



# WIMS WORLD

University of Michigan

Michigan State University

Michigan Technological University

## Director's Message



We just completed our Annual Report for the National Science Foundation, and one of the new things required this year was a Sustainability Plan for the Center after the end of NSF support four years from now. Sustainability means continuing our cutting-edge research on wireless integrated microsystems, and to do that, we

need to be focused on important issues, have state-of-the-art facilities, and have a research team that is second to none. WIMS itself will provide the first of these, and the current expansion of our Michigan Nanofabrication Facility will provide the second. As to the third, we have an outstanding group of people that define this ERC. While many universities have pinnacles of excellence in terms of faculty, I am most proud of the pinnacle of excellence we have as a *team*. Certainly we are strong individually, but as a *team* we may be unmatched. It is this team that must be sustained, and that is going to take continuing investment in money and people.

It is also critical to sustain our efforts in education. At the college level, we must continue to train leaders that know how to use technology to solve complex problems and have the broad perspective to do it. In their professional lives, our students will face daunting challenges in energy production, the environment, global competitiveness, homeland security, and other areas. To compete globally, we must also improve pre-college education and attract many more of our youth into engineering careers. It must become a national imperative to solve these problems, because if we don't, our children and grandchildren will suffer the consequences. We need a national effort akin to what happened in the wake of Sputnik back in 1957. It will take leadership and teamwork, but I believe that Americans are ready to roll up their sleeves and do some amazing things. And WIMS will play a key role.

Mary Sue Coleman, President of the University of Michigan, summed up the importance of *teaming* very well in a speech she gave recently at the National Press Club<sup>1</sup>: "Like many of my peers leading research universities around our country, I came of age with Sputnik and the space race. Getting into space and to the moon was an

obsession. An absolute obsession. And now the generation that couldn't get enough engineering and medicine and math is at the helm of leadership and saying, "We need another Sputnik!" But today's crisis cannot be compared to Sputnik, because this is not your father's space race. ... We have no enemy [this time], except perhaps ourselves. ... There's not a whole lot that we rally behind together as a society, except perhaps who should be the next "American Idol." It's pretty telling when coverage of the Grammy Awards beats out a cover story on America's tenuous position as a leader in science and technology. Today's challenges are incredibly complex, and require the creativity and expertise of many great minds ... [they] are too complicated to be explained by a lone scientist in

a solitary lab. As the great Oscar Robertson said, "You can't manufacture stars, but you can manufacture and sustain good *teams*."

I'll go one step further: there is something *magical* about *team*-building. ... Last month, engineers at Michigan announced they have developed a new cochlear implant that has the potential to provide remarkable sound for the profoundly deaf. This new device is a dramatic development. Not only is it ribbon-thin and more adaptable to the intricate workings of the human ear, it provides greater frequency range and up to eight times better frequency resolution.

... This is the sound of innovation and collaboration, and it will reverberate for generations."

Sustaining our Center post-NSF will require that we maintain our research funding and our efforts in K-12 education. Our industrial program will play an important role, but investments by the State of Michigan and the University will be critical. The State's new 21st Century Jobs Program may offer a path to the former, while it is increasingly recognized that investments to sustain pinnacles of excellence are vital to the University. They are the "poles holding up the tent." WIMS is one of the longer poles, and we are optimistic that the Center will not only continue after NSF funding ends, but will grow as it tackles some of the key problems of the 21st century.

<sup>1</sup>Mary Sue Coleman, "Not Your Father's Space Race," address to the National Press Club, Washington, D.C., March 7, 2006.

