, in addition to alum coagulant, two cationic polymers were used for gathering the colloidal turbidity particles. By process and fabric modifications, it was possible to reduce the filter effluent turbidity to less than 1 JTU. Results were compiled in Mr. Jansen's research report, December, 1980. He received the MS Degree.

Evaluation is occurring regarding journal publication. A copy of the report was forwarded for inclusion in the grant file. A logical extension of the work is to apply the results to dewatering of sludges, where the method appears to have promise.

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TITLE: Factor Influencing the Formation of Trihalomethane Precursors in Lake Washington, Florida

PRINCIPAL INVESTIGATOR: Mr. B. R. Snyder

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-035

A B S T R A C T

Trihalomethanes are often formed when natural waters are disinfected using chlorine. High levels of trihalomethanes, and related chemicals, are of concern when found in drinking water supplies since many are suspected carcinogens. In this project, the relationship between nutrient loading to Lake Washington and trihalomethane formation potential is investigated using in situ bioassay techniques. Samples of Lake Washington water are placed in transparent containers and spiked with, either nitrogen, phosphorous, or canal water. After incubating for seven days, filtered samples from each container are chlorinated and trihalomethane formation measured. Identifying a relationship between nutrient loading and trihalomethane formation potential will aid in the management of surface water bodies used as potable water sources.

This project is being conducted in conjunction with EPA research to optimize water treatment for trihalomethane precursor removal.

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TITLE: An Optimal Model for Economic and Industrial Development with Limited Water Resources
PRINCIPAL INVESTIGATOR: Dr. James S. Taylor, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-006

A B S T R A C T

This research project utilizes existing water quality measurements of the Upper St. John's River made by various state and federal agencies, river discharge quantity records, rainfall and evaporation amounts, soil surveys, and land use determinations to evaluate and predict runoff quantities and water quality in the Upper Basin. The initial investigations incorporated the aforementioned records into Vollenweider, Dillon, Carlson, Larson-Mercier, and Florida DER (hand) trophic status indices to demonstrate the definite eutrophic state of Lake Helen Blazes and Lake Sawgrass and the borderline eutrophy of Lake Washington. Further investigations in this research project are utilizing the computer program "RIVER" to show the point and nonpoint source effects of the existing land use in the Upper Basin on the dissolved oxygen concentrations in the river and lakes for both the seasonal and average effect, and for any specific storm event. Simulation was revealed that loadings from current land use do not provide enough stress to seriously deplete the dissolved oxygen in the Upper St. Johns River. This indicates that (1) either a large slug of BOD is directly provided to the river, i.e. a point source or (2) the nutrients in the runoff provide an existing growth base for algae in the river given the proper environmental conditions. The algae then die and serve as the oxygen depleting source. Research is continuing in this area.

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TITLE: THM Precursor Removal
PRINCIPAL INVESTIGATOR: Dr. James S. Taylor, P.E., Mr. B. R. Snyder, and Graduate Students: K. O'Gill, A. Fisher, C. Ferraro, P. Muller, and K. Payne
SPONSORING AGENCY: EPA - EIES - City of Melbourne, Florida
GRANT NUMBER: 20-1620-001

A B S T R A C T

A two and one-half year study was initiated in the summer of 1980 with the purpose of evaluating the magnesium process for TTHM precursor removal. The study integrates both bench and pilot studies in six phases. These phases are: (1) Conventional Jar Study, (2) Oxidation, (3) Recycle, (4) Organics and Metals Mass Balance, (5) GAC, and (6) Alternate Disinfectants. Each of the phases is directly linked to the magnesium process to evaluate different means of removing or reducing TTHM precursors throughout the magnesium process when high TOC raw water source is utilized.

The research has shown, to date, that the magnesium coagulation process is optimized for color, total organic carbon or total trihalo-methane formation potential removal at high pH (11.3-12.0) and zero recycled magnesium dose. These conditions apply only to low color-high magnesium raw water and different raw water conditions may require some recycled magnesium dose for optimum treatment.

Treatment of the recycled magnesium with either ozone or chlorine dioxide has failed to improve treated water quality. The alternate disinfection phase results have indicated that: (1) ClO_2/O_3 and Cl_2 can remove residual color remaining after coagulation, (2) ClO_2 , Cl and chloramines provide a residual at temperatures of $32^\circ C$ and $16^\circ C$ and that chloramines are the most resistant to disinfection.

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TITLE: Mixing Zones
PRINCIPAL INVESTIGATOR: Dr. M. P. Wanielista, P.E., Prof. R. Smith, P.E.,
Dr. W. E. Carroll, P.E., Dr. M. I. Muiga, P.E.,
and Dr. C. D. Cooper, P.E.
SPONSORING AGENCY: Florida Department of Transportation
GRANT NUMBER: 11-1620-008

A B S T R A C T

This is a 27 month research grant to study the extent of mixing zones caused by wastewater discharges into rivers and lakes. A mixing zone is defined as that area in which water quality violations occur. Dispersion models for rivers and finite element models for lakes are being examined to aid in predicting the extent of the zone for various discharge conditions. Stormwater hydrographs and loadographs are input data to the models. This project is in its final stages of completion.

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TITLE: Stormwater Management Manual and Workshops
PRINCIPAL INVESTIGATOR: Dr. M. P. Wanielista, P.E., and Dr. Y. A. Yousef,
P.E.
SPONSORING AGENCY: State Department of Environmental Regulation
GRANT NUMBER: 11-1620-007

A B S T R A C T

A number of stormwater management practices are available for control. Detention systems require additional data on both efficiencies and cost. This project will aid in the determination of best management practices, including detention. Computer programs using micro-interactive

programs are being developed. Seven workshops are planned for seven areas of the State.

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TITLE: Stormwater Management to Improve Lake Water Quality

PRINCIPAL INVESTIGATOR: Dr. M. P. Wanielista, P.E., Dr. Y. A. Yousef, P.E., and Dr. J. S. Taylor, P.E.

SPONSORING AGENCIES: State Department of Environmental Regulation, Environmental Protection Agency, City of Orlando, and UCF - EIES

GRANT NUMBERS: 18-1621-002, 11-1620-005, 10-1620-004, and 11-1699-013

A B S T R A C T

This abstract is for phase 1 of a 3-phase project to determine minimum cost highly effective means to restore lake water quality by management of stormwater runoff. Phase 1 defines the effectiveness of source management and treatment resulting from removals characteristic of settling and diversion. The lake productivity due to these reduced effluents will be examined. The fate of pollutants will be documented. Nutrients, organics, solids, metals, pathogens, and other quality parameters will be used. Current desk top (SWMM, level 1 and trophic state) equations were used to predict runoff quantity and quality and lake impacts. These analyses were verified by field measurements. Capital and ORM cost data for management practices were used. Lake impacts were measured by nutrient and TOC mass balances with productivity measures. Additional documentation of the fate of pollutants will be provided by laboratory column studies. Lake impacts are used for constraints on the selection of the best parallel or series combination of management practices. The subject of the experiments is Lake Eola in a high density urban area of Orlando, Florida. Stormwater and lake quality data with water budgets are available from previous studies. A computer methodology for stormwater management will be done in phase 2 with verification and manuals for design being the products of phase 3.

PUBLICATIONS: CALABRESE, M. M. and WANIELISTA, M. P. "Optimal Stormwater Management", 1980 Annual Meeting of the American Society of Agricultural Engineers, San Antonio, TX, June 16, 1980.

CALABRESE, M. M. and WANIELISTA, M. P. "Optimization of Stormwater Management Practices and Processes Applicable to Coastal Areas", Urban Stormwater Mangement in Coastal Areas, ASCE National Symposium, June 19, 1980.

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TITLE: Inactivation of Lake Sediment Release of Phosphorus

PRINCIPAL INVESTIGATOR: Dr. Y. A. Yousef and Mr. Harvey Harper

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-034

A B S T R A C T

The feasibility of using coagulants to inactivate the phosphorous release from bottom sediments typical of Lakes Eola and Jessup in the Central Florida area was investigated. The coagulants used were: alum ($Al_2(SO_4)_3 \cdot 18 H_2O$), calcium sludge from a Tampa Water Treatment Plant. The coagulants were dosed through plastic funnels inserted inside nalgene chambers isolating approximately 150 liters of the water column overlying a 0.25 square meter of bottom sediments. Changes in water quality parameters with incubation time under anoxic conditions were documented and compared to similar parameters measured in the adjacent open lake. Also, the impact of various inactivants on the release of phosphorous from the bottom sediments to the overlying water contained inside the isolation chambers were evaluated.

Alum sludge appears to significantly reduce phosphorous release from the bottom sediments of Lake Eola and Lake Jessup. Also, no apparent release of heavy metals from the alum sludge to the water column was observed.

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TITLE: Management of Runoff from Highway Bridges

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

SPONSORING AGENCY: Florida Department of Transportation

GRANT NUMBER: 11-1620-006

A B S T R A C T

Two sites namely, Lake Ivanhoe and Maitland Interchange sites, were selected for this study. Lake Ivanhoe and I-4 site was selected to examine the impact of highway bridge runoff released through scupper drains on the environmental samples. Maitland Interchange site was selected to examine the efficiency of retention/detention ponds for treatment of highway bridge runoff.

Field measurements including DO, temperature and turbidity profiles were conducted. Also water, sediment and biota samples were analyzed for nutrients content and heavy metals concentration. It appears that scupper

drains on the south bridges crossing over Lake Ivanhoe contribute significant total mass of heavy metals, particularly lead, to the lake. Also careful design considerations should be given to improve the removal efficiencies of heavy metals by retention/detention ponds. The final report has been published.

* * * * *

TITLE: Mixing Effects Due to Boating Activities in Shallow Lakes

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

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

GRANT NUMBER: 14-34-00001-6203

A B S T R A C T

A two year study sponsored by the Office of Water Research and Technology, OWRT, Department of Interior was undertaken to investigate the "Mixing Effects due to Boating in Shallow Lakes". Recreational boats equipped with engines varying from 28 to 165 horsepower were used for agitation on Lakes Claire, Mizell and Jessup in Central Florida. Lake Claire is located on the campus of the University of Central Florida (UCF) and motorboating activity on the lake is restricted to research related projects. The surface area of the lake is 8.1 hectares and a mean depth of 2.3 meters. Lake Mizell is located in the chain of lakes in the city of Winter Park. It has a surface area of 25.1 hectares and an average depth of 4.0 meters. Lake Jessup is located in Seminole County with an average area of 44.2 hectares and water depth of 1.8 meters.

Mixing by motorboats in study lakes resuspended bottom sediments and increased turbidity. The increase in turbidity was accompanied by an increase in the phosphorus content and respiration rates within the waterbody. Data from Isolation Chambers for Aquatic Habitat (ICAH) indicated that mixing will increase turbidity and phosphorus at a much faster rate than the rate of decline after cessation of mixing. Also, the lake productivity as measured by the algal count, chlorophyll analysis, and oxygen production, generally increased in the mixing stations of the study lakes as compared to the control stations. A reduction in the overall oxygenation rates was also noticed in the mixing stations of Lake Mizell.

Sediment resuspension is a function of the engine/boat combination, operating parameters, water depth, fineness of bottom sediments, and the depth of sediment deposits over firm soil. Under normal operating conditions, when boat velocities were greater than the square root of the acceleration of gravity and water depth, the average primary wave

amplitudes caused by recreational motorboats equipped with engines varying from 28 to 165 HP, decreased exponentially with water depth. An empirical relationship was developed as follows:

$$v \frac{A_w}{HP} = 0.16 e^{-0.23D}$$

where: A_w = average wave amplitude at the sediment-water interface, ft.
 HP = the engine horsepower of the motorboat
 D = water depth in feet

For a known wave amplitude, the scour velocity for sediment particles and the particle diameter to be eroded can be calculated. A set of curves showing the boat/horsepower combination required to scour sediment particles from 0.05 to 1.0 millimeter diameter and specific gravity of 1.10 were developed. The water depth was varied between 3.0 and 10.0 feet.

The work was completed and a final report was issued.

PUBLICATIONS: YOUSEF, Y. A., MCLELLON, W. M., and ZEBUTH, H. H. "Changes in Phosphorous Concentration due to Mixing by Motorboats in Shallow Lakes", Water Research, Vol. 14, pp. 841-852, July, 1980.

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TITLE: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies Conference

PRINCIPAL INVESTIGATOR: Dr. Y. A. Yousef, P.E.

SPONSORING AGENCY: U. S. Environmental Protection Agency

GRANT NUMBER: R 806715

A B S T R A C T

The conference on "Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies" was held on November 26-28, 1979 at Orlando, Florida. The purpose of this conference was:

- a. To provide an opportunity for researchers, practitioners, and others to receive an up-date on the State of the Art and to learn about research findings dealing with stormwater impact.
- b. To stimulate dialogue among those who are interested in stormwater effects and control, regarding the implication and applications of current research results, particularly from those projects supported by grants from the Environmental Protection Agency.

The proceedings have been published by the U.S. Environmental Protection Agency, EPA-600/9-80-056, December 1980. The following topics are discussed:

- a. Combined Sewer Overflow Control Costs vs. Benefits and General Overview.
- b. Impacts on lakes, rivers and estuaries.
- c. Ecological response to stormwater and methodologies for stormwater impact assessment.
- d. Stormwater management through the use of receiving water quality models for planning and abatement methodology.
- e. Workshop on practical applications and research for receiving water responses to urban stormwater.

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Informal inventories of engineering works in Florida continues, and talks on historic Engineering Works in Florida are made throughout the State. Additional engineering/industrial works within the State are being sought.

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TITLE: Economic Development and Technology Transfer

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

ABSTRACT

Investigation of cooperative arrangements to deliver educational services, extension services, research related to indigenous problems in the interest of enhancing economic development in less developed countries. Specific emphasis relate to (1) better utilization of natural resources (especially development of potable water supplies), (2) development of new energy sources (especially "mini" hydroelectric sites), (3) the creation of new enterprises. Thus, primary interest must be in the (1) design of low cost technology, (2) careful selection of technology targeted on specific problems, (3) simple technology whose use and maintenance requires little or modest training/education and (4) "people oriented" technology, or as frequently termed, "appropriate technology" or "on-site technology". Review of sensitive areas and requisites for including a spectrum of alternatives, providing an element of choice, and recognition of political, economic, and cultural differences are essential in the use of engineering in meeting the needs of the people.

PUBLICATIONS: KERSTEN, R. D. "Small Scale Hydropower: An Appropriate Technology for Less Developed Countries", Proceedings WATERPOWER '79, October 1-3, 1979, Washington, D.C.

KERSTEN, R. D. and HARPER, S. R. "Small Scale Hydropower: An Appropriate Technology for Less Developed Countries", Proceedings, Tercer Simposio Internacional de Ingenieria, July 25-30, 1980, San Salvador, El Salvador, C.A.

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RESUMES OF UNSPONSORED RESEARCH

TITLE: Historic American Engineering Record - Florida

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

A B S T R A C T

Informal inventory of historic engineering works in Florida continues, and talks on Historic Engineering Works in Florida are made throughout the State. Additional engineering/industrial works within the State are being sought.

* * * * *

TITLE: Economic Development and Technology Transfer

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

A B S T R A C T

Investigation of cooperative arrangements to deliver educational services, extension services, research related to indigenous problems in the interest of enhancing economic development in less developed countries. Specific emphasis relate to (1) better utilization of natural resources (especially development of potable water supplies), (2) development of new energy sources (especially "mini" hydroelectric sites), (3) the creation of new enterprises. Thus, primary interest must be in the (1) design of low cost technology, (2) careful selection of technology targeted on specific problems, (3) simple technology whose use and maintenance requires little or modest training/education and (4) "people oriented" technology, or as frequently termed, "appropriate technology" or "on-site technology". Review of sensitive areas and requisites for including a spectrum of alternatives, providing an element of choice, and recognition of political, economic, and cultural differences are essential in the use of engineering in meeting the needs of the people.

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TITLE: The Effects of Science and Technology On Employment

PRINCIPAL INVESTIGATOR: Dr. R. D. Kersten, P.E. and Dr. J. P. Hartman, P.E.

A B S T R A C T

The Principal Investigators have devised a dynamic model of engineer manpower demand based on the following parameters: (a) importance of technology (interpreted as the number of engineers), (b) disposable resources of society, (c) and the ratio of R & D expenditures to the GNP.

This model has been verified/authenticated using U. S. Census data for "technical engineers" for the period 1870 - 1970. Utilizing detailed R & D, GNP Population, and Engineer data for the decade of the 1960's, we now have a current dynamic model which tracks actual engineer demand in the 1970's and serves to give projections of future demand based on the economic indicators assumed.

Development of a complementary model for engineering manpower supply is of current interest. This model should utilize as input (feedback) the output from the demand model. Effects to be included (studied) include (a) job (task) definition (b) degree productivity (c) immigration (d) inflow/outflow from engineering specializations and (e) economic indicators. Effort is continuing. Four publications have been presented in prior years.

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KERSTEN, R. D. and HARPER, S. R. "Small Scale Hydropower: An Appropriate Technology for Less Developed Countries," Proceedings, Tercer Simposio Internacional de Ingenieros, July 25-30, 1980, San Salvador, El Salvador, C.A.

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: Sewer System Evaluation Surveys Conducted in Industrial Plants

CANDIDATE: Mr. Robert Cadle

FACULTY ADVISOR: Dr. Waldron M. McLellon, P.E.

A B S T R A C T

"Sewer System Evaluation Surveys Conducted in Industrial Sewers", describes the methods employed and the results of Sewer System Evaluation Survey studies conducted at two industrial complexes. The procedural techniques for locating and quantifying infiltration and inflow into sewer systems are presented to provide a basic understanding of the steps required to complete such studies. Case studies of actual surveys conducted at two privately operated industrial plants in Tennessee are presented to illustrate the utilization of the investigative techniques. The results of the studies are compared with each other and with similar studies conducted in municipal sewer systems.

