



**Evaluation of Research Centers and Major Research  
Programs Report**

**To**

**Vice President (Research & Development)  
Prairie View A&M University**

**By**

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**Period: 2005-2009**

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# PRAIRIE VIEW A&M UNIVERSITY

A Member of the Texas A&M University System

## ***Executive Summary: 2005-2009 Report***

Since the 2002-2003 academic year when CECSTR was officially approved by the Texas A & M University (TAMU) System Board of Regents until this present 2008-2009 academic year, we have continued to make steady progress towards our stated organizational goals and purpose. We have received over \$ 8 million grant/fund in industrial support for our work on communications systems and other related research areas since 2002.

The Center's mission is to establish a comprehensive research program with the capabilities of seeking an understanding of selected aspects of communication systems, Wavelets and Wavelet Transforms, Compressed Sensing/Compressive Sampling Systems, DSP Solutions, Signal/Image/Video Processing, Mixed Signal Systems, and High Speed (Broadband) Communication Systems by way of algorithm developments, modeling, simulation, analysis, design, testing, and performance evaluation. The center seeks to answer relevant questions concerning various strategic enterprises and explores the means to use the knowledge acquired to benefit mankind and increase the economic competitiveness of the State of Texas and the Nation.

Within the State of Texas and the Nation, a similar center with similar mission, goals and objectives as CECSTR does not exist within an academic setting. CECSTR has been trying to fill the gap in educating the State's and the Nation's future leaders in these emerging highly technological areas necessary for our industries, institutions, and for the economic growth of the State of Texas and the Nation.

The CECSTR has been instrumental in enhancing teaching, research, and service in the area of communications systems. Within the Department of Electrical Engineering, students follow three tracks to the Master's and PhD degree: Communication Systems and Signal Processing, Microelectronics, and Computer Engineering. CECSTR specifically supports the Master's and Ph.D. degree students and has continued to train and support undergraduate students as well.

CECSTR has a Center Advisory Board (CAB) and a Technical Advisory Committee (TAC). In our recent CECSTR Board meeting, the issue of sustainability was discussed and the board empowered the Director of the Center and the Vice President for Research and Development to seek new ways to seek necessary funding to support the research and operational activities of the center in a sustained basis. The actions taken on this issue will be discussed in the next meeting of the Board members and will be monitored thereafter to review progress.

CECSTR since 2005 published 39 journal papers, presented 60 conference papers, wrote 21 technical papers and received 15 grant awards. Since 2005, two Ph.D. students and 44 Masters Students completed their studies in this center under the supervision of the center's director and affiliated researchers. The director of the center and its affiliated faculty researchers has published many books and book-chapter given in appendix C.

CECSTR is also actively promoting outreach program for science and engineering students at various high schools. CECSTR has recently signed MOU with Federal University of Technology, Owerri (FUTO), Nigeria and the Federal Polytechnic, Nekede, Owerri (FPNO), Owerri, Imo State, Nigeria for student/faculty exchange, and collaborative research work. A similar MOU is in process with Ain Shams University, Cairo. CECSTR is representing PVAMU as a member of the Science Application Intl. Corporation (SAIC) for the ARMY'S *IT Enterprise Solutions-2 Services program*.

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## 1.0 Brief Description of the Center

**Center's Name:** Center of Excellence for Communication Systems Technology Research (CECSTR)

**Approval Date:** Approved by The Texas A&M University System Board of Regents On July 25, 2003.

**CECSTR'S Vision:** CECSTR's vision is to be a State and National resource in the selected aspects of Communication Systems research and education for the State of Texas, the Nation, our industry sponsors, government agencies and academia.

**CECSTR'S Purpose:** CECSTR'S mission is to conduct comprehensive research in the selected aspects of communication systems, Wavelets and Wavelet Transforms, Compressed Sensing/Compressive Sampling Systems, DSP Solutions, Signal/Image/Video Processing, Mixed Signal Systems, and High Speed (Broadband) Communication Systems by way of algorithm developments, modeling, simulation, analysis, design, testing and performance evaluation and to support technology transfer to our sponsors. Develop and suggest new curriculum for the Electrical Engineering and Engineering technology Programs in accordance with industry expectations and emerging technologies. Support and train students by recruiting talented students, awarding scholarships and creating pipelines with our industry partners for students' placements.

**Center's Facility:** CECSTR has established five research programs: Analog & Mixed Signal Systems, DSP Systems, Broadband (High-Speed) Communication Systems, Communication Control Systems and Signal/Image/Video Processing Systems. It has about 10,000 square feet of research laboratory and office space with state-of-the-art facilities (Appendix A).

