

1983

## College of Engineering research activities and annual report, July 1, 1982 - June 30, 1983

University of Central Florida. College of Engineering

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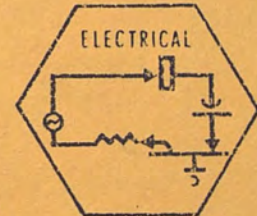
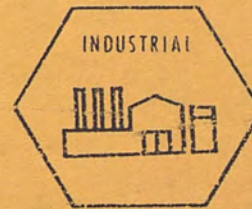
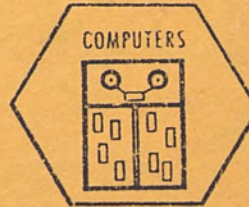
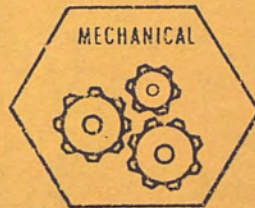
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University of Central Florida  
**COLLEGE OF ENGINEERING**

**RESEARCH  
ACTIVITIES**



**AND  
ANNUAL  
REPORT**

**JULY 1, 1982 - JUNE 30, 1983**

15105







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## INTRODUCTION

A nationwide study released early in 1983 proclaimed Florida as the "number one state where manufacturers would most like to do business." The 1982 study, conducted by Alexander Grant & Co., a Chicago based accounting firm, was made in cooperation with the Conference of State Manufacturer's Associations.

Florida earned its position as having the best overall business climate for manufacturing based on 22 factors. The 22 factors were divided into five broad categories: state and local government fiscal policies, state-regulated employment costs, labor costs, availability and productivity of labor force, and other manufacturing related issues such as energy costs, markets, and environmental control.

This enviable position is the result of continued commitment of state leaders at all levels to the industrial economic development of Florida. The emerging high-technology industrial base of Orlando and Central Florida is a very visible and tangible proof of the merit of this commitment.

Increasingly we hear of the importance of engineering education as a factor in the high stakes race to attract high-technology industry. Fortunately the leadership of the state perceived the nature of this "university connection" several years ago. Today, Florida is one of a very few states (e.g., California, Texas and North Carolina) to make significant "new money" investments in engineering education. Continuation of these efforts will serve Florida well and help keep Florida attractive to modern industry.

Locally, these investments have resulted in significant additions to faculty and laboratory equipment during the last two years. Planning and design efforts for a new Engineering Building (CEBA Phase IA and Phase IB) are nearly complete. Groundbreaking ceremonies are being scheduled for late in the fall term for this \$10,280,000 project, completion of which will more than double available laboratory and faculty office space.

The importance of these new facilities cannot be over-emphasized. While the State of Florida overall ranks fourth among the states in Federal R&D obligations (National Science Foundation Report 81-325), we rank 16th in the university sector. To move up to the top five would require a tripling of federally funded research efforts among Florida's universities.

Thus it must be clear to all concerned that to reasonably expect significant increases in faculty and student research will require continued commitment to develop space, facilities and equipment to support that research. Increasingly, government and industry are looking to the university community to perform the basic research function. This "university connection" between education and research and high-technology industry becomes doubly important in Florida as we seek to continue the industrial and economic development of our State. This activity is a vital part of providing a "true growth" climate in addition to encouraging "relocations." Hopefully the continued strengthening of the university sector will lead to a nurturing of the "think tank" non-profit sector which is essentially absent from Florida.



## DEAN'S OFFICE REPORT

The College of Engineering experienced another excellent year during 1982-83. Every significant parameter (e.g. enrollments, faculty, degrees granted, research income, community service activities, extended studies activities, etc.) showed substantial increases during the year. Engineering faculty and programs are becoming increasingly visible on the national scene. The College entertained visitors from Sweden, England, Denmark, Japan and Mexico 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 exceeded the \$1,330,000 level for the year. The State Technology Application Centers (STAC) program at UCF, UF, USF and FAU 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. Nine served as editors or reviewers of various publications. Dr. Fred Gunnerson received the DOW Outstanding Young Faculty award from ASEE while Dr. Ron Phillips was the recipient of ASEE/SE Research Medal. Dr. Robert Doering was named a Fellow of the Florida Engineering Society and Dr. Gary Whitehouse was elected a Fellow of the IIE, reportedly the youngest person so honored. Dr. Robert Safford (University of Arkansas) and Dr. Thorkild Hvitved-Jacobsen (University of Qalborg, Denmark) spent sabbatical years with colleagues at UCF. Professor Gunnar Hambræus, President of the Royal Swedish Academy of Engineering Sciences was a guest of the University during the year.

Drs. Denning, Hubler, and Kersten 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 was named to the AIIE Educational Scholarship Fund Trustees; Dr. Kersten was re-appointed by Governor Graham as a member of the State Board of Professional Engineers and was named by NCEE as representative to the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. Dr. Hartman continued as Chairman of the Professional Interest Council II and served as a Vice President and member of the Board of Directors of the American Society for Engineering Education. Dr. Kersten was named to the NSPE Educational Foundation during the year.

Dr. Mathews served on the Board of Directors of SOUTHCON and Orlando will host the 1984 meeting. This nationally organized electrical/electronics show attracted over 12,000 participants to the Orlando meeting in 1982. Dr. Gambrell served on the Scientific Advisory Group of the U.S. Army Test and Evaluation Command and the Board of Trustees of the 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 and Dr. Phillip's visit to Guilin, People's Republic of China, for a series of lectures on electro-optics at the International Conference on Optical Waveguide Sciences. Dr. Nuckolls spent the year at the Federal Aviation Administration Technical Center (under an Intergovernmental Personnel Act assignment) involved in Crashworthiness Modeling research.

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, over 90 percent of the UCF Engineering faculty were registered. Dr. Petrasko, Dr. Bauer, and Mr. Belkerdid served on the Telecommunications Task Force of the Florida Joint Legislative Committee on Electronic Data Processing.

As a result of special laboratory equipment allocations by the Florida Legislature during the past two years, a considerable upgrading of basic teaching laboratories is under way. Major additions have been made or are on order for modern instrumentation in several advanced teaching and research laboratories (e.g. environmental engineering, electro-optics, micro-electronics, thermal sciences and experimental mechanics), including a VAX 11-750 computer system. Perhaps the most significant new laboratory development in the past several years was the implementation of a CAD/CAM (computer aided design/computer aided manufacturing) laboratory. This effort received additional support from the General Electric Foundation.

The COE remained active with 19 other major engineering colleges in 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 reaching the 10% level this year. The College continued to participate in the incentive grant program of the National Action Council for Minorities in Engineering. Thirty-two minority student scholars were enrolled in engineering departments during the year as a result. A special pre-college program, OPERATION CARE (Career Awareness and Readiness for Engineering), designed to encourage minorities to pursue more rigorous secondary school programs was implemented this year with support from the Westinghouse Education Foundation.

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



## DEPARTMENTAL REPORT

1982-1983

### DEPARTMENT OF CIVIL ENGINEERING & ENVIRONMENTAL SCIENCES

Chairman: Dr. M.P. Wanielista

Faculty: D.L. Block, W.E. Carroll, C.D. Cooper, J.D. Dietz, H.H. Harper, T. Hvitved-Jacobsen, E. Jackson, J.P. Hartman, D.R. Jenkins, R.D. Kersten, S. Kuo, D.S. Leftwich, C.N. Palmer, W. Rodriquez-Ramos, J.N. Seaman, R. Smith, W.M. McLellon, M.I. Muiga (LOA), B.R. Snyder, J.S. Taylor, and Y.A. Yousef

The Civil Engineering and Environmental Sciences Department consisted of a twenty-two member faculty during the 1982-83 year. Options offered by the Department are in Civil 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. Drs. Hartman and Kersten serve in an administrative role of the College. Professors Dietz, Leftwich and Rodriquez-Ramos joined the faculty in the Fall Semester. Dr. McLellon is Professor Emeritus. Dr. Jenkins was assigned as Acting Chairman of the Mechanical Engineering and Aerospace Sciences Department this year. Dr. Thorkild Hvitved-Jacobsen was a visiting Associate Professor from the University of Aalborg, Aalborg, Denmark.

The CEES department graduation count was 46 BSE and 6 MS, or MSE students. The faculty had \$1,070,000 of research grants and contracts effective during the 1982-83 fiscal year. During the year, external funding received was approximately \$370,000. The Ph.D. Program has 4 people who passed their qualifiers and 6 others. 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 and one half full-time faculty positions during the year.

The Department had initiated a foreign exchange program with Denmark. Dr. Thorkild Hvitved-Jacobsen from the University of Aalborg spent almost one year with the faculty. The Dawkins Research Seminar was attended by over 100 people with Dr. W. Kornegay from Westvaco as the featured speaker.

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 stormwater effects on fresh water resources. Of national significance was his work on metal speciation in natural environments. Dr. Yousef holds the Gordon J. Barnett Chair which enhances the transfer of technical information. The faculty continue to remain active in all types of continuing education activities. Of note was the Florida Federation of Garden Club's Environmental Workshop for high schools, the ASCE Irrigation and Drainage Conference, and a Mini-Computer Applications in Civil Engineering Workshop. Dr. Taylor is continuing his studies in suspect



carcinogens in potable water supplies. Dr. Leftwich was appointed interim director of the Transportation Systems Institute. Dr. Carroll continues his work in finite elements applying his concepts to submarine warfare simulation. Also he is an editor for a column in the Civil Engineering Magazine sponsored by ASCE. Drs. Cooper and Dietz have initiated industrial waste treatment analyses and design. Of note is their work on coal slurry pipe lines. Drs. Wanielista, Yousef, Taylor and Cooper completed writing a textbook to be used for EGN 3704 (Engineering and the Environment) which will be published next year by Brooks/Cole, a division of Wadsworth. Harvey Harper is continuing work on lake impacts from stormwater. He is a frequent speaker among local government organizations. Drs. Yousef and Wanielista and Professor Harper continued their work on stormwater design criteria by attending international and local meetings. Dr. Kuo initiated work on sinkholes and the University has been granted the Sinkhole Institute in Florida. Also, Dr. Kuo initiated an honorary club in Civil Engineering.

Professor Jackson is active with minority programs at the University and in the local high schools. Other faculty have contributed to an outreach program for minorities. Professor Jackson and Dr. Walter Rodriguez-Ramos have initiated a Masters Program in Construction Engineering.

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, American Society for Engineering Education, Water Pollution Control Federation, American Water Works Association, and American Academy of Environmental Engineering Professors.

Dr. Seaman has been the faculty advisor for the ASCE Student Chapter. The student chapter won the State Concrete Canoe Race and placed high among southeastern schools in overall competition. CEES students, both undergraduate and graduate, continue to be active on faculty research projects. The ASCE Student Chapter was very active in this year's Engineering Fair and participated in bridge building contests and other events.

The faculty remain active and show sustained involvement in many education and research areas. Twenty-two proposals were generated of which sixteen were for external funding. In the area of publications, thirty-one of fifty were considered of professional quality with seventeen being refereed journal types. Thirty-six professional presentations were given while the faculty were attending forty-six meetings. This quality and quantity of work reflects credit upon the Faculty and the University. We are taking on the opportunities of the Ph.D. program and a new building for the College of Engineering.



DEPARTMENT OF CIVIL ENGINEERING and ENVIRONMENTAL SCIENCES

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

Books and Monographs

1. Walsh, T., and Wanielista, M.P. Low-Flow Analyses, (a monograph published by the College of Engineering, Orlando, FL), January, 1983.

Articles Published

International Journals (Peer-Refereed)

1. Carroll, W.E. "Computer Aided Engineering - The Educational Environment," Proceedings of the Third International Conference and Exhibit on Engineering Software, Vancouver, BC, (October, 1982).
2. Harper, H.H., Wanielista, M.P. and Yousef, Y.A. "Restoration of Lake Eola," Proceedings of the 2nd Annual Meeting of the North American Lake Management Society, Vancouver, BC, (October, 1982).
3. Hvitved-Jacobsen, T. "The Impact of Combined Sewer Overflows on the Dissolved Oxygen Concentration of a River," Water Research, 16 (1982), 1099-1105.
4. Yousef, Y.A., Wanielista, M.P. and Harper, H.H. "Impact of Watershed on Urban Lake Quality," Proceedings of the North American Lake Management Conference, Vancouver, BC, (October, 1982).

Regional Journals (Peer-Refereed)

1. Carroll, W.E. "Computer Hardware," Proceedings of the Florida Section ASCE Annual Meeting, (1982).
2. Carroll, W.E. "Computer Software," Proceedings of the Florida Section ASCE Annual Meeting, (1982).
3. Cooper, C.D., Alley, F.C. and Overcamp, T.J. "Hydrocarbon Vapor Incineration Kinetics," Environmental Progress, 1, 2 (May 1982), 129-133.
4. Cooper, C. David. "A Microcomputer Model of an Equalization Basin," ASCE Joint Florida-South Florida Annual Meeting, Orlando, FL (September, 1982).
5. Harper, H.H., Yousef, Y.A., and Wanielista, M.P. "Reuse of Water Treatment Sludges for Improvement of Reservoir Water Quality," Proceedings of AWWA National Conference, Las Vegas, NV, (June, 1983).



6. Kruse, G., Burdick, C., and Yousef, Y.A., Edt. Proceedings of the ASCE, I&D Division Specialty Conference on Environmentally Sound Water and Soil Management, Orlando, FL, (July, 1982).
7. Kuo, S. "Analysis of Flexible Pavement on the Basis of Simple Deflection Basins Measured by Bekelman Equipment," ASCE 1982-Joint Florida Annual Meeting, Orlando, FL, (September, 1982).
8. Nielsen, J.D., and Hvitved-Jacobsen, T. "The Role of Nitrate on the Retention of Phosphorus in Estuarine Anaerobic Sediments," Hedeselskabets Tidsskrift, No. 3 (1982). (In Danish).
9. Wanielista, M.P., Reel, S., Dowling, A. and Zahm, A. "Methodology for the Choice of Stormwater Management," ASCE Florida/South Florida Annual Meeting, Lake Buena Vista, FL, (September, 1982).
10. Wanielista, M.P., Yousef, Y.A., Harper, H.H., and Anderson, D.E. "Evaluation of Management Practices for Urban Lands," Proceedings of the ASCE, I&D Division, Specialty Conference on Environmentally Sound Water and Soil Management, Orlando, FL, (July 1982).
11. Yousef, Y.A., Wanielista, M.P., Harper, H.H., and Christopher, J.E. "Management of Drainage Systems from Highway Bridges for Pollution Control," Transportation Research Board, (1983).
12. Yousef, Y.A., Wanielista, M.P., Harper, H.H., and Skene, E.T. "Impact of Bridging on Floodplains," Transportation Research Board.

#### Other Scholarly Works

1. Carroll, W.E. "Overview of Micro Computer Systems," Proceedings of a National Symposium on the Profession in Private Practice.
2. Carroll, W.E. "Computer Graphic Software," Presented in conjunction with Arrigoni Computer Graphics Corp., Orlando, FL, (1982).
3. Carroll, W.E. "Subtac Software - Final Report," NTEC (DOD), Orlando, FL, (1983).
4. Carroll, W.E. "BIE Study - Part I: Two-D Analysis," Final Report, NASA, Huntsville, AL, (1982).
5. Carroll, W.E. "BIE Study - Part II: Three-D Analysis," Final Report, NASA, Huntsville, AL, (1982).
6. Carroll, W.E. "BIE Study - Part III: BIE Crack Growth Analysis," Final Technical Report, NASA, Huntsville, AL, (1983).
7. Dietz, J.D. "Clarification Mechanisms for a Flocculent Slurry," Ph.D. Dissertation, Clemson University, Clemson, SC, (August 1982).



8. Harper, H.H., Wanielista, M.P., Yousef, Y.A., and Domenico, D. Lake Eola Restoration: Water Quality Background and Stormwater Management Practices, FDER, (September 1982).
9. Hvitved-Jacobsen, T. "The Control of Stream Pollution from Combined Sewer Overflows," submitted to the Danish Engineers' Post Graduate Institute, Copenhagen, (1982). (In Danish).
10. Hvitved-Jacobsen, T., and Jensen, B.V. "The Occurrence and Control of Sulfide in Pressure Mains," report submitted to Nellemann and Partners, Consulting Engineers; Department of Environmental Engineering, University of Aalborg, Denmark, (July 1982). (In Danish).
11. Hvitved-Jacobsen, T. "Coastal Water Pollution," University of Aalborg, Denmark, (July 1982) (In Danish).
12. Leftwich, D.S. Winston-Salem Urban Area Transportation Study, "Surveillance Report," North Carolina Department of Transportation, Planning and Research Branch, (1982).
13. Leftwich, D.S. "Oxford Thoroughfare Plan," North Carolina Department of Transportation, Planning and Research Branch, (1982).
14. Leftwich, D.S. "Multipurpose Traffic Assignment using Volume Restraint and Link Restraint in Small Urban Areas," North Carolina Department of Transportation, Planning and Research Branch, (1982).
15. Leftwich, D.S. "Multipurpose Traffic Assignment Model for Application in Small Urban Areas," Ph.D. Dissertation, North Carolina State University, (1982).
16. Leftwich, D.S. "Davie County Thoroughfare Plan," North Carolina Department of Transportation, Planning and Research Board, August, (1982).
17. Leftwich, D.S. "Multi-Purpose Traffic Assignment Model Using Volume Restraint and Link Restraint for Applications in Small Urban Areas," TRB Record.
18. Rodriguez-Ramos, W. Construction Site Design, Construction Industry Institute, Inc., Orlando, FL.
19. Taylor, J.S., and Fisher, A.J. "A Model for THMFP," 9 pages, FSAWWA Technical Conference, Clearwater, FL, (November, 1983).
20. Taylor, J.S. "Potable Water Reuse," Federal Water Quality Commission, Washington, D.C., (April, 1983).



21. Taylor, J.S., Kinloch, E., Crowson, D., and Hogue, C. "Direct Injection of Treated Wastewater into Potable Water Aquifers," FSAWWA Position Paper, 15 pages, FSAWWA, (April 1983).
22. Taylor, J.S., and Tippin, D. Eds. "Utility Financing Seminar Proceedings," 63 pages, FSAWWA, (August, 1983).
23. Taylor, T.S., Snyder, B.R., Ferraro, C., and Fisher, A.J. "Interrelationship of Advanced Water Treatment Parameter," 8 pages, FSAWWA Technical Conference, Clearwater, FL, (November, 1983).
24. Wanielista, M.P., Smith, R., Castro, A., and Cooper, C.D. Mixing Zones, a final report submitted to Florida DOT on Contract No. 997700-7212, (July 1982).
25. Wanielista, M.P., Yousef, Y.A., and Taylor, J.S. "Stormwater Management to Improve Water Quality," Project Summary, EPA-600/S2-83-048, (August, 1982).
26. Wanielista, M.P., "Stormwater Management for Protection of Florida," EXPO-82, Tampa, FL, (July, 1982).

#### PRESENTATIONS

##### International Meetings

1. Harper, H.H., Wanielista, M.P., and Yousef, Y.A. "Restoration of Lake Eola," 2nd Annual Meeting and Conference of the North American Lake Management Society, Vancouver, BC, October, 1982.
2. Yousef, Y.A., Wanielista, M.P., and Harper, H.H. "Impact of Watershed on Urban Lake Quality," The Second Annual Conference of North American Lake Management, Vancouver, BC, October 1982.

##### Regional Meetings

1. Carroll, W.E., and Singhofen, P.J. "Micro-Computer Application in the A&E Firm," ASCE 1983 Spring Convention, Philadelphia, PA, May, 1983.
2. Carroll, W.E. "An Educator's View of AISC," AISC Partners in Education Meeting, Tampa, FL, October, 1982.
3. Carroll, W.E. "Structural Engineering Software - The University Environment," ASCE 1983 Spring Convention, Philadelphia, PA, May, 1983.
4. Carroll, W.E. "Computer Software," ASCE 1982 Annual Meeting, Orlando, FL, September, 1982.



5. Carroll, W.E. "Computer Hardware," ASCE 1982 Annual Meeting, Orlando, FL, September, 1982.
6. Carroll, W.E. "Overview of Micro-Computer System," ACSM/ASP Fall Convention - A National Symposium on the Profession in Private Practice, Ft. Lauderdale-Hollywood, FL, September, 1982.
7. Dietz, J.D., and Keinath, T. "Clarification Mechanisms for a Flocculent Slurry," 55th Annual Conference of the Water Pollution Control Federation, St. Louis, MO, October, 1982.
8. Harper, H.H. "Fate of Heavy Metals and Nutrients in Detention Ponds and Roadside Swales," FDER Stormwater Training Workshop, Leesburg, FL, May, 1983.
9. Harper, H.H. "Stormwater Treatment Around Lake Eola," FDER Stormwater Training Workshop, Leesburg, FL, May, 1983.
10. Harper, H.H. and Yousef, Y.A. "Reuse of Water Treatment Plant Sludges/for Implementation of Reservoir Water Quality," Annual Meeting of the American Water Works Association, Las Vegas, NV, June, 1983.
11. Harper, H.H. "Endangered Species of the World," SEEK 82, August, 1982.
12. Hvitved-Jacobsen, T. "Phosphorus Availability in Coastal Areas - Loads, Effects and Control," The Danish Society of Sanitary Engineers, Copenhagen, May, 1982.
13. Hvitved-Jacobsen, T. "Eutrophication Problems in Danish Coastal Areas," Michigan Technological University, Houghton, MI, October, 1982.
14. Hvitved-Jacobsen, T. "Impact of Combined Sewer Overflows on Receiving Water Dissolved Oxygen," Michigan Technological University, Houghton, MI, October, 1982.
15. Leftwich, D.S., "Multipurpose Traffic Assignment Using Volume Restraint and Link Restraint for Application in Small Urban Areas," TRB Conference, Washington, D.C., January, 1983.
16. Taylor, J.S., Kinloch, E., Crowson, D., and Hogue, C. "FSAWWA Position Paper on Potable Water Reuse," Federal Water Quality Symposium, Washington, D.C., May 1983.
17. Taylor, J.S., Kinloch, E., and Hogue, C. "Direct Injection of Wastewater into a Potable Water Aquifer," Public Meeting, Belle Isle, FL, April, 1983.
18. Taylor, J.S., Snyder, B.R., Ferraro, C., and Fisher, A.J. "The Magnesium Carbonate Water Treatment Process - Solids Handling," FSAWWA Annual Technical Conference, Clearwater, FL, November, 1982.