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TITLE: Impact of Highway Bridge Runoff on Adjacent Receiving Water Bodies

CANDIDATE: James E. Christopher

FACULTY ADVISOR: Dr. Yousef A. Yousef, P.E.

A B S T R A C T

Two locations, Lake Ivanhoe and the Maitland interchange on Interstate 4, were selected to study the impact of bridge runoff on receiving water bodies. The Lake Ivanhoe location includes two similar bridges, one without scuppers and one with scuppers. The Maitland interchange site has several borrow ponds which drain to Lake Lucien.

Samples were collected from Lake Ivanhoe below the bridges and in the open lake away from the bridges. Also, samples were collected from the east pond, west pond, and Lake Lucien, at the Maitland interchange. Samples included water, sediments, plants and benthos to detect differences, if any, in heavy metal concentration due to sampling location. Heavy metals tested included: Zn, Cu, Cr, Cd, Pb, As, Fe, and Ni. Dissolved oxygen, temperature profiles and secchi disk transparency were measured in the field. Additional water quality parameters such as pH, turbidity, carbon and phosphorus were evaluated.

Results indicated significant differences in specific heavy metal concentrations exist between samples collected beneath a bridge with scuppers compared to samples collected beneath a bridge without scuppers. Also, the drainage ponds appear to contain more heavy metals than the adjacent Lake Lucien at the Maitland interchange.

* * * * *

TITLE: SMADA - Stormwater Management and Design Aid

CANDIDATE: Timothy M. Curran

FACULTY ADVISOR: Dr. Martin P. Wanielista, P.E.

A B S T R A C T

The Stormwater Management and Design Aid (SMADA) is a computer model formulated to assess stormwater runoff quantity and quality. Applicable theory is reviewed to introduce a discussion of the modeling methodology.

A pre- vs. post-development design objective can be incorporated to evaluate runoff quantity and qualify for single or multiple land use watersheds. Detention and retention facilities are considered and conveyance systems for runoff transmission can be sized. Initial design assessments and consistent design review and evaluation are possible.

SMADA is written in the BASIC language and is executed in the interactive mode. No computer cards are required and data input is quite self-explanatory. The model is easily adaptable to table-top mini-computers.

* * * * *

TITLE: Ground Access to the Orlando International Airport - Design and Evaluation of Various Mass Transportation Alternatives

CANDIDATE: George S. Fan

FACULTY ADVISOR: Dr. C. David Cooper, P.E. for Dr. Satish Mohan, P.E.

A B S T R A C T

This research presents design and evaluations of various mass transportation alternatives for reducing the problem of the ground access congestion in the Orlando International Airport. The alternatives considered in this research are conventional bus service, minibus service, express bus service, light rail transit service, rail rapid transit service, and monorail service.

Details of the origin-destination studies for the present traffic and future traffic are given. A discussion for the various mass

transportation alternatives is provided, with provisions for future systems expansions.

Three economic evaluation methods were used in this research for evaluation of various alternatives. According to the results of the economic analysis, the modified bus service is recommended.

* * * * *

TITLE: The Effects of Plain Sedimentation on the Quality of Stormwater Runoff From the Lake Eola Watershed

CANDIDATE: Victor J. Godlewski, Jr.

FACULTY ADVISOR: Dr. James S. Taylor, P.E.

A B S T R A C T

The settling characteristics of urban stormwater runoff emanating from the Lake Eola Watershed (Orlando, Florida) were evaluated through a series of 7 column studies. The percentage removal that occurred due to sedimentation was observed for various stormwater pollutants and constituents. These included the General Water Quality Parameters: Total suspended Solids, Non-volatile Suspended Solids, Volatile Suspended Solids, Chemical Oxygen Demand, Total Kjeldahl Nitrogen, Ammonia Nitrogen, Total Organic Carbon, and Total Phosphorus. The metals parameters: Zinc, Cadmium, Arsenic, Nickel, Copper, Magnesium, Iron, Lead, Chromium and Calcium were also considered. The results of the settling analysis indicates that the quality of Lake Eola stormwater can be improved by plain sedimentation or detention as convincing removals were displayed by the solids parameters and total phosphorus. Significant lead removal was achieved throughout the column studies; however, the balance of the metals parameters displayed trends of weak removal. Regression equations were developed that describe percent removal as a linear and logarithmic function of time and settling velocity. Isoconcentration lines were also developed for total suspended solids and total phosphorus removals. In addition, the effect of this treatment on the productivity of Lake Eola was assessed in terms of existing trophic state models.

* * * * *

TITLE: Small Scale Hydropower - Appropriate Technology for Rural Development in Lesser Developed Countries

CANDIDATE: Stephen R. Harper

FACULTY ADVISOR: Dr. Robert D. Kersten, P.E.

A B S T R A C T

Less Developed Countries (LDC's) now have a total of about 2.8 billion people, or approximately 70 percent of the total world population.

World populations and current energy consumption are such that if all the world's countries came up to the U.S. per capita energy use, the world's consumption would multiply by a factor of seven. For the LDC's energy development will be an increasingly important issue.

Hydropower technology is on the shelf, and available now, of proven feasibility both technically and economically, and presents a sound and rational energy solution from the environmental viewpoint. It is a technology which could be useful to the Less Developed Countries for the long term, irrespective of the shift from abundant low-cost fossil fuel options or the development of more exotic alternate energy technologies. With its continuing replenishment and nondepleting characteristics, it remains one of the most attractive sources of energy.

The nature of water resources includes a distributive element which makes it ideal for rural development. The apparent shift in development policy, from the traditional "top-down" industrialization approach to the "bottoms-up" reach the village approach, requires decentralized applications of energy resources attainable through development of hydropower in many regions of the world.

Distributed Small Scale Hydropower (SSH) systems offer excellent opportunities to augment energy supplies to many rural areas. Also, in a modest way the development of a community infrastructure, training of operating and maintenance personnel, and initiation of small scale agribusiness enterprises may be undertaken. Each of these activities could result in relatively major contributions to the improvement of quality of life.

SSH sites are found in abundance in most mountainous regions and offer sensible possibilities for decentralized applications in LDC's.

* * * * *

TITLE: An Investigation of Fabric Filtration for the Removal of Colloidal Turbidity from a Laboratory Water

CANDIDATE: David B. Jansen

FACULTY ADVISOR: Dr. Waldron M. McLellon, P.E.

A B S T R A C T

A kaolin in tapwater suspension was either with alumn or one or two cationic polymers. The resulting suspension was filtered through various configurations of felt cloth filters. The kaolin suspension was justed to 100 JTU. Treatment by polymer consistently lowered the filtered effluent to less than 1 JTU. Jar tests were utilized to determine optimum coagulant dose for the tests. Formation of a complete filter cake in the filter appeared to be the determining factor in the efficiency of water clarification by the filter. The literature lacked references to this concept as applied to water supply problems. The results of this report suggest that continuous filtration should now be examined.

* * * * *

TITLE: Chemical Treatment of Urban Stormwater Runoff By Settling Column Studies

CANDIDATE: Paul R. Moore

FACULTY ADVISOR: Dr. James S. Taylor, P.E.

A B S T R A C T

Lake Eola, in downtown Orlando, was the subject of extensive research to determine the impact of stormwater runoff to the lake and possible management alternatives. The focus of this research was stormwater treatment by chemical coagulation followed by detention.

Phosphorus was the main parameter targeted for removal. Various chemical parameters were also evaluated included: TSS, VSS, NVSS, COD, TKN, NH_3 , TOC, TP, Ca, As, Cd, Cu, Cr, Ni, Mg, Fe, and Pb. The chemical coagulants used for this research included: alum, ferric chloride, and lime. The study involved settling column tests for the various treatment methods to determine stormwater settling characteristics and pollutant removal rates by depth and time.

Detention of the runoff in the column for 120 minutes resulted in average removal rates of 55% for TSS and 30% for TP. Both alum and ferricchloride, coagulation followed by 60 minutes of settling resulted in average removal rates of over 90% for both TSS and TP. Lime coagulation followed by 60 minutes of settling resulted in over 50% removal for both TSS and TP.

Regression analysis was used to develop equations relating pollutant removal with time and settling velocity. Isoconcentration lines were also developed to predict pollutant removal rates for specific parameters.

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TITLE: Evaluation of Various Mass Transportation Alternatives for the University of Central Florida Commuters

CANDIDATE: Jamal Niroumand-Rahimi

FACULTY ADVISOR: Dr. Satish Mohan, P.E.

A B S T R A C T

This research evaluates various mass transportation alternatives for the commuting students, faculty and staff of the University of Central Florida (U.C.F.), located at Orlando. The alternatives considered in this research are bus service, van service/minibus service, vanpool, carpool, and bicycle and pedestrian modes. During the lifetime of the University the private automobile has been the only prevalent mode of transportation used by the U.C.F. commuters.

Opinion surveys conducted in the summer of 1979 indicated that the U.C.F. commuters are confronted with a number of transportation problems including lack of parking spaces on campus, traffic congestion on the access roads to the University and the high cost of commuting using automobiles. Other surveys which were required for the evaluation process were taken during the same academic year. These included location survey, traffic study, intersection delay study, and parking study. Based on the results of these surveys the different transportation modes considered feasible in this situation are analyzed.

According to the results of the comparative cost analysis, using present-worth and equivalent uniform annual cost methods, all the candidate modes were found to be economically advantageous over the existing transportation mode. However, with the existing rate of auto ownership by the commuters, the carpool program could be considered as the most realistic solution to the short-term transportation problems of the University, provided the legal obstacles are overcome before the implementation of the program.

The feasibility and legal consideration of the various modes are discussed in the closing chapter of this report.

* * * * *

TITLE: City of Kissimmee Solid Waste Collection System
CANDIDATE: Larry W. Walker
FACULTY ADVISOR: Dr. Martin P. Wanielista, P.E.

A B S T R A C T

Every year the average American throws out more and more garbage. In the next five years, it is projected to increase 20-25 percent. This garbage, termed solid waste, is stored, collected, hauled and disposed of in some manner. The objective of this report has been to evaluate the City of Kissimmee's one-man residential solid waste collection system.

The study results indicated this generation rate of the City to be 3.28 pounds per person per day, or 29.1 pounds per home per pickup.

The productivity equations developed from the City data did not compare well with the results of EPA.

Also indicated in this report is the effect of the percent pickup factor in a solid waste collection system and its effect on system productivity.

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ELECTRICAL ENGINEERING AND COMMUNICATION SCIENCES DEPARTMENTAL REPORT

Chairman: B. E. Petrasko

Faculty: M. A. Belkerdid, E. E. Erickson, P. Gatt, R. C. Harden,
M. G. Harris, B. E. Mathews, R. N. Miller, B. W. Patz,
R. L. Phillips, S. M. Richie, F. O. Simons, H. C. Towle,
and R. L. Walker.

The Electrical Engineering and Communications Science Department expanded to fourteen with the addition in the winter quarter, of instructors Mr. Phil Gatt and Mr. Sam Richie. Mr. Gatt and Mr. Richie are both strongly involved in research in Computer Generated Imagery and are a major addition to our strong, well funded, program in Digital Systems.

The EECS program graduated 62 BSE students and 16 MSE and MS students in the 1979-80 academic year. Total enrollment for the fall quarter of 1980 was 531 and it is expected that a total of 90 EECS students will graduate in 1980-81. Both our undergraduate and graduate programs benefited from Quality Improvement funding this past year. The nucleus of a microelectronics laboratory was begun and a new faculty member, Dr. Stephen Haley will join EECS in the fall of 1981 to continue efforts in this area. Digital systems, communications and electronics laboratories were also upgraded.

The program in electro-optics, which is under the supervision of Dr. Ronald Phillips, continues to constitute a major portion of the research funding of the department and is receiving both regional and national attention. Relative to the Electro-Optics program, Dr. Eric Jakeman, Scientist of Special Merit, of the Royal Signal and Radar Establishment, Ministry of Defense, United Kingdom presented a series of six lectures on Optical Scattering, Statistical Modeling and Laser Instrumentation. The 1981 Southeastern Symposium on System Theory was held at UCF. Drs. Simons, Erickson and Harden were responsible for the successful Symposium and the proceedings which were published by UCF. A highlight of the Symposium was a session on Computers in Engineering Education. Dr. Simons and Dr. Harden have presented a number of workshops, nationwide, on the efficient utilization of hand-held calculators in engineering education. Dr. Patz, who holds national offices in the IEEE Computer Society was elected President of the Orlando Section of IEEE. His continued work in Computer Image Generator is presently the largest single funded program in the EECS Department, employing two instructors, two graduate students and two undergraduate students. Dr. Towle's continued research in micro-processor based training systems supports both graduate students and undergraduate teaching. Dr. Walker's research in Photovoltaics for the Florida Solar Energy Center is also showing great promise with the recent construction of a solar house powered completely by Photovoltaics.

The faculty is also active in supporting local industry in various roles of consultation and community support. The sustained growth in instruction, research, and public service provides continued service to the growing Central Florida area.

The program in electro-optics, which is under the supervision of Dr. Ronald Phillips, continues to constitute a major portion of the research funding of the department and is retaining both regional and national attention. Relative to the Electro-Optics program, Dr. Eric Bakeman, Scientist of Special Unit, of the Royal Signals and Radar Establishment, Ministry of Defense, United Kingdom presented a series of six lectures on optical scattering, statistical modeling and laser instrumentation. The 1981 Southeastern Symposium on System Theory was held at UCF on Oct. 2-5, 1981 and Dr. Eric Bakeman and his wife were responsible for the successful Symposium and the proceedings which were published by UCF. A highlight of the Symposium was a session on computers in engineering education. Dr. Simmons and Dr. Harben have presented a number of workshops nationwide on the efficient utilization of hand-held calculators in engineering education. Dr. Pats, who holds national office in the IEEE Computer Society was elected President of the Orlando Section of IEEE. His continued work in Computer Image Generation is presently the largest single funded program in the ECES Department, employing two instructors, two graduate students and two undergraduate students. Dr. Towle's continued research in micro-processor based training systems supports both graduate students and undergraduate teaching. Dr. Walker's research in photovoltaics for the Florida Solar Energy Center is also showing great promise with the recent construction of a solar house powered completely by photovoltaics.

The ECES program graduated 62 BSE students and 16 MSE and MS students in their 1980 academic year. Total enrollment for the fall quarter of 1980 was 231 and it is expected that a total of 90 ECES students will graduate in 1980-81. Both our undergraduate and graduate programs benefited from quality improvement funding this past year. The nucleus of a microelectronics laboratory was begun and a new faculty member, Dr. Stephen Hays, will join ECES in the fall of 1981 to continue efforts in this area. Digital systems, communications and electronics laboratories were also upgraded.

The program in electro-optics, which is under the supervision of Dr. Ronald Phillips, continues to constitute a major portion of the research funding of the department and is retaining both regional and national attention. Relative to the Electro-Optics program, Dr. Eric Bakeman, Scientist of Special Unit, of the Royal Signals and Radar Establishment, Ministry of Defense, United Kingdom presented a series of six lectures on optical scattering, statistical modeling and laser instrumentation. The 1981 Southeastern Symposium on System Theory was held at UCF on Oct. 2-5, 1981 and Dr. Eric Bakeman and his wife were responsible for the successful Symposium and the proceedings which were published by UCF. A highlight of the Symposium was a session on computers in engineering education. Dr. Simmons and Dr. Harben have presented a number of workshops nationwide on the efficient utilization of hand-held calculators in engineering education. Dr. Pats, who holds national office in the IEEE Computer Society was elected President of the Orlando Section of IEEE. His continued work in Computer Image Generation is presently the largest single funded program in the ECES Department, employing two instructors, two graduate students and two undergraduate students. Dr. Towle's continued research in micro-processor based training systems supports both graduate students and undergraduate teaching. Dr. Walker's research in photovoltaics for the Florida Solar Energy Center is also showing great promise with the recent construction of a solar house powered completely by photovoltaics.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BELKERDID, M. A., PHILLIPS, A. L. and ANDREWS, L. "Effects of Atmospheric Scattering on an Optical Communication System with a Decoder with Memory." 13th SE Symposium on System Theory Digest, Orlando, FL, March, 1981.
2. BELKERDID, M. A., PHILLIPS, R. L. and ANDREWS, L. "Measurement of Scintillation and Fading Statistics of Laser Beam Propagating Through Turbulence." Technical Digest: Coherent Laser Radar for Atmospheric Sensing, OSA, Aspen, CO, July, 1980.
3. HARDEN, R. C. and SIMONS, F. O., Jr. "Modeling and Simulation Algorithms Specifically Adapted for Calculators/Microcomputers." Modeling and Simulation Conference, Pittsburgh, PA, April 30 - May 1, 1981.
4. HARTMAN, J. P., HOSLER, E. R., MILLER, R. N. and DEBO, J. C. "Energy and Man: A University Course for Non-Engineers." 3rd Miami International Conference on Alternate Energy Sources, Miami, FL, December, 1980.
5. LITKA, WALKER, KHATTAR, MAYTROT. "The FSTC Experimental Photovoltaic Residence: Operation and Simulation." American Section of the International Solar Energy Society, Philadelphia, PA, May, 1981.
6. PHILLIPS, R. L., et al. "A Theoretical and Experimental Comparison of Cross-Correlator Performances Based Upon Output Signal-to-Noise Ratios." Southeastern Symposium on System Theory, Orlando, FL, March 26-27, 1981.
7. PHILLIPS, R. L., et al. "Measurements of Scintillation and Fading Statistics of a Laser Beam Propagating through Turbulence." Topical Meeting on Coherent Laser Radar for Atmospheric Sensing, Aspen, CO, July 15-17, 1980.
8. PHILLIPS, R. L., et al. "The Effects of Atmospheric Scattering on an Optical Communication System Using a Decoder in the Memory." Southeastern Symposium on System Theory, Orlando, FL, March 26-27, 1981.
9. PHILLIPS, R. L., ALLGAIER, D. E., ANDREWS, L. C., and GOPANI, S. "A Theoretical and Experimental Comparison of Cross-Correlator Performances Based Upon Output Signal-to-Noise Ratios." Proceedings of the 13th Southeastern Symposium System Theory, Orlando, FL, March 26-27, 1981.
10. PHILLIPS, R. L. and ANDREWS, L. C. "Laser Weapon Fire Simulation of Long Range Gunnery Training: Mathematical and Experimental Verification." Research Report Submitted to the Office of the

Project Manager, Training Devices, U.S. Army Contract
No. N61339-79-D-D105, July, 1980.