**Partial List Of Facilities:** Mixed Signal Testing and Evaluation Facility, Digital Signal Processing (DSP) Testing and Evaluation Facility, Control Systems Simulation, xDSL Network Emulation Facility for Test and Evaluation, Image/Video processing, VoIP Emulation Facility for Testing, Verification and Research, Various Network Management Elements and Traffic Generators, Various Simulation Software, Unix Server and Client facility, etc.

**Areas Of Expertise & Research Tracks:** Wavelet & Wavelet Transform-Based Application, Compressed Sensing/Compressive Sampling systems, Signal/Image/Video Processing, Analog & Mixed Signal Test and Evaluation, Wireless Communications including WiMAX, Network

Modeling and Performance Analysis, Network Management and Information Security, xDSL System Analysis, Control System Analysis, Biometrics for Homeland Security, Microelectronics and Power Electronics.

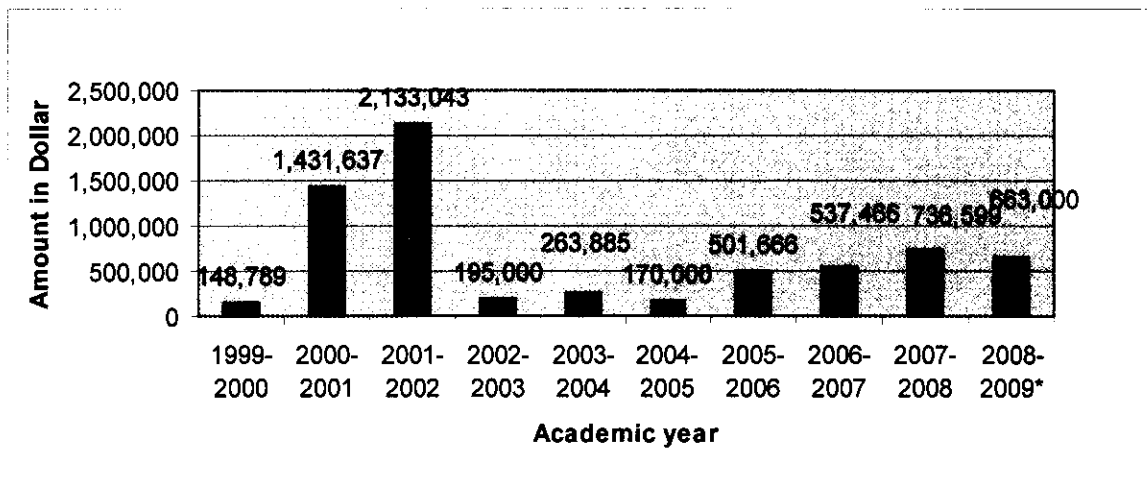
**No. of Center's Employees:** 4 (1 Administrative Assistant, 2 Research Staff, 1 Technical Support Staff (vacant)) and Proposed Post Doctoral Position to be filled September 1, 2009.

**Devoted Percentage of Time:** 100%

**Statistics:** 14 faculty researchers & collaborators, more than 68 graduate research assistantships & more than 100 undergraduate scholarships provided since 2000. CECSTR researchers have raised more than \$8M since 2000 in research grants. CECSTR has established the TI endowed undergraduate scholarship of \$600,000 and TI endowed chair of \$1,000,000.00 with its grants.

## 2.0 Funding/Revenue

The Center's budget is funded by various industry partners and government-agencies' research projects. Graph-1 shows the funding received since 1999-2000 to 2008-2009 academic years. Fund RCVD till today is app. \$ 8 million.



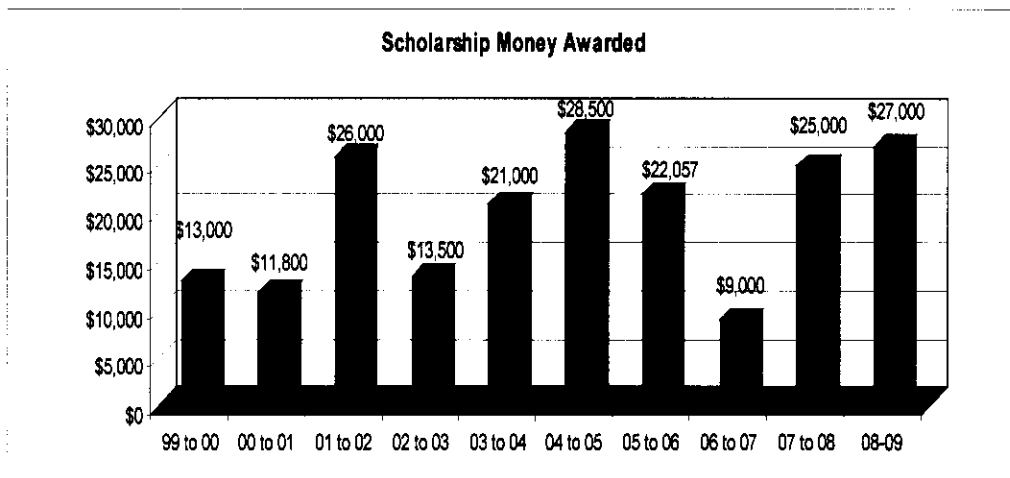
**Graph 1: Fund received at the center since 1999- 2009**