### Ken D. Wise

Director, Engineering Research Center for  
Wireless Integrated MicroSystems



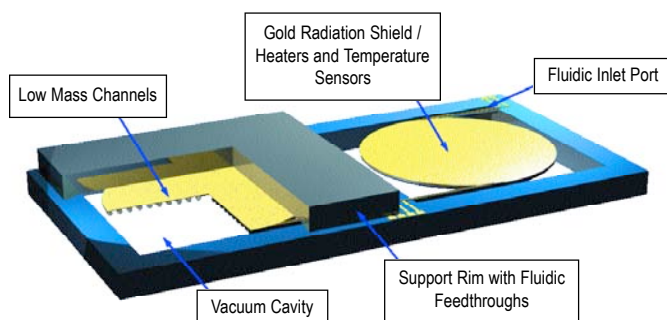
## Research Highlights

### A Low-Power, Pressure- and Temperature-Programmable Micro Gas Chromatograph Column

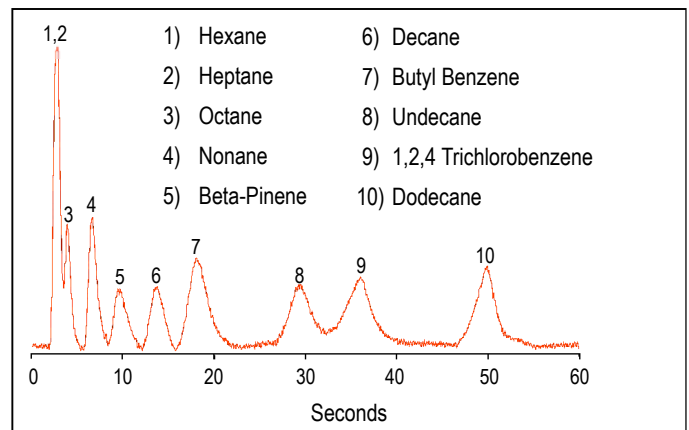
Joseph A. Potkay, Gordon R. Lambertus, Richard D. Sacks, and Kensall D. Wise

The WIMS Center made a large step towards its 2010 goals with the development of the highest-performance, low-power micro gas chromatography ( $\mu$ GC) column realized to date. The suspended-dielectric 1-m-long column is split into two sections, permitting pressure programming.

Furthermore, each section is individually temperature programmable. Each requires only 11mW to raise the temperature of the column by 100°C in vacuum, a fourfold improvement over previous  $\mu$ GC columns. The column has separated 10 alkanes in 52 seconds and five chemical warfare and explosive simulants in 60 seconds. The performance of the column, represents almost a tenfold increase in performance over previous low-power columns.



Low-mass column structure.

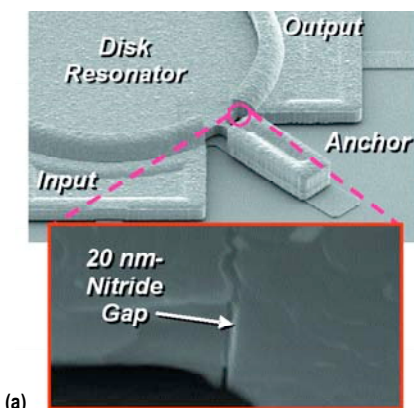


Separation of 10 components in 52 seconds with the 1-m-long column.

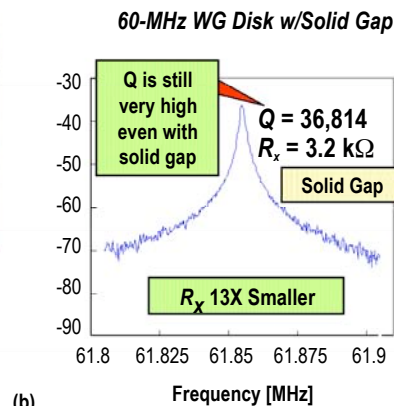
### Vibrating Micromechanical Resonators with Solid-Dielectric Capacitive Transducer Gaps

Clark T.-C. Nguyen

VHF and UHF MEMS-based vibrating micromechanical resonators with new solid-dielectric-filled capacitive transducer gaps to replace previously-used air gaps have been demonstrated at 160MHz, with  $Q$ 's  $\sim 20,200$  (on par with air-gap resonators) and motional resistances ( $R_x$ 's) more than 8X smaller at similar frequencies and bias conditions. This degree of motional resistance reduction comes