11. PHILLIPS, R. L. and ANDREWS, L. C. "Laser Weapon Fire Simulation of Long Range Gunnery Training: A Universal Math Model and Experimental Verification." Research Report Submitted to Office of the Project Manager, Training Devices, U.S. Army Contract No. N61339-79-D-D105, July, 1980.
12. PHILLIPS, R. L., ANDREWS, L. C. and BELKERDID, M. A. "The Effects of Atmospheric Scattering on an Optical Communication System Using a Decoder with Memory." Proceedings of 13th Southeastern Symposium on System Theory, Orlando, FL, March 26-27, 1981.
13. PHILLIPS, R. L., ANDREWS, L. C., BELKERDID, M. A. and O'HARA, J. F. "Measurements of Scintillation and Fading Statistics of a Laser Beam Propagating Through Turbulence." Topical Meeting on Coherent Laser Radar for Atmospheric Sensing, Aspen, CO, July 15-17, 1980.
14. SIMONS, F. O., Jr. and HARDEN, R. C. "Engineering Curriculum Adjustments to Meet Modern Computer Technological Developments." ASEE Frontiers in Education, Houston, TX, October 20-22, 1981.
15. SIMONS, F. O. and HARDEN, R. C. "Root Logs, Algorithms and Routines Adapted to the TI-59." SSST, UCF, March 26, 1981.
16. SIMONS, F. O., Jr. and HARDEN, R. C. "SCS Begins a New Service: Software Resources for Calculators and Personal Computers." Simulation Technical Journal, Vol. 36, No. 2, La Jolla CA, February, 1981.
17. SIMONS, F. O., Jr., SHAVER, M. and HARDEN, R. C. "INTEL 2920, A Single Chip Signal Processor - Promising, But With Problems." SSST, UCF, March 27, 1981.
18. SPOONER, PATZ, BREGALIA. "REAL SCAN Computer Image Generator." 2nd Interservice Industry Conference, Salt Lake City, UT, November, 1980.

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

1. "Southeastern Symposium on System Theory, UCF, Orlando, FL, March 26-27, 1981. (Erickson/Petrasko/Simons/Mathews)
2. Hand-Held Calculator Conference, UCF, January 15, 22, 29, 1981. (Miller/Simons)
3. Two state wide Florida section meetings of the Optical Society of America, UCF, October 16, 1980, May 2, 1980. (Phillips)
4. Workshop on "Efficient Utilization of Hand-Held Calculators in Engineering Education." Event 4221 at the National 1980 ASEE meeting in Amherst, MA, June 26, 1981. (Simons)
5. Introductory Workshop on Efficient Utilization of HP Hand-Held Calculators. Presented at ASEE FIE in Houston, Tx, October 19, 1980.
6. Microcomputer Systems Design Workshop, June, 1980. (Simons)

TITLE: Vacuum Arc Switch Inverter
PRINCIPAL INVESTIGATOR: Dr. R. Miller, P.E.
SPONSORING AGENCY: SCIEP

ABSTRACT

The primary objective of this task was the development of a multi-megawatt inverter operating at a frequency of at least 10 KHz, and employing vacuum arc switches as the active devices. The project was successfully completed on March 1, 1981. During the last 1 1/4 years of the task, one graduate student and three undergraduate students were supported on a part-time basis, and a small research facility was established at the South Orlando Campus. Also during this period two technical papers resulted from this research, and the final report has been submitted.

TITLE: REALSCAN Terrain Display
PRINCIPAL INVESTIGATOR: Dr. B. W. Patz, P.E.
SPONSORING AGENCY: Naval Training Equipment Center
GRANT NUMBER: 20-2100-011

RESUMES OF SPONSORED RESEARCH

TITLE: EMW Scattering II
PRINCIPAL INVESTIGATOR: Dr. E. E. Erickson, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-014

A B S T R A C T

The purpose of this project is to investigate antenna averaging effects on the measurement of electromagnetic wave scattering from rough surfaces. Antenna patterns for horn antennas and phased-array antennas have been determined. Measurements of EMW scattering from a prepared rough surface will be obtained using (1) a broad-beam horn antenna and (2) a narrow-beam phased-array antenna for various heights of the antenna above the rough surface and for various receiving angles with respect to the rough surface. Statistical data are to be compared with the statistical characteristics of the rough surface.

* * * * *

TITLE: Vacuum Arc Switch Inverter
PRINCIPAL INVESTIGATOR: Dr. R. Miller, P.E.
SPONSORING AGENCY: SCEEE

A B S T R A C T

The primary objective of this task was the development of a multi-megawatt inverter operating at a frequency of at least 10 KHz, and employing vacuum arc switches as the active devices. The project was successfully completed on March 1, 1981. During the last 1 1/4 years of the task, one graduate student and three undergraduate students were supported on a part-time basis, and a small research facility was established at the South Orlando Campus. Also during this period two technical papers resulted from this research, and the final report has been submitted.

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TITLE: REALSCAN Terrain Display
PRINCIPAL INVESTIGATOR: Dr. B. W. Patz, P.E.
SPONSORING AGENCY: Naval Training Equipment Center
GRANT NUMBER: 20-2100-011

A B S T R A C T

Continue to improve the REALSCAN algorithms and to create motion pictures illustrating REALSCAN capability.

* * * * *

TITLE: Laser Propagation
PRINCIPAL INVESTIGATOR: Dr. R. L. Phillips, Dr. L. C. Andrews, and Mr. M. A. Belkerdid, E.I.
SPONSORING AGENCY: Naval Training Equipment Center and UCF - EIES
GRANT NUMBERS: 10-2101-028 and 21-1699-016

A B S T R A C T

Laser propagation over long distance near earth paths. Mathematical models were constructed and experimental verification was carried out at NASA Space Shuttle Loading Facility.

* * * * *

TITLE: Shock Tube
PRINCIPAL INVESTIGATOR: Dr. C. E. Nuckolls, P.E., Dr. R. L. Phillips, and Mr. M. A. Belkerdid, E.I.
SPONSORING AGENCY: Naval Research Laboratory
GRANT NUMBER: 10-2101-038

A B S T R A C T

A water shock tube was constructed which could simulate 125 lbs. of TNT underwater explosion a distance of 11 feet. This facility is being used to test the effects of shock waves on fiber optic components.

* * * * *

TITLE: Shock Wave Initiation and NDT Examination of Shock Tube
PRINCIPAL INVESTIGATOR: Dr. C. E. Nuckolls, P.E. and Dr. R. L. Phillips
SPONSORING AGENCY: Naval Research Laboratories
GRANT NUMBER: 10-2101-059

A B S T R A C T

Investigation of shock wave initiation by use of an explosive charge distributed over a surface in the breech is in progress. The concept is to produce the same pressures at point r_0 which would exist at r_0 due to propagation of a spherical wave initiated at $r = 0$.

Non-destructive test techniques to determine the existence, location and size of cracks in the tube are also being investigated.

* * * * *

TITLE: Single Chip Signal Processors - Promising, But With Problems!

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

SPONSORING AGENCY: Naval Training Equipment Center

GRANT NUMBER: 10-2101-058

A B S T R A C T

A major promising breakthrough in digital simulation and implementation of real-time dynamic models is near a reality with the introduction of new signal processing integrated circuits. The Intel 2920 is particularly promising since the processor and I/O (including 4 ADC and 8 DAC channels) are all on one chip. However, there are problems with this new device. These problems are the subject of a research study to determine the extent of the problems, and the best fixes - either external hardware or special software remedies. A follow-on study will be devoted to extending the accuracy of I/O variables beyond 9 bits. Also special emphasis will be devoted to solving a d.c. offset problem.

* * * * *

TITLE: Infantry Weapons

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

SPONSORING AGENCY: Naval Training Equipment Center

GRANT NUMBER: 10-2101-050

A B S T R A C T

Infantry weapons support covers advanced versions of the universal infantry weapons trainer (UIWT) based on 8086 microprocessor systems such as the Intel single-board-computer (SBC)-86-12. These advanced versions will provide training for anti-armour and other indirect fire devices.

* * * * *

TITLE: Photovoltaic House
PRINCIPAL INVESTIGATOR: Dr. R. L. Walker, P.E.
SPONSORING AGENCY: FSEC
GRANT NUMBER: 11-1622-002

A B S T R A C T

The house having been erected, photovoltaic panels were tested on delivery, designs made for ganging them, and mounting them to the roof. The data-logging equipment was selected, sensors to measure quantities of interest were chosen, and the erection of the array carried out up to 4200 peak watts of PV panels, with 1000 more coming later under support from Florida Power and Light. Aid was also received from M.I.T. Lincoln Labs (about \$30,000 in dollar support plus counsel on their experiences with large PV installations). One junior EE student assisted full-time on this project.

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A B S T R A C T

A major promising breakthrough in digital simulation and implementation of real-time dynamic models is near a reality with the introduction of new signal processing integrated circuits. The Intel 2920 is particularly promising since the processor and I/O (including A/D and D/A channels) are all on one chip. However, there are problems with this new device. These problems are the subject of a research study to determine the extent of the problems and the best fixes, either external hardware or special software remedies. A follow-on study will be devoted to extending the accuracy of I/O variables beyond 9 bits. Also special emphasis will be devoted to solving a d.c. offset problem.

* * * * *

Principal Investigator: Dr. H. C. Towle, P.E.

Sponsoring Agency: Naval Training Equipment Center
Grant Number: 10-5101-050

Principal Investigator: Dr. R. L. Phillips

Infantry weapons support covers advanced versions of the universal infantry weapons trainer (UIWT) based on 8086 microprocessor systems such as the Intel single-board-computer (SBC)-8642. These advanced versions will provide training for anti-armor and other indirect fire devices.

* * * * *

RESUMES OF UNSPONSORED RESEARCH

TITLE: Design Root Locus Algorithms Specifically Adapted to Hand-Held Calculators

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

A B S T R A C T

Study, design and present in a paper, root locus algorithms and routines specifically adapted to hand-held programmable calculators.

* * * * *

TITLE: Engineering Curriculum Adjustments to Meet Modern Computer Technological Developments

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

A B S T R A C T

Study the effects of modern computer developments on Engineering curriculum and the adjustments needed to meet the new demands.

* * * * *

TITLE: Modeling Algorithms for Programmable Calculators/ Microcomputers

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

A B S T R A C T

Study and develop several modeling and simulation algorithms specifically adapted to hand-held programmable calculators and/or microcomputers.

* * * * *

TITLE: Root Locus Algorithms for the TI-59

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

A B S T R A C T

Develop root locus algorithms and routines specifically adapted to the TI-59.

* * * * *

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: Multiprocessor/Multicomputer Systems and Optimal Loading Techniques

CANDIDATE: Francis D. Adams

FACULTY ADVISOR: Dr. Benjamin W. Patz, P.E.

A B S T R A C T

This report reviews the subject of multiprocessor/multicomputer systems and optimal loading techniques.

This report covers:

1. The interrelationship of Multiprocessor/Multicomputer (Multiple Instruction stream Multiple Data Stream, MIMD) systems and other architectures by presenting a categorization of computer architectures.
2. Comparison of Multiprocessor/Multicomputer (MIMD), versus Parallel Processor (Single Instruction stream Multiple Data stream, SIMD) systems.
3. Multiprocessor/Multicomputer problems, pitfalls and new goals.
4. Investigation of loading techniques by reviewing particular MIMD executive designs.

* * * * *

TITLE: Digital Acoustic Tracking Analysis Program

CANDIDATE: George H. Ford, Jr.

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

A B S T R A C T

The purpose of this report is to investigate the processing of tracking data for acoustic targets. The programs developed for two- and three-dimensional space calculate the target's position via "hyperbolic-fix" navigation (geometric) considerations using the Newton-Raphson algorithm.

The computer programs and the tracking solution approach contained therein is based on knowledge of only the sensors' locations and the relative time-difference at which a target's referenced, singular, acoustic pressure wavefronts are received at the sensors.

Omnidirectional sensors are found to be sufficient for the two-dimensional space tracking problem. However, it is found that the three-space problem requires usage of directional frequency and ranging (DIFAR) sensors.

Line printer plots are provided for the target position solutions; also, tabular track position solutions are provided.

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TITLE: An Experimental Comparison of Cross Correlator Performances Based Upon Signal-To-Noise Ratios

CANDIDATE: Sunder G. Gopani

FACULTY ADVISOR: Dr. Ronald L. Phillips

A B S T R A C T

Three commonly employed types of cross correlators were designed using standardized components which closely stimulate idealized elements in an effort to experimentally verify the theoretical analysis. These cross correlators are (1) the standard analog cross correlator which consists of bandpass filters, a multiplier and a postmultiplier lowpass filter, (2) the polarity coincidence correlator (PCC) which utilizes a hard clipper in each input channel, and (3) a modified type of PCC which features a hard clipper in only one of the input channels. Two different types of filters viz. (1) the seventh-order Butterworth lowpass filter, and (2) the five-pole Chebyshev lowpass filter with a maximum passband loss of 1 dB were utilized. The output signal-to-noise ratio (SNR) was experimentally computed as a function of input signal-to-noise ratio and compared with theoretical predictions. The performance in terms of output SMRs of the three cross correlators are compared. In all cases, the experimental results were in close agreement with the theoretical models.

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TITLE: Bilin: A Bilinear Transformation Computer Program and Its Applications

CANDIDATE: John Dana Greer

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

A B S T R A C T

Given a transfer function for a differential equation model, an approach for obtaining a solution is by way of the bilinear transformation. The bilinear transform approach is a numerical integration scheme which gives a discrete approximation to the differential equation solution. BILIN applies a series of polynomial transformations to the transfer function $H(s)$. As a result, $H(s)$ is mapped into the complex z plane obtaining the discrete transfer function $H(z)$. From $H(z)$, the difference equation is obtained whose solution $y(nT)$ approximates the actual differential

solution $y(t)$. Hence, BILIN provides a means for obtaining discrete transfer functions for the design of digital filters and/or solving linear time-invariant differential equations.

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TITLE: Adjustable Low Frequency Servo Compensation Using Operational Amplifiers

CANDIDATE: Charles Phillips Partin, Jr.

FACULTY ADVISOR: Dr. Robert L. Walker, P.E.

A B S T R A C T

This paper defines a transfer function that is used to compensate for low frequency structural resonances in a turret so that stabilization of a closed loop servo system can be achieved. Three circuits for implementing this compensation are presented. They are: the feedforward three amplifier biquad, the summing four amplifier biquad, and the single amplifier biquad with pole-zero cancellation. Design equations allowing the engineer to go directly from the given transfer function to the actual component values are developed for each circuit. A comparison of the final circuit designs is also presented.

* * * * *

TITLE: Implementation and Documentation of Oracles (Optimal Regulator Algorithms For The Control of Linear Systems) Software Package

CANDIDATE: Mr. Bahram Parvizin

FACULTY ADVISOR: Dr. Michael G. Harris

A B S T R A C T

The objective of this research is to mount a software package entitled Optimal Regulator Algorithms for the Control of Linear Systems (ORACLS), on a Control Data Corporation (CDC) Cyber 74 digital computer system at Florida State University so that it can be operated from the University of Central Florida. The software package contains 60 sub-routines which can be used for the analysis and design of state variable feedback control laws for time-invariant linear systems.

The procedure for using this package is documented. Several examples are presented to illustrate the capability of ORACLS in both digital and continuous linear-quadratic-gaussian (LQG) controller design and additionally, to demonstrate the construction of typical executive programs.

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TITLE: A Real Time Microprocessor Based Digital Filter Implementation

CANDIDATE: Mark Harold Shaver

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

A B S T R A C T

A major break-through in the real-time digital simulation of dynamic models has occurred with the introduction of the Intel 2920 digital signal processing chip. The problems and potentials for this new device are demonstrated by implementing an elliptic function digital low pass filter via the bilinear Z-transform approach. The software implementation is presented. Debugging and software verification are accomplished via manufacturer's simulation software tools. The hardware performance is checked in the laboratory.

The results of these efforts point to much promise for wide scale applications, however, problems associated with performance indicate early version chip problems.

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TITLE: Optical Phase Modulation Utilizing Magnetoelastic Properties of Metallic Glasses

CANDIDATE: Frank R. Trowbridge

FACULTY ADVISOR: Dr. Ronald L. Phillips

A B S T R A C T

Three different optical fiber phase modulators utilizing the magnetostrictive properties of the metallic glass alloy $Fe_{74}Co_{10}B_{16}$ were constructed. By binding the optical fiber to the magnetostrictive metallic glass, the strain imparted to the metallic glass from the magnetic field is transferred to the optical fiber. The strain on the optical fiber shifts the phase of the light, which can be controlled indirectly by varying the current producing the magnetic field permeating the metallic glass. The performance of the modulators on the basis of optical phase shift as a function of bias magnetic field and optical phase shift as a function of excitation frequency was measured. Speculations were made on the loss mechanism inherent in the various modulator designs in order to explain the deviation in performance of the three modulator designs.