### 3.0 Rationale for Keeping the Center

CECSTR's impact on students, faculty, researchers and the education is enormous. Over the past few years CECSTR has received over \$ 8 million funds and part of it is used for infrastructure development and the total area under this center is now about 10,000 square feet. This provides state-of-the-art research and development facilities to our students and faculty. Some of the key facts about the center's impact on PVAMU are given below:

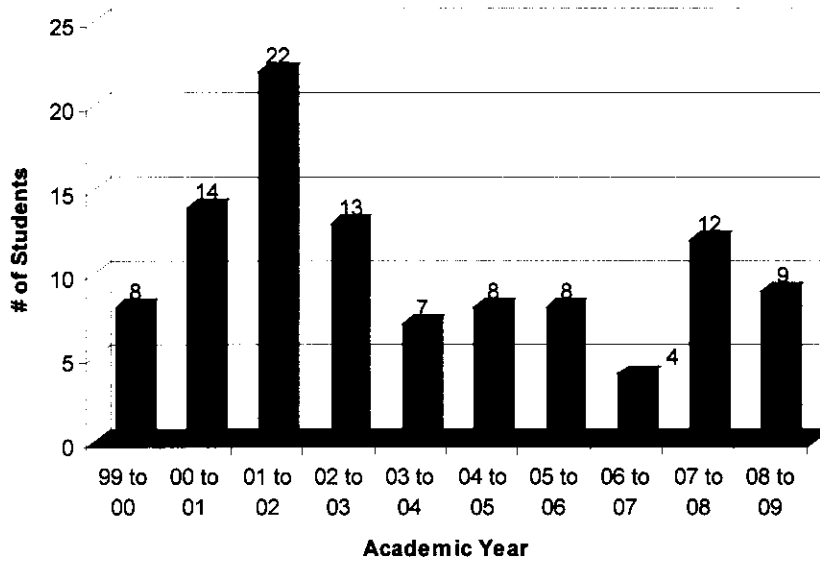
- Provides research and hands-on experiences to our students and faculty
- Attracts more qualified students to the College of Engineering by providing scholarships/financial support and educational training.
- Enhance the electrical engineering curriculum in the study of telecommunications, signal processing and their real world applications.
- Provides avenues for collaboration with other research laboratories within the university, the Texas A&M university system, industry and globally.
- Expose students to real industrial experience by serving as interns with industry during the summer under the supervision of the principal investigators and industry personnel.
- Supports Undergraduate, Masters and Ph.D. Programs in electrical engineering and thereby enhancing the vision of the College of Engineering and PVAMU and CECSTR.
- Helping in publicizing the name of PVAMU through its research publications, presentations and collaborations.

The center is thus filling the gap in educating the State's future leaders in the emerging highly technological areas necessary for our industries, institutions, and for the economic growth of the State of Texas and the Nation. Graph-2 shows the undergraduate scholarship amount awarded since 1999-2000 to 2008-09 academic year. Graph-3 shows no. of Texas Instruments (TI) scholarships given since 1999 and Graph-4 shows the no. of assisted graduate assistants worked in the center since 1999.