19. Taylor, J.S., Kinloch, E., Crowson, D., and Hogue, C. "Direct Injection of Wastewater into a Potable Water Aquifer," DER, Tallahassee, FL, March, 1983.
20. Taylor, J.S., Jones, D.A., and Fisher, A.J. "Evaluation of the Magnesium Carbonate Process," Public Meeting at the Melbourne City Council, Melbourne, FL, February, 1983.
21. Taylor, J.S. "Advanced Potable Water Treatment," FW&PCOA Region Ten Short School, Polk Community College, Winter Haven, FL, November, 1982.
22. Taylor, J.S., Snyder, B.R., Ferraro, C., and Fisher, A.J. "Effect of the Magnesium Carbonate Process on Advanced Water Quality," ASCE National Specialty Conference on Water Supply, Tampa, FL, March, 1983.
23. Taylor, J.S. "Filtration in Potable Water Treatment," Chemical Processing Seminars, Lakeland, FL, February, 1983.
24. Taylor, J.S. "Melbourne Water Treatment Plant," UCF, ASCE Student Club, January, 1983.
25. Taylor, J.S., Kinloch, E., Crowson, D., and Hogue, C. "Direct Injection of Wastewater into a Potable Water Aquifer," City of Orlando, Orlando, FL (Private presentation to city staff and consulting engineers), March 1983.
26. Wanielista, M.P., Yousef, Y.A., Harper, H.H., and Anderson, D.E. "Evaluation of Management Practices for Urban Lakes," ASCE National Specialty Conference on Environmentally Sound Water and Soil Management, Orlando, FL, July, 1982.
27. Wanielista, M.P. "Stormwater Management for Protection of Florida," EXPO-82, Tampa, FL, July, 1982.
28. Wanielista, M.P. "Lake Toho - Its Future," East Central Florida Regional Planning Council Annual Meeting, May, 1982.
29. Wanielista, M.P. "Lake Restoration Standards," DER, Tallahassee, FL, May, 1982.
30. Wanielista, M.P. "Lake Toho Stormwater Designs," Kissimmee Coordinating Council, Tallahassee, FL, July, 1982.
31. Wanielista, M.P., Reel, S., Dowling, A., and Zahm, A. "Methodology for the Choice of Stormwater Management," ASCE Florida/South Florida Annual Meeting, Lake Buena Vista, FL, September, 1982.
32. Wanielista, M.P. "Stormwater Management and Highways," 5th District DOT, Deland, FL, September, 1982.
33. Wanielista, M.P. "Lake Toho Stormwater Management," East Central Florida Regional Planning Council, 208 Meeting, Orlando, FL, February, 1983.



34. Wanielista, M.P. "Stormwater Management/Hydrology/Hydraulics," State DER Annual Meeting, Leesburg, FL, April, 1983.
35. Yousef, Y.A. "Impact of Highway Bridge Runoff on Surrounding Environment," presented before the DOT personnel, Deland, FL, September, 1982.
36. Yousef, Y.A. "Impact of Motorboats on Shallow Lakes in Central Florida," presented before the Ad Hoc Committee for Restrictions on Recreation Uses of Lakes, Orange County, Orlando, Florida, September, 1982.
37. Yousef, Y.A. "Impact of Bridge Drainage on Surrounding Environment," invited to participate in the University of Florida Annual Departmental Seminar Series, Department of Civil Engineering and Environmental Sciences, Gainesville, FL, November, 1982.
38. Yousef, Y.A., Wanielista, M.P., Harper, H.H., and Skene, E.T. "Impact of Bridging on Floodplains," 62nd Annual Meeting of the Transportation Research Board, Washington, D.C., January, 1983.
39. Yousef, Y.A., Wanielista, M.P., Harper, H.H., and Skene, E.T. "Impact of Bridging on Floodplains," Annual Meeting of Transportation Research Board, Washington, D.C., January 1983.



DEPARTMENT OF CIVIL ENGINEERING  
AND ENVIRONMENTAL SCIENCES

Seminars, Special Programs  
and Eminent Speakers

1. SEEK 82, Florida Federation of Garden Clubs at UCF, August 1982 (C. Palmer).
2. Utility Finance Seminar, FSAWWA sponsored, 122 attendees, Tampa, FL, August 1982 (J.S. Taylor).
3. Dawkins Research Seminar, UCF, 85 attendees, Orlando, FL, November, 1982 (J.S. Taylor).
4. Clarification of a Flocculent Slurry Seminar, Clemson, SC, May, 1982 (J. Dietz).
5. Microcomputer Short Course, Summer, 1982 (W.E. Carroll).
6. Numerical Methods for Engineers, Summer, 1982 (W.E. Carroll).
7. Microcomputer Short Course, Spring, 1983 (W.E. Carroll).
8. Programming for Civil Engineer, (in cooperation with ASCE), Spring 1983 (W.E. Carroll).
9. Coordinated the 6th Annual Environmental Engineering and Science Student Conference, UCF, Orlando, FL, May, 1982 (Y.A. Yousef). We are also planning for the 7th conference to be held at UF, May, 1983.



DEPARTMENT OF CIVIL ENGINEERING & ENVIRONMENTAL SCIENCES

ABSTRACTS OF SPONSORED RESEARCH

TITLE: Subtrack Software  
PRINCIPAL INVESTIGATOR: Dr. W.E. Carroll, P.E.  
SPONSORING AGENCIES: U.S. Navy  
GRANT NUMBER: 20-2100-032

A B S T R A C T

Computer software is being developed to process data available from the Mark 81 Fire Control System aboard US Navy attack submarines. Completed in January 1983.

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TITLE: Water Quality Characterization of a Coal Slurry Pipeline Carrying Eastern Coal  
PRINCIPAL INVESTIGATORS: Dr. C.D. Cooper, P.E.; Dr. J.S. Taylor, P.E.; and Dr. J.D. Dietz, P.E.  
SPONSORING AGENCY: U.S.-EPA  
GRANT NUMBER: 20-1620-003

A B S T R A C T

A major coal slurry pipeline has been proposed to bring coal from the Illinois, Ohio, Kentucky area to Florida. The coal will be transported with water which will leach some mineral and organic materials from the coal while in transit. The primary objective of this research project is to characterize the quality of the resulting water with respect to general metals and organic parameters. Pulverized coal will be slurried with water and pumped for two weeks continuously through a miniature pipeline system which has been constructed for this purpose. The system basically consists of a mixing tank, a submersible pump and a forty-foot long one-inch diameter pipe loop. Samples will be taken daily and subjected to numerous analyses. Graduate student training on analytical instruments and techniques is proceeding now and experimental runs will begin shortly.

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TITLE: Council for the Understanding of Technology and Human Affairs  
PRINCIPAL INVESTIGATOR: Dr. J.P. Hartman, P.E.



SPONSORING AGENCY: CUTHA  
GRANT NUMBER: 28-1610-001

A B S T R A C T

Preparation of reports on workshops and other activities for the Council for the Understanding of Technology in Human Affairs (CUTHA). Dr. Hartman is a member of the Executive Committee of CUTHA and Program Director for the Workshops which currently have a primary emphasis on improving technological literacy in general education. Dr. Hartman was also an invited participant in an NSF sponsored workshop on "Fundamentals in Precollege Technology Education."

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TITLE: THM Removal by Magnesium Carbonate Process  
PRINCIPAL INVESTIGATORS: Dr. James S. Taylor and Prof. Bruce R. Snyder  
SPONSORING AGENCY: EPA  
GRANT NUMBER: 20-1620-002

A B S T R A C T

This project is funded through a cooperative agreement among the City of Melbourne, UCF and the EPA with the objectives of evaluating the magnesium carbonate process for THM precursor removal. Major findings from the research were: (1) THMFP and TOC removal during coagulation could be optimized by optimizing color removal during coagulation, (2) continued reuse of magnesium decreased coagulation efficiency, (3) TOC, THMFP and color removal increased for normally recycled magnesium as coagulation pH and dose increased, (4) ozone or  $ClO_2$  was not effective for THMFP reduction, but ozone could be effectively utilized for trace color reduction, (5) development of models that predicted THMFP and  $Cl_2$  residual as function of chlorine dose, TOC, pH, temperature and time, and (6) a GAC pilot plant that showed that a GAC facility in Melbourne could not be effectively used for THMFP removal, but could be used to control color. This cooperative agreement will conclude on December 31, 1983 and has supported seven graduate students and several undergraduate students. The GAC pilot plant and a distribution system project are still in operation.

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TITLE: Mixing Zones  
PRINCIPAL INVESTIGATORS: 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 was a 33 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 were examined to aid in predicting the extent of the zone for various discharge conditions. Stormwater hydrographs and loadographs were input data to the models. The finite element model was developed by Robert Smith and is called "Lake." The model was tested on Lake Eola with "good" fit to the data.

PUBLICATIONS: SMITH, R., and WANIELISTA, M.P. Mixing Zones in Lakes, FDOT and UCF, July, 1982.

CASTRO, A. Applied Steady-State and Transient Modeling of Mixing Zone Requirements in Streams. Thesis. UCF, Spring 1982.

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TITLE: Stormwater Management to Improve Lake Water Quality

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

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

GRANT NUMBERS: 18-1621-002, 11-1620-005, 28-1621-001, and 18-1621-003

A B S T R A C T

This abstract is for phase 2 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.



Thirteen inlet-percolation systems (underground perforated aluminum pipes) were designed, bid and constructed. The approximate cost for about 880 feet was \$230,000. Preliminary tests to determine diversion volume (first flush) and an average annual efficiencies indicate about 1 inch and 95% respectively. Where water tables are high, in-line filters were used. One filter was underground and out-of-sight while the other was above ground and arranged in a "Japanese garden setting. Both filters composed of alum sludge, gravel and sand. Approximate cost for both filters was \$60,000. Preliminary tests indicate an average annual efficiency of about 80% for phosphorus removal. Lake littoral zone was re-planted with arrowhead, pickerelweed, elephant ear, green-fanwort, bull-rush and cypress trees at a cost of approximately \$18,000. Bottom silt recycling of phosphorus was minimized by the placement of alum sludge over the bottom of the lake. This cost was approximately \$11,000.

- PUBLICATIONS: WANIELISTA, M.P., and YOUSEF, Y.A. "An Example of Urban Watershed Management for Improving Lake Water Quality," Restoration of Lakes and Inland Waters, EPA International Symposium, EPA 440/5-81-010, 1982.
- YOUSEF, Y.A., WANIELISTA, M.P., HARPER, H.H. and JELLERSON, D.B. "Inactivation of Anaerobic Release of Phosphorus by Water Treatment Sludges," Industrial Waste Proceedings of the Thirteenth Mid-Atlantic Conference, Ann Arbor Science Press, 1981, pp. 618-629.
- HARPER, H.H., WANIELISTA, M.P., YOUSEF, Y.A., and DI DOMENICO, D., Lake Eola Restoration Water Quality Background and Stormwater Management Practices, September, 1982, DER/EPA final report, 1982.
- HARPER, H.H., WANIELISTA, M.P., and YOUSEF, Y.A., "Restoration of Lake Eola," 2nd Annual Conference of the North American Lake Management Society, Vancouver, BC, October 27-29, 1982.
- WANIELISTA, M.P. "Lake Eola: A Case Study," Urban Stormwater and Combined Sewer Overflow Impacts Workshop, Orlando, FL, EPA, November 27, 1979.
- 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 Management in Coastal Areas, ASCE National Symposium, June 19, 1980.

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TITLE: Stormwater Management for Lake Tohopekaliga Watersheds

PRINCIPAL INVESTIGATORS: Dr. M.P. Wanielista, P.E., Dr. Y.A. Yousef, P.E., Professor H.H. Harper and Professor B.L. Baldwin

SPONSORING AGENCIES: South Florida Water Management District and East Central Florida Regional Planning Council

GRANT NUMBER: 28-1621-002

A B S T R A C T

The Lake Tohopekaliga watersheds in Osceola and Orange Counties was the target for stormwater management. The locations for various stormwater management technologies was determined based on a minimum present value per pound of phosphorus on nitrogen removed per year. Thus, a marginal cost approach was used and the evaluation was done using a computer program. The program is written in BASIC, thus is interactive. It is operational on the TRS-80 system. The management practices analyzed consist of berms, detention ponds, retention ponds, underground percolation tanks, and stream fencing. A sensitivity analysis was completed on loading rates, yearly efficiencies, and cost to 45% determine the "strength" of selected management alternatives. To achieve phosphorus control, it was recommended that berming of pasture lands and commercial/residential detention/retention should be given high priority for construction.

PUBLICATIONS: WANIELISTA, M.P., YOUSEF, Y.A., HARPER, H.H., BALDWIN, B.L., and ZAHM, A.D. Stormwater Management for Lake Tohopekaliga Watersheds, February 1982.

WANIELISTA, M.P., REEL, S., DOWLING, A., and ZAHM, A. "Methodology for the Choice of Stormwater Management," ASCE Florida Section/South Florida Section Annual Meeting, Orlando, FL, September 2-5, 1982.

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TITLE: Effects of Bridging on Biological Productivity and Diversity in the Floodplain

PRINCIPAL INVESTIGATORS: Y.A. Yousef, M.P. Wanielista and H.H Harper

SPONSORING AGENCY: State University System & Florida Department of Transportation

GRANT NUMBER: UCF 21-1620-001

A B S T R A C T

Three bridge sites in Central Florida (I-4 and Padgett Creek, U.S. 17-92 and Shingle Creek, and U.S. 192 and Shingle Creek) were selected to study: (1) the feasibility of treating highway runoff by floodplains beneath these bridges, and (2) the impact of bridging on biological



diversity and productivity. Soil and plant samples were collected from bridge areas affected by highway runoff along with control areas upstream and downstream of the bridge areas. These samples were analyzed for extractable heavy metals, (Pb, Zn, Fe, Cu, Ni, Cr and Cd) to study the retention capacity of these metals by floodplain areas. Soil samples collected from the bridge areas contained significantly higher metal concentrations, particularly Pb, than the control areas. Metals were fixed in the soil and may be released to the surrounding body of water by highly acidic environments, organic chelating agents, and erosion processes.

Plants were also surveyed to determine the dominant species, changes in diversity, and productivity at the bridge and control areas. Additionally, bioassay experiments were designed to examine the potential impact of mixing highway bridge runoff and water from adjacent streams on algal production. There were more individuals of common plant species at the bridge areas than the control areas of all sites surveyed. Bridge areas, however appeared to be dominated by fewer species than the control areas.

The project has been completed and a final report has been published.

PUBLICATIONS: Y.A. Yousef, M.P. Wanielista, H.H. Harper and E.T. Skene, "Impact of Bridging on Floodplains" presented before the Annual Meeting of Transportation Research Board, Washington, D.C., January, 1983. Also in print for TRB Series.

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TITLE: Hazardous Organic Vapors  
PRINCIPAL INVESTIGATOR: Dr. C.D. Cooper, P.E.  
SPONSORING AGENCY: EIES  
GRANT NUMBER: 21-1699-036

A B S T R A C T

Incineration is an increasingly useful means of disposing of hazardous organics. Partialled combusted vapors of hazardous materials can be burned to extinction in a vapor incinerator or afterburner. The kinetics of the reactions in the post-flame gases are crucial to the proper design and operation of a vapor incinerator. This recently completed project provided funds for acquisition and assembly of the components for a bench scale vapor incinerator and appropriate analytical equipment.

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TITLE: Sinkhole Modeling  
PRINCIPAL INVESTIGATOR: Dr. J.P. Hartman  
SPONSORING AGENCY: EIES  
GRANT NUMBER: 21-1699-027

This project studied two different factors within current thinking regarding the formation of sinkholes. A review of historical records was completed to fill in gaps prior to 1960 with respect to sinkhole formation in the Orlando area. The study showed that such formation is more of a function of groundwater withdrawal than season alone since the historical records show very little recorded sinkhole activity from 1940-1960 compared to 1970-1980. Studies are also being made to consider the possibility of dynamic piping due to vertical groundwater gradients which cause loss of soil in the unconsolidated materials above the limestones. This loss of soil could also be a mechanism for sinkhole collapse and can be quite dramatic even if it is a relatively shallow phenomenon and not in the deeper limestone deposits.

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TITLE: Sinkhole Detection by Geophysical Methods and Geotechnical Explorations  
PRINCIPAL INVESTIGATOR: Dr. S.S. Kuo, P.E.  
SPONSORING AGENCY: UCF-In-House Award



GRANT NUMBER:

28-2000-081

A B S T R A C T

In Florida, the soil overlying the limestone layer is mostly permeable sand which promotes rainfall infiltration, enhances the recharging process and causes very large underground cavities to form. These large cavities account for the many lakes formed from sinkhole collapse in Florida.

There are no definite methods which can detect underground cavities under every set of conditions. However, many available methods can detect cavities under specific circumstances. The four main methods including its tool are listed as follows:

1. Remote sensing - aircraft, high altitude (U2), manned space.
2. Surface Geophysical Method - seismic, resistivity, gravity, ground radar, electromagnetics, magnetics.
3. Subsurface Geophysical Method - downhole and hole to hole seismic waves, gravity, and radar. Borehole cameras, video, scanning sonar, and resistivity.
4. Geotechnical Methods - drilling, augering, seepage and groundwater measurements.

Geologic features are also important factors in cavity detection. Fracture patterns, soil type, condition of vegetation, piezometric level, overburden depth, and recent sinkhole activity are all indicators of subsurface cavity formation.

Research is needed to determine which detection methods are most effective in the Central Florida area. Also the creation of a computer database would be helpful in cataloging sinkhole statistics and could be used to predict future trends in sinkhole occurrence.

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TITLE: Winter Park Sinkhole Investigation by Geophysical and Geotechnical Methods

PRINCIPAL INVESTIGATOR: Dr. S.S. Kuo, P.E.

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-037

A B S T R A C T

The area of Central Florida is especially prone to sinkhole occurrence due to termination of the faults that extend northeast through Seminole County. The topography and soils, route runoff to the faults which initiate the dissolving of limestone. The factors compounded by an extended period of below average rainfall that lowered the natural water



table in the area made conditions ideal for the occurrence of a sink of the magnitude of the Winter Park Sinkhole.

The investigation of subsurface cavity must take into account the physical geologic and hydraulic conditions, the cavity size and spatial distribution. Once a subsurface cavity has been identified, then a method must be selected for given circumstances.

The common methods for subsurface cavity detection are remote sensing, surface and subsurface geophysical methods and geotechnical explorations. Each method has different techniques and no one definite method is fail-safe or best for all conditions. A comprehensive research study of the Winter Park Sinkhole would be a beneficial guide to detection and identification methodologies of a future sink in the area and anywhere similar conditions exist.

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TITLE: A Design Method to Prevent Rutting and Shoving  
for Bituminous Concrete Pavements

PRINCIPAL INVESTIGATOR: Dr. S.S. Kuo, P.E.

SPONSORING AGENCY: UCF In-House Award

GRANT NUMBER: 28-2000-113

A B S T R A C T

Bituminous cement will flow under static load eventually leading to rutting and shoving in the surface. Rutting and shoving bituminous pavements are frequently seen on heavy traffic intersections in urban areas, especially in the warmer climate like Florida. Most design procedures for selecting the bituminous mixture and thickness for predicting the pavement life are based on the average daily traffic (ADT) per lane. The important parameters such as wheel or axle load distribution, braking, accelerating, turning, tire pressure, and number of load applications are actually the predominant factors for design criteria.

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- PUBLICATIONS: KUO, S.S. "Analysis of Flexible Pavement on the Basis of Simple Deflection Basins Measured by Benkelman Equipment," A paper presented at the ASCE 1982 - Joint Florida/South Florida Annual Meeting, Orlando, Florida. September 2-5, 1982.
- KUO, S.S. "Detection of Sinkholes by Geophysical Methods and Geotechnical Exploration," A final report submitted to UCF In-House Research Award, Grant 28-2000-081. May, 1983.
- KUO, S.S. "Geotechnical Engineering Investigation and Design on Winter Park Sinkhole," A final report submitted to the Engineering and Industrial Experiment station, Grant 221-1699-037. May, 1983.

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TITLE: Exploration of Criteria for a Fixed Guideway Transit System between Tampa and Orlando

PRINCIPAL INVESTIGATOR: Dr. D.S. Leftwich, P.E

SPONSORING AGENCY: EIES

GRANT NUMBER: 21-1699-058

#### A B S T R A C T

This was a partial (20%) 6-month study to investigate the feasibility of a fixed line transit service between Tampa and Orlando. Increased tourist traffic combined with the expanding base population of Central Florida have made this area a testing ground for new ideas in transportation. At present, studies are being conducted by Japanese and Canadian engineers to project ridership and other market data in the corridor between Tampa and Orlando. Existing studies have shown potential for a fixed guideway system between Tampa and Orlando, although patronage of this system does not seem to be cost effective between Orlando and Tampa unless a larger modal split of the person trips utilizes the fixed rail system.



DEPARTMENT OF CIVIL ENGINEERING & ENVIRONMENTAL SCIENCES

ABSTRACTS OF UNSPONSORED RESEARCH

TITLE: Pilot Plant Designs

PRINCIPAL INVESTIGATOR: Dr. John D. Dietz, P.E.

A B S T R A C T

Drawings and specifications were prepared for development of two pilot scale sedimentation units suitable for research concerning clarification/thickening of activated sludge. The units are nominally equal in depth to prototype systems, with flexibility for modification in depth, feed well design, and hydraulic loading. Development of dual units will permit side-by-side experimentation with a common source of slurry. Erection of the facilities has been initiated at a site adjacent to the UCF wastewater treatment plant to facilitate acquisition of slurry for experimentation.

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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 Engineer Works in Florida are made throughout the State. Talks on American Engineering Heritage and History are also given. Additional engineer/industrial works within the State are being sought.

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TITLE: The Effects of Science and Technology on  
Employment

PRINCIPAL INVESTIGATOR: Dr. R.D. Kersten, 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, and (c) the ratio of the R & D expenditures to the GNP. This model has been verified/authenticated using U.S. Census data for "technical engineers" for the period 1870 - 1980, 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. Four publications have been presented in prior years. Effort is continuing in connection with the Florida Department of Commerce Advisory Committee related to development of high technology strategy for Florida.

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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 design of low cost 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. Three publications, one thesis and one research report have been presented in prior years. Site visits to Guatemala and Honduras were made during the year.

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TITLE: Laboratory Equipment Needs in Engineering Education

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

#### A B S T R A C T

The Florida Deans of Engineering are cooperating in a small pilot study to determine useful "figures of merit" regarding instructional laboratory equipment. Overall, the objective is to develop several data photos of figures of merit vs. time for a pilot group of schools considering factors of size, complexity, research activity, number of accredited programs, etc. Analysis of inventory and annual expenditure data from the pilot group of schools has been completed. The final report was published in September 1983. Presentations of information derived from this study were made to (a) NSPE Annual Meeting (Omaha); (b) ASEE/SE Annual Meeting (Boca Raton); and (c) U.S. House of Representatives Committee on Banking, Finance and Urban Affairs.

PUBLICATIONS: KERSTEN, R.D. Engineering Education Problems: the Laboratory Equipment Factor, Report NSPE Professional Engineers in Education, September 1982.



KERSTEN, R.D. The Laboratory Equipment Factor, Proceedings  
ASEE/SE Annual Meeting, March 1983.

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TITLE: Analysis of Flexible Pavement on the Basis of  
Simple Deflection Basins Measured by Benkelmen  
Equipment

PRINCIPAL INVESTIGATOR: Dr. S.S. Kuo, P.E.

A B S T R A C T

The performance and life expectancy of flexible pavement are expressed by the magnitude of stresses, strains, and displacements developed within the pavement layer system. The change of the surface deflections due to load, material types, and environmental effects are used to evaluate the pavement performance and material characteristics. The in-situ moduli of granular base, sub-base and sub-grade materials are also determined from deflection basins using trial and error best fit processes from layered elastic theory computer program.

The development of this analysis method is based on the measurement of surface deflections by Benkelmen equipment, layered elastic theory, and limiting strains criteria.