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ENGINEERING TECHNOLOGY DEPARTMENTAL REPORT

Chairman: R. G. Denning

Faculty: B. D. Bullard, J. C. Debo, R. F. Dehler, H. L. Griffith,
C. M. Head, J. W. Hubler, T. F. Wells, and H. E. Worbs

The Engineering Technology Department experienced growth in both student enrollment and number of graduates produced. Enrollment was the greatest ever with a head count approaching 350 and the number of graduates was 98 thus establishing UCF as the leading Engineering Technology institution in the State of Florida. Employment opportunities for the Engineering Technology graduates were again excellent with 100% employment with starting salaries averaging \$21,000 per year.

During the 1980-81 academic year one Electronics faculty member resigned and was replaced by Richard F. Dehler. Helmuth E. Worbs, who joined the University in 1978 as STAC director, was appointed Assistant Professor of Engineering Technology and will teach core and design courses. Dr. Head researched the study of "Toxic Waste Disposal by Oceanic Electrodeposition Encapsulation" and Professor Bullard continued his research for the Air Force Office of Scientific Research in "Shipboard Antenna Placement Optimization". The Engineering Technology faculty members were active in professional, educational, and community organizations. Although funds were limited, one printer, one additional Apple Computer, and 12 Microprocessor Trainers were added to enhance the department's capabilities in the important area of manufacturing applications.

In addition to the courses offered during the day, the Engineering Technology Department offered 18 evening courses on the main campus and 16 evening courses at Brevard campus. The number of active Engineering Technology students based at the Brevard campus was approximately 75 during 1980-81. These students were ably advised by Professor Hubler who sees continued growth at the Brevard campus and also at Melbourne where several Electronics courses were offered during 1980-81.

CONFERENCE, WORKSHOPS, SHORT COURSES AT
ED PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BULLARD, B. D. "Shipboard Antenna Placement - (SAPO) Phase II." Final Report - Air Force Office of Scientific Research, April 30, 1981.
2. DEBO, J. C. Co-Author of paper on, "Energy and Man", with Drs. Hartman, Hosler, et al.
3. DEBO, J. C. Co-Presenter of "Energy and Man" paper with Dr. Hosler at Miami Alternate Energy Conference, December, 1980.
4. DENNING, R. G. "Industrial Utilization of Engineering Technologists", 1981 ASEE College-Industry-Education Conference, Lake Buena Vista, FL, January 28-30, 1981.
5. HEAD, C. M. "Reef Accretion as a Means of Hazardous Waste Disposal", Artificial Reef Workshop, Miami, FL, January 14, 1981.

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

1. PCAP Training Lecture for Student Assistants at Computer Center.
(Debo)
2. Artificial Reef Workshop - Rosenthal School of Marine & Atmospheric
Sciences, January 14, 1981. (Head)
3. Design of Steel Framed Buildings." Consultant, Brunhoff Structural,
Fort Pierce, FL. (Hubler)
4. STAC Workshop on "How to Prepare Proposals for DOE Small Grants
Program", January, 1981. (Worbs)

RESUMES OF SPONSORED RESEARCH

TITLE: Feasibility Study of Toxic Waste Disposal by Oceanic Electrodeposition Encapsulation

PRINCIPAL INVESTIGATOR: Dr. C. M. Head, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-011

A B S T R A C T

Preliminary testing indicates that glass, plastic, and metal containers can be encapsulated by accreting minerals from sea water around them. Porosity of the accretion averages 12%, indicating that waste containers ultimately used at sea must be able to withstand oxidation in the ocean. Compressive strengths of the accreted material exceeds that of concrete. Accretion rates were found to be a function of circuit amperage and seawater PH (in closed systems). Construction of an artificial reef containing simulated toxic waste containers is currently in the planning stage. The reef is to be constructed in conjunction with the Oceanic Engineering Department, FAU.

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Our faculty attended a number of continuing education experiences including computer graphics, microcomputers, work measurement and optimization. The department hosted the 3rd National Computers and 18 Conferences in October attended by 200 people from 30 States and 7 foreign countries. The 4th National and Int. International meeting will be sponsored by the department in March 1982. Drs. Bauer, Hosny, Boering, and Whitehouse taught a number of Continuing Education courses on such subjects as Statistical Quality Control, Use of Micro-Computers by the Industrial Engineer, Computer Graphics and Project Engineering. The workshops were attended by more than 200 individuals throughout the United States. Dr. Whitehouse taught continuing education courses in Detroit and Greenville, S. C. under the sponsorship of the American Institute of Industrial Engineers (AIIE). He also taught a course in Project Management in Philadelphia for the Insurance Company of North America. The department sponsored a one day workshop for Practicing Industrial Engineers in April.

The department was involved in a number of sponsored and unsponsored research activities. The faculty are Principal Investigators on contracts funded at a level in excess of \$50,000. Projects include Terrain Display, Heat Waste Recovery, Solar Window Film Analysis, Industrial Productivity, Health Delivery Programs, Industrial Safety, Navy Student Flow Simulation Models, Passive Energy Management, and Project Management. Twenty graduate students have been actively working on research reports and theses.

RESUMES OF UNSPONSORED RESEARCH

TITLE: Steel Construction Manual

PRINCIPAL INVESTIGATOR: Mr. J. W. Hubler, P.E.

A B S T R A C T

The Eighth Edition of the Manual of Steel Construction of the American Institute of Steel Construction, Inc. has procedures for analysis and design of beams, girders and trusses which are confusing to some engineers.

I am doing calculations for a small publication which, hopefully, may eliminate some of the confusion by presenting relatively straight-forward procedures.

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INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS
DEPARTMENTAL REPORT

Chairman: G. E. Whitehouse

Faculty: C. S. Bauer, C. B. Gambrell, Y. A. Hosni, H. I. Klee,
D. G. Linton, G. F. Schrader, J. A. Sepulveda, S. B.
Spain, C. J. White

The period 1980-81 has been a time of activity for the Industrial Engineering and Management Systems Department at the University of Central Florida. The department is in the process of determining the feasibility of a Productivity Center for Central Florida. A number of faculty and students within the department are developing computer programs to solve traditional industrial engineering problems written in BASIC to be run on the TRS 80 and Apple Microcomputers. This activity is being reported in a series of columns in Industrial Engineering Magazine. Over 400 inquiries have been received regarding this activity. Dr. Whitehouse is Editor for this series of columns.

The publication activity within the department remains high with over 40 articles and presentations. Dr. Whitehouse was invited to submit a chapter on "Networks" to the new Industrial Engineering Handbook and a section on "Flowgraphs" to the 3rd Encyclopedia of Statistics.

Our faculty attended over 20 Professional Meetings in addition to a number of continuing education experiences including computer graphics, microcomputers, work measurement and optimization. The department hosted the 3rd National Computers and IE Conferences in October attended by 200 people from 30 States and 7 foreign companies. The 4th National and 1st International meeting will be sponsored by the department in March 1982. Drs. Bauer, Hosni, Doering, and Whitehouse taught a number of Continuing Education courses on such subjects as Statistical Quality Control, Use of Micro-Computers by the Industrial Engineer, Computer Graphics and Project Engineering. The workshops were attended by more than 200 individuals throughout the United States. Dr. Whitehouse taught continuing education courses in Detroit and Greenville, S. C. under the sponsorship of the American Institute of Industrial Engineers (AIIE). He also taught a course in Project Management in Philadelphia for the Insurance Company of North America. The department sponsored a one day workshop for Practicing Industrial Engineers in April.

The department was involved in a number of sponsored and unsponsored research activities. The faculty are Principal Investigators on contracts funded at a level in excess of \$250,000. Projects include Terrain Display, Heat Waste Recovery, Solar Window Film Analysis, Industrial Productivity, Health Delivery Programs, Industrial Safety, Navy Student Flow Simulation Models, Passive Energy Management, and Project Management. Twenty graduate students have been actively working on research reports and theses.

Dr. Bauer was selected as a member of the 1982 Engineer's Week Committee by NSPE. He is the Vice President of the Central Florida Chapter of the Florida Engineering Society (FES). Dr. Doering became a licensed State Energy Auditor. He served as Vice Chairman of FES's FEE committee and was a member of FES's State Steering Committee. Dr. Doering was a representative on FES's Energy Committee and served as National Program Chairman for AIIE's Energy Task Force. He was re-elected as Regional Vice President to Alpha Pi Mu, the Industrial Engineering Honorary. Dr. Gambrell was reappointed to ABET's Board of Directors, ABET's Relocation Committee and the Third Accreditation Commission Study Group. He received the 1981 ICF-CHIEF award for his work with private universities. He serves on the Board of Directors of Winter Park Hospital, Embry Riddle Aeronautical University, Prescott College and the Accreditation Board for Engineering and Technology. Dr. Gambrell is presently on leave and is Vice President and Provost at West Coast University. Dr. Hosni was president of the local AIIE Chapter and was helped by Drs. Gambrell, Linton, Whitehouse and Prof. White who served on the Board of Directors. Drs. Klee, Hosni, Linton and Whitehouse served as reviewers for the International Journal of Computers and Industrial Engineering. Dr. Whitehouse was recently named Associate Editor for this Journal. Dr. Hosni attended a number of seminars as a faculty guest of the Material Handling Institute. Dr. Linton is a referee for the IEEE Transactions on Reliability. Dr. Whitehouse was an invited speaker at AIIE's Manager's Conference in New Orleans. He is Editor of the New AIIE Micro-Software Series. He served on the A.N.S.I. National Committee on Network Notations and FES's Engineering Education Committee. Drs. Gambrell, Schrader and Whitehouse continue to serve as ABET accreditation visitors. Dr. Schrader served as National Executive Vice President for Chapter Operations for AIIE. Dr. Bauer won the top teaching award from the College of Engineering for the second straight year. Dr. Doering initiated and chairs a campuswide Energy Committee.

The College of Engineering Computing Laboratory under the direction of the IEMS Department continues to grow and has moved to new larger quarters. Areas of emphasis include Computer Graphics, Mini/Micro Computer Systems, Computer Speech and Robotics.

Our students continue active and for the sixth straight year they won first prize for the group competition in the Annual Engineer's Fair at UCF. They also won the "Award of Excellence" from the National AIIE Organization. The UCF Chapter of Alpha Pi Mu initiated 10 members during the year. The AIIE students instituted a Collegewide newsletter and published three volumes this year.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BAUER, C. S. and WHITEHOUSE, G. E. "Everything You Always Wanted Know About Micro-Computers But Were Afraid to Ask." 3rd National Computers and I.E. Conference, Orlando, FL, October, 1980.
2. BAUER, C. S. and WHITEHOUSE, G. E. "Everything You Wanted To Know About Mini/Micro Computers." Florida Instructional Computing Conference, St. Petersburg, FL, February, 1981.
3. BAUER, C. S. "Computer Use in UCF Engineering Curriculum." 13th Southeast Symposium on System Theory, UCF, March, 1981.
4. BAUER, C. S. "Microcomputer Research at UCF." Graduate Symposium, University of Florida, Gainesville, FL, June 4, 1981.
5. DOERING, R. D. "A Simulator System for Tactical Training of Police Under Fire." The Police Chief, Vol. XLVII, No. 10, IACP, Gaithersburg, MD, October, 1980.
6. DOERING, R. D. "Comparison of Low Temperature and Conventional Dishwasher Systems." Proceedings Society for the Advancement of Food Service Research 1980 Conference, November, 1980.
7. DOERING, R. D. "The Potential for Cogeneration and Waste Heat Recovery in Florida." Proceedings, AIIE 1980 Fall Industrial Engineering Conference, December, 1980.
8. DOERING, R. D. and HOSNI, Y. A. "Total Energy Plant - Simulation Model." Proceedings 1980 Winter Simulation Conference, December, 1980.
9. DOERING, R. D. "A Systems Approach to Slips and Falls Accident Analysis." National Safety News, Vol. 123, No. 2, February, 1981.
10. DOERING, R. D. "Development of Energy Management System at Walt Disney World via Centralized Computer Control." 3rd National Conference on Computers and Industrial Engineering, Orlando, FL, October, 1980.
11. DOERING, R. D. "Advanced Solid Waste Handling in Restaurant Operations." National Restaurant Association, Lake Buena Vista, FL, February, 1981.
12. DOERING, R. D., et.al. "Florida Future Tied to Petroleum Supplies." The Florida Specifier, Vol. 2, No. 4, April, 1981.

13. DOERING, R. D., et.al. "Pulp Industry Energy Uses Examined." The Florida Specifier, Vol. 2, No. 4, April, 1981.
14. DOERING, R. D. "Process Food Energy Use Summarized." The Florida Specifier, Vol. 2, No. 4, April, 1981.
15. GAMBRELL, C. B., et.al. "Simulation Techniques in Operator and Maintenance Training, Performance Assessment, and Personnel Selections." Computers and Industrial Engineering Conference, Orlando, FL, October, 1980.
16. HOSNI, Y. A., et.al. "Learning Curve Using Microcomputers." Industrial Engineering, Vol. 13, No. 5, May, 1981.
17. HOSNI, Y. A. and BAUER, C. S. "Speech Synthesizers Development and Impact on Industrial Engineering." Computers and I.E., Vol. 4, No. 1, 1980.
18. HOSNI, Y. A. and BAUER, C. S. "Mini-Microcomputers - Overview of Microcomputers for IE Use." Industrial Engineering, Vol. 12, No. 6, June, 1980.
19. HOSNI, Y. A., et.al. "Short-range Forecasting on a Seasonal Basis Using Microcomputers." Industrial Engineering, Vol. 12, No. 10, October, 1980.
20. HOSNI, Y. A. "On the Development of Structured Software." 13th Annual Southeastern Symposium on System Theory, Orlando, FL, March, 1981.
21. HOSNI, Y. A. "Software Cost Estimation." 3rd National Conference for Computers and IE, Orlando, FL, October, 1980.
22. KLEE, H. I. "Solar Economics - Short Term Costing." A.S.M.E. Solar Energy Division Simulation and Economic Analysis Solar Heating and Cooling Conference, Reno, Nevada, April, 1981.
23. KLEE, H. I., et.al. "Solar Economics." Florida Solar Coalition Newsletter, Vol. 3, February, 1981.
24. LINTON, D. G. "Life Distributions and Degradation for a 2-out-of n:f System." IEEE Transactions on Reliability, April, 1981.
25. LINTON, D. G. and WHITEHOUSE, G.E. "Simulation: A Tool for Forecasting the Future." Emphasis Magazine (UCF), June, 1981.
26. LINTON, D. G. "Analysis of Parallel Redundant Systems with Repair of Primary and Secondary Failures." ORSA/TIMS/CORS Conference, Toronto, Canada, May, 1981.
27. LINTON, D. G. "Some Advancements in Monte Carlo Integration Methods with Applications to Proximity Fuzes." 3rd National Conference on Computer and I.E., Orlando, FL, October, 1981.

28. SEPULVEDA, J. A. "Ruralism: A Simulation Model for Design and Evaluating Rural EMS Systems." Proceedings of the Second International Conference on System Science in Health Care, Montreal, Canada, July, 1980.
29. SEPULVEDA, J. A., et.al. "Rural Emergency Transportation Systems: Planning through Simulation." 3rd National Conference of Computers and Industrial Engineering, Orlando, FL, October, 1980.
30. WHITEHOUSE, G. E., BAUER, C. S. and HOSNI, Y. A. "Use of Microcomputers to Solve Traditional Industrial Engineering Problems." Proceedings of AIIE Annual Conference, Detroit, MI, May, 1981.
31. WHITEHOUSE, G. E. "Microcomputers and the I.E." Proceedings of AIIE Manager's Conference, New Orleans, LA, March, 1981.
32. WHITEHOUSE, G. E., et.al. "Slam Model for Student Training." Proceedings of 3rd NTEC Conference, Salt Lake City, UT, November, 1980.
33. WHITEHOUSE, G. E. "Project Networks and Computers." Civil Engineering, May, 1981.
34. WHITEHOUSE, G. E., et.al. "Work Sampling Observations." Industrial Engineering, Vol. 13, No. 4, March, 1981.
35. WHITEHOUSE, G. E., et.al. "Work Sampling Size." Industrial Engineering, Vol. 13, No. 4, April, 1981.
36. WHITEHOUSE, G. E., et.al. "Activity Networks." Industrial Engineering, Vol. 12, No. 12, December, 1980.
37. WHITEHOUSE, G. E., et.al. "PERT." Industrial Engineering, Vol. 13, No. 1, January, 1981.
38. WHITEHOUSE, G. E., et.al. "Resource Allocation." Industrial Engineering, Vol. 13, No. 2, February, 1981.
39. WHITEHOUSE, G. E., et.al. "Assembly Line Balancing." Industrial Engineering, Vol. 12, No. 8, August, 1980.
40. WHITEHOUSE, G. E., et.al. "Introduction to BASIC." Industrial Engineering, Vol. 13, No. 5, May, 1981.