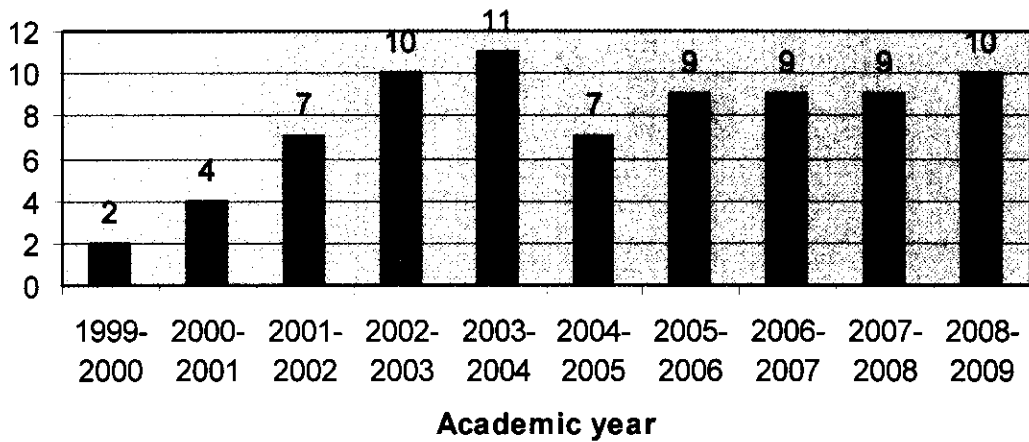
Graph 2: Undergraduate scholarship awarded since 1999

### TI Scholarships Awarded



**Graph 3: No. students received TI scholarship since 1999**

### No. of Graduate Research Assistant



**Graph 4: No. students received Graduate Assistantship since 1999**

## 4.0 Center's Production

CECSTR gives the PVAMU faculty researchers opportunities for research and access to collaborate among PVAMU and other universities, industry partners and government agencies. Currently, the center has 14 affiliated faculty researchers across the campus (*See Appendix B for list of names*).

Current university partners are: TAMU Intra-Systems, Texas Tech, Ohio State University, University of Michigan, University of Houston, Howard University, Central Connecticut State, Tuskegee University, University of Puerto Rico, Federal Univ. of Tech. Nigeria, Univ. of Parma, Italy, Ross University, St. Kitts., Ain Shamns Univ. Cairo, Egypt.

Current industry partners are DoD, NASA, NSF, L3-Communications, Texas Instruments, Sprint Communications, ITG and California Space Grant Foundation (CSGF).

The researchers produce numerous publications each year (*see Appendix C for list of publications since 2005*) and at the same time help the sponsors and partners to achieve their goals. In 2004, the center filed for a patent on Motor Control Method and Apparatus with Multi-Objective Observer for Disturbance Rejection. Throughout the year, the center produces technical reports for its sponsors and partners. Selected report-list (since 2005) is given in *Appendix E*.

CECSTR's students are also active in research and publications with the affiliated faculty and won two prestigious awards (graduate level-2<sup>nd</sup> and 3<sup>rd</sup> place) from the 2006 TAMU Pathway Symposium and also two more from the 2008 TAMU Pathway Symposium. One is graduate level 1<sup>st</sup> place and the other one is under graduate level 2<sup>nd</sup> place. Each year affiliated faculty researchers write potential proposals to various government agencies. A list of submitted/awarded proposals is given in *Appendix D*. *Table-2* shows the center's productivity at a glance for 2005-08 academic year.

TABLE 2: 2005-2008 CENTER'S PRODCUCTIVITY AT A GLANCE

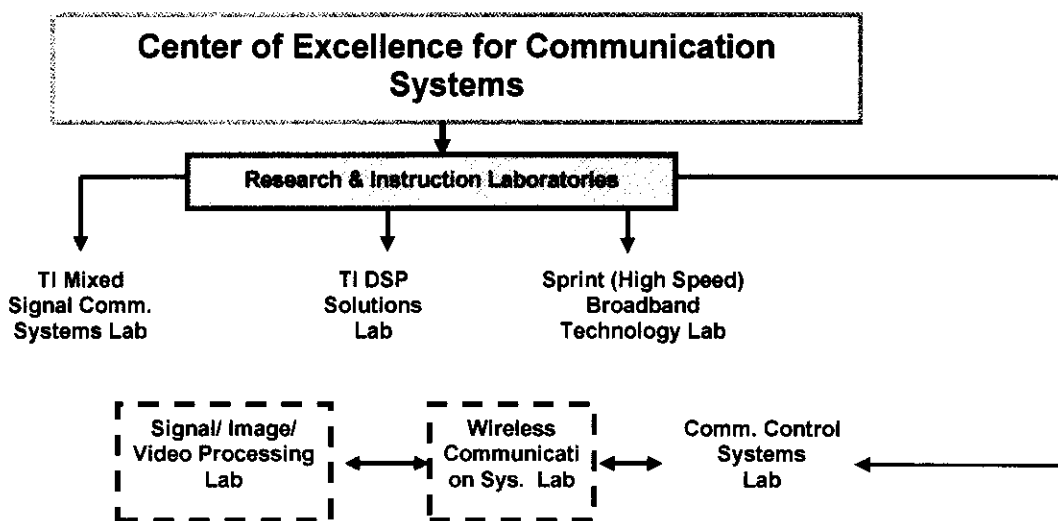
Item	No.
No. of Journal Papers	39
No. of Peer Reviewed Papers	60
No. of Technical Papers	21
No. of Selected Sub. Proposals	20
No of Awarded Proposals	15
No. of Ph.D. Students Passed	1
No. of MS Students Passed	9
No. Grad Students Supervised and Supported	9
No. of UG Students Supervised and Supported	21
No. of Conferences Attended	45
Book /book chapter (Partial list)	11