(a)



(b)

about via not only the higher dielectric constant provided by a solid-filled electrode-to-resonator gap, but also by the ability to achieve smaller solid gaps than air gaps. These advantages with the right dielectric material may now allow capacitively transduced micromechanical resonators to match the 50–377 $\Omega$  impedances expected by off-chip components (e.g., antennas) in many wireless applications without the need for high voltages. In addition, to lower motional resistance, the use of filled-dielectric transducer gaps (a) better stabilizes the resonator structure against shock and microphonics; (b) eliminates the possibility of particles getting into an electrode-to-resonator air gap (c) greatly improves fabrication yield by eliminating the difficult sacrificial release step needed for air gap devices; and (d) potentially allows larger micromechanical circuits by stabilizing constituent resonators as the circuits they comprise grow in complexity. These benefits, together with the novelty of the technique, earned this work the Best Student Paper Award in the Frequency Control Category at the 2005 IEEE International Frequency Control Symposium.



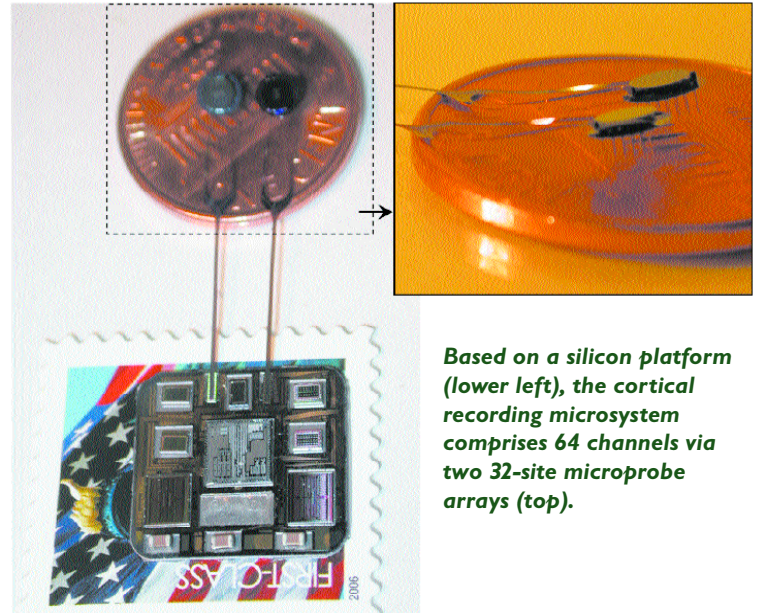
## Implantable 64-Channel Microsystem for the Recording of Biopotentials from Motor Cortex of the Brain

Amir M. Sodagar, Gayatri E. Perlin, Ying Yao, Brendan Casey, Mayurachat Gulari, Kensall D. Wise, and Khalil Najafi

Direct recording of action potentials from different regions in the brain offers great promise to physicians and neuro-physiologists trying to better understand brain behavior. Such recording should help reveal the mechanisms of brain disorders so remedies can be found.

This research highlight deals with an implantable neural microsystem that records from 64 sites on the motor cortex. The system includes: two micro-assembled, 32-site passive microprobes with miniaturized ribbon cables; one signal conditioning front-end; two neural processors; and one bidirectional telemetry chip. All components are assembled on a silicon platform, as shown at the right.

The system has two operational modes: Scan and Monitor. In the Scan Mode, all channels are searched for the occurrence of neural spikes. The addresses of the active channels are sorted, packed, and sent to the outside world through the reverse telemetry link. In this mode, each channel can be individually set up to detect positive, negative, or biphasic spikes. Also, the spike detection thresholds can be adjusted for each one of the channels individually. In the Monitor Mode, any of the 64 neural channels can be sent out directly in analog form or after quantization to 8 bits.

