

Spring 2014

The Department of Electrical and Computer Engineering Newsletter

University of Dayton. Department of Electrical and Computer Engineering

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CALENDAR OF EVENTS

UD Reunion Weekend '14
June 6-8, 2014

Women in Engineering
Summer Camp
July 13-18, 2014

Summer Graduation
August 4, 2014

Fall Classes Begin
August 27, 2014

100

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THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SPRING 2014

CHAIR'S CORNER *Dr. Guru Subramanyam*



Subramanyam

As we wrap up the 2013-14 academic year, I am proud of the accomplishments during this year by our faculty, staff and students. Professor Wicks and his team have created the new Center of Excellence in Distributed Sensing in the Mumma Radio Lab. The new lab will be called the Mumma Radar Lab. The lab has unique microwave imaging, radar, and mul-

ti-ple-input multiple-output (MIMO) measurements with four robots that can pretty much place the sources and receivers at any precise point in space, to the accuracy of $\sim 10 \mu\text{m}$. We are looking forward to formally opening the lab in the summer and starting new research activities in the lab.

Our faculty continue to do impressive research and scholarship. Professor Asari's Vision Lab has become a tech playground with lots of new toys including a hexacopter, Segway and mobile robot. Professor Taha has secured new DARPA and NSA funding this term. Many of our faculty continue to support Air Force Research Laboratory (AFRL) through funded research. Our department faculty, staff

and students are playing a major role in organizing the 2014 IEEE National Aerospace and Electronics Conference (NAECON 2014), to be held for the first time on our campus. It is an exciting opportunity to showcase our new research projects.

For the first time in over a decade, we have crossed the 500 mark for the total number of students in the department based on the spring 2014 enrollment numbers. We had 270 undergraduates, 178 M.S. students and 64 Ph.D. students enrolled in the spring term. The fall 2014 recruitment looks very strong with over 530 applications for our undergraduate programs and 500+ applications for our graduate programs.

NAECON CONFERENCE

The 2014 IEEE National Aerospace and Electronics Conference (NAECON) will be held June 25-27 at the University of Dayton Research Institute Conference Center (Meyer Room), 1700 S. Patterson Blvd., Dayton, Ohio. The 2014 theme is "sensory processing." NAECON is a major forum for researchers, practitioners and students interested in advanced aerospace systems, sensors, navigation, power systems, imaging, advanced materials, RFIC design, THz and signal processing, passive and active sensing, cyber and Trust in semiconductor design.

The NAECON Grand Challenge theme is "sensory materials and interfaces to achieve high performance, trust, reliability and improved sensory processing." NAECON is sponsored by the IEEE Aerospace and Electronic Systems Society (AESS) and the IEEE Dayton Section. The conference will have an expo of industry sponsors as well.



HYPERSPPECTRAL CAMERA CAN SEE THE IMPOSSIBLE

Imagine a camera that captures information invisible to the human eye. Well, the Vision Lab's new Resonon Pika II hyperspectral camera is able to do just that. Unlike standard cameras that capture three channels of the electromagnetic spectrum (red, green and blue), a hyperspectral camera provides 240 spectral channels. That is 80 times more data than can be captured by a household camera!

The camera can "see" things that are invisible to humans due to its spectral range of 400 to 900 nanometers wavelengths, which extends well beyond visible light. When asked what Vision Lab has planned for the hyperspectral camera, Ph.D. student Paehding Sidike explained, "The numerous spectral bands provide a unique signature for specific materials. We can potentially utilize

this information for detecting pipeline oil leaks, since oil has different reflective properties than water or vegetation."

The Vision Lab has already begun extending their visibility improvement research to exploit the additional data and further enhancement of the imagery. For more information on the hyperspectral camera and other Vision Lab projects, visit visionlab.udayton.edu.



VISION LAB HEXADRONE

The Center of Excellence for Computer Vision and Wide Area Surveillance Research (Vision Lab) is taking to the skies. The acquisition of an unmanned aerial system, the Turbo Ace Cinewing 6 Hexacopter, equipped with a variety of imaging and positioning sensors, enables aerial surveillance projects to thrive. "Previously, our algorithm development relied on data from infrequent and expensive piloted flights. Our new hexacopter allows for us to capture aerial imagery at any place, any time," said Yakov Diskin, a Ph.D. student researcher with the Vision Lab's intelligent robotics group. The UAV capabilities aid multiple Vision Lab projects, including the Air Force Research Laboratory-sponsored aerial target tracking and large-scale 3-D scene modeling efforts.