## 5.0 Assessment & Future Growth

The center's assessment is done based on the research activities, no. of grant proposal writing, no. of grant/fund received and students' activities. Since the establishment of the center, we have received approximately \$ 8 million grant/funding from our corporate partners and government agencies. Though, the center has steadily grown to where it can sustain it self and support its staffs and students, it requires continuous effort to sustain various activities of the center. To strengthen the center's goal, recently a Post Doc position is created and announced for hiring to enhance the research and grant writing capability. To achieve the center's goal along with the university's goal, we have started seeking industry support in the last six months and submitted potential grant proposals which are now under reviewing process. Future growth directly depends on research grant and industry support. In recent time, CECSTR has signed MOU with Federal University of Technology, Owerri (FUTO), Nigeria and the Federal Polytechnic, Nekede, Owerri (FPNO), Owerri, Imo State, Nigeria for student/faculty exchange, and collaborative research work. A similar MOU is in process with Ain Shams University, Cairo. CECSTR is representing PVAMU as a member of the Science Application Intl. Corporation (SAIC) for the ARMY'S *IT Enterprise Solutions-2 Services program*. Army awarded \$20 billion to 11 contractors. SAIC is one of them. Dr. Akujuobi, the Principal Investigator of PVAMU-team will continue to meet with SAIC personnel to ensure that PVAMU receives its fair share of tasks to complete.

# Appendix

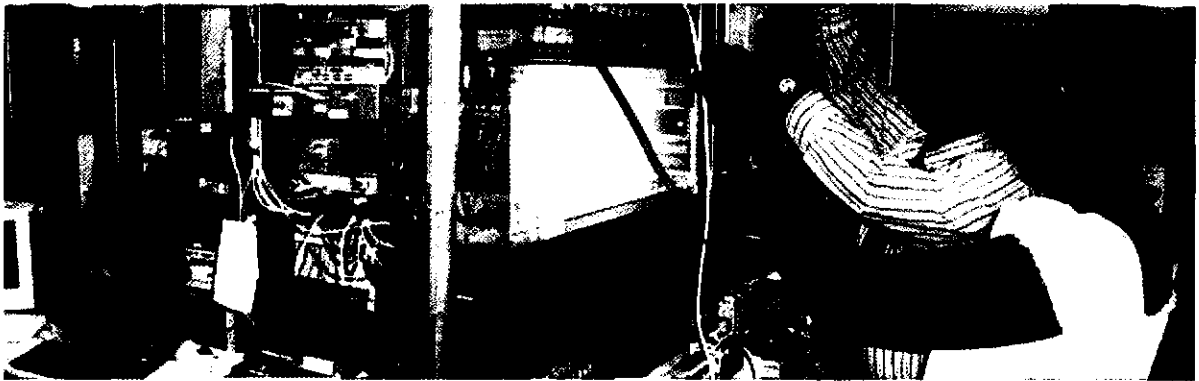
## Appendix A: CECSTR's Lab Facility



Texas Instruments Analog-Mixed Signal LAB



**Texas Instruments DSP Solutions Lab**



**Sprint Broadband Technology Lab**



**Communication Control Systems Lab**

## Appendix B: CECSTR Affiliated Researchers/Faculty

<b>Faculty Researchers' Name</b>	<b>Department</b>	<b>Specialization Field</b>
Dr. Annamalai Annamalai	ECE	Communications Systems
Dr. Cajetan M. Akujuobi, Director CECSTR	ECE and Head, ETECH	Signal Processing and Communication Systems
Dr. Charlie Tolliver	ECE	Microwave Imaging
Dr. Jian-Ao	Math	Computer aided geometric design
Dr. John Fuller	ECE	Digital Design
Dr. Lin, Li	CS	Computer Networks
Dr. Matthew N.O Sadiku	ECE	Electro magnetism
Dr. Pamela H. Obiomon	ECE	Micro electronics
Dr. Sarhan Musa	ENTEC	Numerical Modeling of Electromagnetic Problems
Dr. Suxia Cui	ENTEC	Image Processing
Dr. Warsame Ali	ECE	Control Systems
Dr. Yonggao Yang	CS	3D Modeling
Dr. Yonghui Wang	ENTEC	Image Processing
Dr. Yongpeng Zhang	ENTEC	Control Systems