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

1. "Use of Microcomputers to Solve Practical IE Problems", November, 1980, March, 1981, June, 1981. (Bauer/Hosni/Whitehouse)
2. "Computers in IE Conferences", Fall, 1980. (Bauer/Hosni/Whitehouse)
3. UCF COE/FL DOT Workshops "Statistical Quality Control in Highway Construction", Ft. Lauderdale, Panama City, and Jacksonville, FL, Summer 1980. (Bauer/Klee/Whitehouse)
4. 2 day short course on Interactive Computer Graphics, College of Extended Studies, Orlando, June, 1981. (Bauer)
5. Project Management Continuing Education Workshop, Marriott Hotel Orlando, FL, February 18 - 20, 1981. (Doering)
6. "Planning for the Future: A Practical Seminar", Orlando, FL, April 11, 1981. Sponsored by AIIE Chaps 104 & 811. (Doering)
7. PE review course sponsored by Florida Engineering Society. (Doering)
8. Seminar on Eng. Software Design, UCF, April 11, 1981. (Hosni)
9. Workshop on Use of Inexpensive Computers to Solve IE Problems. (Hosni)
10. Florida Solar Coalition Annual Meeting, Winter Park, FL, December 5 - 6, 1980. (Klee)
11. SEEK 80, Lecture on Solar Energy, Orlando, FL, August 5, 1980. (Klee)
12. "Energy Conservation for the Financial Community", Orlando, FL, December 16-17, 1980. (Klee)
13. Seminars on "Improving the Productivity of Your I.E. Dept. Using MicroComputers" sponsored by AIIE, Detroit, May 16 & 17, 1981 and Greenville, SC, March 23, 1981. (Whitehouse)
14. Seminar on "Project Management" at FES Convention, Marco Island, FL, August, 1980. (Whitehouse/Doering)

RESUMES OF SPONSORED RESEARCH

TITLE: Analysis of Solar Window Film Installations in State Buildings

PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E. and Dr. Y. A. Hosni, P.E.

SPONSORING AGENCY: Governor's Energy Office

GRANT NUMBER: STAR Project 79066

A B S T R A C T

The control of solar heat gain through fenestration appears to have a good potential for saving energy in State buildings. There are over 500 major buildings, and many were constructed in the era of low energy costs when little attempt was made to reduce the solar heat gain through the envelope. The design philosophy at that time was a lower initial cost at the expense of long term operating costs. The economics and availability of energy have now changed and the advantage of controlling solar heat gain through windows has become very important.

The primary objective of this study was to examine all existing State buildings on an individual basis to determine the feasibility of fenestration shading control via solar film application. The results were presented in terms of a payback period for each project so that they could be evaluated/ranked on an economic basis for funding consideration by Departments within State government. This project was completed and the final report submitted September, 1980.

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TITLE: Energy Conservation

PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E. and Dr. R. D. Doering, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-048

A B S T R A C T

As a result of the 1973 energy crisis the State of Florida adopted an energy policy with a goal of 65% energy savings. Coupled with this requirement and a basic concern over future energy problems, UCF initiated an individual energy conservation program. With the passage of an Energy Conservation Resolution for the State of Florida, Governor Graham has resolved to further increase these savings by 15%.

The major effort of this work was to identify a workable plan to (1) mobilize support for energy conservation effects on campus and to generate

publicity for conservation among the academic community, and (2) to conduct a technical energy audit of the campus under the Federal Grants to Schools and Hospitals Program.

The plan developed by Drs. Doering and Bishop was included in a proposal entitled, "An Energy Audit and Conservation Program for the University of Central Florida.

* * * * *

TITLE: The Potential for Cogeneration and Waste Heat Recovery in Florida

PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E., Mr. A. Minardi, and Dr. R. D. Doering, P.E.

SPONSORING AGENCY: Governor's Energy Office

GRANT NUMBER: 11-1624-004

A B S T R A C T

This study was directed towards the identification, definition, and evaluation of cost effective projects in the residential, commercial, and industrial sectors within the Florida economy which would conserve energy through waste heat recovery methodologies and cogeneration. A secondary objective was to provide guidelines for legislative tax action which would encourage waste heat recovery projects.

Initially, each of the three major economic sectors were examined in terms of their energy use profile so that typical operating processes could be determined. In a parallel effort a workable list of energy recovery methodologies was compiled and screened against the requirements in each sector. In compiling the list only methodologies which could be implemented with off-the-shelf hardware and had been field tested were considered. These methodologies were further screened relative to their application to new retrofit installations.

The investigation was conducted on a sample basis for each of the sectors working closely with utility and manufacturing plants in the paper/pulp, citrus, phosphate, cement and glass industries.

A summary of viable projects by economic sector with the capital requirement, projected annual energy savings and monetary savings was extended to the State level. These data show that if these projects were implemented they would effect energy equivalent savings of 11.9 million barrels of residual fuel oil annually.

* * * * *

TITLE: Industrial Productivity

PRINCIPAL INVESTIGATOR: Dr. C. B. Gambrell, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-036

A B S T R A C T

With Florida's increasing interest in increasing its industrial base, UCF has been exploring the feasibility of establishing a productivity institute within the College of Engineering. Such an institute could;

1. Establish a liaison with selected manufacturing industries in Central Florida.
2. Coordinate productivity improvement programs-education research.
3. Serve as a clearing house for productivity improvement information from the U.S. productivity centers.
4. Develop measures of productivity for industry and government organizations in Florida.
5. Serve as a college liason with economic development organizations - local and state.
6. Develop an information base on automation technology pertinent to Florida industries.

Local industries have been contacted and surveyed regarding productivity interests and a preliminary plan for the development of a productivity center has been developed.

* * * * *

TITLE: Re-engineering for the Blind

PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E.

SPONSORING AGENCIES: Florida Department of Education - Division of Blind Services and UCF - EIES

GRANT NUMBERS: 15-1624-002

A B S T R A C T

A final report for the second years' activities was submitted to the sponsoring agencies. The report is available at the agency. The report contains updates to previously developed equipment, as well as classifications of potential job and the recommended equipment. Documentation for software programs developed for the microcomputer acquired in the first year is included in the report.

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TITLE: Regional Resources Constrained Economic Base Model
PRINCIPAL INVESTIGATOR: Dr. R. D. Doering, P.E. and Dr. Y. Hosni, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-015

A B S T R A C T

The original intent was to develop a pilot analytical model of a Regional EBM that will introduce energy, water supply, housing, and sewage facilities, as constrained resources. The pilot model was supposed to be submitted to potential agencies for further funding. The model was developed, several agencies were contacted, however funding did not materialize due to uncontrollable circumstances. The model was reconstructed to fit one of the STAR grants, and a formal proposal was submitted to the Governor's Energy Office for possible funding.

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TITLE: Simulation of a Residential Waste Heat Recovery System
PRINCIPAL INVESTIGATOR: Dr. H. Klee, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-005

A B S T R A C T

A digital simulation of an A/C waste heat recovery system is being developed. The transient simulation program TRNSYS is being used to study the thermal performance of a working system. A/C manufacturer's specifications and tabulated thermodynamic properties of refrigerant R-22 are being used to model the A/C cycle. This is necessary to compute the heat capacity of the refrigerant exiting the compressor and entering the heat exchanger of the heat recovery unit. The simulation will be validated using data from the system which is to be fully instrumented. Particular attention is being given to determining the fraction of heat normally rejected in the A/C condenser that can be recovered by the heat recovery unit.

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TITLE: Feasibility Analysis of Electronic Panel Simulation for Maintenance Training Devices
PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.
SPONSORING AGENCY: U. S. Army
GRANT NUMBER: 10-2101-004

A B S T R A C T

Currently, many of the U.S. Army's maintenance training procedures are performed using microprocessor-controlled hardware panel mock-ups of the system being maintained. In this study, a subsection of a representative maintenance panel was constructed and a two-dimensional (2-d) computer graphics simulation of this panel was developed using the Tektronix 4052 Computer Graphics System. Using students as subjects, an experiment was designed to determine whether learning efficiency is degraded when students are trained on the 2-d simulation. Based on both equipment costs and learning effectiveness, the results indicate that the 2-d simulation is a feasible alternative to the present approach of using hardware mock-ups. Potential pitfalls of the 2-d simulation approach and the necessary remedies are also discussed. (Final Report, December, 1980)

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TITLE: Electric Vehicle
PRINCIPAL INVESTIGATOR: Dr. G. F. Schrader, P.E. and Dr. C. E. Nuckolls, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-038

A B S T R A C T

The purpose of this project was to convert a 1972 AMC Gremlin from an internal combustion engine to an electric motor drive so as to provide a basis for future research on electric vehicle characteristics. The research vehicle is being designed in accordance with SAE J227a electric vehicle test standards for a driving range of 50 km at 50 km/hr. For experimental purposes, a shunt wound, 20.8 horsepower General Electric DC electric motor and a General Electric EHV series controller have been installed in the vehicle. In addition, the vehicle has been modified to provide space for the installation of 18 standard 6-volt automotive batteries. The vehicle is currently in operation and undergoing operational tests.

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TITLE: Integration of a Multidisciplinary Research Team Into the Local Health System Environment
PRINCIPAL INVESTIGATOR: Dr. J. A. Sepulveda, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-020

A B S T R A C T

An interdisciplinary research team formed by qualified interested faculty and non-faculty members is being established. The team will coordinate efforts to become part of the regional health decision-making structure through participation in planning committees and through aiding in the decision-making process and planning function. The objective of this research effort is to develop a program responsive to the medical care system as its needs will surface in the future. Its significance rests in the ability of the research team to define such future needs, to provide quantitative approaches to actual situations faced by health planners in regional decision-making problems and to take steps to increase the likelihood that the research findings will be implemented. The project is aimed towards research into the various components of the health care system, with emphasis on regional allocation of resources. Specifically, it will be applied-type research, with the objective of developing quantitative models to enable local councils to estimate specific needs in their communities and to estimate the quantity and level of services, facilities and resources needed to meet these needs. A special effort to develop suitable measures of performance for various components of the health system will be made. A methodology will be developed to measure patient, community and health providers perceptions of (and satisfaction with) the system, as well as to consider the traditional measures used by planners (i.e., time and/or money) to evaluate performance. Along with the definition of these areas, it is expected that this phase will include a comprehensive literature survey and the development of a system for collecting baseline data, if it is found that no reliable data base is available.

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TITLE: A Study of Safety Related Problems Experienced by Various Industries in Central Florida

PRINCIPAL INVESTIGATOR: Mr. C. J. White, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-036

A B S T R A C T

A study is in progress to identify safety problems being experienced by various industries in the Central Florida area. Data from this study will be compiled to identify specific problem areas with a view toward providing emphasis on solution of these problems in regularly schedule safety engineering classes. The data will also be used to evaluate the interest of local industry personnel in attending safety programs at the University of Central Florida.

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TITLE: Project Management with Limited Resources
PRINCIPAL INVESTIGATOR: Dr. G. E. Whitehouse, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-037

A B S T R A C T

In project scheduling by network analysis traditional critical path methods fail to include resource considerations. Other methods must be used to allow for resource constraints. This research extends some of the work that Dr. Whitehouse has done in the resource allocation area. In particular, it looks at heuristic approach involving a COMSOAL approach to project scheduling. The results have been encouraging but would suggest that some more refinement of the model will be needed. It is expected that funding will be sought from federal agencies to continue to study the potential benefits of this approach.

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TITLE: Simulation Model of Student Flow in Naval Training
PRINCIPAL INVESTIGATOR: Dr. G. E. Whitehouse, P.E.
SPONSORING AGENCY: TAEG Division of NTEC Grant
GRANT NUMBER: N61339-79-D-010S-0002

A B S T R A C T

In order to provide a basis for future planning for the Naval Training Operations with particular emphasis upon the acquisition of the 10H1 self paced learning center, the department has been developing a computer simulation model of the training center at Pensacola, Florida.

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TITLE: SLAM Model for U.S. Navy "A" School Training
PRINCIPAL INVESTIGATOR: Dr. G. E. Whitehouse, P.E. and Dr. D. G. Linton, P.E.
SPONSORING AGENCY: U.S. Navy
GRANT NUMBER: 10-2101-052

A B S T R A C T

The system by which the U.S. Navy trains personnel is modeled using the SLAM computer language. By incorporating both network simulation techniques and discrete event logic, the flow of students from a Recruit

Training Center (RTC) through the Basic Electricity and Electronics (BEE) schools, the "A" schools and eventually to the fleet, is modeled to a level of detail represented by an individual BEE/"A" school classroom. Inputs for the model include the daily influx of trainees into an RTC for each classification, as well as the various drop, attrition and setback rates.

Since the objective of the study was to allow Navy representatives to identify potential bottlenecks prior to their occurrence, the output variables depict both resource utilization and queuing statistics. The simulation model was executed and the resulting outputs were used by decision making personnel or problem resolutions.

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used to allow for resource allocation... work that... particular... project... that some more... that funding... potential... so... short... part... simulate... data... PRINCIPAL INVESTIGATOR: Dr. G. E. Whitson, R. E. ... SPONSORING AGENCY: TAGC Division of IREB Grant

GRANT NUMBER: NA133-79-D-0102-0002

In order to provide a base for future planning... Training operations with particular emphasis upon the acquisition of the... 10H1 self paced learning center, the department has been developing... computer simulation model of the training center at Pensacola, Florida.

TITLE: SLAM Model for U.S. Navy "A" School Training
PRINCIPAL INVESTIGATOR: Dr. G. E. Whitson, R. E. ...
SPONSORING AGENCY: U.S. Navy
GRANT NUMBER: 10-2101-022

The system by which the U.S. Navy trains personnel is modeled using the SLAM computer language. By incorporating both network simulation techniques and discrete event logic, the flow of students from a Recruit

RESUMES OF UNSPONSORED RESEARCH

TITLE: Industrial Engineering Applications Using
Microcomputers

PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E.

A B S T R A C T

As part of an on-going research in the IEMS department, four computer programs for Industrial Engineering applications were developed, documented, and being used by IEMS department students. The programs are in the areas of: (1) Learning Curve, (2) Line of Balance, (3) Time Standard, and (4) Equipment Replacement. Potential applications in the field of layout design were identified and being developed.

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TITLE: Multi-Identity Target Engagement Simulation

PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E.

A B S T R A C T

Engagement Simulator Systems, such as Multiple Integrated Laser Engagement Systems (MILES), employ laser guns and detectors to simulate "fire" and "hit" in engagement scenarios. The system works with success despite some maintenance problems. Guns produce safe laser, when fired, that affects the target detectors scoring hits, misses, near misses, etc. A truth table is used at the detector side to determine the effectability of the "hit". Current systems have fixed truth tables, which mean that the target/gun has fixed single identity, and consequently specific equipment (detector) has to be used.

This research deals with the technical feasibility of having dynamic truth tables, that can be updated by input parameters. A microcomputer at the target side would enable the target and consequently the affecting guns to change identities through software parameters.

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TITLE: Regional Input/Output Commercial Model

PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E. and Dr. R. D. Doering, P.E.

A B S T R A C T

The EBM developed by UCF was studied, and formulated analytically. The formulation was used in a proposal submitted, and funded by EIES, which resulted in a formal proposal for a STAR Grant.

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TITLE: Software Standardization

PRINCIPAL INVESTIGATOR: Dr. Y. A. Hosni, P.E.

A B S T R A C T

Software cost is the major cost item for computer base applications. The Engineering approach for reducing the cost of manufacturing operations is standardization and mass production. To apply the same concept to the software "manufacturing", developed and potential software application needs to be surveyed to identify common functions/routines, as well as its required parameters, and its frequency of use in typical runs. This research explores the feasibility of establishing software standards by function for software in support of Flight Simulators. Research outcome should aid the simulation industry in estimating costs and updating previously developed software.

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TITLE: Economic Analysis of Residential Heat Recovery Systems

PRINCIPAL INVESTIGATOR: Dr. H. Klee

A B S T R A C T

A questionnaire has been designed for consumers to determine if an A/C waste heat recovery system would be economically desirable. The worksheet solicits information relative to hot water and A/C demand as well as economic parameters such as fuel and general inflation and discount rates. A computer program accepts the pertinent data and generates various thermal and economic summary reports. In particular, the annual fractional contribution of energy for heating water delivered by the heat recover unit and the associate savings are shown. Simple and discounted payback period, rate of return and present worth factors are also computed.

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TITLE: Availability Analysis of Paralleled Systems with General Failure Time Distributions

PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.

A B S T R A C T

A two unit parallel redundant system with general failure and repair for one unit and Erlang failure and repair for the second unit is treated. By using the supplementary variable technique and polynomial root theory, an explicit expression is derived for the Laplace transformation of the expected down time during (0,t)(Presented at ORSA Conference, Washington, D.C., May 6, 1980).

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TITLE: Analysis of Parallel Redundant Systems with Repair of Primary and Secondary Failures

PRINCIPAL INVESTIGATOR: Dr. D. G. Linton, P.E.

A B S T R A C T

A 2-out-of-n system is analyzed under the assumption of exponential failure and general repair. In addition to the n primary units, up to m secondary units may also fail. Failure of secondary units do not necessitate immediate repair; however, when a primary unit does fail, the primary unit and all secondary failures are repaired. (Presented at ORSA Conference, Toronto, CA, May 1981).

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TITLE: Life Distributions and Degradation for a 2-out-of-N:F System

PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.

A B S T R A C T

A 2-out-of-N:F System with exponential failure and Erlang repair time is considered. Under specified assumptions, the probability density function for the time-to-system-failure (T) is exhibited and the probability generating function for the number of degradations occurring during (0,T) is derived. Numerical results are also presented (IEEE Transactions on Reliability, Vol. R-30, No. 1, April 1981).

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TITLE: Some Advancements in Monte Carlo Integration Methods with Applications to Proximity Fuzes

PRINCIPAL INVESTIGATOR: Dr. D. G. Linton, P.E.

A B S T R A C T

A simulation method is developed for estimating any quantity defined in terms of a multiple integral with variable limits of integration (which may be infinite). The procedure evaluates multiple integrals by sampling uniformly over the multi-dimensional volume defined by the original region of integration and employing the sample variance (associated with Monte Carlo Methods) to obtain a probabilistic representation for the error. The calculation of detection probabilities for a proximity fuze is used to illustrate the results (as well as to show how such problems arise) and comparisons with alternative solution procedures (e.g., Gaussian quadrature, transformation methods) are discussed (to be presented at Third National Conference on Computers & Industrial Engineering, Orlando, FL, October, 1980).