The Vision Lab's intelligent robotics group, consisting of a mix of undergraduate, master's and Ph.D. students, works on transferring in-house vision-based artificial intelligence algorithms onto real-time mobile systems. Concerning the future of this project, Diskin explained, "Our eventual goal is to have fully automated robots that conveniently aid and interact with humans. Over the last couple of years, we have learned a lot from our experiences with the RAIDER [Robust Artificial Intelligence-based Defense Electro-Robot], and now, we are eager to incorporate our algorithms onto a much more challenging aerial system."

EXTREME LOW-POWER COGNITIVE PROCESSORS

Dr. Taha's research team is working on novel extreme low-power computer processors for cognitive applications. These are very specialized systems based on a new class of devices discovered in 2008, called memristors. Initial research indicates that these processors can potentially reduce the power consumption for cognitive applications by about 300,000 times compared to conventional desktop computing processors. Dr. Taha has presented the findings of this work at several organizations including DARPA, the Lawrence Livermore National Laboratory and the Air Force Research Laboratory. At present this research is funded through the NSF, AFOSR and DARPA (via AFRL). Dr. Taha and Dr. Subramanyam are collaboratively working with the AFRL to fabricate and characterize memristor devices. One of their recent publications in this area received the 2013 Best Paper Award at the International Joint Conference on Neural Networks (one of the premier conferences in neural networks). These computing systems have many applications, including UAVs, biomedical systems and portable electronics.



Taha

UPDATES ON THE RAIDER

Artificial intelligence is already among us! The University of Dayton Vision Lab has been developing an interactive “self-thinking” mobile robot. The Robust Artificial Intelligence-based Defense Electro-Robot, or simply RAIDER, has seen an enormous transformation over the past year. Through a collaborative effort with UD’s mechanical engineering department, the RAIDER has physically transformed and is now equipped with a variety of sensors and an onboard processor. The latest efforts enhance the RAIDER’s ability to follow a person by integrating the Vision Lab’s face detection technology with the pan/tilt/zoom (PTZ) base of an Axis camera. Positioned in the head of RAIDER, the PTZ base will allow for the RAIDER to mimic a human’s ability to “look around” or “follow a person with only the eyes,” specifically without physically turning the robotic body. The Vision Lab’s RAIDER project began in 2011 to encourage multidisciplinary collaborations. Since then, the RAIDER team has grown to ten students ranging from undergraduates to Ph.D.-level researchers. The project

encompasses real-world engineering problems, including designing and building the mechanics of the robot, developing “self-thinking” algorithms, accelerating the algorithms onto hardware, and integrating the sensors and subsystems.



MARK WEISENBERGER'S UD EXPERIENCE — A Family's Perspective



Mark has gained a position with Nationwide and will start in June.

Our son graduated from the University of Dayton today! Just like all parents of graduates, we are proud of our son’s accomplishments. We would like to share a little about Mark’s journey and what made it special for us. About five years ago, Mark decided he wanted to become an engineer. Then he said he wanted to go away to college as his sister did. Aware of Mark’s Autism Spectrum Disorder, we felt uncertain about whether or not this would work.

Mark has always been persistent at his work and his classes regardless of how long it takes. Throughout grade school, high school and college, Mark spent many long hours working to learn and understand. With any class, skills need to be applied in the homework. It takes Mark a very long time to process concepts and complete the work. Even at times when he was given an option to reduce his homework load, he did the work anyway. That has always been his way.

The University of Dayton provided assistance to Mark with the learning center, tutors and caring professors. His adviser, Guru Subramanyam, was especially helpful, and Mark could not have made it without Guru’s guidance and reassurance. Guru was also helpful to us when we felt uncertain about Mark’s progress. Guru believed in Mark and was encouraging and patient.