ECE- Electrical and Computer Engineering

ENTEC- Engineering Technology

CS- Computer Science

MATH - Mathematics

## Appendix C: Selected List of Publications 2005-08

### *JOURNAL PAPERS*

1. Cajetan M. Akujuobi and Emad Awada, "Differential Nonlinearity Testing of Mixed Systems ADC Using Wavelet Transform", IEEE Transactions on Circuits and Systems I", Submitted March 2008.
2. Cajetan M. Akujuobi and Emad Awada, "Wavelet-Based Effective Number of Bits Testing in Mixed Signal Systems", IEEE Transactions on Circuits and Systems II", Submitted Feb. 2008.
3. Olusegun O. Odejide, Cajetan M. Akujuobi, A. Annamalai, Gerald L. Fudge, "The Case of Gini Index in the Determination of Best Basis for Compressive Sampling", IEEE Transactions on Signal Processing, Submitted Feb. 2008.
4. Ampah, N. K., Akujuobi, C. M., Alam, S., Sadiku, M. N. O. "An Intrusion Detection Technique Based on Discrete Binary Communication Channels", International Journal of Network Security (IJNS), (Submitted for publication), November 2007.
5. Ampah, N. K., Akujuobi, C. M., Alam, S., Sadiku, M. N. O. "An Intrusion Detection Technique Based on Auto-Reclosing for Enterprise Networks", Security and Communication Networks Journal (SCNJ), Wiley (Submitted for publication), November, 2007.
6. M. N. O. Sadiku, C.M. Akujuobi, S.M. Musa, and S. R. Nelatury, "Analysis of time-dependent cylindrical problems using Monte Carlo," Microwave and Optical Technology Letters, vol. 49, no. 10, Oct. 2007, pp. 2571-2573.
7. M. N. O. Sadiku, C.M. Akujuobi, S.M. Musa, and S. R. Nelatury, "Direct Monte Carlo simulation of time-dependent problems," Technology Interface, Fall 2007.
8. S. M. Musa and M. N. O. Sadiku, "Modeling and simulation of shielded microstrip lines," Technology Interface, Fall 2007.
9. S. M. Musa and M. N. O. Sadiku, "Using finite element method to calculate capacitance, inductance, characteristic impedance of open microstrip lines," Microwave and Optical Technology Letters, vol. 50, no. 3, March 2008, pp. 611-614.
10. S. M. Musa and M. N. O. Sadiku, "Calculating the Capacitance and Inductance of Multiconductor Transmission Lines," Technology Interface, Spring 2008.
11. M. N. O. Sadiku and S. R. Nelatury, "High definition television in detail," IEEE Potentials, Jan. /Feb., vol. 26, no. 1, 2007, pp. 31-35.
12. 36. M. N. O. Sadiku and P. Obiomon, "Diversity in the workplace," IEEE Potentials, vol. 26, no. 5, Sept. /Oct. 2007, pp. 5-6.
13. Ampah, N. K., Akujuobi, C. M., Alam, S., Sadiku, M. N. O. "An Intrusion Detection Technique Based on Continuous Binary Communication Channels", International Journal of Security and Networks (IJSN), (Submitted for publication), October 2007.
14. H.P. Wang, L.S. Shieh, Yongpeng Zhang, J.S. Tsai, "Minimal Realization of the Transfer Function Matrix with Multiple Time Delays", *IET Control Theory and Applications*, Vol. 1, No. 5, pp. 1294-1301, 2007.