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TITLE: Single Crane Optimization: A Graphical Approach

PRINCIPAL INVESTIGATOR: Dr. Walter E. Rodriguez-Ramos

A B S T R A C T

Development of a mathematical prescriptive model to establish the optimal location of a crane within a construction site. The objective function of the model is the minimization of the total transportation cost between construction supportive facilities that are serviced by the crane. The technique considers radial and angular movement for construction materials. A simple graphical procedure was developed to facilitate the use of the model. The model was tested on several Central Florida construction sites.

PUBLICATIONS: RODRIGUEZ-RAMOS, W. and R. FRANCIS. "Single Crane Location Optimization: A Graphical Approach," Journal of the Construction Division, ASCE, Submitted for publication, February 1983 (copy available from the author).

RODRIGUEZ-RAMOS, W. Construction Site Design, The Construction Industry Institute, Inc., Orlando, FL, 1982 (copy available from author).



DEPARTMENT OF CIVIL ENGINEERING & ENVIRONMENTAL SCIENCES

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS & THESES

TITLE: A Computer Method to Evaluate the Vibration Response of Stiffened Floor Systems to Impact Loads

CANDIDATE: Michael E. Donahue

FACULTY ADVISOR: Dr. Wayne E. Carroll, P.E.

A B S T R A C T

Composite construction of floor systems with steel joist or I-beam stiffeners supporting a concrete slab have a tendency to sustain perceptible vibration due to small impacts. An engineering design aid, utilizing a small micro-computer and a BASIC computer program, was developed to analyze rectangular floor systems for susceptibility to sustain vibrations perceptible to humans. The analytical method for the normal modes of vibration using the Rayleigh-Ritz method and the superposition of the normal mode response is derived. A vibration index is calculated to qualitatively rate the floor. The computer method was validated using published data for an I-beam supported concrete slab and a design application for a steel-joist supported floor is demonstrated using a representative human induced impact load.

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TITLE: The Effects of TOC on Settling Velocity and FLOC Formation Using Alum and Lime as Coagulants

CANDIDATE: Michael T. Dunn

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

A B S T R A C T

The settling characteristics of alum,  $\text{CaCO}_3$  and  $\text{CaCO}_3\text{-Mg(OH)}_2$  were studied for three drinking water sources: UCF (groundwater), Tampa (Hillsborough River), and Melbourne (Lake Washington). The analysis was performed at a constant temperature of  $10 \pm 1^\circ\text{C}$  and the pH was maintained constant for alum coagulation at  $6 \pm .2$  units.  $\text{CaCO}_3$  and  $\text{CaCO}_3\text{-Mg(OH)}_2$  precipitation was controlled by dosing the samples with  $\text{Ca(OH)}_2$  and  $\text{Na}_2\text{CO}_3$  to a pH  $< 10.6$  for  $\text{CaCO}_3$  precipitation and a pH  $> 11.3$  for  $\text{CaCO}_3\text{-Mg(OH)}_2$  precipitation. The quantity of calcium and magnesium precipitated was determined by titration with EDTA.

Particle size was measured using a Coulter Counter Model TA-II. Measurements were taken immediately after the slow mix phase ( $T = 0$  min) and at the end of the sedimentation phase ( $T = 20$  min). Two liter square beakers were used to extract samples for turbidity measurements at various time intervals. These turbidity measurements were used to plot percent turbidity versus the settling velocity on log-probability paper. The rate of turbidity removal was greater for the high TOC waters (Hillsborough



River and Lake Washington) than for the low TOC water (UCF). Particle size was greater in the high TOC waters for alum. Particle size was also greater in the high TOC waters for CaCO<sub>3</sub>. Settling velocity of CaCO<sub>3</sub> and CaCO<sub>3</sub>-Mg(OH)<sub>2</sub> was greater in the low TOC water.

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TITLE: On-Site Excreta Treatment and Disposal  
CANDIDATE: Godfrey E. Igbokwe  
FACULTY ADVISOR: Dr. Yousef A. Yousef, P.E.

#### A B S T R A C T

Wastewater collection, treatment and disposal is well developed in the industrialized countries. This is not the case for the developing and underdeveloped countries consisting of more than two-thirds of the world's population. Many areas in these countries are lacking the very basic sanitary facilities. Therefore, it is hoped to provide information on those principles and practices for on-site excreta treatment and disposal that are most likely to be used in those underdeveloped countries in Africa, with particular reference to Nigeria.

This study was directed to: (1) examine the literature on waste disposal systems in these countries, (2) determine the operating problems, and (3) determine alternative and economically more feasible systems with minimum environmental impact.

This study concluded that well designed and maintained septic tanks with the narrow trench type soil absorption field would be more favorable than other existing and alternate systems. Also, the clivus multrium composting system appears to be a promising alternate.

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TITLE: Heavy Metals in Floodplains Receiving Highway Bridge  
Runoff  
CANDIDATE: Elizabeth T. Skene  
FACULTY ADVISOR: Dr. Yousef A Yousef, P.E.

#### A B S T R A C T

A study was supported by SUS/STAR to investigate the fate of heavy metals in bridge runoff which are received by surrounding floodplains. Three bridge sites in Central Florida were selected and various locations in each site were sampled. Soil, plant and water samples were analyzed for Cd, Zn, Cu, Fe, Pb, Ni and Cr. Statistical analysis of results for heavy metal content of plants and soils at control versus bridge sampling areas were conducted. In agreement with other investigators, Pb was found to be a good indicator of highway pollution in soil, plants and water.



Possible mechanisms for metal sorption were developed from laboratory sorption experiments. Soil capacities for lead increased with increasing pH, organic content, and soil buffering capacity. Also, information about the types of heavy metal compounds in a floodplain was obtained using various extraction solutions.

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TITLE: Concrete, Its History in Florida to World War II  
CANDIDATE: John M. Weavil  
FACULTY ADVISOR: Dr. J. Paul Hartman, P.E.

#### A B S T R A C T

Early concrete structures in Florida were built of tabby, a primitive concrete made with hydraulic lime, oyster shell and water. Cuban masons and lime burners brought the knowledge of lime making to Florida when recruited by the Spanish to build the Castillo de San Marcos in St. Augustine, Florida in the late 1600's. Tabby was used by Florida's plantation owners in the late 1700's and 1800's and remains of tabby plantation homes and slave quarters can be found throughout the state.

The invention and manufacture of portland cement in the late 1800's supplied the builder with a cement which provided a stronger and more durable concrete. Franklyn Smith's portland cement concrete house, built in St. Augustine in 1885, and Henry Flagler's adoption of concrete for use in constructing his St. Augustine hotels began a building trend that produced buildings still in use today. Flagler's railway extension used miles of concrete viaducts from the Florida mainland to Key West, Florida.

Concrete ships were built in Jacksonville during World War I and during Florida's land boom of the 1920's, concrete highway and reinforced concrete frame buildings gained in popularity. Florida's early subdivisions were dominated by concrete masonry homes.

Concrete has not only played an important role in the growth and development of Florida, but also in preserving much of its history.

\* \* \* \* \*

TITLE: A Computer Model to Determine Location of Stormwater Management Practices  
CANDIDATE: Alan D. Zahm  
FACULTY ADVISOR: Dr. Martin P. Wanielista, P.E.

#### A B S T R A C T

To optimize the placement of stormwater management systems, a Radio Shack BASIC computer program "SELECT" was written. The program selects locations for berms, detention ponds, retention ponds, and underground



percolation tanks based upon minimum marginal cost (total present value cost per pound of nutrient removed annually). Either nitrogen or phosphorus can be chosen as the selected nutrient. The selections occur until the desired percentage removal is obtained. Five output tables show the results of the selection process.

The computer model was used to evaluate stormwater management locations for the Lake Tohopekaliga watershed in Florida. Input data consisting of soil types, land costs, and construction costs were obtained. "SELECT" was run to determine stormwater management locations for different nitrogen and phosphorus percentage removals. Sensitivity analyses upon land costs, nutrient loading, and removal efficiencies for the 45 percent removal cases of nitrogen and phosphorus were evaluated.



DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATIONS SCIENCES

DEPARTMENTAL REPORT

Chairman: B.E. Petrasko

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

The Electrical Engineering and Communications Sciences Department consisted of eighteen faculty members during the 1982-83 year. One hundred and one B.S.E. students and 13 M.S.E. and M.S. students obtained degrees in this period; and three Ph.D. students successfully completed the first offering of Ph.D. Qualifying Exam in the EECS program.

Enrollments continue to increase with 786 students in attendance in the Spring Semester.

The departmental teaching and research laboratories were improved substantially with the addition of approximately \$450,000 of capital equipment. Space in the Engineering Building, formerly occupied by the Psychology Department, was converted to microelectronics laboratories.

Major equipment donations by Martin Marietta, Piezoelectric Technology Inc., Harris Corporation and SAWTEK were supplemented by newly purchased equipment and facility enhancements to form the nucleus of a modern fabrication facility. A microelectronics fabrication course was offered for the first time in the Spring Semester. Network analyzers were purchased to support the advanced teaching and research programs in microwaves, electro-optics and microelectronics.

In addition, the core, communications, digital systems, and electro-optics laboratories were significantly improved in both number of stations and features per station.

The design of laboratories for the new Engineering Building, scheduled for ground breaking in the Fall of 1983 was completed in the Spring Semester. Separate laboratories for circuits, electronics, communications, digital electronics, digital systems, electro-optics and senior design will provide more than a three-fold increase in instructional laboratory space.

The scope of the research effort in the EECS department continues to include digital communications, multi-processor simulation, linear system response and fault tolerancing, multiaperture seeker systems, robotic vision, SAW devices and applications, real time simulation of dynamic models, computer image generation, electro-optics, and microprocessor based training systems.

The EECS faculty presented papers and supported a number of major conferences held in the Orlando area. These included SOUTHCON-83, and the IEEE Computer Society's Tutorial Week East National workshop on Fiber



Optics was hosted at UCF by the EECS department. In addition, Drs. Simons and Harden continued presenting workshops on the efficient utilization and on advanced applications for hand-held calculators.

The EECS faculty continues to provide service to the region and the state. Dr. Walker is president of the Board of Trustees, Cape Canaveral Hospital. Drs. Phillips and Walters serve on the Committee on Physical Science of the John Young Science Museums. Dr. Petrasko and Mr. Belkerdid are members of the Telecommunications Task Force for the Florida Joint Legislative Committee on Electronic Data Processing. Faculty have also made presentations at public schools in the Orlando area.



DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATIONS SCIENCES

PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

Articles Published

International Journals (Peer-Refereed)

1. Harden, R.C. and Simons, F.O., Jr., "A Compact Card Guide and Program for Your HP-41C," published in IEEE POTENTIALS, a magazine for engineering students, Winter 1983, pp. 27-29.
2. Harden, R.C. and Simons, F.O., Jr., "Laplace and Z Transform Solutions of Differential and Difference Equations with the HP-41C," Computers in Education Division of ASEE, Vol. III, No. 1, January 1983 Journal.
3. Harden, R.C. and Simons, F.O., Jr., "Laplace and Z Transform Solutions of Differential and Difference Equations with the HP-41C," Proceedings of the 90th ASEE Annual Conference, Texas A & M College Station, Texas, June 19-24, 1982.
4. Malocha, D.C. and Gopani, S., "Broadband Analysis of SAW 3-Phase Low Loss Filters," IEEE Sonics and Ultrasonics Symposium Proceedings, October 19 82.
5. Mathews, B.E. and Walters, R.A., "Random Effects on Multiple Aperture Element Density," Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 17-19, 1983.
6. Phillips, R.L. and Andrews, L.C., "Universal Statistical Model for Irradiance Fluctuations in a Turbulent Medium," J. Optical Soc. of Am. Vol. 72. No. 7, July 1982, pp. 864-870.
7. Gopani, S.G., Phillips, R.L., and Andrews, L.C., "A Theoretical and Experimental Comparison of Output Signal-to-Noise Ratios of Three Types of Cross-Correlators," IEEE Trans on Acoustics, Speech, and Signal Processing, Vol. ASSP-31, No. 1, February 1983, pp. 202-205.
8. Phillips, R.L., and Andrews, L.C., "Spot Size and Divergence for Laguerre Gaussian Beams of Any Order," Applied Optics, Vol. 22, No. 5, March 1, 1983, pp. 643-644.
9. Phillips, R.L. and Andrews, L.C., "Analysis of Noise in Phase Detection in a Fiber Optic Rate Sensor," Fiber-Optic Rotation Sensors, S. Ezekiel and H.J. Arditty (Eds.) Springer-Verlag, Berlin (1982) pp. 357-361.
10. Simons, F.O., Jr., and Harden, R.C., "HP-41(s) Frequency Response Programs Based on New Optimized Algorithms," 14th Annual Pittsburgh Conference on Modeling and Simulation, University of Pittsburgh, Pennsylvania, April 21-22, 1983.



11. Walters, R.A. and Mathews, B.E., "Opposition Multiaperture Optical Systems Operating in Signature and Pseudo Space," National Aerospace and Electronics Conference, May 1983.
12. Kellogg, S.C., Walters, R., Phillips, R., et al., "Multiple Aperture and Single Aperture Optical Imaging System Comparisons for Correct Detection Probability and Resolution," Proceeding of the National Aerospace and Electronics Conference. Dayton, OH, May 17-19, 1983.



### Other Scholarly Works

1. Belkerdid, M.A., Harris, M.G., and Martin, R.J., "Experiments in Communications: Filtering and Modulation, UCF Bookstore, August 1982; Revised January 1983.
2. Litka, A.H., Co-author with Gobind Atmaram of FSEC, The FSEC: Final Report on Innovative Photovoltaic Application for Residences Experiment - June 1982. Published by Massachusetts Institute of Technology Lincoln Laboratory for U.S. Dept. of Energy DOE/ET20279-210 (Lexington, MA).
3. Malocha, D., Wagers, R., and Goll, J. Patent #4369390 Title: Synthetic Beam Width Compression Multi Strip Coupler, January 1983.
4. Patz, B.W., Blend Region Report for NTEC.
5. Patz, B.W., Identification of Advanced Simulation Research, Navy Task Force.
6. Phillips, R.L. and Andrews, L.C., "Temperature Fluctuations and Other Noise Sources and Their Effects on Fiber-Optic Gyros," Final Report to Martin Marietta (1983).
7. Marshall, Shaw, Bond, Towle, STAGS - TOW, Trainer, NTEC.
8. Girgis, Fairey, Ventre, and Walker, "Passive Solar Retrofit Techniques for Warm-Humid Climates," ASME Solar Energy Division, Orlando, April, 1983.
9. Doering, Beck, Fairey, Girgis, Hosni, Houston, Khattar, Ventre, Walker, "Passive Solar and Low-Energy Building Design," Final Report for Florida Public Service Commission, October 1982.
10. Walters, R.A., Patent Disclosure: (UCF-9/16/82), Title - Aspatial Sampled Multiaperture Optical Recognition System.

### International Meetings

1. Harden, R.C., and Simons, F.O., Jr. "Laplace and Z Transform Solutions of Differential and Difference Equations with the HP-41C," Proceedings of the 90th ASEE Annual Conference, Texas A & M College Station, Texas, June 19-24, 1982.
2. Malocha, D.C. and Gopani, S., "Laplace and Z Transform Solutions of Differential and Difference Equations with the HP-41C," IEEE Sonics and Ultrasonics International Symposium, October 1982. Abstracts are refereed.
3. Phillips, R.L. and Andrews, L.C., "Theory and Experiments on the Probability Density of the Irradiance in Atmospheric Turbulence," SPIE (Society of Photo-Optical Instrumentation Engineers) National Meeting, Washington, DC, April 4-8, 1983 (Invitation submitted by Ronald L. Fante, AVCO Systems Division, Wilmington, MA).



4. Phillips, R.L. and Andrews, L.C., "The Effects of Birefringent Fluctuations on a Fiber Optic Gyro," International Symposium on Optical Wave Guide Sciences, Kwinlin China, June 20-23, 1983.
5. Simons, F.O., Jr., and Harden, R.C., "HP-41H(s) Frequency Response Programs Based on New Optimized Algorithms," 14th Annual Pittsburgh Conference on Modeling and Simulation, University of Pittsburgh, PA, April 21-22, 1983.
6. Walters, R.A. and Mathews, B.E., "Apposition Multiaperture Optical Systems Operating in Signature and Pseudo Space," National Aerospace and Electronics Conference, May 1983.
7. Walters, R.A., Schrock, L.W. and Long, J.F., "Multiaperture Sensor with Software Decoded Focal Plane," Proceedings 1982 Spring Conference on Applied Optics/Gradient-Index Optical Imaging Systems, JOSA, Vol. 72, No. 8, August 1982.

#### Regional Meetings (Presentations)

1. Belkerdid, M.A. and Martin, R.J., "Pulse Width Modulated Delay Generator," Southeastcon, Orlando, April 15, 1983.
2. Malocha, D.C., "Surface Acoustic Wave Technology," IEEE Electron Device Society Meeting, January 1983, Orlando, FL.
3. Martin and Schaffer, "Pulse Width Modulated Biquad," Southeastcon, April 14, 1983, Orlando.
4. Martin and Belkerdid, "Pulse Width Modulated Delay Generator," Southeastcon, April 14, 1983, Orlando, FL.
5. Harris, Martin & Weeks, "A Technique for Improving the Common Mode Rejection Ratio in Instrumentation Amplifiers via Common Mode Feedback," Southeastcon, April 14, 1983, Orlando, FL.
6. Phillips, R.L. and Andrews, L.C., "Laser Lear Propagation through Atmospheric Turbulence," Optics and Applied Technology Laboratory, United Technologies, West Palm Beach, FL, November 1982.
7. Simons, F.O., Jr. and Harden, R.C., "Optimization Scaling of Dynamic Variables in Intel's 2920 Simulation," SOUTHCON/83, Atlanta, Georgia, January 18-20, 1983.
8. Simons, Jr., F.O., and Harden, R.C., "The Optimization of Algorithms for Calculator Programming," IEEE SOUTHEASTCON 83, Orlando, FL, April 11-14, 1983.
9. Simons, F.O., Jr., Weeks, A., and Kotick, K.M., "An Optimized Algorithm for Factoring Higher Order Polynomials on the Atari



Home Computer," IEEE SOUTHEASTCON 83, Orlando, FL, April 21-22, 1983.

10. Simons, F.O., "Utilization of Hand-Held Calculators as an Aid in Large-Scale Simulation," Fall, 1983 Regional SCS (Society of Computer Simulation) meeting in Huntsville, AL.
11. Walters, R.A., "Robotic Vision Using Spacial Optical Sampling," Proceedings of IEEE Southeastcon 1983, Orlando, FL, April 11-14, 1983.
12. Weeks, A., and Kotick, D.M., "An Optimized Program for Factoring Higher Order Polynomials on the Atari Home Computer." Southcon, Orlando, April 12, 1983.



DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATIONS SCIENCES

Seminars, Special Programs  
and Eminent Speakers

1. Seminar on Telecommunications Fundamentals. Presented as part of contract with Joint Legislative Committee on Electronic Data Processing, Summer, 1982. (Belkerdid).
2. Session Chairman, IEEE Southeast Conf. Orlando, FL, April 13, 1982. (Erickson).
3. Two regional Photovoltaic Short Courses at FSEC. (One day each) August 26, 1982: January 27, 1983. A third Short Course was offered April 28, 1983. (Litka).
4. NTEC High Technology Briefing, March 1983. (Malocha).
5. Southeastcon-83, Computer Software, Session Chairman. (Petrasko).
6. Short course entitled "Fiber Optics" 48 professional students, UCF, January 4-6, 1983. (Phillips).
7. 4-week microprocessor course at Nanjing Aeronautical University, Nanjing, People's Republic of China. (Towle).
8. Photovoltaics Workshops, Florida Solar Energy Center, January 1983, April 1983. (Walker).
9. A pre-conference workshop on the Efficient use of Hand-Held Computers, 90th ASEE Annual Conference, Texas A&M College Station, Texas, June 19-24, 1982. A post-conference workshop on Digital Signal Processing followed. (Simons).



DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATION SCIENCES

ABSTRACTS OF SPONSORED RESEARCH

TITLE: Computer System Programming and Data Management Aids  
PRINCIPAL INVESTIGATOR: Dr. E.E. Erickson, P.E.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-033

A B S T R A C T

The Computer Systems Laboratory of the Naval Training Equipment Center is performing research and development in the use of computers for simulation and training. Development and/or modification of computer programs for the VAX 11/780 are required in support of the R & D. Existing programs will be modified or new programs developed as necessary for use in analysis of data, for the conversion of data received from various sources, and to interface the VAX 11/780 computer to special purpose hardware devices.

\* \* \* \* \*

TITLE: Multiple Microcomputer Control  
PRINCIPAL INVESTIGATOR: Dr. E.E. Erickson, P.E.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-046

A B S T R A C T

The Computer Systems Laboratory of the Naval Training Equipment Center is performing Research and Development in the use of computers for simulation and training. A multiple microcomputer control concept will be investigated. Documentation of the multicomputer system will be reviewed, hardware modification will be performed as required, and a Bus Arbitration Logic will be incorporated in software of firmware.

\* \* \* \* \*

TITLE: Bidirectional Surface Acoustic Wave Transducer Study  
PRINCIPAL INVESTIGATOR: Dr. Donald C. Malocha  
SPONSORING AGENCY: Texas Instruments, Inc., Dallas, Texas



GRANT NUMBER: 28-2000-126

A B S T R A C T

The purpose of this study is to provide the fundamental elements for a CAD system for accurate design and analysis of bidirectional transducers. There are five principal tasks to be accomplished: (i) CAD system architecture, (ii) filter synthesis, (iii) graphics, (iv) bidirectional transducer center frequency characterization and (v) the broadband transducer frequency response. These tasks have been successfully completed and are described. Documentation, computer programs, references and examples are provided. This study provides a cornerstone on which a comprehensive CAD system can be implemented.

\* \* \* \* \*

TITLE: Intermediate Planes Applied to Existing CIG Systems  
PRINCIPAL INVESTIGATOR: Dr. Benjamin W. Patz  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-051

A B S T R A C T

The intermediate projection plane approach offers a method for rapidly projecting increased scene detail by increasing the computer's memory while decreasing the computational burden. This is accomplished by computing segments of the scene only one time for use in a large number of display frames. Hence, the scene data base is not recommended at the display rate. The pre-computed scene segments need only be projected to the new viewing window.

\* \* \* \* \*

TITLE: Study of OIS Conferenced Digital Communication  
PRINCIPAL INVESTIGATOR: Dr. B.E. Petrasko  
SPONSORING AGENCY: NASA  
GRANT NUMBER: 20-16622-001

A B S T R A C T

The study is supporting the design and development of a digital Operational Intercom System (OIS) for the launch and industrial complexes at the John F. Kennedy Space Center. The study investigates architectures for digital switching with a high degree of conferencing. The study also investigates the integration of fiber optics in the distributed switching system and algorithms for companded code addition and volume control. A test bed and prototyping facility is being constructed for investigation of



switch concepts and components.