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TITLE: Time-To-Failure Characteristics for 2-Out-of-n:F System with Repair of Primary and Degradation Failures

PRINCIPAL INVESTIGATOR: Dr. D. G. Linton, P.E.

A B S T R A C T

Time-to-failure characteristics for a 2-out-of-n:F system are derived under the assumption of exponential failure and general repair. In addition to the n primary units, up to m degradation units may also fail. Failure of degradation units do not necessitate immediate repair; however, when a primary unit does fail the primary unit and all degradation failures are repaired. Numerical results are presented for the mean time to system failure.

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ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: A Computer Simulation of the Operations of a Spent Nuclear Fuel Receiving and Storage Station

CANDIDATE: Jeanna L. Barnard

FACULTY ADVISOR: Dr. Darrell G. Linton, P.E.

A B S T R A C T

Spent nuclear fuel is received at a storage facility in heavily shielded casks transported either by rail or by truck. Once at the storage facility, the casks are inspected, emptied, decontaminated, and reshipped.

Allied-General Nuclear Services' (AGNS) nuclear fuel reprocessing plant in Barnwell, South Carolina, is constructed but not yet licensed for spent nuclear fuel storage or reprocessing. Recently, however, AGNS was granted funds by the Department of Energy to prepare the necessary procedural and regulatory paperwork in order that the Fuel Receiving and Storage Station (FRSS) of the plant can be licensed by 1985. In this paper, the activities involved in the receiving and unloading of casks at the Barnwell FRSS is simulated by computer using IBM's program software package, General Purpose Simulation System (GPSS). The GPSS model is developed and verified, and steady-rate output statistics are achieved. Also, several sensitivity analyses are performed such as, changes in expected arrival schedules and decision policies, and changes to the physical characteristics of the existing FRSS to monitor the effect of these changes in the existing system.

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TITLE: Project Scheduling Under Constrained Resources

CANDIDATE: Mohammed Benameur

FACULTY ADVISOR: Dr. Yasser A. Hosni, P.E.

A B S T R A C T

This report examines the widely acceptable Heuristic and Exact procedures for solving the problem of project scheduling and control under constrained resources. Heuristic approaches are more practical, however, they depend on the type of the project as well as the resources involved.

Exact procedures are illustrated using an Integer Linear Programming formulation of the problem and also solving it using the Branch and Bound Technique. Impracticality of the exact methods stems from the fact that the computations expand to an unmanageable amount.

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TITLE: Project Network Scheduling with Limited Resources Using Heuristic Solution Techniques

CANDIDATE: Enrique J. Daboin Rojas

FACULTY ADVISOR: Dr. Gary E. Whitehouse, P.E.

A B S T R A C T

Traditional critical path methods imply the assumption of unlimited availability of resources. Mathematical models and heuristic techniques are two alternatives that consider resource limitation to sequence the activities of a project. This research explores the consideration of project scheduling under resource constraints for the specific case of single resource, single project scheduling. A computer model called GENRES-II search model is developed using a modification of Brooks' algorithm to develop project schedules. The criteria used are various weighted combinations of ACTIM, ACTRES and ACTFOL. An improvement of GENRES-II solutions is obtained when the best set of GEN-II values is input to a computer model called COMSOAL simulation model. The criteria developed generates a large number of feasible solutions rapidly. The probability of generating optimal solutions is related to the size of the generated sample. Eight network cases were considered to validate both computer models. Special attention was given to those activities that were considered critical at a specific time. The number of resources available was increased to a new higher limit in order to schedule activities that became critical. The GENRES-II model was effective in finding project durations equal to or less than ACTIM, ACTRES, GENRES or ACTFOL. The COMSOAL model was found very effective in most of the cases in improving the GEN-II solutions.

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TITLE: Comparative Study of Inflation Techniques Currently Used in Engineering Economy Studies

CANDIDATE: Think P. Dong

FACULTY ADVISOR: Dr. R. D. Doering, P.E.

A B S T R A C T

Recent increases in inflation rates make it essential that inflation be considered and properly treated in engineering economic studies. This research report presents a survey to determine how practitioners of engineering economics are accounting for inflation in their studies.

After looking at inflation in general, and defining it, this report identifies the major existing techniques of handling inflation. It then discusses each in terms of advantages and disadvantages in evaluating investment projects. Finally, the report recommends an appropriate technique, and presents a computer program which calculates the present worth based on this technique which permits the user to analyze the effects of inflation over a range of values.

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TITLE: Industrial Engineering Applications Using Microcomputers
CANDIDATE: Farid Guediri
FACULTY ADVISOR: Dr. Yasser A. Hosni, P.E.

A B S T R A C T

Five computer programs have been developed for practical use by Industrial Engineers in a production environment. The programs cover the areas of forecasting, learning efficiency, production control, network analysis and optimum equipment replacement policies. Theory, complete program documentation and case examples for each program are presented. Programs are written in an interactive Basic mode and have been tested on the Radio Shack TRS-80 and Apple II Plus systems.

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TITLE: Risk Analysis - An Economic Comparison of Oil and Coal Power Plants
CANDIDATE: Mohammad M. Iranmanesh
FACULTY ADVISOR: Dr. C. S. Park

A B S T R A C T

The demand for electric energy increases every year. However, due to recent changes in the U.S. energy supplies, a growing gas shortage forced suppliers to curtail deliveries of natural gas for power generation. Many utilities anticipating supply problems switched to burning more costly light distillate oil. Unfortunately, the Arab boycott of 1973 and the following price increases for oil again forced utilities to seek a cheaper source of fuel, namely coal, as a substitute for oil. Power generation was limited in the past because of a higher capital cost associated with installing air pollution control devices. Therefore, current utilities primary concerns are "Does the lower fuel price of the coal power plant really outweigh its disadvantages of higher construction costs as compared to the oil-burning power plant?" Thus, the purpose of this paper is to evaluate the economic preference of the coal burning power plant compared to the oil-burning power plant in supplying base load power. An extensive analytical model accounting for the effects of escalating fuel prices was examined and a computer simulation model was developed to handle risk associated with various input parameters using the SLAM as a simulation language.

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TITLE: The Effect of Random Number Generators on Applications
CANDIDATE: Edwin G. Landauer
FACULTY ADVISOR: Dr. Harold I. Klee, P.E.

A B S T R A C T

Several pseudorandom number generators are described and compared on the basis of cost of generation and length of period of the sequences that are produced. The major statistical tests, which are used to obtain a measure of randomness for the different generators are discussed and compared.

Four pseudorandom number generators are programmed in GPSS and are used to generate interarrival and service times for an M/M/1 queuing system. The results of each of the trials are compared to the theoretical results which can be obtained from queuing theory.

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TITLE: Economics of Residential Heat Recovery Unit

CANDIDATE: Mohammad N. Redhwi

FACULTY ADVISOR: Dr. Harold I. Klee, P.E.

A B S T R A C T

Determining residential airconditioning waste heat recovery system costs and savings is achieved using a computer program. A worksheet is designed to accept consumer data as an input to the program. The program features load and waste heat recovery calculations on a monthly basis. Economic criteria, including rate of return, present worth, and payback period are computed. Sensitivity of these criteria to fuel escalation and consumer discount rate is demonstrated. The program provides the user with both thermal analysis and economic analysis summary reports.

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TITLE: Plant Layout Technique Analysis for the U.S. Postal Service General Mail Facility

CANDIDATE: Howard Stillwell

FACULTY ADVISOR: Dr. R. D. Doering, P.E.

A B S T R A C T

The layout of the U.S. Postal Service General Mail Facility (GMF) workroom operation is essential factor to the overall productivity of the mail processing activities. An efficient workroom layout will minimize the cost of transporting containerized mail between the various distribution operations. Any changes in distribution methods, increases or decreases in mail volumes, or the addition of mechanization must be analyzed by the GMF industrial engineer to determine what effect these changes have on the existing workroom layout. He must also be able to evaluate layout changes recommended by management and floor supervisors.

The present methods available to the engineer consist primarily of manual analytical techniques and intuitive flow layout analyses. These methods do not:

1. Quickly provide a rating for the layout that can be compared to other alternate layouts.
2. Provide a means to produce an optimal layout.
3. Provide analysis of layout change requests
4. Include the cost of relocating departments

The objectives of this paper to evaluate several computerized plant layout techniques along with two existing methods available to the industrial engineer on the basis of a typical GMF workroom layout, and then to make a recommendation on the feasibility of implementing those computerized techniques that appear to have the capability of further assisting the industrial engineer in his GMF facilities layout assignment.

There are two categories of problems which the computer-aided layout techniques typically address: improvement changes and new construction. The improvement routines are designed to evaluate existing layouts and generate new solutions by interchanging operations within a fixed boundary until a final improved layout is created. The CRAFT and CRAFT-M programs are two popular improvement routines that are discussed and evaluated.

Construction routines, which develop new layouts first determine the order in which the process operations enter the layout and then the physical position of each operation is determined to generate the optimum layout.

CORELAP, Interactive CORELAP, ALDEP, and PLANET programs are discussed and evaluated; however, more emphasis is placed on CRAFT and CORELAP since the other routines are improvements of these two basic systems.

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TITLE: A Cross Assembler for the M6800 Microprocessor

CANDIDATE: Donald J. Walsh, Jr.

FACULTY ADVISOR: Dr. Harold I. Klee, P.E.

A B S T R A C T

This research paper describes a cross assembler for the Motorola 6800 assembly language which was written in Fortran to run on the Digital Equipment Corporation PDP 11/34. The assembler provides an assembly listing on the CRT or Printer and an Object File. In addition, the assembler will check for errors during PASS 1 and also during PASS 2.

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MECHANICAL ENGINEERING AND AEROSPACE SCIENCES DEPARTMENTAL REPORT

Chairman: B. E. Eno

Faculty: J. K. Beck, P. J. Bishop, K. K. Chang, F. S. Gunnerson,
F. A. Moslehy, A. H. Hagedoorn, E. R. Hosler, A. Minardi,
C. E. Nuckolls, W. F. Smith, and G. G. Ventre

The 1980-81 period evidenced continued change in the Mechanical Engineering and Aerospace Sciences Department. Drs. Gunnerson and Moslehy joined the faculty as Assistant Professors. Prof. Worbs transferred to the Engineering Technology Department. Dr. Ventre continued serving as Director of Education and Information Systems at the Florida Solar Energy Center.

The Department graduated 40 BSE students and 4 MS and MSE students. Both core and option courses and laboratories were updated and improved. Increased emphasis was placed on the graduate programs of Energy Systems and Mechanical Systems.

The faculty have remained active in professional society work and professional development. Dr. Bishop serves as a member of the National ASME Heat Transfer Committee, Dr. Hosler is the Chairman of the National AIChE Heat Transfer and Energy Conversion Division, and Drs. Bishop and Hosler served as co-directors of the 1980 ASME/AIChE Heat Transfer Conference. Dr. Eno serves as a member of the National ASME Solar Energy Fundamentals Committee and as Chairman of the Central Florida ASHRAE Education Committee. Prof. Beck has served as Vice-Chairman of the Florida Section of ASME and Dr. Smith continues to serve as Secretary/Treasurer of the Central Florida Chapter of ASME. The faculty hold membership in 19 professional societies. Of the 11 current faculty in the department, 8 are now registered professional engineers. The faculty also participated in many civic, educational and community service activities at the local, state and national levels.

The faculty presented and published 20 technical papers and reports. Sponsored research included development of a residential energy use model, thermoelectric heating and cooling, photovoltaic systems for remote traffic control, industrial cogeneration and heat recovery, heat transfer analysis of nuclear accident scenarios, and absorption-regeneration studies in the energy systems area. In the mechanical systems area research included the development of the laser speckle technique in experimental stress analyses, shock tube analyses, and thermomechanical properties of aluminum alloys.

Students of the Department were recognized for their scholarly efforts. Lisa Brightwell received the ASHRAE Central Florida Chapter Outstanding Student Award. Timothy Clay received the Gerald Ward Outstanding Senior Award and the Omicron Delta Kappa Leadership Award. Gene Groves, Thomas Hayne, Paul Holmeister, and Melanie Roberts received the national \$1500 Institute of Nuclear Power Operations (INPO) Scholarships for 1981-82.

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

1. BISHOP, P. J., DOERING, R. D. and MINARDI, A. "Florida's Future Tied to Petroleum Supplies." Florida Specifier, Vol. 2, No. 4, April, 1981.
2. BISHOP, P. J., DOERING, R. D. and MINARDI, A. "Phosphate Industry - Industry Power Consumption Analyzed by University Report." Florida Specifier, Vol. 2, No. 3, February, 1981.
3. BISHOP, P. J., DOERING, R. D. and MINARDI, A. "Potential for Cogeneration and Waste Heat Recovery in Florida." STAR Project Final Report #79065, GEO, Tallahassee, FL, December, 1980.
4. BISHOP, P. J., DOERING, R. D. and MINARDI, A. "Process Food Energy Use Summarized." Florida Specifier, Vol. 2, No. 4, April, 1981.
5. BISHOP, P. J., DOERING, R. D. and MINARDI, A. "Pulp Industry Energy Uses Examined." Florida Specifier, Vol. 2, No. 4, April, 1981.
6. BORG, T. K., CAULFIELD, J. B., MOSLEHY, F. A. and RANSON, W. F. "Structural Basis of Ventricular Stiffness." U.S. - Canadian Division of the International Academy of Pathology, Laboratory Investigation, Vol. 44, No. 1, 1981.
7. CHANDRA, S., CHANG K., LITKA, A. and NGUYEN, C. "Semiannual Report Feasibility Study on PV Panel and Wind Generator for Remote Transportation Application." Florida Transportation Department, March, 1981.
8. CHANG, K. K. and ENO, B. E. "Feasibility Study on Residential Thermoelectric Heating and Cooling." EIES Final Report, February, 1981.
9. DOERING, R. D., BISHOP, P. J. and MINARDI, A. "The Potential for Cogeneration and Waste Heat Recovery in Florida." IEEE Fall Conference, Minneapolis, MN, December, 1980.
10. ENO, B. E. and BISHOP, P. J. "Energy Programs and Courses Related to Buildings." Institute on Energy and Engineering Education, ACEC, State College, PA, February, 1981.
11. ENO, B. E. and FELDERMAN, E. J. "Supplemental Heat for Grain Drying with a Transportable Solar Heater." ASAE Transaction, Vol. 23, No. 4, 1980.
12. GUNNERSON, F. S. "Film Boiling Behavior of a PWR-Type Fuel Bundle." Journal of Nuclear Technology, January, 1981.

13. GUNNERSON, F. S. and YACKLE, T. R. "Quenching and Rewetting of Nuclear Fuel Rods." Journal of Nuclear Technology, Vol. 56, June, 1981.
14. HAGEDOORN, A. H. "Interactive Command System FEGRPH." Arnold Engineering Development Center, Tullahoma, TN, August, 1980.
15. HARTMAN, J. P., HOSLER, E. R., MILLER, R. and DEBO, J. C. "Energy and Man, A University Course for Non-Engineers." Clean Energy Research Institute, Miami, FL, December, 1980.
16. MOSLEHY, F. A. "Laser Speckle and Boundary-Integral Techniques in Experimental Mechanics." Florida Academy of Science, May, 1981.
17. MOSLEHY, F. A. and RANSON, W. F. "Experimental Boundary Integral Equation Applications in Speckle Interferometry." Southeastern Seminar in Photomechanics, Auburn, AL, March, 1981.
18. MOSLEHY, F. A. and RANSON, W. F. "General Shearing Speckle Interferometry and BIE Method Applications in Mechanics." Naval Research Laboratory, Orlando, FL, September, 1980.
19. NUCKOLLS, C. E., PHILLIPS, R. L., CONNELL, L. and BELKERDID, M. A. "Design and Analysis of an Explosive Driven Hydrodynamic Conical Shock Tube for the Testing of Fiber Optic Pressure Hull Feed Throughs." EIES Report, November, 1980.
20. SMITH, W. F. Structure and Properties of Engineering Alloys. New York: McGraw-Hill, November, 1980.

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

1. Fluids/Thermo P.E. Review. (Beck)
2. UCF Energy Education Workshop, co-directors, Orlando, FL, January 20 and 27, 1981. (Bishop/Minardi/Eno)
3. SEEK Conference, Orlando, FL, August, 1980. (Bishop/Hosler/Minardi)
4. Energy Efficiency Programs and Lending Practices, Energy Extension Services Program for Financial Institutions, sponsored by IFAS and GEO, Orlando, FL, December, 1980. (Bishop/Minardi)
5. Energy Workshop, June 20 and 21, 1980. (Chang)
6. American Society of Civil Engineering meeting, January 10, 1980. (Hagedoorn)
7. South Eastern Leadership Institute in Energy Education, June 7, 1980. (Hagedoorn)
8. Energy Leadership Institute at Wachula, FL, March 10, 1981. (Hagedoorn)
9. Tri-County Energy Leadership Institute, January 22, 1981. (Hagedoorn)
10. Seminole School Board Energy Teachers Workshop, January 19, 1981. (Hagedoorn/Hosler)
11. EI and PE review session October 28, November 3, 1980 and March 2, 9, and 16, 1981. (Nuckolls)

TITLE:

A Parametric Study of Freeze and Thaw Tunnel

PRINCIPAL INVESTIGATOR:

Dr. P. J. Arden, UCF

SPONSORING AGENCY:

UCF - E125

GRANT NUMBER:

13-1693-019

ABSTRACT

An investigation into economic energy usage in freeze tunnels was conducted. Freeze tunnels are commonly used in the food processing

RESUMES OF SPONSORED RESEARCH

TITLE: An Initial Study of Turbulence Level Correlation
with Laser Beam Scatter

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-029

A B S T R A C T

The initial effort is aimed toward the experimental establishment of nearly isotropic homogenous flow fields of known turbulence intensities. It is then desired to propagate a laser beam through the turbulent stream and determine a possible correlation between the statistics of the laser beam scatter with the level of turbulence intensity.