Mark generally kept to himself throughout his five years at UD. You may have seen him in class or the cafeteria or at Mass. Mark’s RA described him as a nice and quiet guy. He never bothered anyone.

It has been exciting to see Mark’s gifts and talents develop as he progressed through the engineering program. He has always had a strong ability to excel in mathematics, calculus and physics. Now, we have seen him become more confident in his engineering skills and applications.

We have experienced many challenging situations along the way. We never could have envisioned what Mark’s life would be like at the University of Dayton. But Mark stayed the course and after five years, he finished his degree. Today, he is an electrical engineer!

Many thanks to all the people from the University of Dayton who supported Mark and any “differently-abled” students along their way!

— Pete and Barb Weisenberger

Kubach Gift to UD Will Benefit Engineering Faculty and Students

A gift of more than a half-million dollars to the University of Dayton will benefit electrical and computer engineering faculty and their students.

The \$566,411 bequest from the estate of Reinhold Kubach will establish the Reinhold W. and Alice Mohl Kubach Faculty Fellowship in the School of Engineering. "The funds from the fellowship will be used to support faculty and help them develop their teaching approach and philosophy and establish their research program and laboratories. The faculty development and research opportunities, in turn, will help us continue to provide a transformative education to our students," School of Engineering Dean Tony Saliba said. "I knew professor Kubach as a student and later as a colleague. I admired his passion for teaching and his dedication to students. We hope this gift inspires future faculty to provide the same dedication to their students."

Kubach emigrated from Germany in 1950 and, after several stops, established roots in Dayton. He taught at the University of Dayton School of Engineering from 1958 to 1989. "They never had children, and their family lived so far away in Germany," said Nancy Stork, a former University of Dayton development officer who now works in student development. "Their neighbors became very good friends, in a way adopting them when they first came. They were so committed to education and to UD, I think, because UD gave them a chance to establish a new life here when they came over from Germany. That meant a lot to Reinhold, and he loved being with students."

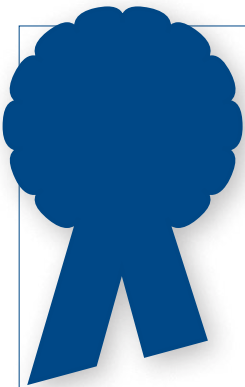
Kubach, who died in 2012, was a long-time supporter of the University, dating back to his teaching days. For many years, Stork said, Kubach gave a portion of his salary to the annual fund. The Kubachs are charter members of the



Kubach

University of Dayton President's Club. They occasionally came back to campus for alumni activities and events with the Leo Meyer Society, which honors those who have made planned gifts to the University. Alice Mohl Kubach died in 2006.

"They wanted their legacy to remain here in the States, at the University of Dayton," Stork said. "To make a difference for others in a place that made such a difference to them."



AWARDS / HONORS / PROMOTIONS

- **Dr. Qiwen Zhan**, professor of electro-optics and electrical and computer engineering, was recently elected as a Fellow Member of The Optical Society (OSA). Fellow membership in OSA is limited to no more than 10 percent of the membership and is reserved for members who have served with distinction in the advancement of optics. Zhan is being honored specifically for seminal contributions to the development of new optical polarization engineering techniques for controlling light-matter interactions on the nanometer scale.
- **Kevin Stevens** was awarded the Thomas R. Armstrong, '38 Award of Excellence for Outstanding Electrical Engineering Achievement in Memory of Brother Ulrich Rappel, S.M., and W. Frank Armstrong – donated by Thomas R. Armstrong.
- **David Zimmerman** was the recipient of the Brother Louis H. Rose, S.M. '33 Award of Excellence to the Outstanding Junior in Electrical Engineering.
- **Jialin Lu** and **Heting Li** were jointly awarded the Anthony Horvath, '22 and Elmer Steger, '22 Award of Excellence to the Outstanding Senior in Electrical Engineering – donated by Anthony Horvath and Elmer Steger.
- **Carly Gross** was the recipient of the Mary C. Millett Endowment Award for the Outstanding Senior Electrical and Computer Engineering Student in Memory of Mary C. Millette.