\* \* \* \* \*

TITLE: Fiber Optic Gyro  
PRINCIPAL INVESTIGATORS: Dr. Ronald L. Phillips and Dr. Larry C. Mathews  
(Mathematics Department)  
SPONSORING AGENCY: Martin Marietta  
GRANT NUMBER: 20-1622-022

A B S T R A C T

The effects of reduced optical coherence induced by optical scattering in the optical fiber and laser fluctuations were mathematically modelled for Sagnac interferometer rate sensors. Also, the deleterious effects of birefringence fluctuations in the optical fiber were mathematically modelled and the resulting minimum detectable rotation determined. The mean rotation ratio was calculated when the optical field had an additive optical noise component.

\* \* \* \* \*

TITLE: Shock Wave  
PRINCIPAL INVESTIGATORS: Dr. Ronald L. Phillips  
Mr. Madjid Belkerdid  
SPONSORING AGENCY: Naval Research Laboratories  
GRANT NUMBER: 20-2100-019

A B S T R A C T

Optical fiber connectors were tested for pressure and shock using the shock tube facility developed by the Mechanical Engineering Department at the University of Central Florida. The connectors were tested for pressures up to 5000 psi and shock waves with peak pressures of 10,000 psi.

\* \* \* \* \*

TITLE: VAX 11/780 Computer Graphics Software Development  
PRINCIPAL INVESTIGATOR: Dr. Fred O. Simons, Jr.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-049

A B S T R A C T



Computer Image Generation (CIG) devices, which support modern real-time trainer simulators, require unique software support. For economic reasons and performance constraints, standardized common "object generation modules" must be adapted to utilize raw typological data base information for generating realistic dynamic scenes.

\* \* \* \* \*

TITLE: CIG (Computer Image Generation) Interface Requirements  
PRINCIPAL INVESTIGATOR: Dr. Fred O. Simons, Jr.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-047

A B S T R A C T

The Computer System Laboratory at NTEC has a requirement to interface a VAX 11/780, LSI 11/23, and an IKONAS frame buffer display unit, all of which will be used in training systems studies. This study is devoted to developing the utility programs required to support an effective integrated system.

\* \* \* \* \*

TITLE: ASW (Anti-Submarine Warfare) Software Models  
PRINCIPAL INVESTIGATOR: Dr. Fred O. Simons, Jr.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-030

A B S T R A C T

The NTEC Computer Systems Laboratory is developing an ASW Research Facility for use in demonstrating various ASW training approaches and techniques. To support this work, special-purpose software generation/documentation architectural studies will be conducted.

\* \* \* \* \*

TITLE: Software for Visual Technology Research Simulator--Convection Take-off and Landing Simulator and Vertical Take-off and Landing Simulator (CTOL/VTOL)  
PRINCIPAL INVESTIGATOR: Dr. Fred O. Simons, Jr.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-037



A B S T R A C T

The Visual Technology Research Simulator serves as a testing facility for research and development in visual simulations for flight simulators. NTEC is conducting research into Conventional Takeoff and Landing (CTOL) and Vertical Takeoff and Landing (VTOL) flight simulator visual systems. The CTOL simulation is being modified to include air-to-surface weapons and the VTOL simulation is being modified to a Seahawk configuration. These modifications efforts require new software tools, modification of existing simulation software and analysis and documentation of existing software.

\* \* \* \* \*

TITLE: Real-Time Video Tape Generations  
from a CIG Data Base

PRINCIPAL INVESTIGATOR: Dr. Fred O. Simons, Jr.

SPONSORING AGENCY: Naval Training Equipment Center

GRANT NUMBER: 20-2100-052

A B S T R A C T

This effort is devoted to generating real-time video training scenes of what a pilot would see while docking a ship. The ship's equations of motion will be used to establish scenes in a CIG data base space. These scenes will be processed via an IKONAS frame buffer and recorded with an AMPEX Electronic Still Store video system.

\* \* \* \* \*

TITLE: Anti-Armor Support

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

SPONSORING AGENCY: Naval Training Equipment Center (NTEC)

GRANT NUMBER: 20-2100-060

A B S T R A C T

This contract is a continuation of the multiprocess system implementation described under STAGS Development Assistance.

PUBLICATION: A.H. Marshall, H.C. Towle, et al. NTEC, 1982, TOW Antitank Weapons Trainer -- STAGS (T)

\* \* \* \* \*

TITLE: STAGS Development Assistance

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



SPONSORING AGENCY: Naval Training Equipment Center (NTEC)

GRANT NUMBER: 20-2100-053

A B S T R A C T

This research resulted in the implementation of a multiprocessor system to provide real time simulation of the TOW missile during a training exercise and the subsequent analysis of the trainee's performance.

PUBLICATION: Simulated Tank Anti-Armor Gunnery System (STAGS-T) A.H. Marshall, H.C. Towle, et al., NTEC, 1983.

\* \* \* \* \*

TITLE: FSEC Walker Salary

PRINCIPAL INVESTIGATOR: Robert L. Walker

SPONSORING AGENCY: Florida Solar Energy Center

GRANT NUMBER: 21-1622-001

A B S T R A C T

Further improvements were required in instrumentation in the photovoltaic house and in passive-cooling studies, both at the Passive Cooling Laboratory at FSEC and in six modified homes in Orlando.

\* \* \* \* \*

TITLE: FSEC Walker Salary II

PRINCIPAL INVESTIGATOR: Robert L. Walker

SPONSORING AGENCY: Florida Solar Energy Center

GRANT NUMBER: 21-1622-002

A B S T R A C T

Calibration of all instruments at the photovoltaic house was required. Design of a battery controller for energy storage at the house was carried out and tested.

\* \* \* \* \*



TITLE: Analysis and Design of Low Loss 3-Phase  
Unidirectional Surface Acoustic Wave Transducers  
PRINCIPAL INVESTIGATOR: Dr. Donald C. Malocha  
SPONSORING AGENCY: UCF-EIES  
GRANT NUMBER: 21-1699-063

A B S T R A C T

The purpose of this project was four fold in nature.

To develop an accurate model which predicts the overall filter response. This includes accurate predictions of the acoustic UDT's which surpass the present model by including the acoustic susceptance as given by the Hilbert Transform, modeling of the substrate parameters for the delay path, and inclusion of an accurate triple transit model.

To take the model and develop computer programs for CAD of the total filter. This capability will be unique to both industry and university.

To obtain results which advance the current state of the art for low loss UDT filters. The accomplished results will be published.

To obtain outside funding for continued research and development in this area. Funding for modeling of SAW conventional transducers for \$27,000 was obtained for the Fall '82 and continued support will be solicited.

\* \* \* \* \*

TITLE: Microelectronic Systems  
PRINCIPAL INVESTIGATOR: Dr. Donald C. Malocha  
SPONSORING AGENCY: UCF-EIES  
GRANT NUMBER: 21-1699-045

A B S T R A C T

The purpose of this project was to investigate a general class of micro-electronic systems which can prove fruitful to the Electrical Engineering and Communication Sciences Department. The proposed tasks included researching of the current and past work, establishing equipment and facilities in the micro-electronics area, and defining areas of research and funding. The areas pursued reflected the expertise of the faculty and the resources available. The department currently has



funded projects in the optics and acousto-electronics areas and continued work in these areas will be presented.

\* \* \* \* \*

TITLE: Realscan Algorithm Refinement  
PRINCIPAL INVESTIGATOR: Dr. Benjamin W. Patz  
SPONSORING AGENCY: UCF-EIES  
GRANT NUMBER: 21-1699-044

A B S T R A C T

The University of Central Florida has developed the REALSCAN computer image generation (CIG) algorithms under contract to NAVTRAEQUIPCEN. The goal of this research is to provide a real time CIG system capable of producing high detail terrain imagery for visual simulation in flight training. The results of a real time system hardware design indicate that the algorithms utilized need to be made more efficient before hardware implementation is viable.

\* \* \* \* \*

TITLE: Random and Ordered Data Processing Techniques  
for Multiaperture Optical Sensors  
PRINCIPAL INVESTIGATOR: Dr. Roy Walters  
SPONSORING AGENCY: UCF-EIES  
GRANT NUMBER: 21-1699-038

A B S T R A C T

The advent of the Gradient Index lens (GRIN) has made possible the application of the fly's eye concept to miniature optical systems. In this work a totally random array of lenses was coupled via fiberoptic techniques to a linear array detector. The sensor was literally taught where objects in its field of view were located and later polled as to a best estimate at the location of an observed target. Techniques involving perfect alignment of images were not used here because they are extremely difficult to implement. In support of this approach is the fact that the ultra efficient insect eye cannot image its target due to the lack of adequate numbers of detectors and must use some kind of parallel processing in order to perceive presence and movement of targets. Thus, the goal of this research is, "to develop the technology of the highly efficient multiaperture electro-optic sensor while not being influenced by the traditional goal of generating a human eye equivalent perfect image."

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DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATION SCIENCES

ABSTRACTS OF UNSPONSORED RESEARCH

TITLE: Establishment of a Surface Acoustic Wave Research Capability

INVESTIGATOR: Dr. D.C. Malocha, P.E.

A B S T R A C T

The objective of this research proposal was to establish the capability to perform research in the area of Surface Acoustic Wave (SAW) devices and related areas at the University of Central Florida. In order to establish this capability two primary tasks were to be undertaken: the first was the initial set up of a thin film microelectronics laboratory and the second was the establishment of SAW Computer Aided Design (CAD) capability.

The program scope was to establish maximum capability in the device fabrication area with the available time and equipment constraints and also to establish a complete CAD design system capable of SAW design and analysis and production of a tape suitable for photomask generation.

\* \* \* \* \*

TITLE: Data Flow Systems

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

A B S T R A C T

Data flow processors are designed to recognize which of the instructions in its program memory are enabled, and all such instructions are dispatched to execution units as soon as resources are available. There is no notion of a single locus of control. If sufficient resources are provided, the processor can exploit all concurrency present in a program. The research involves a study of the interprocessor communication needs in a data flow system and switch structures to support these needs.

\* \* \* \* \*

TITLE: Optical Scattering Generated by Phase Screens

PRINCIPAL INVESTIGATOR: Dr. R.L. Phillips, and Dr. L.C. Andrews

A B S T R A C T

Optical scattering due to a phase screen is being investigated using a computer generated phase screen. The phase screen is made by exposing a film plate on a scanning microdensitometer system. The system scans the film plate with a HeNe laser while modulating the intensity of the laser with a random signal. The film plate is then developed. A laser beam is then shown through the plate and the plate translated. After passing



through the plate, the statistics of the scattered laser beam are measured. This experiment simulates the problem of a laser radar on a microwave radar signal propagating through local atmospheric turbulence.

\* \* \* \* \*

TITLE: Theory of Cross Correlation Applied  
to Two Dimensional Images

PRINCIPAL INVESTIGATORS: Ms. Linda Coulter and Dr. R.L. Phillips

#### A B S T R A C T

The research is to experimentally investigate via simulation the theory of cross correlation applied to two dimensional images.

The problem assumes a two dimensional narrow band, noise model. This model has been scanned with the data stream placed in arrays. The noise files can be formed using the random number generator on computer.

The correlation process between two input images is performed by shifting one noise array relative to another. The adjacent points of both arrays are multiplied together. The results at each delayed position are then accumulated. The points are accumulated according to a criteria equivalent to low pass filtering.

\* \* \* \* \*

TITLE: Fiber Optic Accelerometer

PRINCIPAL INVESTIGATORS: Mr. Steven Furlong and Dr. R.L. Phillips

#### A B S T R A C T

A fiber optic accelerometer is being designed. The fiber is wrapped around two cylinders, each cylinder being connected to the interior opposite walls of a box. As the box accelerates in a direction parallel to the axis of the cylinders, one cylinder elongates while the other compresses. The laser light beams propagating in the fibers wrapped on each cylinder are then phase shifted in opposite directions. The beams are then combined at the output of the fibers and the phase shift measured by digital circuits.

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TITLE: Noise Analysis of Multi-aperture  
Optical Tracking Systems

PRINCIPAL INVESTIGATORS: Mr. Steven Kellogg and Dr. R.L. Phillips

#### A B S T R A C T

This research will develop a mathematical model for a multiple or distributed aperture optical system that will predict quantitatively the behavior of system parameters such as SNR, field of view, resolution, and



positional accuracy as a function of variations in the number, arrangement, and focal length of the apertures.

The following steps will be used to achieve the final conclusions: (1) Analysis of a single large aperture: (2) Analysis of multiple apertures mounted in the same plane and having equal focal lengths; (3) Analysis of multiple apertures mounted in different planes and having different focal lengths so they share the same focal plane; (4) Analysis of multiple apertures in different planes with varying focal lengths and focal planes.

The analysis will assume a point source of light is being tracked and that there is a given number density of sensors at the focal plane for each aperture which have a threshold sensitivity above which they indicate the presence of an image and below which they indicate the absence of the image.

\* \* \* \* \*

TITLE: Spread Spectrum Communication System Analysis

PRINCIPAL INVESTIGATOR: Dr. D. Malocha, P.E. and Mr. Madjid Belkerdid

#### A B S T R A C T

Spread Spectrum Communication is getting more and more popular in today's technology. The technique most commonly used is MSK (minimum shift keying). The MSK modulation signal is a constant amplitude carrier with frequency (either  $f_1$  or  $f_2$ ) conveying information. The phase of this carrier remains continuous while the frequency changes (from  $f_1$  to  $f_2$ ). MSK can be thought of as a special quadrature phase shift keying system (QPSK), with both channels having sinusoidal envelopes.

The objective of this research is to improve the sinusoidal envelope by introducing a new function: The Eigen function, the power spectrum of the Eigen function was proven to have much lower sidelobes than any other function used. It also looks like it might yield a better bit-error rate.

\* \* \* \* \*

TITLE: Laser Beam Control Study

PRINCIPAL INVESTIGATORS: Dr. R.L. Phillips and Dr. Larry C. Andrews

#### A B S T R A C T

When a laser beam propagates through the atmosphere, clear air turbulence can cause severe energy fluctuations within the beam as well as cause the beam to wander in toto. The statistical fluctuations are being mathematically modeled and the models verified experimentally in tests to be conducted at Kennedy Space Center.

\* \* \* \* \*



TITLE: Fiber Optic Modal Noise

PRINCIPAL INVESTIGATOR: Mr. Arthur Weeks and Dr. R.L. Phillips

A B S T R A C T

The noise generated in multimode optical fiber by the random interference of the simultaneously propagating modes was measured as a function of temperature and mechanical vibration. The average size of a single speckle cell was measured and compared to theoretical calculations. The speckle cell measurements were made by photographing via a microscope the random pattern emerging from the fiber and then measuring the pattern fluctuation on a scanning microdensitometer.

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DEPARTMENT OF ELECTRICAL ENGINEERING AND COMMUNICATION SCIENCES

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS & THESES

TITLE: Development of a 64 to 1 Monolithic Analog Multiplexer  
CANDIDATE: Vincent H. Angleton  
FACULTY ADVISOR: Dr. Robert Walker

A B S T R A C T

A 64 to 1 monolithic multiplexer for video signal switching applications was designed. The performance analysis and the testing of the first devices fabricated and packaged show close agreement in on channel resistance and on channel bandwidth. Other requirements, such as off channel isolation and output signal distortion, have poorer agreement in the calculated values versus the measured data. Arguments for these differences are presented.

\* \* \* \* \*

TITLE: A Real Time Microprocessor Based  
Digital Lead-Lag Compensation  
CANDIDATE: Vincente C. Garcia, Jr.  
FACULTY ADVISOR: Dr. Fred O. Simons, Jr.

A B S T R A C T

This paper attempts to determine a practical hardware digital lead-lag compensation implementation example using an Intel 2920 digital signal processing chip. The emphasis here is not on the choice and design of the digital lead-lag compensation, but is on the practical steps and use of available development aids to arrive at the software for the final hardware PROM 2920 instructions and necessary hardware for operation.

The paper assumes a knowledge of control theory and digital signal processing terminology and techniques. The software is developed with the aid of a programmable TI-59 calculator and an Intel microprocessor development system, hence, frequently the details of the design require knowledge of these systems.

Chapter I is a demonstration of arriving with an analog lead-lag compensation function for a plant to satisfy specifications. Included are the bode plots of the open loop plant transfer function, compensated open loop function, and an outline of lead-lag compensation design.

Chapter II is a demonstration of how to convert an analog to digital transfer function. Included are the set of coefficients for the digital lead-lag compensation transfer function, optimum binary representation of the coefficients, and a simulation diagram for the digital lead-lag



compensation.

Chapter III evaluates the digital lead-lag transfer function of correctness. Included are techniques for testing the frequency response and transient response for pulse and step inputs.

Chapter IV is an illustration of the development of software using development aids. Included is the sequence of events necessary to create a source program, assemble the program for debugging purposes and simulate the digital lead-lag compensation's response.

Chapter V illustrates the actual hardware necessary for an operational digital lead-lag compensation function. Included are several severe considerations in the final software version not discussed in sufficient detail in the literature and the designed clock, reference voltage and other specifications necessary for an operational Intel 2920 chip.

Chapter VI discusses the conclusions of the design and implementation of a real time digital lead-lag compensation. Included is the discussion of bit resolution and saturation problems.

\* \* \* \* \*

TITLE: Theoretical Modeling for Detectivity and Resolution Comparisons Single Aperture & Multiple Aperture Optical Imaging Systems

CANDIDATE: Steven Curtis Kellogg

FACULTY ADVISOR: Dr. Ronald L. Phillips

#### A B S T R A C T

The detectivity and resolution of single aperture and multiple aperture optical imaging systems are compared for single point sources in optically background limited environments. The single aperture system assumes a single large diameter lens with a detector array at the focal plane. The multiple aperture system assumes an independent detector array at the focal plane of each of the apertures of the multiaperture system. The multiaperture lenses are arranged in a rectangularly symmetric pattern within the perimeter that a single large aperture would occupy.

Due to the presence of a constant signal plus an optical noise field whose amplitude is Rayleigh distributed, Rician squared statistics are used to model the detector voltage random variable. The detectivity is analyzed assuming a detector optical amplitude threshold is chosen such that the signal is considered present when the optical amplitude exceeds threshold and considered absent when the optical amplitude falls below threshold. The optimum threshold is found to be given by

$$I_0 (AT/n^2) \approx \text{EXP}[A^2/ (2n^2)]$$

where  $(A^2/n^2)$  is the signal to noise power ratio,  $T$  is the optical amplitude threshold and  $I_0$  is the modified Bessel function of order zero.



Detector size is found to be the predominant factor in resolution, due to the minute size of an Airy disc image from a point source. The resolution angle ( $\gamma$  resolution) can be approximated by  $\gamma$  resolution =  $(A_e/f)$  where  $A_e$  is the distance between detector centers and  $f$  is the imaging system focal length.

Single aperture and multiple aperture systems are found to be equal in detectivity performance when optically background limited. For equal detector sizes and spacings, and equal imaging system focal lengths, multiple aperture systems are found to provide resolution improvement over single aperture systems. This resolution improvement depends on the overlap of the field of view between the detector arrays of the individual apertures in the multiple aperture system.

\* \* \* \* \*

TITLE: Personal Computer Simulation Program  
for Step Motor Drive Systems

CANDIDATE: William M. Koos, Jr.

FACULTY ADVISOR: Dr. R.C. Harden

A B S T R A C T

A system of equations modeling a class of step motors known as the permanent magnet rotor step motor is presented. The model is implemented on an APPLE personal computer in a version of BASIC. Measurements are then made on an existing motor and input to the program for validation. A special test fixture is utilized to take performance data on the motor to facilitate comparisons with the predictions of the program for validation. A special test fixture is utilized to take performance data on the motor to facilitate comparisons with the predictions of the program. The comparisons show the model is indeed valid for design of step motor drive systems and emphasize the practical nature of using personal computers and simulations for design.

\* \* \* \* \*

TITLE: The Performance of the 8089 Integrated I/O  
Processor in iAPX 86 Microprocessor Systems

CANDIDATE: Jeffrey A. Lohman

FACULTY ADVISOR: Dr. H.C. Towle

A B S T R A C T

The concept of an intelligent processor dedicated to performing low-level, device-dependent I/O activity originated in the 1960's with the peripheral processors in the CDC 6600 and the I/O channels in the IBM System/360. Intel Corporation's 8089 is an integrated I/O processor for iAPX 86 microcomputer systems. This thesis examines the performance of the 8089 through a predictive performance model for the I/O subsystem



architectures available to the designer of an iAPX 86 system. The model provides system throughput estimates and is intended to be used prior to any detailed design. Measurements of throughput on a demonstration system indicate that the model is very accurate. Model estimates are then combined with subsystem costs to evaluate the cost effectiveness of the 8089.

\* \* \* \* \*

TITLE: An Extension to the Best Numerical  
Integration Formula Development

CANDIDATE: Jorge Medina

FACULTY ADVISOR: Dr. Benjamin W. Patz

A B S T R A C T

A mathematical analysis seeking an accurate measure of the worth of numerical integration techniques used for real-time digital flight simulation problems is presented.

This investigation allows the subject of "best" integration methods to be pursued making emphasis on the choice of practical steps and the use of available mathematical techniques to illustrate and evaluate a potential root matching approach involving a selected first-order differential system.

This study allows certain evaluational techniques to be developed. Notable among these are the schemes for comparing roots of continuous integrators to roots of sampled integrators, the development of a predictor and of an iteration formula, and the creation of a computer program.

\* \* \* \* \*

TITLE: An Expandable Structure for a  
Conferencing Digital Switch

CANDIDATE: Timothy A Mitchell

FACULTY ADVISOR: Dr. Brian E. Petrasko

A B S T R A C T

This paper describes the switching portion of a digital communications system that is dedicated to conferencing. The basic ideas and methods of circuit switching and packet switching are introduced. The conferencing function is described, and several resulting design considerations are discussed. The architecture of the switch is then presented. Circuit switching and arithmetic processing is used to accomplish the conferencing function. The architecture is developed in such a way that it is expandable in all directions to meet a given set of requirements. The requirements include the number of users the system supports and the number of conference channels provided. The processing stages of the switch can



be sized based on these requirements and selected component speeds. The basic timing of each stage is given to describe its operation and establish the critical delay paths. The resulting switching architecture is then examined in terms of the circuit switching methods first introduced. The switch is also examined to see if it fits the criteria for being a distributed processing system. It is concluded that if a provision for dynamic reconfiguration is added, the switch fits the criteria. Finally, further topics of study are suggested.

TITLE: Design Methodology of Very Large Scale Integration

CANDIDATE: Ankushbarati Devraj Oberai

FACULTY ADVISOR: Dr. Brian E. Petrasko

#### A B S T R A C T

Very Large Scale Integration (VLSI) deals with system complexity rather than transistor size or circuit performance. VLSI design methodology is supported by Computer Aided Design (CAD) and Design Automation (DA) tools, which help VLSI designers to implement more complex and guaranteed designs. The increasing growth in VLSI complexity dictates a hierarchical design approach and the need for hardware DA tools.

This paper discusses the generalized Design Procedure for CAD circuit design; the commercial CAD's offered by CALMA and the Caesar System, supported by the Berkely design tools. A complete design of a Content Addressable Memory (CAM) cell, using the Caesar system, supported by Berkely CAD tools is illustrated.

\* \* \* \* \*

TITLE: Computer-Aided Filter Design Using Intel Software

CANDIDATE: Robert L. Olive II

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

#### A B S T R A C T

This paper demonstrates conversion of an analog filter into a digital filter using computer aided software. The filter design to be demonstrated is a common third order Butterworth filter. This paper is not an attempt to review all filter designs or applications, but rather the attempt is to give a detailed explanation of the steps required to design almost any digital filter.