* * * * *

TITLE: Renewable Energy Resources

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

SPONSORING AGENCY: Department of Agriculture and Consumer Affairs

GRANT NUMBER: 11-1626-017

A B S T R A C T

This effort consisted of an objective critique of six biomass-fuel conversion projects proposed by the Division of Forestry. Recommendations were made for proposal changes to DOF as well as a priority ranking of the projects based on the data submitted.

* * * * *

TITLE: A Parametric Study of Energy Use in A Freeze
Tunnel

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-039

A B S T R A C T

An investigation into economical energy usage in freeze tunnels was conducted. Freeze tunnels are commonly used in the food processing

industry to freeze products, and in some cases may use large amounts of electricity. An actual freeze tunnel was observed and modeled on a computer.

A parameter study was conducted. The results of the parameter study indicate the efficiency and energy costs in freeze tunnels may vary widely. Important parameters included were the Nusselt number, air temperature, and the ratio of fan work divided by the useful refrigeration effect. Although no single set of optimum conditions were found, methods for improving the effectiveness of freeze tunnels, both in existing and future designs, were discussed. It was also concluded that the ratio of fan work to the freeze tunnel's useful refrigeration effect was a dominant factor in the energy cost of operating a freeze tunnel.

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TITLE: Energy Audit
PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-008

A B S T R A C T

A technical energy audit was conducted for the 15 buildings at UCF under the Federal Grants to Schools and Hospitals Program so that an Energy Audit (EA) could be done. The EA consisted of (1) obtaining cost/fuel data on the campus buildings, (2) walking through each building and observing operational/maintenance problems associated with each building that would have an adverse effect upon energy consumption, and (3) filing EA forms with the State of Florida Governor's Energy Office on the energy use of each building.

The major conclusions of the study were that (1) thermostats were not set properly for weather such that buildings were too warm in winter and too cold in summer (2) lighting fixtures should be changed from incandescent to fluorescent inside buildings and from fluorescent to higher efficiency lamps for building exteriors, (3) weatherstripping was needed on most buildings (4) periodic checks should be made of the boiler fuel/air ratios at the utility plant, and (5) the Energy Use Index for each building was high, at 552,000 Btu/ft.² yr., so that individual metering of each building would gain additional understanding of individual energy losses.

* * * * *

TITLE: Energy Conservation
PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E. and Dr. R. D. Doering, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-048

A B S T R A C T

As a result of the 1973 energy crisis the State of Florida adopted an energy policy with a goal of 15% energy savings. Coupled with this requirement and a basic concern over future energy problems, UCF initiated an individual energy conservation program. With the passage of an Energy Conservation Resolution for the State of Florida, Governor Graham has resolved to further increase these savings by 15%.

The major effort of this work was to identify a workable plan to (1) mobilize support for energy conservation effects on campus and to generate publicity for conservation among the academic community, and (2) to conduct a technical energy audit of the campus under the Federal Grants to Schools and Hospitals Program.

The plan developed by Drs. Doering and Bishop was included in a proposal entitled, "An Energy Audit and Conservation Program for the University of Central Florida.

* * * * *

TITLE: Energy Simulation
PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E. and Mr. A. Minardi, E.I.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 21-1699-018

A B S T R A C T

Detailed information on energy savings using particular conservation techniques in the State of Florida is not available due to our hot, humid climate. This study is developing a computer modeling tool that is simple and inexpensive to run to simulate the energy profile of a typical residence. The model is being developed as a modified bin method relying on ASHRAE information where necessary and NOAA weather data. Upon completion of model development, testing and evaluation of the model will take place in the late summer. Comparisons will be made with data obtained from the Orlando Utilities Commission Residential Energy Survey results.

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TITLE: The Potential for Cogeneration and Waste Heat Recovery in Florida

PRINCIPAL INVESTIGATOR: Dr. P. J. Bishop, P.E., Mr. A. Minardi, E.I., and Dr. R. D. Doering, P.E.

SPONSORING AGENCY: BOR - STAR Program/Governor's Energy Office

GRANT NUMBER: 11-1624-004

A B S T R A C T

This study was directed towards the identification, definition, and evaluation of cost effective projects in the residential, commercial, and industrial sectors within the Florida economy which would conserve energy through waste heat recovery methodologies and cogeneration. A secondary objective was to provide guidelines for legislative tax action which would encourage waste heat recovery projects.

Initially, each of the three major economic sectors were examined in terms of their energy use profile so that typical operating processes could be determined. In a parallel effort a workable list of energy recovery methodologies was compiled and screened against the requirements in each sector. In compiling the list only methodologies which could be implemented with off-the-shelf hardware and had been field tested were considered. These methodologies were further screened relative to their application to new retrofit installations.

The investigation was conducted on a sample basis for each of the sectors working closely with utility and manufacturing plants in the paper/pulp, citrus, phosphate, cement and glass industries.

A summary of viable projects by economic sector with the capital requirement, projected annual energy savings and monetary savings was extended to the State level. These data show that if these projects were implemented they would effect energy equivalent savings of 11.9 million barrels of residual fuel oil annually.

* * * * *

TITLE: Feasibility of Photovoltaic Systems for Remote Traffic Application

PRINCIPAL INVESTIGATOR: Dr. K. K. Chang, P.E.

SPONSORING AGENCY: Florida Department of Transportation

GRANT NUMBER: 28-1626-002

A B S T R A C T

Studies were made on the performance and feasibility of photovoltaic systems for remote traffic applications. It was found the PV is cost effective for some remote applications, e.g. flashing beacons, railroad

crossings, etc., particularly if required lighting lumen levels are relaxed and the nearest available power line is more than a mile away. A demonstration station for a flashing beacon system is being built on the roof of the College of Engineering building. It is expected to operate for one year to evaluate performance and validate the sizing philosophy. A semiannual progress report has been sent to the Florida Department of Transportation including the guidelines of PV Procurement for Florida applications.

* * * * *

TITLE: Feasibility Study of Residential Thermoelectric Heating and Cooling

PRINCIPAL INVESTIGATOR: Dr. K. K. Chang, P.E. and Dr. B. E. Eno, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-045

A B S T R A C T

A parametric study was performed to examine the feasibility of a solar-driven thermoelectric (TE) generator and heat pump for residential space conditioning. A market survey provided TE module performance information which was used in developing a computer simulation of the proposed system. A conical-shaped concentrating collector provided the heat necessary to drive the electric generator. The electric current in turn was used to drive a TE heat pump for winter heating or summer cooling. TE generator waste heat was used either for winter space heating or heating water. The TE generator/heat pump system has the advantage of no moving parts but the simulation showed that such a solar-driven system is not economically feasible at this time. It is projected that, as TE energy conversion efficiencies improve and conventional energy costs rise, the proposed TE system may become a feasible alternative.

* * * * *

TITLE: Development of Passive Cooling and Energy Conservation Retrofit Research Projects

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-017

A B S T R A C T

A project was initiated to examine the potential for research in certain areas of passive cooling and energy conservation. Literature surveys of waste heat recovery methods in residential and industrial applications was made. Two research proposals resulted, one for an in-depth survey and analysis of the potential for cogeneration and waste

heat recovery in the chemical, phosphate and paper industries submitted to the SUS/STAR program office. The other, submitted to FPSC, provides for an experimental analysis of residential air-conditioning heat recovery units and dedicated heat pumps for water heating.

* * * * *

TITLE: The Behavior of a Nine-Rod Fuel Assembly During Power-Cooling-Mismatch Conditions - Results of Test PCM-7

PRINCIPAL INVESTIGATOR: Dr. F. S. Gunnerson

SPONSORING AGENCY: EG & G Idaho, Inc.

GRANT NUMBER: 28-1626-004

A B S T R A C T

The Power-Cooling-Mismatch (PCM) Test PCM-7 was performed as part of the Thermal Fuels Behavior Program conducted by EG & G Idaho, Inc., for the U.S. Nuclear Regulatory Commission. This test was one of a series of PCM tests designed to characterize the behavior of light water reactor type fuel rods operating under power-coolant imbalance conditions. The primary objective of Test PCM-7 was to subject a nine-rod fuel bundle to stable film boiling conditions to investigate the potential for film boiling and rod failure propagation by allowing the test bundle to remain in film boiling for a period of time. The applicability of the previously established PCM single-rod data base to multiple-rod geometrics was of fundamental interest.

Test PCM-7 incorporated nine pressurized water reactor (PWR) type fuel rods with active fuel lengths of 0.914 m arranged in a 3 x 3 bundle geometry. The test fuel rods were clad with zircaloy-4 and held in position by a series of grid spacers which provided a lattice spacing typical of commercial 15 x 15 PWR fuel bundle assemblies. In this configuration, the environment of the central fuel rod is similar to that expected in a commercial power reactor lattice during PCM conditions.

This research encompasses the analysis and subsequent writeup of the PCM-7 test results report.

* * * * *

TITLE: The Mitigation of Cladding Thermal Stresses During the Quenching of Overheated Nuclear Fuel Rods

PRINCIPAL INVESTIGATOR: Dr. F. S. Gunnerson

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-003

A B S T R A C T

The result of many postulated light water reactor (LWR) accidents is a power-coolant imbalance condition where the heat generation rate of the nuclear core exceeds the heat removal capacity of the coolant. Such accidents may give rise to dryout or film boiling within the nuclear core and are usually heralded by a degradation in the local heat transfer and rapidly rising fuel rod temperatures. In order to minimize fuel rod damage and potential rod failure, safe or lower fuel cladding temperatures must be re-established by promoting coolant/cladding contact. This process is commonly referred to as quenching.

Unfortunately, the quenching of overheated nuclear fuel rods impose substantial thermal stresses on the cladding. Under certain conditions, this results in fuel rod failure and the release of radioactive fission products to the primary coolant system and an enhanced potential for environmental contamination. The extent of fuel rod failure upon quench depends on several interrelated factors including: (1) the cladding time-at-temperature prior to quench, (2) the cladding temperature at the onset of quench and (3) the thermal-hydraulic nature of the quench coolant. The first factor (1), addressed primarily from a metallurgical point of view, has been extensively investigated both experimentally and analytically during the past decade. Recent investigation of the latter two factors (2 and 3) has shown the quenching process and hence, the imposed cladding thermal stresses, may be regulated somewhat by discrete selection of the in-reactor thermal-hydraulic conditions before and during the quench process.

The proposed research interfaces the time-at-temperature metallurgical aspects of quenching with the controllable thermal-hydraulic aspects. Thus, given an accident scenario where dryout or film boiling is occurring within a LWR, and operator intervention is required, an engineering judgement could be made regarding the time-power coolant conditions which would best facilitate a safe cooldown by minimizing cladding thermal stresses and the propensity for associated radiation releases.

* * * * *

TITLE: Parametric Trends of Minimum Film Boiling Behavior

PRINCIPAL INVESTIGATOR: Dr. F. S. Gunnerson

SPONSORING AGENCY: EG & G Idaho, Inc.

GRANT NUMBER: 28-1626-003

A B S T R A C T

The purpose of this research was to qualitatively summarize the parametric trends of minimum film boiling behavior as reported in the current literature. Emphasis is given to the influence of the following parameters on the minimum conditions:

Heater geometry and orientation
Heat flux distribution
Coolant mass flux
Liquid subcooling
Local equilibrium quality
Pressure
Heater surface condition
Interfacial wettability

It was shown that the minimum film boiling temperature and the minimum heat flux may span a wide range of values depending upon the thermophysical natures of the heating surface and the boiling liquid. As a result, boiling behavior cannot be fully illustrated on a two-dimensional curve, but rather a multi-dimensional boiling surface is required.

* * * * *

TITLE: Absorption-Regeneration Studies of $\text{CO}_2\text{-KHC}_3\text{-K}_2\text{CO}_3$ Solutions
PRINCIPAL INVESTIGATOR: Dr. E. R. Hosler, P.E.
SPONSORING AGENCY: UCF-Graduate Research Council
GRANT NUMBER: 28-2000-013

A B S T R A C T

An absorption refrigeration cycle can theoretically be operated in reverse as a heat engine. Theoretical studies of a $\text{CO}_2\text{-KHC}_3\text{-K}_2\text{CO}_3$ cycle have shown that it could have significantly higher efficiencies than a Rankine cycle operating between the same temperatures and pressures.

This research is to obtain basic thermodynamic data on $\text{CO}_2\text{-KHC}_3\text{-K}_2\text{CO}_3$ systems in the ranges of temperatures and pressures that would exist in an operating power cycle. These data will be used to demonstrate whether further study of this cycle for power generation is warranted and to support construction of a working model if the cycle is considered desirable theoretically.

* * * * *

TITLE: Investigation of Flow Regimes on the Steam-Side of Steam Generating Heat Exchangers
PRINCIPAL INVESTIGATOR: Dr. E. R. Hosler, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-004

A B S T R A C T

From a previous investigation of tube damage problems in the heat exchangers used to generate steam in electric utility plants, it has become evident that there is a need to obtain a better understanding of the two phase flow hydrodynamics of the steam-water flow in these heat exchangers. A basic test facility is being built in order to simulate and study in detail these flow characteristics.

* * * * *

TITLE: University of Central Florida Energy Workshop
PRINCIPAL INVESTIGATOR: Mr. A. Minardi, E.I. and Dr. P. J. Bishop, P.E.
SPONSORING AGENCY: U. S. Department of Energy
GRANT NUMBER: 10-1626-005

A B S T R A C T

The University of Central Florida, Department of Mechanical Engineering and Aerospace Sciences, provided two in-service workshops for elementary school teachers from Orange and Seminole Counties. The participants were chosen with the help of the science coordinators, Dallas Maddron and Arlene Bridges in Orange County and Betty Palmer in Seminole County.

A general education curriculum was presented highlighting problems and knowledge in the use of fossil fuels, nuclear fuels, and new energy alternatives such as solar photovoltaics. The emphasis of these workshops was to provide teachers with usable handouts and classroom-gearred laboratory demonstrations that assist elementary school children to effectively understand energy problems.

* * * * *

TITLE: Advanced Concepts in Experimental Mechanics
PRINCIPAL INVESTIGATOR: Dr. F. A. Moslehy
SPONSORING AGENCY: UCF - EIES
GRANT NUMBERS: 21-1699-004 and 21-1699-013

A B S T R A C T

Laser speckle interferometry is used as an experimental technique to measure in-plane surface displacement components of a deformed solid. The basic method utilizes high resolution photographs of the surface of the object which is illuminated with a laser. When the object is deformed, a point on the object will be displaced and the speckle associated with this point will be displaced accordingly. The method of regarding displacement information is to photograph the surface of the body, before and after the

stress application, on the same photographic film, which results in a permanently stored whole field record of the deformation.

The analysis data consist of an optical Fourier filtering of the laser speckle photograph. Data analysis in speckle interferometry yields a map of the surface displacement components along a specified closed contour on the surface of the body. The experimental values of displacement are then used as input data to numerically calculate, with a high degree of accuracy, the state of stress at any desired point inside the region and the elastic constants of the material using the boundary element method.

Several examples are presented to illustrate the application of the coupled laser speckle interferometry and boundary-integral solution technique to two-dimensional elasticity problems. This coupled technique proved to be an accurate and efficient procedure for solving significant engineering problems.

* * * * *

TITLE: Electric Vehicle
PRINCIPAL INVESTIGATOR: Dr. G. F. Schrader, P.E. and Dr. C. E. Nuckolls, P.E.
SPONSORING AGENCY: UCF - EIES
GRANT NUMBER: 11-1699-038

A B S T R A C T

The purpose of this project was to convert a 1972 AMC Gremlin from an internal combustion engine to an electric motor drive so as to provide a basis for future research on electric vehicle characteristics. The research vehicle is being designed in accordance with SAE J227a electric vehicle test standards for a driving range of 50 km at 50 km/hr. For experimental purposes, a shunt wound, 20.8 horsepower General Electric DC electric motor and a General Electric EHV series controller have been installed in the vehicle. In addition, the vehicle has been modified to provide space for the installation of 18 standard 6-volt automotive batteries. The vehicle is currently in operation and undergoing operational tests.

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TITLE: Shock Wave Initiation and NDT Examination of Shock Tube
PRINCIPAL INVESTIGATOR: Dr. C. E. Nuckolls, P.E. and Dr. R. L. Phillips
SPONSORING AGENCY: Naval Research Laboratories
GRANT NUMBER: 10-2101-059

A B S T R A C T

Investigation of shock wave initiation by use of an explosive charge distributed over a surface in the breech is in progress. The concept is to produce the same pressures at point r_0 which would exist at r_0 due to propagation of a spherical wave initiated at $r = 0$.

Non-destructive test techniques to determine the existence, location and size of cracks in the tube are also being investigated.

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TITLE: Grain Growth Kinetics in Rapidly Solidified Aluminum Alloys

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

SPONSORING AGENCY: Pratt and Whitney Aircraft

GRANT NUMBER: 28-1626-001

A B S T R A C T

An investigation is being made of the grain growth kinetics of 7075 + 0.8%Co aluminum alloy produced from Pratt and Whitney Company rapidly solidified powder and of 7075 extruded rod as a control for the experiments. Samples of each alloy have been heated for varying times from 5 min. to 4 hrs. and at temperatures from 700 to 1000°F. The samples were tested for hardness (Rockwell B) and were examined by optical microscopy. Results have shown that the two kinds of alloys differed considerably in their behavior. The results of these experiments will be summarized in a report to be finished by August 1980.