15. H.P. Wang, L.S. Shieh, J.S. Tsai, Yongpeng Zhang, "Optimal Digital Controller and Observer Design for Multiple Time-Delay Transfer Function Matrices with Multiple Input-Output Time Delays", *International Journal of Systems Science*, Vol. 39, No. 5, pp. 461-476, 2008.
16. Y. Yang and J. Lian, "Make 3D Object Surfaces Smoother: Two New Interpolating Subdivision Schemes," submitted to IEEE magazine.
17. Y. Yang, A. Lodgher, and S. Xing, "Bring Rigid Bodies to Life," *IEEE Potentials*, Vol. 26, No. 5, Sep./Oct., 2007, pp. 26-31.
18. F. Nave, S. Frizell, S. Cui, J. Perkins, and P. Obiomon, "Female Faculty Mentoring: A Case Study of the Experience of Female Faculty in the College of Engineering at Prairie View A&M University". *Journal of Faculty Network*.
19. S. M. Musa, M. N. O. Sadiku, and C. M. Akujuobi, "S-Parameters for three and four two-port networks," *Technology Interface*, vol. 7, no. 2, Spring 2007.
20. Obiomon, P., Frizell, S., Holland, A., The Importance of Incorporating Industry Experience in the Classroom, *IEEE Potentials Magazine*, article accepted with revisions and re-submitted.
21. Obiomon, P., Tradeoffs between Oscillators and Integrators in Low-Power Readout Circuitry, *IEEE Potentials Magazine*, submitted.
22. Obiomon, P., A to D Converters used in Microsystems, *IEEE Potentials Magazine*, submitted. Obiomon, P., Holland, A., Holland-Hunt, S. Tickles, V., *The Impact of Globalism on the Millennial Student*, *Network: A Journal of Faculty Development*, Spring 2007.
23. Pamela Holland Obiomon, Adrienne Holland Wowo, Shirley Holland-Hunt, Virginia Cook Tickles, *Advancement of Women of Color in STEM Disciplines: Understanding the Barriers and Cultivating Solutions*, *Network: A Journal of Faculty Development*, Spring 2008.
24. Pamela Holland Obiomon, Felecia M. Nave, Sherri S. Frizell, Suxia Cui, Betti Poindexter-Blackshear, Judy Perkins, *Female Faculty Mentoring: A Case Study of the Experiences of Female Faculty in the College of Engineering at Prairie View A&M University Network: A Journal of Faculty Development*, Spring 2008.
25. R. C. Palat, A. Annamalai and J. H. Reed, "Bit Error Rate Analysis of Bandlimited Cooperative OSTBC Networks under Time Synchronization Errors," to appear in the *IEEE Trans. Vehicular Technology*.
26. R. C. Palat, A. Annamalai and J. H. Reed, "An Efficient Method for Evaluating Information Outage Probability and Ergodic Capacity of OSTBC System," *IEEE Communications Letters*, Vol. 12, No. 3, March 2008, pp. 191-193.
27. Cajetan M. Akujuobi, Jie Shen, and Matthew N. O. Sadiku, "A New Parallel Greedy Bit-Loading Algorithm With Fairness for Multi-Users in a DMT System", *IEEE Transactions on Communications*, Vol. 54, No. 8, August 2006.

28. W. Ali, Yongpeng Zhang, C.M. Akujuobi, C.L. Tolliver, L.S. Shieh, "DSP-based PID Controller Design for the PMDC Motor", *International Journal of Modeling and Simulation*, Vol. 26, No. 2, 2006.
29. Yongpeng Zhang, C.M. Akujuobi, W. Ali, C.L. Tolliver, L.S. Shieh, "Disturbance Resistance Speed Controller Design for PMSM", *IEEE Trans. on Industrial Electronics*, Vol. 53, No. 4, Aug 2006.
30. Cary Smith, Cajetan M. Akujuobi, Kurt Kloesel and Phil Hamory, An Approach to Vibration Analysis Using Wavelets in an Application of Aircraft Health Monitoring, *Journal of Mechanical Systems and Signal Processing*, Accepted for Publication June 16, 2006, Ref. # MSSP05-189R2, Elsevier, 2006.
31. Matthew N.O. Sadiku and Cajetan M. Akujuobi, "Magnetic Levitation", *IEEE Potentials Journal*, Vol. 25, No. 2, March/April 2006, pg. 41-42.
32. Cajetan M. Akujuobi, Scott Briles and Jian-ao Lian, "On Morlet and Spline Wavelets", *International Journal of Wavelets, Multiresolution and Information Processing (IJWMIP)*, Accepted for Publications, to appear November 2006.
33. S. M. Musa, Emmanuel Opara, Cajetan M. Akujuobi, and N. F. Mir, "Utilization Of Buffers For Performance Evaluation Of Local Area Network Protocols", *Communication of the International Information Management Association Journal (CIIMA)*-in press, October 2006.
34. S. M. Musa, Cajetan M. Akujuobi, and N. F. Mir, "VoDSL Information Management for Broadband Communication Network Access," *Journal of Computing and Information Technology* in press October 2006.
35. M. N. O. Sadiku, S.M. Musa, and C. M. Akujuobi, "SMART MATERIALS AND THEIR APPLICATIONS," *IEEE Potential Journal* submitted March 16, 2006.
36. C. M. Akujuobi and Matthew N. O. Sadiku, "The Present and Future of Broadband Communication", *IEEE Potential Journal*, October/November 2005, pg. 12-16.
37. Cajetan M. Akujuobi and Jian-ao Lian, "Image Compression Using Nonorthogonal and Orthogonally Compensated W-Matrices", *Chinese Journal of Engineering Mathematics*, Vol. 22, No. 5, Oct. 2005.
38. Matthew N. O. Sadiku, Cajetan M. Akujuobi and Raymond C. Garcia, "An Introduction to Wavelets in Electromagnetics", *IEEE Microwave Magazine*, June 2005.
39. Cajetan M. Akujuobi, Jie Shen, and Matthew N. O. Sadiku "A New Parallel Greedy Bit-Loading Algorithm With Fairness for Multi-Users in a DMT System", *IEEE Transactions on Communications*, paper # TCOM 04-0197, Accepted to Appear after being Revised and resubmitted, 2005.