No knowledge of the Intel Series 210 microcomputer development system is assumed. The appendices contain introduction to the Series 210 system.

Chapter I demonstrates the steps needed to design this filter without computer aid. Included are both analog and digital filter response characters.



Chapter II supplemented with Appendix C demonstrates the computer aided filter design. Again, filter characteristics are included.

Chapter III compares the results of Chapters I and III.

Even though this paper attempts to be inclusive of most of the computer details, it should not be used in exclusion of the available Series 210 manuals.

\* \* \* \* \*

TITLE: The Development of a Computer Aided Design Program for  
Constant Group Delay Monolithic Crystal Filters

CANDIDATE: Michael A. Robitaille

FACULTY ADVISOR: Dr. Donald Malocha

#### A B S T R A C T

A computer program, which realizes monolithic crystal filters with constant group delay, is developed. This program analyzes and synthesizes a class of transfer function developed by J.D. Rhodes called equidistant linear phase transfer functions. Using cascade synthesis, the program calculates the values of the inductor and capacitors of the ladder sections which realizes these functions. The ladder sections are implemented using monolithic crystal filters.

\* \* \* \* \*

TITLE: An Evaluation of the 8051 Microcontroller

CANDIDATE: George C. Schafner

FACULTY ADVISOR: Dr. Herbert C. Towle

#### A B S T R A C T

With the increasing availability and use of 16-bit microprocessors, the 16-bit data bus is becoming more prevalent. However, many peripheral devices such as printers and tape/disk drivers still require an 8-bit data bus for their interface.

This paper will explain how an Intel 8051 microcontroller may be used to interface a 16-bit data bus to a peripheral requiring an 8-bit data bus. A FIFO is used to buffer data from a 16-bit processor so that efficient use of processing time is maintained. The 8051 is used to control the peripheral and data transfer.

\* \* \* \* \*

TITLE: An Analysis of Modal Noise in Multi-Mode Optical Fibers

CANDIDATE: Arthur Weeks



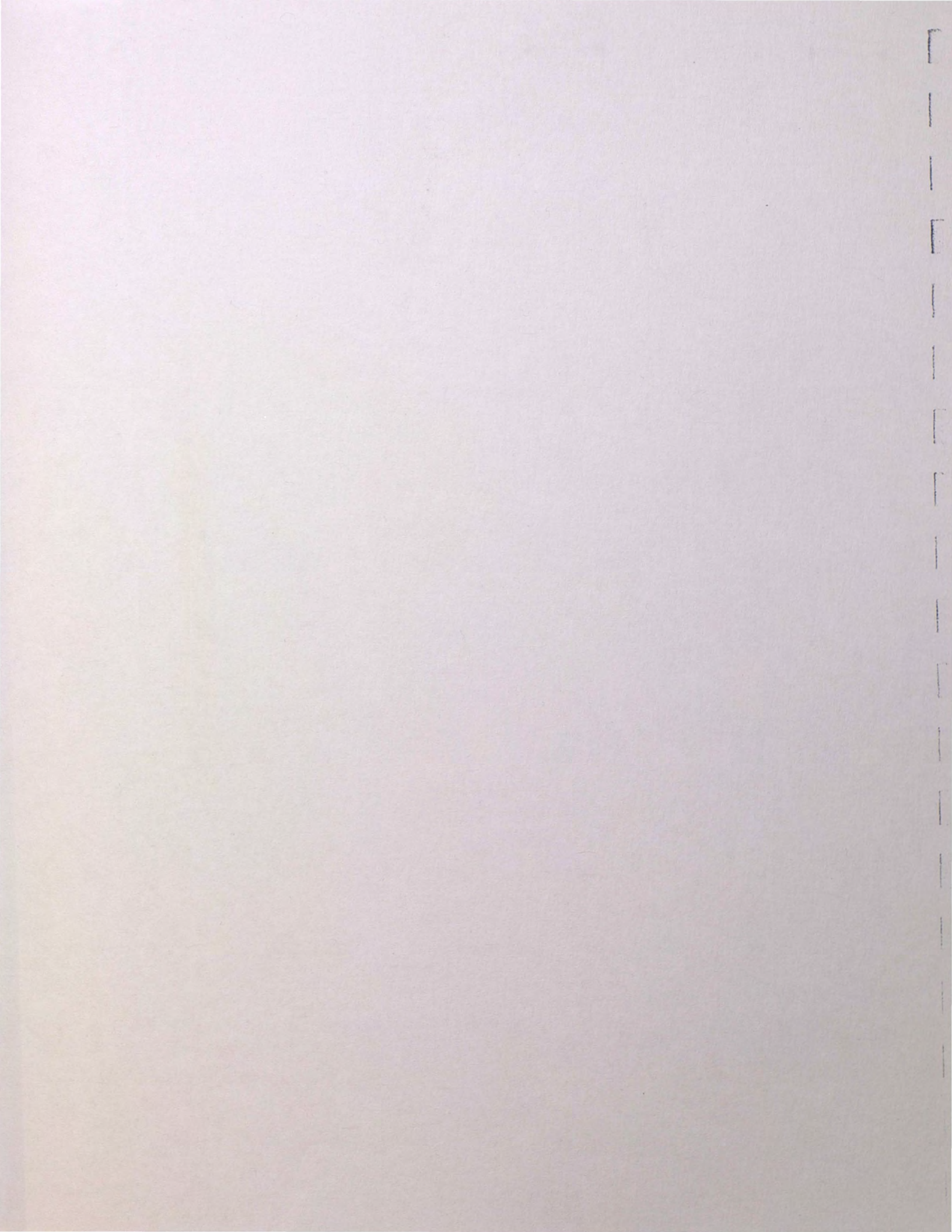
FACULTY ADVISOR: Dr. R.L. Phillips

A B S T R A C T

An analysis of modal noise in multimode optical fibers was performed. Both spatial and time varying modal noises were analyzed. The time varying modal noise was generated in two ways: the first, by vibrating the optical fiber, the second, by varying the temperature of the optical fiber. Under controlled conditions the temperature of the optical fiber varied between 68°F to 200°F while the fiber was held stationary. The optical fiber was then vibrated while the fiber was held stationary. The optical fiber was then vibrated while the temperature was held constant. Data indicated that the modal noise statistics agreed with the Beta distribution. The statistics of the spatial modal noise were measured and were then compared to the time varying modal noise. These statistical moments disagreed with the Beta statistics. This indicated that modal noise generated in optical fibers is possibly a non-ergodic process. Next the optical fiber's spatial autocorrelation function and spatial intensity fade statistics were computed.

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DEPARTMENT OF ENGINEERING TECHNOLOGY

DEPARTMENTAL REPORT

Chairman: Richard G. Denning

Faculty: B.D. Bullard, J.C. Debo, R.F. Dehler, H.L. Griffith, C.M. Head, J.W. Hubler, G. Lewis, F.J. Sammer, C.C. Strange, D. Kravitz, and H.E. Worbs

The Engineering Technology faculty continued to grow professionally through presentations to professional organizations and meetings, graduate studies, several published articles, and by taking active roles in numerous professional organizations, and attendance at professional society meetings.

The faculty experienced another very productive year in the area of service both off and on the campus. Two faculty members sat for the EI exam and one for the P.E. exam. Three faculty members participated in two or more ABET visits, and progress was made in the area of creative activities with several texts being produced and the presentation of several professional papers.

During 1982-83 the department acquired significant capital equipment for laboratories. This equipment included a set of Fischer Technic blocks, several additional TRS 80 and Apple computers, and needed electronic equipment. Additionally, \$260,000 worth of electronics, design, and computer technology laboratory equipment was ordered for the recently completed UCF-BCC Life-Long Learning Center at the Cocoa Campus.

The Engineering Technology Department experienced the greatest enrollment during the 1982-83 school year with the headcount reaching 435 during the Fall semester, 1982. The Department has graduated over 500 students during the past five years. The Engineering Technology graduates continued to be welcomed by industry with almost 100% employment. The UCF Student Placement Office published survey results which indicated the recent graduates in Engineering Technology reported annual starting salaries averaging \$22,000. The production of 96 graduates during the year placed UCF as 29th out of approximately 100 institutions offering the Bachelor's Degree in Engineering Technology nationwide.

During the 1982-83 academic year Professor Bullard returned from a year's leave of absence and professional development at Martin-Marietta. Professor Lewis was on leave due to the illness of his son. Mr. Clint Strange was added to the faculty.

Dr. Denning completed his Department of Energy funded Energy Conservation Measures research, and Professor Griffith received funding for a Microprocessor Interface project. Although not funded, an increase in the number of research proposals was noted during the year and indicates stronger faculty interest in applied research.



In addition to the courses offered during the day, the Engineering Technology Department offered numerous evening classes on the main campus and the Brevard campus. The number of active Engineering Technology students based at the Brevard Campus was approximately 100 during 1982-83. These students were advised by Dr. Denning on a weekly basis. With the completion of the UCF-BCC Life Long Learning Center at Cocoa, department activities are expected to increase significantly in the near future. Plans were completed this year to add Computer Technology on the Cocoa campus in the Fall of 1983 and three faculty positions were established to support the Engineering Technology programs at Cocoa.

A major milestone was realized during the 1982-83 academic year with the second ABET accreditation visit completed during December of 1982. While the final/formal evaluation will not be known until mid 1983, the department is expected to receive most favorable results.



DEPARTMENT OF ENGINEERING TECHNOLOGY  
PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

Books and Monographs

1. Head, C.M., Face of Florida, Kendall-Hunt Publishers, Professional textbook, Co-Author, R.B. Marcus.
2. C.M. Head, Shaping the Florida Platform, University Press.

Articles Published

Regional Journals (Peer-Refereed)

1. Head, C.M. "Drought and Recent Sinkhole Occurrence in Orange and Seminole Counties, Florida," The Florida Geographer.

Other Scholarly Works

1. Denning, R.G. Research Report: Governor's Energy Office Technical Assistance Program - 4 Volumes, Co-Author, Dr. R. Doering

PRESENTATIONS

International Meetings

1. Worbs, H.E., "A Method for Correlating the Transient Heat Behavior through Sunlit Walls," Paper to be presented at the June ASHRAE annual national meeting in Washington, D.C.

Regional Meetings

1. Worbs, H.E., Presented paper on "A Computer Aided Approach to Predicting Building Energy Usage using the Florida Model Energy Efficiency Code for Buildings," 32nd Annual Air Conditioning Conference, Gainesville, FL, March 3-4, 1983.



DEPARTMENT OF ENGINEERING TECHNOLOGY

ABSTRACTS OF SPONSORED RESEARCH

TITLE: Technical Assistance Program-Energy  
Conservation Measures

PRINCIPAL INVESTIGATORS: Dr. R.G. Denning, P.E. and  
Dr. R.D. Doering, P.E.

SPONSORING AGENCY: Governor's Energy Office

GRANT NUMBER: 20-1627-001

A B S T R A C T

A study of Energy Conservation Measures to be implemented for the following UCF Buildings: Chemistry, Village Center, Classroom Building, and 4 dormitories.

Energy conservation measures studied in the project included: Reduction in Lighting Levels, Use of Solar Film on Windows, High Efficiency Motors for Air Handling Units and Pumps, and Solar Domestic Water Heating.

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DEPARTMENT OF ENGINEERING TECHNOLOGY

ABSTRACTS OF UNSPONSORED RESEARCH

TITLE: Computer Aided Engineering in Technology

PRINCIPAL INVESTIGATOR: Barry D. Bullard, P.E.

A B S T R A C T

A study was made to determine the optimum computer aided engineering program which could be incorporated into the UCF-BET degree program as it is presently constructed. The study was restricted to the use of high-level languages only.

A study indicated three high-level languages which are of importance to the engineering technologist at the present time; BASIC, Pascal, and FORTRAN. A survey of modern AS programs shows that BASIC is generally included.

Therefore, it should be the goal of the BET program (junior/senior years) to include the instruction of Pascal and FORTRAN. With proper advisement, this is feasible under the present UCF-BET degree program.

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TITLE: Survey of University of Central Florida  
Engineering Technology Graduates  
and Employer Satisfaction

PRINCIPAL INVESTIGATOR: Dr. Richard G. Denning, P.E.

A B S T R A C T

A study to determine: Graduate satisfaction with BET program, progress of UCF-BET graduates in industry, employer satisfaction with graduates and UCF-BET program, and to acquire input for program/course changes, additions and deletions.

Data has been accumulated and study is still in progress to determine results of survey.

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TITLE: Computer-Electro-mechanical Trainer  
for Manufacturing Laboratories

PRINCIPAL INVESTIGATOR: Professor H.L. Griffith

A B S T R A C T

A computer electro-mechanical trainer has been developed and is now in use in the classroom. A TRS-80 color computer (6809 MPU) has been



interfaced with a Heath 3300 breadboard. The interface card needed to bring the forty pins of the computer MPU to the face of the breadboard was developed and constructed in-house. The interface card provides an addressing system and electronic buffering. In the laboratory, German Fischer Technik components are used to simulate mechanical mechanisms. The large solderless socket face of the Heath 3300 is used by the student to develop electronic circuits needed for a computer to control mechanical action and instrumentation. Difficult prototype electronic circuits can now be developed safely with a maximum of speed and flexibility.

\* \* \* \* \*

TITLE: Florida's Coastline Processes

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

A B S T R A C T

The study evaluated the effects of man's activities along the Florida coastline as a means of geomorphic change. Emphasis centered on the interaction of natural processes of erosion and deposition with man's coastal development. Study areas included the effects of groins and jetties, seawalls, artificial beach nourishment, and destruction of mangrove coastlines. The impact of cold and warm water rings on coastal eco-systems was also investigated.

The study is continuing as additional data is accumulated.

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TITLE: Computer Simulation of Klein's  
Entrepreneurial System

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

A B S T R A C T

Several universities around the country offer a composite engineering/entrepreneurial evaluation service for would-be inventors. The service evaluates inventions from both an engineering and entrepreneur basis and provides the inventor with a technical and salable evaluation of this idea. Klein has developed a manual system for such evaluations. This project developed a computer simulation of Klein's system, the idea of developing a similar service through the auspices of COE and the College of Business.

The simulation is undergoing continued evaluation.

\* \* \* \* \*

TITLE: Computer Assisted Student Advising Program

PRINCIPAL INVESTIGATOR: Frank J. Sammer



## A B S T R A C T

This program provides automated analysis of a student's prior course work for transfer to meet University of Central Florida, College of Engineering, Engineering Technology Department requirements. The analysis matches a student's course work at UCF, a Community College and up to two other schools to UCF requirements for the categories of General Education, Lower Level Tech Transfer, Free Electives, Upper Level Tech Core, and ENT Major (Option). The latter includes the options of Electronics Technology, Design Technology, Operations Technology, and Environmental Control Technology. Predetermined Community College courses suitable for meeting the General Education requirements are included in the program. The program verifies that the student has met semester hour requirements for each category and has earned at least 64 credits at Senior Institutions. Printouts, by student, as selected by the operator, include all the data accumulated for each student, a listing of possible courses to be taken, and data for petitioning the College of Arts and Sciences to accept transfer courses to meet the General Education requirements. Provision is made for adding new students, and adding, changing or deleting data for any student. Unauthorized access to the data is denied by means of an access routine that uses student-specific data.

This program has been developed to execute on the Radio Shack TRS-80 Models II, 12, and 16.

The program is substantially operational. Current output is to the computer monitor. The program meets a substantial part of the requirements on user friendliness and computer RAM limits (64K) are being reached. Further effort is required to partition the current program into more (computer memory) manageable sections and improve the interaction with the operator.

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TITLE: DIPSTK - A Process Control Language

PRINCIPAL INVESTIGATOR: C.C. Strange, Jr.

## A B S T R A C T

Process control languages are generally complex and machine oriented. Their use requires a high degree of skill, not only in the control process knowledge, but also in the programming. On one extreme, control programs are written in assembly language. This is a time consuming process and the high investment is tailored to a specific application. The resulting programs are difficult to communicate between the programmer and the user. On the other extreme, attempts have recently used high-level languages, i.e. FORTRAN, but these still require assembly-level supplements. In general, only the programmers know what the program does. Thus a void exists between the programmer and the user.

This paper presents a user-oriented, high-level language, DIPSTK, which has the following design objectives:



- 1) can control both digital and analog signals
- 2) is easy to learn and communicate
- 3) provides the necessary user operating support
- 4) integrates a graphical data display, and
- 5) is easily modified for additional control structures

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TITLE: Natural and Forced Convective Heat  
Transfer in a Vertical Pipe

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

#### A B S T R A C T

This study deals with the experimental results for upward flow of water in a vertical pipe. The system under consideration is a flow upward situation with the pipe open at the top to atmospheric pressure. Fluid pressure at the bottom of the steam-heated section is controlled by a constant weir overflow hydrostatic head. A calming section upstream of the heated section insures that fully developed flow occurs at the start of the heated test section.

The experimental results are first compared to the constant wall temperature predictions first developed by Martinelli and Boelter. While the agreement is quite good, the results are somewhat higher. Graetz numbers were varied between 5 and 22 with corresponding variation in the natural convection parameter between  $1.3 \times 10^4$  and  $5.3 \times 10^4$ .

An analytical differential equation was then developed and used to evaluate the heat transfer for the constant wall temperature case. This analytical tool was then used to compute the heat transfer for the varying wall temperature case. Besides explaining the upward shift in the data the equations presented in the study may be used to determine the prescribed temperature variation in the fluid.

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DEPARTMENT OF INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS  
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

DEPARTMENTAL REPORT

Chairman: Dr. G.E. Whitehouse

Faculty: C.S. Bauer, J.E. Biegel, G.H. Brooks, R.D. Doering, C.B. Gambrell, Y.A. Hosni, H.I. Klee, D.G. Linton, R.R. Safford, G.F. Schrader, J.A. Sepulveda, L.L. Smith, S.B. Spain, and C.J. White.

The period 1982-83 has been a busy time 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 Manufacturing Systems Center for Central Florida. A number of faculty and students within the department continue to develop computer programs to solve traditional industrial engineering problems, written in BASIC, to be run on the TRS 80, Apple, and IBM PC Microcomputers. This activity is being reported in the Mini/Micro Computer Column in Industrial Engineering Magazine. Over 800 inquiries have been received regarding this activity. Dr. Whitehouse is Editor of this column for IIE.

The publication activity within the department remains high with over 40 articles and presentations. Our faculty attended over 15 Professional Meetings in addition to a number of continuing education experiences including computer graphics, micro-computers, health care, and the human factors. The department hosted the 2nd International and 5th National Computers and Industrial Engineering Conference in March where 140 papers were presented. The faculty taught a number of Continuing Education courses on such subjects as Software Engineering, Use of Micro-Computers by the Industrial Engineer, Computer Graphics and Project Engineering.

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

Dr. Bauer was selected as "Outstanding Teacher" in the Engineering College. He is the President-Elect of the Central Florida Chapter of the Florida Engineering Society (FES). Dr. Doering is a representative on FES's Energy Committee and serves as Director-Elect of IIE's Energy Division. He was re-elected as Regional Vice President to Alpha Pi Mu and was elected as "Outstanding Researcher" in the Engineering College. Dr. Gambrell is presently on leave and is Vice President and Provost at West Coast University, and is expected back in August. Dr. Linton was a director of the local IIE Chapter and Prof. White was the treasurer. Drs. Klee, Hosni, Linton and Whitehouse served as reviewers for International Journals. Dr. Hosni attended a number of seminars as a faculty guest of the Material Handling Institute. Dr. Whitehouse and Dr. Hosni are editors



of the IEEE Micro-Software Series. Dr. Doering was elected "Fellow" of FES and Dr. Whitehouse was elected "Fellow" of IIE. Dr. John Biegel of Kansas State and Dr. Leighton Smith of the University of Texas at Arlington joined the faculty in the Fall. Dr. Robert Safford of University of Arkansas spent his sabbatical at UCF and helped with our Human Engineering activities.

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

The IIE Student Chapter won the "Award of Excellence" from the National IIE Organization. The UCF chapter of Alpha Pi Mu initiated 15 members and won First Place in the Engineering Fair. Students David Noller and Donald Washburn were named as two of three national winners of Armstrong Cork's Outstanding Industrial Engineering Student Awards. Student Leslie Turner won the State and National Consulting Engineer's Scholarship. Dr. Whitehouse won the IIE's Computer and Information Systems Division Award for 1982.



DEPARTMENT OF INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS  
PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

Articles Published

International Journals (Peer-Refereed)

1. Doering, R.D. "Energy Management," Book Review, Management Monitor, Buckinghamshire, England.
2. Doering, R.D. "Effective Cost Cutting with Energy Planning," Food Service Marketing, (March 1983).
3. Hosni, Y.A., et al. "Continuous Variations in Parametric Linear Programming," Journal of Computers and IE, (January 1983).
4. Klee, H.I. "Solar Economics - Short Term Costing," International Journal of Computers and Industrial Engineering, Vol. 6, (1982).
5. Whitehouse, G.E., et al. "Multiple Regression," Industrial Engineering, (June 1982).
6. Whitehouse, G.E., et al. "Linear Programming," Industrial Engineering, (January 1983).
7. Whitehouse, G.E. "The Use of Semi Probabilistic Grading to Motivate Decision Analysis Students," Engineering Economist, (June 1982).
8. Whitehouse, G.E. "Flowgraphs," Encyclopedia of Statistical Sciences, Vol. III, John Wiley, (April 1983).

Other Scholarly Works

1. Whitehouse, G.E. and Hosni, Y.A. IIE Micro Software  
Network Analysis - APPLE Version, (May 1982).  
Work Measurement - TRS Version, (August 1982).  
Work Measurement - APPLE Version, (August 1982).  
Published by IIE, Atlanta, Georgia.



## PRESENTATIONS

### International Meetings

1. Bauer, C.S. "An Industrial Engineering Lab Approach to CAD/CAM/Robotics Systems Training and Research," Proceedings, 12th Annual Frontiers in Education, ASEE, Columbia, South Carolina, October, 1982.
2. Bauer, C.S. "Multifunction Laboratories for Academic IE Curricula," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
3. Bauer, C.S., et al. "Multiple Microprocessor Control of Physical Process Models," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
4. Biegel, J.E. "CAM and the IE," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
5. Brooks, G.H. "Materials Requirement Planning Using a Micro-computer," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
6. Brooks, G.H. "Pascal Paradigms for Personal Processors," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
7. Doering, R.D., et al. "The Mechanical Engineering Energy Systems Program at the University of Central Florida," ASEE Annual Conference Proceedings, June, 1982.
8. Doering, R.D. and Bauer, C.S. "A Low Cost Based Training Simulator for Wastewater Plant Operators," Proceedings, Winter Simulation Conference, San Diego, California, December, 1982.
9. Doering, R.D. "Effective Cost Cutting with Energy Planning in Equipment and Systems," Proceedings of the 39th SAFSR Conference, The State-of-the-art, Lake Buena Vista, Florida, April, 1983.
10. Doering, R.D., et al. "Modeling and Simulation Activities at EPCOT," Half-Day Tutorial, 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
11. Hosni, Y.A. "Optimum Facility Location and Relative Allocation Problem on the Microcomputer," TIMS/ORSA, National Conference, Chicago, Illinois, April, 1983.
12. Hosni, Y.A. "Industrial Facilities Layout Algorithms," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.