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TITLE: Thermomechanical Treatment of Aluminum Alloys

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 11-1699-047

A B S T R A C T

A literature study was made of the various methods used in the thermomechanical processing of aluminum alloys. A technique for preparing thermomechanical processed samples using available UCF equipment was developed and some test samples made. Small tensile test samples of an Al-4.5% Cu-1.5%Mg alloy were prepared by cold rolling and subsequently heat treating them. It is intended to do further work on this project at a later date.

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TITLE: State Technology Applications Center (STAC)

PRINCIPAL INVESTIGATOR: Mr. H. E. Worbs, P.E.

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

GRANT NUMBER: 11-1610-001

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 UCF, USF, UF, and UNF.

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ABSTRACTS OF RESUMES OF UNSPONSORED RESEARCH AND THESES

TITLE: TE Heat Pump Simulation

PRINCIPAL INVESTIGATOR: Dr. K. K Chang, P.E.

CANDIDATE: Harold A B S T R A C T

This is a continuation of the feasibility study of residential thermoelectric (TE) heating and cooling. Computer simulations of a solar-driven TE generator and a TE heat pump have been made. The daily average Central Florida insolation has been used as the heat source to drive the TE generator. The solar rays are focused on each TE module through conical-shaped collectors. The TE generator electrical output is calculated. The required electrical input to the TE heat pump is calculated for typical Florida residence winter heating and summer cooling days. Work is continuing on this project.

* * * * *

Average monthly energy requirements for one citrus plant was analyzed. It was determined that the important parameter, in addition to a minimum demand level, for assessing economic acceptability is the demand thermal to electric ratio. One set of steam conditions will not necessarily provide the maximum source energy savings and at the same time be the most economically beneficial. The values of the economic criteria will remain relatively constant over a range of rated turbine capacities for each set of steam conditions.

TITLE: Design and Analysis of an Explosive Driven Hydrodynamic Conical Shock Tube

CANDIDATE: Leonard W. Connell

FACULTY ADVISOR: Dr. Charles E. Nickolls, P.E.

A B S T R A C T

An explosive driven, water filled, conical shock tube was designed and evaluated regarding its ability to amplify a charge weight and to produce hydrodynamic spherical shock waves. The results show that the shock waves in the tube are essentially spherical in nature--with an initial exponential shape, peak pressure distribution as $(1/R)^{-1}$ and time constant spreading roughly as $(R)^{-1/2}$.

The charge weight was amplified by a factor of 3400 compared to a theoretical amplification of 7770. An estimate of the energy absorbed by the breach plug (which houses the charge) during an explosion was performed.

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: A Model for Assessing the Economic and Energy Implications of Cogeneration with Steam Turbines in Citrus Plants

CANDIDATE: Harold L. Carpenter

FACULTY ADVISOR: Dr. P. J. Bishop, P.E.

A B S T R A C T

A cogeneration system using a noncondensing steam turbine to simultaneously provide electricity and process steam to a citrus plant was modeled in order to assess the source energy savings and the economic implications with the employment of this type system under conditions of time varying plant energy demand.

Average monthly energy demand data from one citrus plant was analyzed. It was determined that the important parameter, in addition to a minimum demand level, for assessing economic acceptability is the demand thermal to electric ratio. One set of steam conditions will not necessarily provide the maximum source energy savings and at the same time be the most economically beneficial. The values of the economic criteria will remain relatively constant over a range of rated turbine capacities for each set of steam conditions.

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TITLE: Design and Analysis of an Explosive Driven Hydrodynamic Conical Shock Tube

CANDIDATE: Leonard W. Connell

FACULTY ADVISOR: Dr. Charles E. Nuckolls, P.E.

A B S T R A C T

An explosive driven, water filled, conical shock tube was designed and evaluated regarding its ability to amplify a charge weight and to produce hydrodynamic spherical shock waves. The results show that the shock waves in the tube are essentially spherical in nature--with an initial exponential shape, peak pressure attenuation as $(1/R)^{1.13}$ and time constant spreading roughly as $(R)^{.22}$.

The charge weight was amplified by a factor of 3400 compared to a theoretical amplification of 7770. An estimate of the energy absorbed by the breach plug (which houses the charge) during an explosion was performed.

The peak pressure data taken from the detonation of number 8 strengthblasting caps were seen to satisfy the semiempirical scaling law. However, with the addition of plastic explosives to the blasting cap, peak pressure lower than that predicted by the scaling law was observed. At this time it is felt that a decreasing amplification factor with charge weight is the cause for the lower than predicted peak pressure. More data are needed to verify this hypothesis.

* * * * *

TITLE: A Parametric Study of Economical Energy Usage in Freeze Tunnels

CANDIDATE: Marc A. Harrison

FACULTY ADVISOR: Dr. P. J. Bishop, P.E.

A B S T R A C T

An investigation into economical energy usage in freeze tunnels was conducted. Freeze tunnels are commonly used in the food processing industry to freeze products, and in some cases may use large amounts of electricity. An actual freeze tunnel was observed and modeled on a computer.

A parameter study was conducted. The results of the parameter study indicate the efficiency and energy costs in freeze tunnels may vary widely. Important parameters included the Nusselt number, air temperature, and the ratio of fan work divided by the useful refrigeration effect. Although no single set of optimum conditions were found, methods for improving the effectiveness of freeze tunnels, both in existing and future designs, were discussed. It was also concluded that the ratio of fan work to the freeze tunnel's useful refrigeration effect was a dominant factor in the energy cost of operating a freeze tunnel.

* * * * *

TITLE: Analysis of a Solar Collector in and Absorption Cycle Including a Pump Operated by Thermoelectric Cells

CANDIDATE: Stuart Jee-Fong Chen

FACULTY ADVISOR: Dr. K. K. Chang, P.E.

A B S T R A C T

A mathematical computer model has been developed for the prediction of the thermal performance of a flat-plate solar collector used as the generator for an absorption cycle cooling system. The system employs thermoelectric cells to power its pump. The exponential relationship between the auxiliary energy and the collector area is used to optimize the system. It is predicted that the system will become feasible when the fuel price is raised to four times the current value.

INVESTIGATOR INDEX

Adams	41	GUNNERSON	73, 74, 75, 82
Alley	5	HAGEDOORN	75, 76
Allgaier	33	HARDEN	1, 31, 33, 34, 40
Andrews	33, 34, 37	HARPER, H.	3, 5, 8, 9, 10, 11, 19
Barnard	68	Harper, S.	27
BAUER	50, 51, 52, 53, 54, 55,	HARRIS	52
BECK	73, 76, 77	Harrison	91
BELKERDID	33, 34, 37, 75	HARTMAN	1, 4, 5, 6, 11, 23, 24, 33, 75
Benameur	68	Hatcher	8
BISHOP	56, 57, 73, 74, 76, 77, 79, 80, 85, 90, 91	Hazeltine	6
BLOCK	1, 3	HEAD	45, 46, 47, 48
Borg	74	HOSLER	6, 33, 73, 75, 76, 84
Bregalia	34	HOSNI	50, 51, 52, 53, 54, 55, 56, 58, 59, 64, 65, 68, 70
BULLARD	45, 46	HUBLER	1, 47, 49
Cadle	25	Iranmanesh	70
Carpenter	90	Jansen	28
CARROLL	3, 4, 5, 11, 12, 17	Jellerson	9
Cassagnol	8	JENKINS	3, 4, 6, 11, 13, 14
Caulfield	74	KERSTEN	1, 6, 23, 24, 27
Chandra	74	Khattar	33
CHANG	74, 76, 80, 81, 89, 91	Kimes	8
Chen	91	KLEE	51, 53, 55, 59, 65, 70, 71, 72
Christopher	8, 25	Knab	6
Connell	75, 90	Landauer	70
COOPER	3, 5, 11, 17, 26	LINTON	51, 53, 59, 62, 65, 66, 67, 68
Curran	8	Litka	33, 74
DEBO	6, 33, 46, 47, 75	Manderson	5
DEHLER	45	MATHEWS	1, 35
DENNING	1, 46	Mathey	6
DOERING	50, 51, 52, 53, 55, 56, 57, 59, 64, 69, 71, 74, 79, 80	Maytrott	33
Dong	69	MCLELLON	1, 3, 4, 7, 9, 15, 20, 21, 25, 28
Eilers	7	MILLER	34, 35, 36, 37
ENO	73, 74, 76, 81	MINARDI	82, 84, 86, 88, 91
ERICKSON	31, 35, 36	MOHAN	29
Fan	26	MOSLEHY	73, 74, 75, 85
FAGAN	20	MUIGA	1, 3, 4, 7, 17
Felderman	74	Muller	16
Ferraro	8, 16	Nguyen	74
Fisher	16	NIMMO	82
Ford	41	NUCKOLLS	37, 60, 75, 76, 86, 90
GAMBRELL	1, 51, 53, 58		
GATT	31		
Godlewski	7, 27		
Gopani	33, 42		
Greer	42		
Guediri	70		

O'Gill 8, 16
 PARK 70
 Partin 43
 Parvizin 43
 PATZ 31, 34, 36, 41
 Payne 16
 PETRASKO 35
 PHILLIPS 31, 33, 34, 35, 37,
 42, 44, 75, 86
 Rahimi 29
 Ranson 74, 75
 Redhwi 71
 RICHIE 31
 Rojas 69
 SCHRADER 1, 51, 60, 86
 SEAMAN 3, 7
 SEPULVEDA 54, 60
 Shaver 34, 44
 SIMONS 31, 33, 34, 35, 38,
 41, 42, 44
 SMITH, R. 3, 7, 17
 SNYDER 3, 7, 8, 11, 19, 20
 SMITH, W. 73, 75, 87
 SNYDER 3, 7, 15, 16
 Spooner 34
 Stillwell 71
 TAYLOR 3, 7, 8, 9, 16, 18, 27,
 29
 TOWLE 31, 38, 39
 Traver 10
 Trilling 6
 Trowbridge 44
 ENTRE 1, 73
 Walker, L 30
 Walker, R 31, 33, 43
 Walsh 72
 WANIELISTA 3, 5, 8, 9, 10, 11, 17, 18
 19, 26, 30
 WHITE 51, 61
 WHITEHOUSE 50, 51, 52, 53, 54, 55, 62,
 69
 WORBS 45, 47, 73, 88
 29, 30, 31, 32
 YOUSEF 3, 5, 8, 9, 10, 11, 17, 18,
 19, 20, 21, 25
 Zebuth 9, 21

SPONSOR INDEX

FEDERAL GOVERNMENT

National Aeronautics and Space Administration (NASA)	12, 88
National Bureau of Standards	13, 14
Naval Training Laboratory	37, 86
Naval Training Equipment Center	36, 37, 38, 62
U.S. Army	59
U.S. Department of Agriculture and Consumer Affairs	77
U.S. Department of Energy	85
U.S. Department of Interior	20
U.S. Environmental Protection Agency	21
U.S. Navy	62

STATE AND LOCAL GOVERNMENT

City of Kissimmee, Florida	13
City of Melbourne, Florida	16
City of Orlando, Florida	18
Florida Department of Commerce	88
Florida Department of Education - Division of Blind Services	58
Florida Department of Environmental Regulation	17, 18
Florida Department of Transportation	17, 19, 80
Florida Solar Energy Commission	39
Governor's Energy Office	56, 57, 80
UCF Engineering and Industrial Experiment Station (EIES)	12, 13, 15, 16, 18, 19, 36, 37, 48, 56, 58, 59, 60, 61, 62, 77, 78, 79, 81, 82, 84, 85, 86, 87

INDUSTRY

PARK 70
Part EG & G Idaho, Inc. 82, 83

PATZ Pratt & Whitney Aircraft 87

OTHER

Rahim SCEE 36

Redh UCF Graduate Research Council 84

SEAMAN 7
SEPULVEDA 09, 45, 59 U.S. Army

Shaver 44, 46 U.S. Department of Agriculture and Consumer Affairs

SMITH, R. 7, 17 U.S. Department of Energy

SNYDER 8, 11, 19, 20 U.S. Department of Interior

SMITH, W. 18, 25, 27 U.S. Environmental Protection Agency

SNYDER 3, 7, 15, 16 U.S. Navy

Spencer 21 U.S. Navy

Stillwell 17 U.S. Navy

TAYLOR 22, 27, 28, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

TOWLE 29 U.S. Navy

Traver 10 U.S. Navy

Tritting 13 U.S. Navy

Trowbridge 4 U.S. Navy

WALKER 16 U.S. Navy

Walker, J. 30 U.S. Navy

Walker, R. 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

WATKINS 27 U.S. Navy

WHEELER 18 U.S. Navy

WILSON 18 U.S. Navy

WILSON 18 U.S. Navy

SUBJECT INDEX

Absorption Refrigeration Cycle	84
Using A Solar Collector	91
Accident Analysis	52
Acoustic Tracking	41
Activity Networks	54
Aerated Composting Process	7
Army Maintenance Training	59
Assembly Line Balancing	54
Biological Productivity	9
Blind, Engineering For	58
Boundary Integral	5, 12, 75
Building Design, Industrial	5
Computers	
Army Maintenance Training	59
BASIC	54
and Civil Engineering	11
Cross Assembler	72
Digital Filter	44
Energy Management	52
Image Generator	34
Industrial Engineering	54, 64, 70
Learning Curve	53
Microcomputers	52, 53
Naval Training	62
Optimal Loading Techniques	41
Project Networks	54
Random Number Generators	71
Selection	5
Signal Processors	34, 38
Software	34, 53, 65
Speech Synthesizers	53
Weapons	38
Computer Routines/Algorithms	
Bilinear Transform	42
Calculators/Microcomputers	33, 40
For the TI-59	34
ORACLS	43
Computer Simulation	
Energy Consumption	79
Forecasting	53
Heat Pump	89
Operator and Maintenance Training	53
Police Training	52
Rural Emergency Transportation	54
Total Energy Plant	52
Weapons	64
Cross-Correlators	33, 42
Development, Economic	
and Industrial	16, 23, 24, 27

Dishwasher Systems		52
Economics		
Coal vs. Oil		70
Inflation Techniques		69
Solar		53
Waste Heat Recover		65
Education		
and Computers	34, 40, 52,	54
Energy		6
Environmental		9, 11
Non-Technical	5, 6, 33, 46,	75
Electric Vehicle		60, 86
Electromagnetic Wave Scattering		36
Energy Use/Management		
Analytical Model		59, 64
With Computers		52
Conservation	56, 79,	81
Energy Audit		78
Freeze Tunnels		77, 91
Nuclear Energy	74, 75,	82
Oil Vs. Coal		70
Passive Cooling		81
Petroleum	52,	74
Phosphate Industry		74
Process Food	53,	74
Programs For Buildings		74
Pulp Industry	53,	74
Renewable Resources		77
Simulation	79,	89
Steam Turbines		90
Engineering Technologists		46
Environmental Engineering	7,	9
Environmental Health Training		7
Experimental Mechanics	75,	85
Film Boiling, Minimum		83
Hazardous Waste Disposal	5, 11, 46,	48
Health Environment		60
Heat Exchangers		84
Heat Pump Simulation		89
Historical Engineering	6,	23
Hydropower	23,	27
Infrared Thermography		6
Lake Restoration		8
Laser Beam Propagation	33, 34,	37
Laser Speckle	75,	77, 85
Laser Weapons		33, 34
Materials Structure/Property		75, 87
Mechanical Tests		6
Mixing Effects in Water	9,	20
Mixing Zones	8,	17
Moisture Detection in Roofing		6, 14
Monte Carlo Integration	53,	66
Naval Training		62
Operational Amplifiers		43

Optical Fiber/Communication	33, 34, 44
Parallel Redundant Systems	53, 65, 66
PERT	54
Photovoltaics	33, 39, 80
Plant Layout	71
Productivity	58
Project Scheduling/Management	62, 68, 69
Random Number Generators	71
Reactor Analysis	5
Resource Allocation	54
Safety Related Problems	61
Sewer Systems	
In Industrial Plants	25
Overflow	10, 21
Shipboard Antenna Placement	46
Shock Absorber Design	7
Shock Tube	37, 75, 86, 90
Simulation Algorithm	33
Sludge Combustion	7
Solar Energy	
Collectors:	
In an Absorption Cycle	91
Hail Impact Testing	6, 13
Wind Loading	13
Economics	53
Solar Heater	74
Solid Waste Management	30, 52
State Technology Applications Center	88
Steam Turbines	90
Steel Construction	49
Stormwater/Runoff	
Chemical Treatment	29
Effect on Lakes	8, 9, 10, 18, 21
From Highway Bridges	8, 19, 25
Management Manual	17
Plain Sedimentation	27
Retention/Detention	5, 7, 8
SMADA	26
Treatment	5
Structural Analysis	5
Sulfur Supply and Demand	5
Switch Inverter	36
System Life/	
Failure Distributions	53, 66, 67
Thermoelectrics	74, 81
Transportation, Remote	74
Ventricular Stiffness	74
Waste Heat Recovery	52, 57, 59, 65
	65, 71, 74, 80
Waste Incineration	13
Water Treatment and Supply	
In Africa	7
Benthic Organisms	9
Color Removal	8

Water Treatment and Supply, cont.

Fabric Filtration	28
Flocfil Process	15
Lake Restoration	8
Phosphorus	9, 19, 20
Point Sources	9
Resources	12
TOC Removal	8
Trimalomethanes	8, 15, 16
Watershed Management	8
Weapons	33, 34, 38, 64
Word Processors	6
Work Sampling	54
Workshops	11, 35, 47

55, 76, 85

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