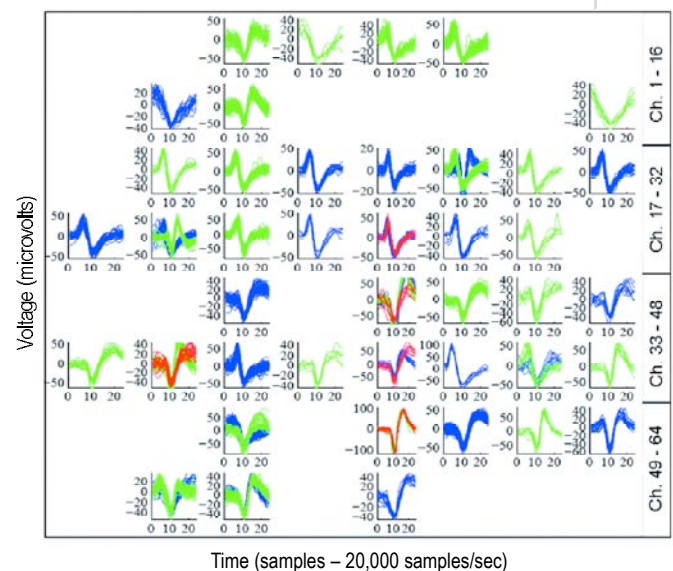


Based on a silicon platform (lower left), the cortical recording microsystem comprises 64 channels via two 32-site microprobe arrays (top).

## Feasibility Studies for a Cortical Neural Prosthesis

Daryl R. Kipke

Sixty-four-site microassemblies of Michigan neural probes have been implanted in the motor cortex in a series of eight non-human primates as part of the development of a neural prosthesis targeted at paralysis. These electrodes form the front-end of a wireless implantable microsystem now being completed. Through these implants, a great deal has been learned about implant procedures and electrode design. In the best of these implants, 64 of 64 channels were electrically viable and able to record high-quality local field potentials and neural spikes for in excess of two months. At one month post-op, discernable single- and multi-unit activity was present on 46 of 64 channels, and within these channels, 54 single units were present with a calculated mean signal-to-noise ratio (SNR) of 4.2. Spike amplitudes ranged from  $50\mu V_{p-p}$  to  $800\mu V_{p-p}$  with background noise levels typically below  $25\mu V_{p-p}$ . At 67 days post-op, 53 of 64 channels exhibited discernable unit activity with 69 units present. A primate was trained to perform accurate 3-D cursor control in a virtual reality environment and control of a robotic arm using the recorded neural activity. Thus, unit stability was sufficient over a period of two months to drive a neuroprosthetic system.



Recordings from primate motor cortex, taken one month post-op.

## Education Highlights

### WIMS ERC Hosts IMPACT Day 2006



**Ruba Borno (SLC President and WIMS Graduate Student), Jose Almodovar-Faria (visiting student from University of Puerto Rico – Mayaguez), Mark Ferriss (WIMS ERC Graduate Student and SLC Member), Ken Wise (WIMS ERC Director), Idongesit Ebong (visiting student from Carnegie-Mellon University), Beth Stalnaker (Graduate Program Coordinator for Electrical Engineering), and Leo McAfee (WIMS ERC Education Director); Not pictured is William Taylor (visiting student from Prairie View A&M University).**

In early March, the WIMS ERC hosted several potential graduate students during IMPACT Day, which brings together underrepresented students to learn about the University of Michigan's degree programs, requirements, research strengths, general opportunities, and infrastructure resources. Three students visited the Center, among the eight who focused their attention on the Electrical Engineering and Computer Science (EECS) program. The event provided an opportunity for these three students to meet and interact with Center faculty, research staff, and Student Leadership Council (SLC) graduate students. We at the Center heartily welcomed the occasion to introduce and recruit highly motivated and capable potential graduate students to WIMS research and teams.

Visiting students, faculty, and staff attended a general joint session for three graduate degree programs of the EECS Department. Associate Chairs Martha Pollack and Brian Gilchrist offered a warm welcome to the students and introduced the graduate degrees and programs. The Departmental Computing Organization's (DCO) leader Don Winsor described the computing facilities, resources, and software packages available to students, and Liz Fisher, EECS Financial Awards Coordinator, described the traditional types of financial awards.