13. Hosni, Y.A., et al. "Wage Bargaining Simulation," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
14. Klee, H.I. "An Empirical Procedure for Evaluating the Effectiveness of Energy Conserving Products," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
15. Linton, D.G., Whitehouse, G.E., et al. "A SLAM Model of the Computer Managed Instruction System," ORSA/TIMS 1982 Joint National Meeting, San Diego, California, October, 1982.
16. Smith, L.L. "The Effects of Exposure Time, Retention Time on Location Memory in Visual Information Processing," Proceedings of the 26th Annual Conference of the Human Factors Society, Seattle, Washington, October, 1982.
17. Sepulveda, J.A., et al. "Evaluating the Effectiveness of At-Scene and During Transportation Treatment by Emergency Vehicle Personnel," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.
18. Whitehouse, G.E.; Hosni, Y.A.; and Linton, D.G. "Tailoring Your IE Application for Solution on a MicroComputer," Proceedings of IIE Annual Meeting, New Orleans, Louisiana, May, 1982.
19. Whitehouse, G.E. "What is the Best Algorithm to Solve the Resource Allocation Problem? Who Cares?" Proceedings fo the IIE Annual Meeting, New Orleans, Louisiana, May, 1982.
20. Whitehouse, G.E.; Linton, D.G.; et al. "Using Microcomputers in Simulation Studies," Proceedings, 10th IMACS Conference, Montreal, Canada, August, 1982.
21. Whitehouse, G.E., and Hosni, Y.A. "Use of Microcomputers by IE Departments," Proceedings of National ASEE Conference, College Station, Texas, June, 1982.
22. Whitehouse, G.E. "What's New with Micros." Address to National Association of Furniture Manufacturers Conference, Louisville, Kentucky, September, 1982.
23. Whitehouse, G.E. "Developing User-Friendly Programs," 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983.

#### Regional Meetings

1. Bauer, C.S. "Robotics." Ninth Annual Florida State Symposium for Engineers and Scientists, Society for Women Engineers, Orlando, November, 1982.



2. Doering, R.D. "The Potential for Waste Heat Recovery in Florida," Volusia Manufacturers Association Energy Seminar, Daytona Beach, June, 1982.
3. Doering, R.D. "Comparison at Low Temperature and Conventional Dishwasher Systems," Georgia Environmental Health Association Annual Education Conference, Jeckyll Island, Georgia, July, 1982.
4. Doering, R.D., et al. "Passive Solar and Low Energy Building Design Residential Conservation Demonstration Project," Technical Symposium, Florida Solar Coalition Annual Conference, Winter Park, November, 1982.
5. Hosni, Y.A., et al. "Continuous Variation in Parametric Linear Programming," 47th Annual Meeting of Florida Academy of Sciences, FIT, Melbourne, April, 1983.
6. Hosni, Y.A. "Computerized Authoring System for Training Manuals," Proceedings Southeastern '83, IEEE Publication, Orlando, April, 1983.
7. Whitehouse, G.E. "Micros and IE," Keynote Address at Quaker Oats IE Conference, New Orleans, Louisiana, May, 1982.
8. Whitehouse, G.E. "Microcomputers and the IE Decision Maker," Keynote Address, IE/Micro Conference, Johnson City, Tennessee, March, 1983.
9. Whitehouse, G.E. "Microcomputers in the Classroom," North Carolina A&T, Greensboro, North Carolina, April, 1983.



DEPARTMENT OF INDUSTRIAL ENGINEERING  
AND MANAGEMENT SYSTEMS  
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

Seminars, Special Programs  
and Eminent Speakers

1. 5th National and 2nd International Conference on Computers and Industrial Engineering, Hilton Inn, Orlando, March, 1983. (G.E. Whitehouse, Chairman).
2. "Microcomputers and Industrial Engineering," Las Palmas Inn, Orlando, September, 1982. (Whitehouse/Bauer/Hosni).
3. "Training Device Simulation Software," Hyatt Hotel, Orlando, November, 1982. (Hosni/Amico).
4. "Software Engineering and Design," Hilton Inn, Orlando, March, 1983. (Hosni/Bauer).
5. "Programming a Microcomputer for Industrial Engineering Programs," Hilton Inn, Orlando, March, 1983. (Linton/Whitehouse).
6. "Training Device Simulation Software," Langford Hotel, Winter Park, April, 1983. (Hosni/Amico).
7. "Microcomputers and Industrial Engineering," Las Palmas Inn, Orlando, January, 1983. (Whitehouse/Bauer/Hosni.)
8. "Engineering Project Management," Howard Johnson's, Orlando, February, 1983. (Doering/Whitehouse).
9. "Microcomputers and Industrial Engineering," Las Palmas Inn, Orlando, June, 1982. (Whitehouse/Bauer/Hosni).



DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS  
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

ABSTRACTS OF SPONSORED RESEARCH

TITLE: Formation of New University Institute for  
Simulation and Training

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

SPONSORING AGENCY: UCF Office of Graduate Studies and Research and  
Naval Training Equipment Center

GRANT NUMBER: 20-2100-054

A B S T R A C T

Dr. C.S. Bauer was appointed Acting Director of the new Institute for Simulation and Training in December of 1982. This organization will provide (1) specialized research services using University faculty and students, (2) specialized short courses for industrial and governmental organizations, and (3) provide other services of general nature to support the simulation and training community.

\* \* \* \* \*

TITLE: CNATRA Training Management Information System

PRINCIPAL INVESTIGATOR: G.H. Brooks, P.E.

SPONSORING AGENCY: Naval Training Equipment Center

GRANT NUMBER: 20-2100-062

A B S T R A C T

The thrust of this effort is to furnish cooperative assistance in exploring the use of microcomputers for the training of clerical personnel in the Navy. Simulation and other models have been developed, and equipment selection is underway.

\* \* \* \* \*

TITLE: Passive Solar, Low Energy Building Design  
Demonstration Project

PRINCIPAL INVESTIGATORS: Robert D. Doering, P.E.  
James K. Beck, P.E.  
Project Directors

SPONSORING AGENCY: Florida Public Service Commission

GRANT NUMBER: 21-1624-001



## A B S T R A C T

This project demonstrated the potential of selected passive solar design techniques for reducing the electrical power consumption of typical Florida residences. Six existing residences in the Central Florida area were selected and retrofitted by standard architectural and construction practices to permit them to be more efficiently air conditioned within the Florida environment. Each residence was studied to determine which energy saving concept would be most appropriate and cost effective relative to its architecture and construction details. The primary concepts included vented skin walls and roofs, exterior wall insulation, radiant barrier roof, and attic ridge vents. Each residence was also equipped with an instrumentation system to monitor and record, at 15-minute intervals, temperature data and power consumption. One residence was also equipped to record ground and ambient temperatures, ambient relative humidity and solar insolation. Other data collected included the resident's response to the architectural modification, their life style and historical power consumption.

Each energy conservative design was also tested at the Florida Solar Energy Center in the Passive Cooling Laboratory. This involved installation and instrumentation of each wall/roof design in the building and collection of temperature, radiation, humidity and heat flow data under controlled conditions. The results of the two studies were correlated using a thermal resistance-capacitance network model.

The results showed the most cost effective wall treatment was the vented skin design followed by exterior insulation. On the roof, the radiant barrier was most effective, followed by the vented skin-ridge vent treatment. The cooling season performance for the field residences showed a high savings of 37% with an overall average of 13% of the total residence monthly power billing.

\* \* \* \* \*

TITLE: Authoring System  
PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E.  
SPONSORING AGENCY: TAEG - Naval Training Equipment Center  
GRANT NUMBER: 20-2100-039

## A B S T R A C T

A software system was developed for aid in authoring of Training/ Instructional manuals. The system is fully computerized including pictures and graphical representations. A final design was completed, and 50% of the programs were developed. The system design, and programs developed were documented in a final report submitted to the sponsoring agency.

\* \* \* \* \*



TITLE: Microsoftware for Engineering Courses  
PRINCIPAL INVESTIGATOR: Dr. Y. Hosni, P.E.  
SPONSORING AGENCY: Apple Education Foundation

A B S T R A C T

A number of programs for teaching Engineering Courses will be developed using Graphics Tablet as a means of inputting the data to the programs. It is expected that the results of the project will be published and distributed to engineering schools on a National level.

\* \* \* \* \*

TITLE: EIES/Simulation Model for CMI System  
PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.  
SPONSORING AGENCY: Naval Training Equipment Center (TAEG)  
GRANT NUMBER: 20-2100-040

A B S T R A C T

The computer managed instruction (CMI) system is used to grade student exams, provide remediation instruction and perform administrative functions for many basic engineering and electronic schools in the U.S. Navy. This paper describes a SLAM simulation model of the CMI system which was used to test alternate system configurations.

\* \* \* \* \*

TITLE: Manpower Data System  
PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.  
SPONSORING AGENCY: Naval Training Equipment Center  
GRANT NUMBER: 20-2100-031

A B S T R A C T

Student projects at NTC, including computer scheduling of RTCs and readability algorithms, are monitored.

\* \* \* \* \*

TITLE: NTIPP Computer Authoring  
PRINCIPAL INVESTIGATOR: Dr. D. Linton, P.E.  
SPONSORING AGENCY: Naval Training Equipment Center



GRANT NUMBER: 20-2100-056

A B S T R A C T

Student projects at NTEC, including the design and development of software for a computer-based authoring system to be used in preparing instructors' guides, student guides, training manager guides and special skill packages.

\* \* \* \* \*

TITLE: CNATRA Training Management Information System

PRINCIPAL INVESTIGATOR: Dr. George H. Brooks and  
Dr. D. Linton, P.E. (Co-PI's)

SPONSORING AGENCY: NTEC (TAEG)

GRANT NUMBER: 20-2100-062

A B S T R A C T

Student projects at NTEC, including the development of algorithms, flow charts and software for the CNATRA Training Management Information System.

\* \* \* \* \*

TITLE: Classification Tools

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

SPONSORING AGENCY: NTEC

GRANT NUMBER: 20-2100-058

A B S T R A C T

Student projects at NTEC, including the development of flow charts and computer programs for analyzing and evaluating the training and cost effectiveness of aircrew operator simulators.

\* \* \* \* \*

TITLE: Simulation and Training Device Technology  
Assessment and Needs Analysis

PRINCIPAL INVESTIGATOR: Dr. G.F. Schrader

SPONSORING AGENCY: NTEC

GRANT NUMBER: 20-2100-054

A B S T R A C T



In response to the Naval Training Equipment Center's request, the University of Central Florida's Institute for Simulation and Training conducted a research project concerned with the assessment and forecast of the simulation and training device (S & TD) technology pertinent to the Center's current and future needs. The research project was carried out by an interdisciplinary task force whose members reviewed the training device technology thrusts within selected areas or laboratories within the NTEC Research Department. The task force members and the technological areas wherein their review efforts were concentrated were as follows: Dr. B.W. Patz, EECS, and Dr. G.E. Whitehouse, IEMS, (Advanced Simulation); Dr. G.W. Orwig, Educational Services, and Dr. J.J. Turnage, Psychology, (Human Factors); Dr. C. Hughes, Computer Science, (Computer Systems); Mr. V. Amico, Extended Studies, and Dr. G.F. Schrader, Engineering (Training Value); Dr. L.L. Smith, IEMS (Maintenance Training). A comprehensive report on the project was prepared and submitted to the Naval Training Equipment Center.

\* \* \* \* \*

TITLE: Maintenance Training Subtask  
PRINCIPAL INVESTIGATOR: Dr. Leighton L. Smith  
SPONSORING AGENCY: S and TD Task Force (NTEC)  
GRANT NUMBER: 20-2100-054

A B S T R A C T

A detailed literature review into the history of maintenance training programs was conducted. An assessment of the current state of technology in the maintenance training environment was made with recommendations of potentially beneficial avenues of basic research in this area being made. Two formal research proposals were generated. One was submitted to O.N.R. and the other to N.T.E.C.

\* \* \* \* \*



TITLE: An Investigation of Potential for Productions  
Research in the University of Central Florida  
Service Area

PRINCIPAL INVESTIGATOR: Dr. George H. Brooks, Ph.D.

SPONSORING AGENCY: UCF EIES

GRANT NUMBER: 21-1699-046

A B S T R A C T

Data were gathered relative to the number, size, and location of industries in the Central Florida Area which might be classified as 'high technology' industry. The purpose of the research was to furnish background for preparation of research proposals.

\* \* \* \* \*

TITLE: Materials Requirement Planning Using a  
Microcomputer

PRINCIPAL INESTIGATOR: Dr. George H. Brooks, P.E.

SPONSORING AGENCY: UCF EIES

GRANT NUMBER: 21-1699-054

A B S T R A C T

A system of three programs for a microcomputer to do materials requirement planning was developed, using a computational concept different from that employed on larger computers. The 'Gozinto' method is used for structuring Bill of Material data, and matrix multiplication is used for data manipulation and report generation. The system is relatively fast, and uses disc memory to alleviate memory constraints. Written in UCSD Pascal, it is usable in many microcomputers.

PUBLICATIONS: Brooks, G.H., "Materials Requirement Planning with a Microcomputer." Presented at 5th National and 2nd International Conference on Computers and Industrial Engineering, Orlando, March, 1983, and submitted for publication in Computers and Industrial Engineering Journal.

\* \* \* \* \*



TITLE: Computer Aided Instruction in Math Review for Reentry Women

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

SPONSORING AGENCY: UCF Academic Learning Council

GRANT NUMBER: 21-1699-015

A B S T R A C T

A limited number of problems from the text in the Math Review for Reentry Women have been programmed on the TRS-80. The appropriate detailed solutions are also stored in memory for use when the student is unable to identify the correct answer to a problem. Additional problems will be included.

\* \* \* \* \*

TITLE: An Empirical Procedure for Evaluating the Effectiveness of Energy Conserving Products

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

SPONSORING AGENCY: UCF - EIES

GRANT NUMBER: 21-1699-047

A B S T R A C T

The following programs were developed in the course of this research:

- 1) "READ/WRITE WEATHER FILE" - Enters Orlando weather data from National Weather Service; creates data file "WEATHER" and retrieves weather data.
- 2) "POWER BILL" - Accepts utility bill data (dates, kwhr) then reads "WEATHER" and computes weather severity for billing period.
- 3) "POLYNOMIAL REGRESSION" - Correlates energy consumption and weather severity. Analysis of data for an Orlando residence has been completed.

\* \* \* \* \*

TITLE: Immunologic Pathogenesis of Mitral Value Prolapse

PRINCIPAL INVESTIGATORS: Dr. L. Acierno (Resp. Therapy)  
Dr. M. Sweene (Bio. Science)  
Dr. J. Sepulveda (IEMS)

SPONSORING AGENCY: UCF Research Council

A B S T R A C T

The purpose of this study is to determine the existence of immune mechanisms and the pathogenesis of the so-called primary form of MVP. This is a pilot study with the aim of detection of an immune pathologic process in tissues acquired from mitral valvectomy and concomitant papillary muscle



biopsy as well as from cadavers. The sampling populations will consist of ten surgical patients, ten cadavers and a number of controls matched by age, sex and race. Non-parametric techniques will be used in the statistical analysis of the results.

\* \* \* \* \*

TITLE: Computer Training and Evaluation  
PRINCIPAL INVESTIGATOR: Dr. Leighton L. Smith  
SPONSORING AGENCY: EIES  
GRANT NUMBER: 21-1699-056

A B S T R A C T

An experiment was designed to investigate whether the use of computer generated presentations were more effective than traditional (human lecture, chalkboard, slides, etc.) presentations for three different types of training objectives (abstract, quantitative, and physical).

\* \* \* \* \*

TITLE: Training Assessment  
PRINCIPAL INVESTIGATOR: Dr. Leighton L. Smith  
SPONSORING AGENCY: EIES  
GRANT NUMBER: 21-1699-051

A B S T R A C T

Investigation into the state of the art for the use of the microprocessor in the training community was conducted. It was found that the microprocessor was used in a variety of applications for the presentation of training objectives and that there were no instances found where the microprocessor was used for the evaluation (testing) of the level of training achieved.



DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS  
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

ABSTRACTS OF UNSPONSORED RESEARCH

TITLE: Water Treatment Plant Operator Training Simulator

PRINCIPAL INVESTIGATOR: Dr. Robert D. Doering, Ph.D., P.E.

A B S T R A C T

Operators of potable water treatment plants have a major responsibility for health and welfare of the public. Operator training historically has been on-the-job with some classroom programs conducted as refresher courses. The basic problems associated with this type training program are (1) management needs to budget time for one-on-one training sessions, (2) the classroom training is limited to classroom exercises, (3) emergency situation training cannot be accommodated, and (4) budget limitations allow only a few operators to participate in the training.

This project explored the feasibility of developing a low cost training simulator in which the trainee could in effect "operate" a specified water treatment plant under regular and upset emergency conditions. The simulator would consist of a control board which would represent the system being simulated with necessary control valves, feed pumps, and instrumentation readout to show the conditions of the influent/effluent water and at intermediate stages of treatment processes in terms of quality variables. Changes in influent flow and quality could be effected by the instructor. The trainee would then be required to determine his options and take action via the control board to bring the plant effluent into the specified quality range. In this manner the trainee could be exercised not only against typical plant operational problems, but also against emergency situations which could not be duplicated in on-the-job training in the real plant.

The plant operations would be simulated by a microcomputer (TRS-80 or similar) which would be programmed with the unit operations of a water treatment plant. The instructor could thus "call-up" different unit processes to generate a specified plant and the program would accept inputs from the trainee in his responses to the problems and respond to the trainee actions by calculating and displaying the quality parameters on the control board. Performance standards would be developed against objective criteria by running the training scenarios against qualified operators.

A feasibility study and unsolicited proposal for this training simulator is underway. It is envisioned that this simulator could also be used in engineering classroom instruction at UCF.

\* \* \* \* \*

TITLE: Crane Operator Training Simulator

PRINCIPAL INVESTIGATOR: Dr. Robert D. Doering, Ph.D., P.E.



## A B S T R A C T

Crane operations on construction sites constitute one of the major safety hazards in the country today. The probability of an accident is high, there is considerable exposure to personnel and the potential damage is extreme. Operator training is typically on-the-job. An aspiring crane operator must start as a rigger, advance to oiler and then be instructed by a qualified operator on a one-to-one basis. This training method hampers operations and the trainee is never exercised against emergency situations. It is further noted that even in recognized training schools the fuel costs now severely limit the actual hands-on training the trainee can log before he graduates.

This project explored the feasibility of developing a low cost training simulator in which the trainee could in effect "operate" a crane to train against normal operational scenarios and emergency situations. The simulator would consist of a typical crane cab mockup complete with seat; controls, instruments and observation windows, which would be mounted on a powered platform to provide rotation and tipping motion in two axes. A visual display would be provided by a 3 dimensional model and optics along with hand signal displays and audio communications to train against blind load pickup/placement scenarios. A sound generation system keyed to the controls would provide engine pitch/amplitude noise to enhance the realism.

Operations would be simulated and controlled by a microcomputer. The computer would receive the signals from the trainee via his control and cause the cab motion, engine noise and visual display to conform to the operations of a real crane under these conditions. A series of operational scenarios of increasing complexity and emergency situations would be developed to instruct the student. Performance standards would be generated by observing the scores of qualified operators against each of the scenarios.

A feasibility study and unsolicited proposal for this training simulator are underway.

\* \* \* \* \*

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 project 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) From/to Chart (2) the Relationships Generator (3) Equipment Determination (4) the Optimum Facility Location. All programs are in the area of plant layout. Other programs are under development.

\* \* \* \* \*



TITLE: Measuring Exposure to Radioactive Materials at a Nuclear Fuel Processing Plant

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

A B S T R A C T

A feasibility study was conducted on a simulation model to measure the effect of handling radioactive material in a processing plant. The objective was to determine the limit at which "Material Handler" should change jobs, before it is too late. Input to the model would be frequency function of handling and the type of exposure.

The problem was formulated as a project submitted to the EIES/COE/UCF for funding, and it was recommended to seek other pertinent sources which will be pursued.

\* \* \* \* \*

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. The guns activated laser 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.

\* \* \* \* \*

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 EMB 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.

\* \* \* \* \*



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 based 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.

\* \* \* \* \*

TITLE: Video Disk - Base, Information Retrieval System

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

A B S T R A C T

A study was conducted to determine the feasibility of using video media, (tape, disk), as a storage medium for data bases. This type of data base could be a valuable alternative for traditional magnetic media data bases, in cases where mixed pictures/text need to be stored and retrieved. Also for cases of information retrieval by character/words where "non-ASCII" languages are being used. It is difficult to carry a search by character/word. With the video a complete page can be retrieved and displayed showing non-ASCII, as well as pictures without the need to 'digitize' the page. The study shows that the video disk is superior to the tape since the life of the tape can be shortened as a result of displaying 'still' frames (essential for information retrieval), whereas the disk was not affected. MicroComputers with controlling programs can be used to access specific frames, and switch control to the disk using the same monitor (TV). Off the shelf equipment was found available for system design, and the project is continuing while funds are being sought to develop a prototype.

\* \* \* \* \*

TITLE: Software Development Projects Resources/Cost Estimation

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

A B S T R A C T

Software project managers are in need of a tool by which they can estimate and allocate the resources/costs to the different phases of software development projects. Unlike other projects, estimates for



resources can be very 'fuzzy' due to the nature of software projects and the difficulty of measuring programmer(s) productivity. Unexpected changes in the systems design during the development phase add to the complexity of the problem. Through a study it was determined that manpower distribution along software projects life cycle follows a Releigh function. Two parameters (Difficulty and Complexity) are used to determine a 'first-cut' information for managers about resources (programmers and analysts) needed for the project. Other parameters, if available, can lead to information pertinent to cost of development, software 'sizing', and computer memory requirements.

The methodology was programmed and packaged for personal computers for use in a short course -- Training Simulators, Software, Design and Management -- offered by the College of Extended Studies.

\* \* \* \* \*

TITLE: Computer Programming Language in Arabic

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

#### A B S T R A C T

A computer programming language in Arabic was developed. Functions of the language commands are equivalent to the BASIC computer language. Implementation of language on a microcomputer is done through functional keys avoiding the development of interpreter/compiler. The research is under study as a patent by the Department of Graduate Studies and Research.

\* \* \* \* \*

TITLE: Industrial Engineering Applications Using Microcomputers

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

#### A B S T R A C T

Three microcomputer programs were developed in the area of plant layout design: (1) Micro-CRAFT; (2) Micro-CORELAP; and (3) Plant Layout Evaluation. The programs have a graphical component that enables the representation of the layout arrangement on the screen (if used with Apple II system). Programs are being used by the IEMS students for the Facilities Planning and Design course (Spring, 1983).

\* \* \* \* \*

TITLE: Microsoftware for Teaching Mechanical Engineering Courses

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

#### A B S T R A C T



An effort from last year's unfunded project with the same title resulted in developing and funding of a project for continuation by the Apple Education Foundation (Refer to Funded Research section).