## **PEER-REVIEWED PAPERS**

1. Yongpeng Zhang, "A Simple but Optimal Semi-Active Control Method", *11<sup>th</sup> ASCE Earth & Space Conference*, Long Beach, CA, Mar 3-5, 2008.
2. S.X. Cui, Y.H. Wang, Yongpeng Zhang, C.M. Akujuobi, "Laboratories Enhancement with LabVIEW-Based Graphical Development Tools", *115<sup>th</sup> ASEE Annual Conference & Exposition*, Pittsburgh, PA, June 22 - 25, 2008.
3. Yongpeng Zhang, C.M. Akujuobi, A. Ajuzie, X. Chao, "Input Delay Compensation with Digital Redesigned A/D Conversion", *IEEE Conference on Robotics, Automation and Mechatronics (RAM)*, pp. 410-414, Chengdu, China, Sep 22-25, 2008.
4. Y. Yang and J. Lian, "A new sqrt(2)-subdivision scheme for arbitrary surface design", *Proc. of International Conference on Computer Graphics and Virtual Reality*, July 2008, pp 41-46.
5. J. Perkins, M. Hudson, and Y. Yang, "Developing a GIS-Based System for Analyzing Medical Transportation Activities," *Proc. of International Conference on Information & Knowledge Engineering*, July 2008, pp243-249.
6. S. Xing and Y. Yang, "Approaches on Internet Growth Measurement: Hostname-Based vs. Address-Based," *Proc. International Conference On Computing (ICOMP'07)*, 2007, pp. 200-206.
7. Y. Yang, F. Jiang, and S. Xing, "Use Physics-Based Animation to Generate Polyhedra," *Proc. International Conference on Modeling, Simulation and Visualization (MSV'07)*, 2007, pp. 316-320.
8. Northern & Fuller, "Project Based Learning for a Digital Circuits Design Sequence at HBCU's", *ASEE Conference*, Hawaii, Summer 2007
9. C. M. Akujuobi, N. K. Ampah, and M. N. O. Sadiku, "Application of wavelets and self-similarity to enterprise network intrusion detection and prevention systems," *IEEE Wireless Communications and Networking Conference*, 2007.
10. C..M. Akujuobi, E. Awada, M. Sadiku, and W. Ali, "Wavelet-based differential nonlinearity testing of mixed signal system ADCs," *IEEE Southeast Conference 2007*, pp. 76-81.
11. M. N. O. Sadiku, C.M. Akujuobi, S.M. Musa, and S. R. Nelatury, "Monte Carlo analysis of time-dependent cylindrical problems," *IEEE Southeast Conference 2007*, pp. 778-782.
12. M. N. O. Sadiku, S.M. Musa, and S. R. Nelatury, "Comparison of approximate formulas for the capacitance of microstrip line," *IEEE Southeast Conference 2007*, pp. 427-432.
13. S. M. Musa and M. N. O. Sadiku, "Analysis of rectangular coaxial lines," *IEEE Region 5 Technical Conference*, April 2007, pp. 322-325.
14. S. M. Musa and M. N. O. Sadiku, "Modeling of multiconductor shielded microstrip lines," *Proc. of Int.Scientific Conf. on Information, Communication, and Energy Systems and Technologies (ICEST)*, June 2007, pp.211-214.
15. S. R. Nelatury, M. N. O. Sadiku, and V. K. Devabhaktuni, "CAD models for estimating the capacitance of a microstrip interconnect: comparison and improvisation," *PIERS Proceedings*, Prague, Czech Republic, Aug. 2007. pp. 18-23.