A WIMS welcome and overview was presented by Professor Wise. Professor Maharbiz discussed his research area of bioMEMS, and Professor McAfee and Beth Stalnaker discussed course selection and plans of study for the students. Professor Gianchandani discussed his research area of advanced materials, packaging, and processes, and Professor Flynn discussed his research area of wireless interfaces and mixed-mode electronics. The day's activities concluded with lab tours and demonstrations conducted by WIMS System Integrators Robert Gordenker and Jamille Hetke.

In recent years, over 60% of the students who attended IMPACT Day chose Michigan for their graduate studies. This year, of the three visiting students, two decided to enroll as graduate students starting in September 2006. The Center looks forward to future IMPACT Day participants enriching its diversity and becoming vital parts of University of Michigan history.

## Recent Events

### Student Lends a Hand in Mississippi

When Mark Poll, a first-year engineering student who video-taped last semester's WIMS seminar series, arrived at the University of Michigan last September, he never thought he would be spending spring break in Mississippi, on rooftops, assisting in Hurricane Katrina relief. At the end of February, nonetheless, that is exactly what happened. He, and about 25 other U of M students and faculty, traveled to Gautier, Mississippi, a town



**Mark Poll repairing roof.**

near Biloxi, and Mark spent most of his time working on roofs. Three groups made up the party, including members of Wesley Foundation campus ministry, Niche campus ministry, and the Ecumenical Center and International Residence (ECIR). They worked for all or part of six days, but the volunteers also had some chances to see the area and take a tour of the widespread damage. The church in Gautier split the U of M group into smaller crews, and paired them up with professional volunteers from other states to guide them. They had the good fortune to meet some of the people they were helping, who were incredibly grateful. Mark said it was fulfilling to see their accomplishments at the end of the day, and know they were making a huge impact on someone's life.

Mark and his fellow workers were strongly affected by their experiences in Mississippi, especially the extent of damage that they saw to businesses and homes that were destroyed or missing. Some of the volunteers are trying to arrange to go back to Gautier this summer so they can help more. Mark learned in Mississippi that most of the hurricane victims do not just want to capitalize on handouts from the government and others, they want to rebuild and continue their lives. He said he felt privileged to be able to help them in this endeavor.



## Faculty/Student Awards

### Professor Dennis Sylvester Chosen to Receive 2006 Henry Russel Award

Professor Dennis Sylvester has been selected to receive the 2006 Henry Russel Award. This prestigious award, conferred through the University of Michigan's Rackham Graduate School, recognizes distinguished scholarship and/or creativity and conspicuous ability as a teacher. Professor Sylvester received his award at a ceremony held in conjunction with the Henry Russel Lecture on March 14, 2006.



**Dennis Sylvester, U of M President Mary Sue Coleman, and U of M Interim Provost Edward Gramlich.**

### Engineering Faculty and Staff Honored at University Awards Convocation

Six College of Engineering faculty and staff members at Michigan State University received awards at the annual Founders' Day and University-wide Awards Convocation on February 9th at the Pasant Theatre, Wharton Center. Among the 30 members of the campus community who were honored was **Professor Andrew Mason**, who received the MSU Teacher-Scholar Award. This award is presented to junior faculty members who have demonstrated dedication and skill in teaching, as well as promise of becoming outstanding scholars. Professor Mason is an assistant professor in electrical and computer engineering for the WIMS ERC.



**Andrew Mason**



**Khalil Najafi**

### Professor Khalil Najafi Honored

**Professor Khalil Najafi**, Deputy Director of the WIMS ERC and Director of the NSF National Nanotechnology Infrastructure Network (NNIN) at Michigan has been named the Schlumberger Professor of Electrical Engineering and Computer Science, effective March 1, 2006. Dr. Najafi has a distinguished record of research accomplishments. He has been editor of several professional journals, an Arthur F. Thurnau Professor at the University of Michigan, and is a Fellow of the IEEE and the AIMBE.