\* \* \* \* \*

TITLE: Use of Low-Cost Part Task Trainers to Lower Demand on Training Simulators

PRINCIPAL INVESTIGATOR: Dr. H. Klee and Dr. J. Sepulveda

A B S T R A C T

A project was initialized to develop a method for scheduling part task trainers as a means of lowering demands on sophisticated training simulators while maintaining prescribed levels of operational readiness. In addition, research will concentrate on the definition of a conceptual approach to introducing microcomputer technology in the training performance evaluation process.

\* \* \* \* \*

TITLE: Hospital Reimbursement Methods - An Evaluation of Impact of Medicare Adoption of Diagnosis Related Groups on Hospital Revenues

PRINCIPAL INVESTIGATOR: Dr. Jose A. Sepulveda

A B S T R A C T

On October 1st, 1984, Medicare will start reimbursing hospital under a prospective program called DRG (Diagnosis - Related Groups). The objectives of adopting this reimbursement system are to improve efficiency, reduce administrative burdens on hospitals and assure users of access to quality health care.

The system will provide nationally set rates derived from base year cost averages for groups of related diagnoses, with adjustments for severity, local wage differences, and special cases (psychiatric, long term, pediatric hospitals are excluded). The system will allow hospitals to keep the profit (but will have them take the loss) if they can provide care at a cost smaller than the reimbursement rate. This research will focus in a local hospital case-mix. Using digital computer simulation, a representative sample of cases will be evaluated under the current (per diem) reimbursement method and under the prospective (DRG) approach.

The analysis will focus on potential management actions, hospital productivity (global and partial) and profitability as well as on the projected case mix of patients and its financial implications. The clinical and financial data bases needed to monitor and control costs on a DRG program will also be discussed.

\* \* \* \* \*



TITLE: Tailoring Your I.E. Application for Solution on a Microcomputer

PRINCIPAL INVESTIGATOR: Dr. G.E. Whitehouse, P.E., Dr. Y.A. Hosni, P.E., and Dr. D.G. Linton, P.E.

A B S T R A C T

In this paper, the kinds of problems amenable to microcomputer solution, the features of microcomputers (such as size and speed) and the characteristics of successful interactive software will be discussed.

\* \* \* \* \*

TITLE: Using Microcomputers in Simulation Studies

PRINCIPAL INVESTIGATOR: Dr. G.E. Whitehouse, P.E., Dr. D.G. Linton, P.E., Mr. Clifford Davis, Jr., and Mr. Jerrace C. Mack

A B S T R A C T

The microcomputer can be used as an aid in executing simulation models in at least two ways. First, as a vehicle for running a package which has been translated to the BASIC language and second, as a terminal to a host computer for accessing main-frame packages directly. Both of these approaches will be discussed in general, and with respect to alleviating the problems associated with long turn-around times, high execution costs and the difficulty in convincing others of the capabilities of the model.

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DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS  
ENGINEERING MATHEMATICS AND COMPUTER SYSTEMS

ABSTRACTS OF MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE:                    Microsoftware for Facility Lab  
CANDIDATE:               James Dean Anderson  
FACULTY ADVISOR:       Dr. Yasser A. Hosni

A B S T R A C T

This study presents five supporting programs in the area of facility layout design. Programs are "stand alone" adapted type which cover data analysis and analytical techniques. Programs are From/To (From/To Chart generator), CRAFT\* (Computerized Relative Allocation of Facilities Technique), RELVAL (Relationship Chart generator), CORELAP\* (Computerized Relationship Layout Planning), and EVAL (Layout Evaluation program). Theory, complete program documentation, and case example for each program are presented. Programs are written in an interactive basic mode and have been tested on the Apple II Plus system.

\* CRAFT, CORELAP are heuristic techniques for plant design

\* \* \* \* \*

TITLE:                    Simulation of Traffic at a T-Intersection Using SLAM  
CANDIDATE:               Karen M. Anderson  
FACULTY ADVISOR:       Dr. Darrell G. Linton

A B S T R A C T

The flow of traffic at an intersection is often controlled by a traffic signal. This research report models a T-intersection with a disjoint network for each direction of traffic flow, eastbound, westbound and southbound. The traffic signal is modeled with a fourth network. Three types of signal control (pretimed, semi-actuated and full-actuated) are modeled to examine the effect of each type of the average delay time and average length of queue for each lane of traffic at the intersection.

The computer models presented in this report use the SLAM computer language to simulate the traffic signal and vehicle flow.

\* \* \* \* \*

TITLE:                    Hospital Short Term Planning through Patient Census Forecast  
CANDIDATE:               Howard W. Chiu



FACULTY ADVISOR: Dr. Jose A. Sepulveda

A B S T R A C T

An adequate health care resource allocation in a hospital is directly dependent upon the ability to estimate the hospital's patient census accurately. Efforts to estimate hospital's patient census are classified into two general methods: estimating from historical data, and demographic analysis. This paper takes the position that the estimate from the historical data is more economic and convenient for understanding than the estimate from the demographic analysis. Seven models that predict hospital's patient census by using the hospital's historical data are evaluated to fit the characteristics of each pattern shown in historical information. Where a microcomputer is available, this forecasting system provides detailed prediction of patient census with the comparable percentage of forecasting error among each model. Data from a ten-unit hospital in Florida is analyzed and provides a predicted patient census for the hospital's short-term plan. Results of this patient census estimating system and its advantage over the other forecasting method are discussed.

\* \* \* \* \*

TITLE: DETERMINING SOLAR WATER HEATING SYSTEM PERFORMANCE BY SIMULATION

CANDIDATE: Mohammad Erami

FACULTY ADVISOR: Dr. Harold Klee

A B S T R A C T

TRNSYS (Transient Simulation) is used to simulate a solar hot water heating system. Three different collector areas, hot water demand and temperature settings are used to determine system performance under varying environmental conditions. The percent solar utilization or solar fraction and collector efficiency is found to be a function of collector area, tank temperature setting, daily hot water demand and solar radiation.

Regression analysis is used to study solar fraction sensitivity to these same variables. Predictive models relating solar utilization with hot water load and collector area are obtained by fixing radiation level and tank temperature. Results are portrayed graphically.

\* \* \* \* \*

TITLE: IMERS: An Interactive Medical Records System

CANDIDATE: Mary A. Garner

FACULTY ADVISOR: Dr. C.S. Bauer, P.E.

A B S T R A C T

As computer printouts replace handwritten and typewritten information



in the Medical Records department, it becomes more advantageous for the Registered Records Administrator (RRA) to learn how to interact with a computer terminal. Computer applications in the Medical Records field increase the availability and accessability of patient information.

The Medical Records System discussed in this paper is an attempt to aid the Medical Records department of the College of Health Sciences in the education of their students to the advantages of computers.

This system will provide hands on experience to all medical records students. It has the capability of adding, deleting or changing the medical records of patients on the Master Patient Index and the Master Patient File. Statistics are calculated and reports are generated monthly or on request for areas of particular interest, such as Payment Source analysis, Discharge Analysis of Clinical Service, and Utilization Review. These reports help analyze the effectiveness of specific treatment and the flow rate of patients.

As requests are received, the system will subsequently be modified in order to reflect the technological advancements in the medical records field.

\* \* \* \* \*

TITLE: The Development of a Reentry Program for Women in Engineering at the University of Central Florida

CANDIDATE: Lucy C. Morse

FACULTY ADVISOR: Dr. Gary E. Whitehouse

#### A B S T R A C T

In order to familiarize local women with advanced degree possibilities in engineering and with expanding local industry, as well as increasing the graduate enrollment in the College of Engineering, the University of Central Florida has developed a Reentry Program for Women in the Industrial Engineering Department. Master of Science degrees are offered to the women with four options: Operations Research, Computer Systems, Engineering Administration, and Engineering Systems Analysis.

The program is designed for women who received a Bachelor's Degree at least two years ago in mathematics, engineering, physics, or another hard science. Seed money for the program was obtained as a mini-grant from Women's Reentry Consortium. The major component of the program is a mathematics review course which offers an intensive review of college math through differential equations.

An industrial advisory board is an integral part of the program and is giving support for potential employment for women during their schooling and afterwards, as well as making sure the women are going in directions consistent with the needs of industry.

A special orientation, available tutoring, and a Professional



Development Day are some of the features incorporated in this program. After the math review course, the women are mainstreamed into the standard graduate program with continued support.

\* \* \* \* \*

TITLE: Simulation of Naval Training Pipelines

CANDIDATE: Roger H. Werner

FACULTY ADVISOR: Dr. G.E. Whitehouse

A B S T R A C T

Flow of enlisted Navy men through basic training, BEE school and "A" school was simulated using SLAM. Queuing for courses, pass, setback and failure of students, and the limitation of resources in BEE schools were modeled for variable numbers of "A" courses and enlisted student ratings. A travel delay between schools was modeled as a direct step function of the distance involved.

For each course modeled, data included course duration, interconvening time between classes, minimum and maximum class sizes, pass, failure and setback rates, and the time, measured from the beginning of the simulation, when the first class is to convene. For each rating modeled, data included course sequence information (variable number of courses and school sequences), the number of that rating expected to report to basic training for the entire Navy each year for up to five years, the fractions of that total which report to each of three bases for basic training, the fractions which report each month, and the fractions which report each day of the week. Fleet returnees are modeled to enter the system as an across-the-board percentage of all basic training graduates.

Output for each course included average, maximum and current queue lengths; standard deviation of the queue length; average waiting time in the queue for the course; total numbers of students who had started, failed, passed, and been setback in the course; and the number who were under instruction at the time the report was written. Output for each rating included a list of the "A" courses taken, numbers of regular recruits and fleet returnees who had completed training, and average times required to complete training, with optional histograms.

A preliminary check was made for bottleneck situations before the simulation was started.

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DEPARTMENT OF MECHANICAL ENGINEERING AND AEROSPACE SCIENCES

DEPARTMENTAL REPORT

CHAIRMAN: D.R. Jenkins, (Acting)

FACULTY: L.A. Anderson, J.K. Beck, P.J. Bishop, H. Carpenter, K.K. Chang, B.E. Eno, F.S. Gunnerson, A.H.J. Hagedoorn, R.L. Henry, E.R. Hosler, S.M. Metwalli, A. Minardi, F.A. Moslehy, C.E. Nuckolls, W.F. Smith, G.G. Ventre

The quality of the faculty and of the academic program in the Department of Mechanical Engineering and Aerospace Sciences continued to grow in the 1982-83 academic year. This is the only tenable response to the needs of society which Mechanical Engineers are required to address. Our field of engineering, through research, development and engineering practice in energy and energy conservation, manufacturing, transportation, aerospace and materials develops answers to these needs. During the year, Mr. Rodney L. Henry joined our faculty as a Visiting Instructor. In addition, a successful search for a new Department Chairman was concluded with the appointment of Dr. Stephen L. Rice to the position. He will join us in July, 1983.

Growth was apparent in our undergraduate student group which now numbers more than 400 and in the graduate student body which exceeds 40. Several of the latter are in the advanced graduate student category, i.e., those who are planning to enter the Ph.D. program. At this date, 5 students are planning to take the Qualifying Exam for Ph.D. candidates. It is a source of great pride to the Department to note the 64 students who received the Bachelor of Science in Engineering degree, Mechanical Engineering option. Four students received Master of Science in Engineering or Master of Science degrees.

Research continues to be a major activity of the MEAS faculty. A number of new areas of research were explored and to some extent this appears to be bearing fruit. Aeronautics and aircraft performance is one of these areas. Another area is transient pressure surges in cryogenic liquid-vapor systems. A third is the development of a technique for direct strain determination from the analysis of the spectral density of laser speckle observations. Two large sponsored programs in residential energy conservation were completed during the year. One of these was a demonstration project which involved both IEMS and MEAS faculty. The other is a potentially significant study of the use of heat-recovery units for water heating. Also in the energy systems field, MEAS faculty have been involved in development of models to simulate energy loads in residences, studies of cogeneration systems in Florida industry, the evaluation of solar hot-water system performance, and investigation of a solar-driven residential heat pump. Further work along this line includes critical heat flux mapping in nuclear reactors, studies of pressure loss at restrictions in two-phase flow, and the analysis of two-phase flow in steam generators by use of high speed movies. Turning to the mechanical systems area, work in progress includes analysis of the response of layered concrete slabs to



laterally applied impact loads, investigation of the control of the tactile force in robots, the application of random-to-deterministic transforms to linear and non-linear systems and to transient response, the optimum design of flywheels, rotors, and springs, computer aided data analysis in laser speckle photography, and large deflections of plates with nonlinearities. Other activity continued from last year involves the design of a distributed breach shock tube and computer simulation of the response of an aircraft to a crash event. As a result of the above activity a total of 41 technical papers and reports were produced.

Activity in the professional service area also continued at a high level. Dr. Bishop, who is a member of ASME Committee K-6 on Energy Systems, served as Co-Chairman of technical sessions at three national technical meetings. Dr. Eno continues to serve on the ASME Solar Fundamentals Committee as well as ASHRAE Committees on Solar Energy Utilization, Heat Transfer/Fluid Flow, and Solar Energy Research. He was also a member of the Program Advisory Board of the Florida Solar Energy Center and acted as Chairman of a technical session at a recent ASME Solar Energy Conference. Dr. Hagedoorn was Vice-Chairman of the Florida Section of ASME. Dr. Hosler is a member of the Executive Committee of the AIChE Heat Transfer and Energy Conversion Division and was Chairman of the Nominating Committee of that Division in 1982. He also serves on the Donald Q. Kern Award Committee and the Max Jakob Award Committee of AIChE. Along with Dr. Bishop and Dr. Jenkins, he was a member of the Local Arrangements Committee for the 1982 ASME Pressure Vessel Conference. Dr. Jenkins continues his membership on ASTM Committee E-6, Performance of Building Construction and the Subcommittees E6.11 on Structural Performance of Horizontal Structures, E6.14 on Structural Performance of Completed Structures, and E6.21 on Serviceability. He also serves on the Orange County Standard Fire Prevention Code Board of Appeals and is a member of the ASME Citrus Engineering Conference Committee. During the past year he was Chairman of the Central Florida Chapter of ASM. Dr. Metwalli is active on the national level in ASME as a member of the Shock and Vibration Committee, the Design Automation Committee, the Stress Analysis and Failure Prevention Committee and the Speech Synthesis and Recognition Committee. He is Chairman-Elect of the Engineering Section of Florida Academy of Sciences. Further he acted as Session Chairman at one session and as Co-Chairman of another at an ASME Design and Production Engineering Technical Conference. Dr. Nuckolls spent another year at the Federal Aviation Administration Technical Center doing Crashworthiness Modeling research. Dr. Smith has nearly completed an undergraduate textbook "Principles of Materials Science and Engineering" for McGraw-Hill Book Co. This faculty also gives generously of its time in a variety of community service activities.

Dr. Chang received a rather unusual recognition when one of his inventions, a clear plastic adhesive strip with holes to fit universal 3-ring binders, was the subject of a lead article in the UCF Report. The strip can be attached to any sheet of paper and avoids the necessity of having to make holes in the paper and losing some of the printed information already there.

The MEAS Student Organizations (ASME, SAE, AIAA, ASM) had a very active year. The level of student participation was much higher than in



previous years and the leaders of the organization are to be commended for this. Under the direction of Dr. Hagedoorn, the Faculty Advisor, a Mini-Baja vehicle was constructed and entered the National Competition at Ft. Belvoir, VA this Spring. Although finishing first would have been better, an eleventh-place finish in the nearly 60-entry field was very satisfying.

Two of our faculty received special recognition. Dr. Bishop was promoted to the rank of Associate Professor of Engineering. Dr. Gunnerson received the Dow Outstanding Young Faculty Award of the ASEE Southeastern Region.



DEPARTMENT OF MECHANICAL ENGINEERING AND AEROSPACE SCIENCES  
PUBLICATIONS AND PRESENTATIONS OF PROFESSIONAL PAPERS

Books and Monographs

1. Smith, W.F., Principles of Materials Science and Engineering, McGraw-Hill Book Co., 1983 (expected date).

Articles Published

International Journals (Peer-Refereed)

1. Anderson, L.A., "A Simulation Approach to Sizing Hybrid Photovoltaic and Wind Systems," Journal of Energy, AIAA, New York, NY.
2. Chang, K.K., A. Minardi and T. Clay, "Parametric Study of the Overall Performance of a Solar Hot Water System," Solar Energy Vol. 29, No. 6.
3. Metwalli, S.M., Shawki, G.S.A. and Sharobeam, M.H., "Optimum Design of Variable-Material Flywheels," presented at the ASME Eighty Design Automated Conference, Washington, D.C., September 12-15, ASME Paper No. 82-DET-99, 1982 and accepted for publication in the ASME Journal of Mechanical Design.
4. Varney, A.M. and J.K. Beck, "Refined Biomass Burn Demonstration at Florida State Hospital," American Flame Research Committee, 3rd International Conference, Newport Beach, CA.
5. Younan, M., Metwalli, S.M., and El-Zoghby, A.A., "Fracture Mechanics Analysis of a Fire Tube Boiler," Journal of Engineering Fracture Mechanics, Vol. 17, No. 4, pp. 335-338, 1983.

Regional Journals (Peer-Refereed)

1. Henry, R.L. and S.M. Metwalli, "Optimum Design of Helical Springs Using Nonlinear Programming," presented at the Forty-Seventh Annual Meeting of the Florida Academy of Sciences, Melbourne, FL, April 8-9, 1983, Florida Scientist, Vol. 46, pg. 31-32, 1983.
2. Metwalli, S.M. "Transient Response Evaluation from Steady State Spectral Output of Dynamic Systems," Florida Scientist, Vol. 46, pg. 31, 1983.
3. Moslehy, F., "Use of Computerized Digital Correlation and Laser Speckle Photography and Application in Engineering," Florida Academy of Sciences, FIT, April 7-9, 1983, refereed, regional, Florida Scientist, Vol. 46, Supplement 1, p. 31.



### Other Scholarly Works

1. Bishop, P.J. and A. Minardi, "A Detailed Assessment of Cogeneration Using Actual Hourly Plant Data," EIES Final Report, UCF Engineering Experiment Station.
2. Doering, R.D., J.K. Beck, et al., "Passive Solar and Low Energy Building Design, Residential Conservation Demonstration Project," Final Report, Florida Public Service Commission, October 1982.
3. Jenkins, D.R., "A Review of Selected Literature," Report of Research in an Analytical Study of the Penetration Resistance of Layered Concrete Slabs, National Bureau of Standards, August, 1982.
4. Jenkins, D.R., "Bending and Fracture Mechanics Behavior of Layered Plates," Report of Research on an Analytical Study of the Penetration Resistance of Layered Concrete Plates, National Bureau of Standards, January 1983.
5. Jenkins, D.R., J.I. Knab, and R.G. Mathey, "Laboratory Studies of Thermography in Roofing Moisture Detection: In Moisture Migration in Buildings," ASTM STP 779, July 1982.
6. Jenkins, D.R. and R.G. Mathey, "Hail Impact Testing Procedure for Solar Collector Covers," NBSIR-82-2487, April 1982 now incorporated in ASTM Standard E822-81 Practice for Determining Resistance of Solar Collector Covers to Hail Impact with Propelled Ice Balls.

### PRESENTATIONS

#### International Meetings

1. Anderson, L.A., "A Computer Prediction of Hybrid Wind Turbine Generator and Solar Photovoltaic Performance," ASME Energy Sources Technology Conference and Exhibition, New York, NY.
2. Chang, K.K. and B.E. Eno, "Feasibility of a Solar-Driven Thermoelectric Heat Pump," IECEC Conference, Orlando, August 1983 and ASME Winter Annual Meeting, November 1983.
3. Dahlquist, J.E., F.S. Gunnerson and R.A. Nelson, "Critical Heat Flux Mapping," 3rd Multi-Phase Flow and Heat Transfer Symposium, Miami Beach, FL, April 18-20, 1983.
4. T. Hartman and E.R. Hosler, "Multi-Use Power Cycle," 3rd Multi-Phase Flow and Heat Transfer Symposium-Workshop, April 18-20, 1983, Miami Beach, FL.
5. Ghandeharioun, S. and E.R. Hosler, "Two Phase Flow Pressure Drop Across Thick Restrictions of Annular Geometries," 3rd Multi-Phase Flow and Heat Transfer Symposium-Workshop, April 18-20, 1983, Miami Beach, FL.



6. Metwalli, S.M., "Direct Strain Measurements Through Laser Speckle Spectral Density," Proceedings of SESA 1983 Spring Meeting, Cleveland, OH, May 15-20, 1983.
7. Elarby, M.E., S.M. Metwalli, and A.A. Elkader, "Synthesizing Optimal Controllers for a Class of Linear Dynamic Systems with Small Stochastic Perturbations in Parameters," Proceedings of the Second Cairo University Conference on Mechanical Design & Production, Egypt, December 27-29, 1982.
8. Metwalli, S.M. "Multiple Cluster Spacing of Compound Epicyclic Gear Trains," Proceedings of Second Cairo University Conference on Mechanical Design and Production, Egypt, Dec. 27-29, 1982.
9. Metwalli, S.M. and M.M. Hashem, "Classical Versus Modern Control Modifications of Industrial Controllers," presented at the Fifth National and Second International Conference for Computers and Industrial Engineering, Orlando, FL, March 16-18, 1983, Abstract Proceedings, pg. 10.
10. Metwalli, S.M., Moslehy, F.A. and Sheikhrzai, R., "Application of Spectral Density in Laser Speckle Strain Measurement," Proceedings of the 18th Midwestern Mechanics Conference, The University of Iowa, Iowa City, May 16-18, 1983.
11. Metwalli, S.M., and Megahed, S.M., "Random Response of Nonlinear Systems by Deterministic Equivalence," Proceedings of the 18th Midwestern Mechanics Conference, The University of Iowa, Iowa City, May 16-18, 1983.
12. Metwalli, S.M., "Application of Random to Deterministic Transform in Engineering Mechanics," Proceedings of 1983 ASCE EMD Specialty Conference, Purdue University, West Lafayette, IN, May 23-25, 1983.
13. Metwalli, S.M., Shawki, G.S.A. and Sharobeam, M.H., "Optimum Design of Variable-Material Flywheels," Presented at the ASME Eighth Design Automation Conference, Washington, DC, September 12-15, ASME Paper No. 82-DET-99, 1982 and accepted for publication in the ASME Journal of Mechanical Design.
14. Shawki, G.S.A., S.M. Metwalli and M.H. Sharobeam, "Optimum Configuration for an Isotropic Rotor," presented at the ASME Winter Annual Meeting, Phoenix, AZ, Nov. 14-19, 1982.
15. Moslehy, F., "Theory of Large Deflections of Plates with Geometrical and Physical Nonlinearities," 18th Midwestern Mechanics Conference, The University of Iowa, May 16-18, 1983, refereed, national.
16. Nuckolls, C.E., D. Laananen and L. Neri, "Crashworthiness Analysis of Aircraft Seats Using Program SOMLA," 1983 SAE Business Aircraft Meeting, Wichita, KA, paper no. 830747.