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O. Djaneye-Boundjou, **R. Ordonez**, V. Gazi, "Stable Adaptive Particle Swarm Optimization," *13th International Conference on Control, Automation and Systems (ICCAS)*, Gwangju, Korea, October 2013.

H. Ananthanarayanan, **R. Ordonez**, "Real-Time Inverse Kinematics of Redundant Manipulator Using a Hybrid (Analytical and Numerical) Method," *2013 International Conference on Advanced Robotics (ICAR)*, Montevideo, Uruguay, November 2013.

M. Corwin, **R. Penno**, L. Kempel, S. Schneider, "Inductively Loading a Half Width Leaky Wave Antenna to Control the Main Beam Direction", (submitted to *IEEE Transactions on Antennas*, pending).

J. Heebl, E. Thomas, **R. Penno**, A. Grbic, "An Investigation of Frequency Tuned and Impedance Tuned Wireless Non-Radiative Power Transfer Systems," *IEEE Antennas and Propagation Society Magazine* (accepted for publication).

Gene Harding, Purdue University, **Robert Penno**, University of Dayton, "Simulation of the Electromagnetic Scattering from Complex Scattering Targets," *IEEE Radar Conference*, May 2014.

M. Barber, J. King, K. Hamblin, M. Forster, D. Kuhl, D. Saunders, T. Dalrymple, S. Dooley, **R. Penno**, "Spiral Modeformer Demonstration with Integrated Broadband SiGe Modeformer ICs," *GOMACTECH Conference*, Las Vegas, March 2013.

G. Subramanyam, M. W. Cole, N. X. Sun, T. S. Kalkur, N. M. Sbrockey, G. S. Tompa, X. Guo, C-L. Chen, S. P. Alpay, G. A. Rosetti, K. Dayal, L-Q. Chen, and D. G. Schlom, "Challenges and opportunities for multi-functional oxide thin films for voltage tunable RF/Microwave components," *Applied Physics Review, J. Applied Physics*, vol. 114, 191301-35, November 2013.

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2013 FACULTY PUBLICATIONS/CONFERENCE PROCEEDINGS/JOURNALS/PATENTS

M. Liu, C. R. Ma, G. Collins, J. Liu, C.L. Chen, A. Alemaeyu, **G. Subramanyam**, Y. Ding, C.H. Chen, C. Dai, Y. Lin, and M. Cole, "Ferroelectric BaTiO₃/SrTiO₃ multilayered thin films for room-temperature tunable microwave elements," *Nanoscale Research Letters*, vol. 8, 338, 2013.

M. Liu, J. Liu, C.R. Ma, G. Collins, C.L. Chen, A. Alemaeyu, **G. Subramanyam**, J. He, J.C. Jiang, and H. Meletis, "Enhanced dielectric properties of (Ba,Sr)TiO₃//Ba(Zr,Ti)O-3 heterostructures with optimized structure design," *Crystal Engineering Communications*, vol. 15, no. 34, pp. 6641-44, 2013.

M. Liu, C.R. Ma, J. Liu, G. Collins, C.L. Chen, A. Alemaeyu, **G. Subramanyam**, C. Dai, Y. Lin, and A. Bhalla, "Microwave Dielectric Properties of Epitaxial Mn-doped Ba(Zr,Ti)O-3 Thin Films on LaAlO₃ Substrates," *Ferroelectrics Letters*, vol. 40, no. 1-3, pp. 65-69, 2013.

C. Yakopcic, **T. M. Taha**, G. Subramanyam, and R. E. Pino, "Generalized Memristive Device SPICE Model and its Application in Circuit Design," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, 32:(8), 1201-1214, August 2013.

C. Chen and **T. M. Taha**, "A Communication Reduction Approach to Iteratively Solve Large Sparse Linear Systems on a GPGPU Cluster," *Cluster Computing*, accepted.

C. Yakopcic, R. Hasan, **T. M. Taha**, M. McLean, and D. Palmer, "Memristor-based neuron circuit and method for applying a learning algorithm in SPICE," *IET Electronics Letters*, accepted.

R. Hasan and **T. M. Taha**, "On-Chip Static vs. Dynamic Routing for Feed Forward Neural Networks on Multi-core Neuromorphic Architectures," *IEEE International Conference on Advances in Electrical Engineering*, December 2013.