## Regional Meetings

1. P.J. Bishop and A. Minardi, "Potential for Cogeneration in Industry:", Southeast Industrial Expositoin, 1982, July 22, 1982, Tampa, FL. Invited lecture.
2. Eno, B.E., "In-Field Test Results of Heat Recovery Units and Heat Pumps for Domestic Water Heating," Florida Public Service Commission, Florida Solar Coalition Conference, Winter Park, FL, Nov. 1982.
3. Henry, R. and A.M. Varney, "Development of a Computer Model for Pilot Ejection Seat Systems," and "Development of a Projectile Recovery System," ASME Meeting, Winter Park, FL, Nov. 1983.
4. Moslehy, F., and D. Lampert, "Computer-Aided Photoelastic Data Analysis," Southeastern Seminar on Photomechanics, University of South Carolina in Columbia, April 8-9, 1983, nonrefereed.
5. Pozefsky, A. and D.R. Jenkins, "The Information Explosion, UCF-STAC, The Gateway to Information," Citrus Engineering Conference, ASME, Lakeland, FL, March 24, 1983. Invited, refereed.



DEPARTMENT OF MECHANICAL ENGINEERING  
AND AEROSPACE SCIENCES

SEMINARS, SPECIAL PROGRAMS, AND EMINENT SPEAKERS

1. The Role of the Patent in Engineering Design, Edward Carreras, Patent Attorney, Orlando, Florida, MEAS Faculty and EML 4505 Class, Engineering Building, October 14, 1982.
2. Product Liability in Engineering Design, Stanley R. Andrews, Attorney, Titusville, Florida. MEAS Faculty and EML 4505 Class. Engineering Building, November 18, 1982 and March 23, 1982.
3. Personal Rapid Transit, Prof. Edward Anderson, University of Minnesota, MEAS Faculty and EML 4505 class. Engineering Building, March 2, 1983.



DEPARTMENT OF MECHANICAL ENGINEERING AND AEROSPACE SCIENCES

ABSTRACTS OF SPONSORED RESEARCH

TITLE: Passive Solar and Low Energy Building  
Design Demonstration Project

PRINCIPAL INVESTIGATORS: Dr. Robert D. Doering, P.E. and  
Professor James K. Beck, P.E.

SPONSORING AGENCY: Florida Public Service Commission

GRANT NUMBER: 21-1624-001

A B S T R A C T

This project is concerned with the cooling and heating energy requirements of typical Florida residences by the application of innovative building design concepts.

Six central Florida residences have been modified using exterior insulation, vented roofs or walls, radiation barriers and/or ridge vents, solar screens, and so forth. Energy-monitoring instrumentation has been installed for evaluating the various concepts and comparisons will be made with laboratory controlled experiments conducted at the Florida Solar Energy Center.

The final report was submitted October 1, 1982.

\* \* \* \* \*

TITLE: Relative Advantages of Heat Recovery Units and  
Dedicated Heat Pumps for Residential Water Heating

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

SPONSORING AGENCY: Florida Public Service Commission

GRANT NUMBER: 21-1626-002

A B S T R A C T

A field experiment was carried out to examine the relative advantages of air-conditioning heat recovery units (HRU's) and dedicated heat pump water heaters (HPWH's) as energy conservation devices. HRU's were retrofitted to six central Florida residences, three of these with additional 80-gallon preheat water storage tanks. The other three residences were equipped with HPWH's which could be operated alternatively to the HRU's. The systems were instrumented with BTU meters and KWH meters to measure the required water heating energy, the energy supplied by either the HRU or HPWH, and the energy provided as backup to either the resistance coils or the HPWH. Data as logged on magnetic tape every 15 minutes and computer interpreted for analysis.



The method of installation and the modes of operation are discussed. Problems with the energy conservation equipment and the instrumentation are reported. Results are presented in terms of daily distributions of energy supplied, energy use, and energy saved for water heating in each of the six residences. Hourly distributions of energy required and HRU supply are provided to allow examination of the time-wise mismatch between air-conditioning waste heat availability and hot water demand. Projections of annual energy savings are made and suggestions for maximizing the performance of the HRU's are discussed. A simple payback analysis is done on the HRU's and HPWH's based upon observed performance, present day installed costs, and cost of displaced electricity.

Significant results indicate somewhat higher annual energy savings with the HPWH except where the HRU is operated in conjunction with a space heating and cooling heat pump. The HRU energy savings are maximum during periods of large air-conditioning demand, which is beneficial to the electrical peaking problem. The installed cost of the HPWH is significantly higher than that of the HRU indicating, in general, that the HRU has a shorter payback. The HPWH also appears to be more prone to mechanical failures.

\* \* \* \* \*

TITLE: Heat Flux Mapping  
PRINCIPAL INVESTIGATOR: Dr. F.S. Gunnerson  
SPONSORING AGENCY: EG & G Idaho, Inc.  
GRANT NO.: 28-1626-007

#### A B S T R A C T

The term "critical heat flux (CHF)" is often used to define the condition for which a small increase in the surface heat flux, or a small decrease in the coolant mass flux, gives rise to inordinate deterioration in the heat transfer.

Prediction of the critical heat flux, over a wide range of thermal-hydraulic conditions, is essential for accurate nuclear reactor modeling. In spite of the very large amount of work that has been done on the CHF in flow boiling, there is not yet a complete understanding of the physical mechanisms involved. Numerous correlations, both analytical and more often empirical, have evolved over the years to model CHF behavior. Unfortunately, present CHF correlations are often severely limited to narrow ranges of thermal-hydraulic conditions and to specific geometries. Many correlations must be simultaneously incorporated in order to model CHF behavior over a wide spectrum of conditions.

Basic research will be performed to provide fundamental insight into the prediction of the critical heat flux. Such research may provide input necessary to accurately model CHF behavior within a two-phase, forced convection system over a wide range of thermal-hydraulic conditions.



The scope of the work herein is to construct a multidimensional critical heat flux map based on coolant mass flux, void fraction (or quality) and existing critical heat flux correlations.

From a CHF map, thermal-hydraulic regions not included within present predictive techniques can be identified, and corresponding modes of inter-polated or prediction within these regions addressed. At low flow-high void fraction conditions, for example, where evaporation of micro/macrolayer may dominate the CHF behavior, present correlations are not adequate. Predictive techniques, under such conditions, will be assessed. In addition, the limiting quality phenomenon, not considered in current codes, will be incorporated with the CHF mapping study.

The key result anticipated from the proposed research is a comprehensive two-phase, forced-convection critical heat flux map. The map may be used to analytically predict and/or visually illustrate CHF behavior for a much wider spectrum of thermal-hydraulic conditions than is presently possible. Better confidence in CHF predictive techniques, over a wider range of thermal-hydraulic parameters, is expected.

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TITLE: Mathematical Model for Estimating  
Transient Pressure Surges in a  
Cryogenic Liquid-Vapor System

PRINCIPAL INVESTIGATORS: Dr. E.R. Hosler, and Dr. F.S. Gunnerson

SPONSORING AGENCY: NASA

GRANT NUMBER: 20-1626-003 (NASA Contract NAS-10-10588)

The Space Shuttle Liquid Oxygen Servicing System is specifically designed to transfer liquid oxygen (LOX) between the Ground Storage Tank (ST) and the Shuttle External Tank (ET). During the transfer process, vapor cavity formation within the servicing system is likely. The subsequent collapse of the entrapped vapor has been accredited with unpredictable surges in system pressure and, under certain conditions, may jeopardize the system integrity. To minimize pressure surges in the LOX system, a transient waterhammer-type analysis is often required for each potential operating procedure. Unfortunately, methods for predicting pressure surges in a single-component, two-phase cryogenic system are not well developed.

The objective of the project is to develop and validate a general mathematical model (with associated computer software) for estimating transient pressure surges in the single-component, two-phase Shuttle LOX servicing system. The effects of liquid column separation and vapor cavity collapse on peak pressure transients will be assessed.

\* \* \* \* \*



TITLE: Analysis of Visual Data from  
Steam Generator Studies

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

SPONSORING AGENCY: Electric Power Research Institute

GRANT NUMBER: 28-1626-006  
(EPRI Contract S-206-2)

A B S T R A C T

High speed motion picture data obtained in several test programs have been analyzed to determine the nature of the steam water flow in the vicinity of the support plates of vertical tube steam generators. The nature of the two phase flow regimes were determined and a representative selection of the observations were combined into an illustrative motion picture which can be used by designers and operators to help understand the phenomena which are occurring inside steam generators.

\* \* \* \* \*

TITLE: Experimental Stress Determination by  
Spectral Density of Laser Speckles

PRINCIPAL INVESTIGATOR: Dr. Sayed M. Metwalli

SPONSORING AGENCY: UCF-DSR

GRANT NUMBER: 28-2000-135

A B S T R A C T

The proposed technique depends on a surface property which does not generally change from one point to the other except under deformation. Random laser speckle pattern will be used to define its spatial spectral density in the direction of deformation. This property is a measure of the distribution of average spacing between speckles. When the surface quality is the same over some area of the body, this average spacing between speckles should not change. Under deformation, the average spacing will change and thus deformation detected. Experimental studies and generalization is, however, required. The objective of this work is then to test the feasibility of using this laser technique to define local deformation in machine components.

\* \* \* \* \*

TITLE: Development of Distributed Breach  
for the Conical Shock Tube

PRINCIPAL INVESTIGATORS: Dr. S.M. Metwalli and Dr. F.A. Moslehy, P.E.

SPONSORING AGENCY: Naval Research Laboratory



GRANT NUMBER: 20-1622-002

A B S T R A C T

The project represents the development of a new distributed breach for the conical shock tube. An initial design of the distributed breach has been used to find the effect of prestressing before firing on the stress state after firing. Finite element method has been used to evaluate in-plane and hoop stresses before and after firing. A coarse finite element model is used to find points of high stresses before a finer mesh thereat is adopted. Results confirm the existence of a prestress three dimensional continuum which creates a very high resistance to firing loads. In fact, stresses have literally been improved after firing due to prestressing effect. The results of the initial design led to modifications which can further improve the stress distribution in the breach.

\* \* \* \* \*

TITLE: A Plan to Measure the Effects of Heavy Rain on Aircraft Performance During Landing and Take-Off

PRINCIPAL INVESTIGATORS: Dr. Loren A. Anderson, P.E.  
Prof. James K. Beck, P.E.

SPONSORING AGENCY: UCF-EIES

GRANT NUMBER: 21-1699-062

A B S T R A C T

There is a general interest in the DOD-NASA agencies for information that would delineate the effects of heavy rainfall on the subsonic performance characteristics of aircraft and missiles. The effort associated with this study was directed toward a brief literature search for background data and preliminary planning to develop the requirements for a successful series of experiments that would aid in future performance evaluations.

The end result of the effort was a proposal to the Air Force Wright Aeronautical Laboratories, Dayton, Ohio.

\* \* \* \* \*

TITLE: Cogeneration Study

PRINCIPAL INVESTIGATOR: Dr. P.J. Bishop and Mr. A. Minardi

SPONSORING AGENCY: EIES

GRANT NUMBER: 21-1699-032



## A B S T R A C T

Cogeneration is the simultaneous production of electrical and thermal energy from the same fuel source. A study was made to better determine the potential for cogeneration at an industrial site accounting for both the plant process and the use of electrical power generated. A model was developed using hourly data of a specific medium temperature industrial plant in the citrus industry. Hourly steam and electric demand were obtained from the plant.

Energy savings and economic feasibility will be determined by the model for a centralized cogeneration system. A comparison of a centralized as opposed to a decentralized unit will be made. The cogeneration strategy for this plant will be determined based upon its actual operations as determined by the payback period and energy and cost savings.

Buy back of electricity is incorporated into the model in an effort to determine the effect of a proposed federal regulation on cogeneration potential.

\* \* \* \* \*

TITLE: Computer Simulation Model for  
Residential Energy Loads

PRINCIPAL INVESTIGATOR: Dr. P.J. Bishop and Mr. A. Minardi

SPONSORING AGENCY: EIES

GRANT NUMBER: 21-1699-018

## A B S T R A C T

A residential energy simulation model for heating and cooling loads has been developed. The objective of this model is to be inexpensive, flexible, accurate and include latent effects. The model employs ASHRAE techniques to calculate energy loads based upon the most accurate weather data (temperature, solar insolation and humidity) for the shortest possible time interval. Humidity is included because of its importance in hot, humid climates.

The model inputs also include the thermal and physical characteristics of a "base" house with specified indoor temperature (which varies for the heating or cooling season). Because of its inputs, the model allows the study of the energy conservation potential of window shading, infiltration, fenestration, insulation, house orientation and other conservation strategies compared to a base house.

The model has been completed and costs approximately \$1.50 per simulation on the IBM 360. It is capable of calculating hourly loads. Design charts are currently being constructed to enable architects and builders to incorporate energy conservative features in houses.

\* \* \* \* \*



TITLE: Robotic Automated Tactile System Control  
PRINCIPAL INVESTIGATOR: K.K. Chang  
SPONSORING AGENCY: EIES  
GRANT NUMBER: 21-1699-064

A B S T R A C T

It is proposed to study the possibility of a robotic tactile system that imitates the human behavior which grasps an object through the principle of relative motion. Several methods of relative motion detections are being investigated and compared. This includes strain gage method. Mechanical roller method and photo current state change method. The results will be used to prepare a proposal for possible outside fundings.

\* \* \* \* \*

TITLE: Absorption-Regeneration Studies of  $\text{CO}_2\text{-KHCO}_3\text{-K}_2\text{CO}_3$  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  $\text{CO}_2\text{-KHCO}_3\text{-K}_2\text{CO}_3$  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  $\text{CO}_2\text{-KHCO}_3\text{-K}_2\text{CO}_3$  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. Two technical papers have been generated based on this work.

\* \* \* \* \*

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: 11-1699-044



## 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 has been built to simulate and study in detail these flow characteristics. The test facility has been used by two graduate students to obtain experimental data for Master's theses. Future work with this facility will include obtaining high speed motion pictures of the flow.

\* \* \* \* \*

TITLE: Random-Deterministic Transform  
Application to Linear Systems

PRINCIPAL INVESTIGATOR: Dr. S.M. Metwalli

SPONSORING AGENCY: UCF-EIES

GRANT NUMBER: 21-1699-035

## A B S T R A C T

This project is concerned with the applications of a new theory in random-deterministic transform. The objective is to apply the theory to multi-input linear systems and intend to achieve the parallel equivalence in all pertinent variables and quantities of both deterministic and random domains. This will facilitate the study of more complex systems subjected to multi-input random disturbances that have not previously been possible.

\* \* \* \* \*

TITLE: Software Development and Evaluation for Computer  
Aided Analysis and Design of Mechanisms

PRINCIPAL INVESTIGATOR: Dr. Sayed M. Metwalli

SPONSORING AGENCY: UCF Faculty Summer Grants Program

GRANT NUMBER: 01-1020-005

## A B S T R A C T

It is intended to maximize the effectiveness and efficiency of the teaching-learning process by providing a computer program for interactive use to analyze and design mechanisms. Such analysis and design is required in the course EML 3265 and can be used extensively in both EML 3502 Machine Design and EML 4505 Engineering Design.

The computer is programmed in an interactive mode which allows the students to vary any parameter and repeat the analysis at will. This provides the students with the sufficient tool and speed to understand, visualize and effectively design mechanisms.



\* \* \* \* \*

TITLE: Transient and Steady State  
Equivalence of Dynamic Systems

PRINCIPAL INVESTIGATOR: Dr. Sayed M. Metwalli

SPONSORING AGENCY: UCF/DSR

GRANT NUMBER: 28-2000-109

A B S T R A C T

In this work a new technique is presented through which transient solution can be obtained from steady state spectral response. The complete steady state spectrum should be known to evaluate its equivalent transient response. On the other hand steady state spectrum can also be obtained from transient equivalent. This process makes it possible to work with either transient analysis or steady state analysis and then perform a transformation to the other equivalent.

\* \* \* \* \*

TITLE: Computer Aided Analysis in Laser Speckle  
Photography and Application in Engineering

PRINCIPAL INVESTIGATOR: Dr. F.A. Moslehy, P.E.

SPONSORING AGENCY: The Faculty Summer Research Awards, UCF

A B S T R A C T

The development of laser speckle photogrpahy techniques in stress analysis continue to be of great importance in experimental mechanics and future research will utilize computer applications as a method of data analysis.

This report describes and demonstrates the compatibility of speckle techniques with digital computer systems for measuring in-plane displacements and strains of objects. The report also investigates the theoretical concept and practical application of displacement measurements utilizing the correlation of a reference and deformed image.

Examples of digital correlation in data analysis are presented to illustrate the application of the technique.

\* \* \* \* \*



DEPARTMENT OF MECHANICAL ENGINEERING & AEROSPACE SCIENCES

ABSTRACTS OF UNSPONSORED RESEARCH

TITLE: Analytic Formulation for Optimized  
Cooling Water Control for STEG

PRINCIPAL INVESTIGATOR: Dr. K.K. Chang

A B S T R A C T

Works have been done to find an analytical expression for an optimized cooling water control scheme for a solar thermoelectric generator system. The analytical formulation obtained is expected to predict the results of computer simulations with reasonable accuracy and thus support the conclusion of the previous work.

\* \* \* \* \*

TITLE: An Interactive Program for  
Photoelastic Data Analysis

PRINCIPAL INVESTIGATORS: Dr. F.A. Moslehy, P.E.  
D. Lampert, student

A B S T R A C T

In this research effort an interactive computer program has been developed to analyze photoelastic data. This program is the first to input directly photoelastic fringe information from a photoelastic photograph via a graphics tablet to an Apple II computer. The program calculates spline functions from which fraction fringe orders can be computed by an interpolation process.

A separate program using the boundary element method is being written now and will be coupled with the photoelastic data analysis program to yield directly stress values from photoelastic photographs.

\* \* \* \* \*

TITLE: Quadratic Ridge - Path Optimization Technique

PRINCIPAL INVESTIGATOR: Dr. S.M. Metwalli

A B S T R A C T

A new ridge-path method is intended through which quadratic function procedure is used. This process would further develop the ridge-path techniques and makes it more efficient for use in quadratic and non-quadratic function minimization. Evaluation of the new technique is also intended.

\* \* \* \* \*



DEPARTMENT OF MECHANICAL ENGINEERING & AEROSPACE SCIENCES

MASTER'S DEGREE RESEARCH REPORTS AND THESES

TITLE: Examination of the Feasibility of an Earth Coolant Tube to Provide Residential Space Cooling

CANDIDATE: W. Jerry Bowman

FACULTY ADVISOR: Dr. Patricia J. Bishop

A B S T R A C T

A study was performed to gain an understanding of the feasibility of an Earth Coolant Tube for use in cooling and heating air for residences and industry. It was concluded that previous studies did not include the effect of coolant tube depth or coolant tube operation over long periods of time. A numerical methods approach using a finite difference form of the general energy conduction equation was used to evaluate these effects. It was concluded that a coolant tube 1 foot in diameter and 100 feet long could provide as much as 1/6 ton of refrigeration for a 4 month time period. It was also concluded that for coolant tubes below a depth of five feet, depth had little effect on coolant tube performance. This study also presents estimates on expected rates of energy transfer for coolant tubes, and recommends a simplified approach for designing coolant tubes.

\* \* \* \* \*

TITLE: Two-Phase Flow Pressure Drop Across Thick Restrictions of Annular Geometries

CANDIDATE: Saeed Ghandeharioun

FACULTY ADVISOR: Dr. E. Ramon Hosler

A B S T R A C T

In shell-tube type heat exchangers, support plates are spaced periodically to keep the same geometrical arrangements between tubes. Thus, the annular passages are formed when tubes extend through circular holes in support plates, permitting the shell-side two-phase flow to leak past the support plate, increasing the shell-side pressure drop.

Two rational approaches of predicting steady-state two-phase pressure drop are presented with emphasis on the orientation of tubes-to-support plate holes, and the thickness of support plates.

\* \* \* \* \*

TITLE: A Calorimeter for Solar Collector Testing Facilities

CANDIDATE: James Clifford Huggins



FACULTY ADVISOR: Dr. Burton E. Eno

A B S T R A C T

The reference heat source (RHS) is an electrical calorimeter used with solar collector test facilities. It can be used to calibrate the test facility or to measure the thermal performance of a collector. The RHS described here as designed to be accurate enough to be used as a standard for verification of test facility calibrations. The core of the unit consists of resistance heaters, platinum resistance thermometers, a thermopile, and flow mixers. This core is surrounded by a thermally driven copper shield to control heat loss. The electrical power input of the core is measured with an electronic power transducer. The output of this transducer as well as the temperature sensors is indicated on digital panel meters. All measurements are made independent of the test facility's data acquisition system. The entire unit is mounted on a 0.5 x 1.5 m cart for portability.

In operation, liquid from the test facility is circulated through the RHS core. The liquid is heated by passing over the resistance heaters. If the test facility's calibrations are under investigation, the RHS input power and temperatures are compared with those recorded by the test facility. If a collector is under test, the RHS is placed in series with the collector. The power input to the RHS core heaters is adjusted to give a temperature rise through the RHS equal to some fraction (usually one-half to one) of the temperature rise across the collector. Since the same mass flow passes through both the RHS and the collector, the energy gain in the collector is simple the RHS input power multiplied by the ratio of the temperature rises.

This RHS was designed for use at temperatures from 0°C to 100°C and liquid flow rates from one to forty liters per minute. The results presented here were obtained using typical flat plate solar collectors. The operational experience obtained in an active test facility is discussed with regard to the achieved accuracy, practical operation, and recommendations for further applications.

\* \* \* \* \*

TITLE: Convective Heat Transfer from  
a Cylinder Rotating in Air

CANDIDATE: O. Kemal Pasamehmetoglu

FACULTY ADVISOR: Dr. Patricia J. Bishop

A B S T R A C T

This study had a two-fold purpose. The initial emphasis was placed upon the analysis of heat transfer to ambient air from a rotating cylinder. Three distinct heat transfer regimes can be identified. For low rotational speeds corresponding to a Reynolds number less than the critical value for initiation of turbulence, the flow is laminar and the rotation has no effect on the average heat transfer coefficient. In the transition region,



the heat transfer coefficient depends upon both natural convection and rotational effects. For higher rotational velocities, the flow is fully turbulent and rotational effects dominate.

Previous analytical and experimental studies have been conducted for all three regions. These studies are summarized in this thesis and it is seen that there are gaps and limitations in the existing state of knowledge. Therefore, further study is required especially for high rotational speeds.

In the second phase of study, an experimental program was designed to determine heat transfer coefficients at various rotational speeds and heat transfer rates. The rotating cylinder is designed in such a way that it can be inclined by 30°, 45°, 60° or 90° with the horizontal. High rotational speeds are possible yielding Reynolds numbers of  $2 \times 10^5$ . The maximum power is approximately 400 W.

\* \* \* \* \*

TITLE: Pressure Drop across a Restriction of Annular Geometry

CANDIDATE: Farshid Yarizadeh

FACULTY ADVISOR: Dr. E.R. Hosler

#### A B S T R A C T

This report presents experimental results for the pressure drop across a restriction of annular geometry used in a typical pressurized water reactor steam generator. The pressure drops were obtained for air, water, and the corresponding two-phase mixtures.

The loss coefficients associated with these pressure drops were experimentally determined and empirical relations correlating the results were developed.

The tests were performed at atmospheric conditions (atmospheric temperature and pressure), and the two-phase flow mass velocity ranged from 236 to 711 lbm/s-ft<sup>2</sup>.

\* \* \* \* \*



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