T. M. Taha, R. Hasan, C. Yakopcic, and M. R. McLean, "Exploring the Design Space of Specialized Multicore Neural Processors," *IEEE International Joint Conference on Neural Networks (IJCNN)*, August 2013.

R. Hasan and **T. M. Taha**, "On-Chip Routing for Neuromorphic Architectures," *IEEE International Joint Conference on Neural Networks (IJCNN)*, August 2013.

C. Yakopcic, **T. M. Taha**, G. Subramanyam, and R. E. Pino, "Memristor SPICE Model and Crossbar Simulation Based on Devices with Nanosecond Switching Time," *IEEE International Joint Conference on Neural Networks (IJCNN)*, August 2013. Received IJCNN 2013 Best Paper Award.

C. Yakopcic and **T. M. Taha**, "A Novel Memristor-Based Neural Architecture Capable of Perceptron Training Verified in SPICE," *IEEE International Joint Conference on Neural Networks (IJCNN)*, August 2013.

T. Atahary, **T. M. Taha**, S. Douglass, "Hardware Accelerated Cognitively Enhanced Complex Event Processing," *14th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD 2013)*, July 2013.

ECE GRADUATES – MAY 2014

UNDERGRADUATES

Mohammed Alsinan
Bryan Badalamenti
David Fan
Elizabeth Gaugler
Adam Gear
Carly Gross
Brandon Gunn
Kyle Healy
Tyler Hohman
Heting Li
Jialin Lu
Nathaniel Maas
Ryan McCurdy
Ahmed Nasrallah

Wade Schroeder
Thomas Sharp
James Sloat
Kevin Stevens
Andrew Thompson
Mark Weisenberger
Joshua Zurko

MASTER'S GRADUATES

Ahmad Abdalla
Nihad Al-Faisali
Mohammed Aljarrash
Abdullah Almeqdad
Rui Ban
Tarun Bhaskar

Nagi Buassa
Ranadheer Reddy Charabuddi
Yashwant Chowdhary Gorantla
Md Raqibul Hasan
Bojie Jiang
Guanzhou Li
Ruixu Liu
Yu Sen Lu
Chi Ma
Iman Namroud
Parthiban Ramba
Michael Rucci
Navid Sharafdoust
Xichen Shen
Zhuming Sun

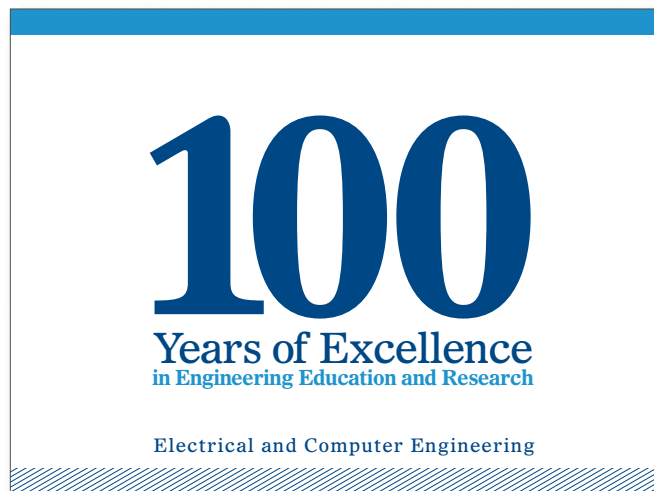
Zhongliang Tang
Pranav Kumar Ungarla
Xiang Wang
Huan Xu
Yaodi Xu
Venkata Sai Kirtana Chivukala
Chen Zhang
Yang Zhao
Minyang Zhou

PH.D. GRADUATES

Dustin Brown
Alex Mathew
Christopher Yakopcic

Announcing the ECE Centennial Book

It is with great pleasure that we announce the completion of the book *100 Years of Excellence in Engineering Education and Research: Electrical and Computer Engineering*. The book highlights the humble beginnings of the electrical engineering department at UD in 1911. It chronicles the growth of the department and the people that were instrumental in making this program what it is today. The book is available to all our alumni, parents, students and friends for \$25 each. To place an order for your copy please fill out the order form below.



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