### Professor Kensall Wise Receives the U of M 2007 Henry Russel Lectureship

**Professor Kensall Wise**, William Gould Dow Distinguished University Professor of Electrical Engineering and Computer Science, the J. Reid and Polly Anderson Professor of Manufacturing Technology, and Director of the WIMS ERC received the Lectureship, which is the highest honor bestowed by U of M upon a faculty member. Professor Wise will present his lecture on March 13, 2007. Wise is also a fellow of IEEE and the AIMBE and a member of the National Academy of Engineering. His present research interests focus on the development of integrated microsystems for health care, process control, and environmental monitoring.



**Kensall Wise**

## Personnel Focus



**Julia Hrycko** was hired in October 2005 as a research secretary for WIMS ERC Professors Dennis M. Sylvester and Michael P. Flynn. In this position, she performs a full suite of office support duties and provides special assistance in preparing for major WIMS Center conferences. Previously, she handled conference planning, faculty support, accounting, and ordering in the Chemistry Department.



**Deb Lyons** was hired in January to assist with the WIMS ERC's financial activities. With direction from Barb Rice, the Center's financial director, Deb will work with Mary McCune to process the volume of paperwork generated on a daily basis. She will be reconciling accounts, placing orders, assisting with payroll and student paperwork, as well as handling registrations for our biannual IAB meetings. Before joining the Center, she was an office assistant in the Department of Biomedical Engineering, and before that, Deb worked at the Department of Atmospheric, Oceanic, and Space Science.



**Jonathan E. Plummer** was recently hired to take over the WIMS ERC's webmaster responsibilities. He recently concluded a 29-year career as a University of Michigan Facilities Manager. Before joining the Center, Jonathan worked for University Hospitals, Plant Department, and Housing Departments. He is the CEO of Michigan Start Pages, LLC, the award-winning online source for Michigan information. He holds a Bachelor of Business Administration, concentrating in IT management. He is a member in good standing with the International Association of Webmasters and Designers and is listed in the *Who's Who Directory of Business Professionals*.

## In Memoriam — Professor Richard D. Sacks

Professor of Chemistry Richard Sacks died February 11 at his home in Ann Arbor after a courageous battle with cancer. He was 63.

Sacks received his bachelor of science in chemistry from the University of Illinois at Urbana-Champaign in 1965, and his doctorate in analytical chemistry from the University of Wisconsin-Madison in 1969. He began his career as an assistant professor in Ann Arbor that same year and was promoted to associate professor in 1974 and full professor in 1979. He served the Chemistry Department as associate chair for graduate studies from 1987–92.

During his 37 years as a faculty member, Sacks taught both undergraduate and graduate students the principles of modern analytical chemistry and instrumentation and was a driving force in modernizing the analytical chemistry curriculum. He developed courses on chemical instrumentation at the undergraduate level and, at the graduate level, he introduced courses on electronic measurements and microcomputer control of analytical instruments, as well as modern separations methods.

He served as mentor to more than 35 doctoral graduate students who have gone on to distinguished careers in academia, industry, and government laboratories.

Sacks was recognized internationally for his pioneering work on analytical instrumentation. During the early part of his career, his research focused on novel atomic emission spectroscopic methods, including direct solid-sample elemental analysis. In the 1970's, he developed exploding thin-film platforms for solids analysis that combined simplicity of sample introduction with unprecedented low detection limits. In the mid-1980s, he turned his attention to innovative approaches to high-speed gas chromatographic separations of complex mixtures of volatile organic compounds. His methodologies reduced measurement times for complex mixtures almost 100-fold and attracted great academic and industrial interest, eventually leading to formation of a spin-off company, Chromatofast Inc.

In recent years, he helped to lead efforts at the University to create wireless micro-analytical systems for environmental, homeland security, and deep-space applications. During his career, Sacks and his colleagues published more than 150 research papers on these topics and presented their findings at scientific conferences all over the world. Sacks is survived by his wife, Kristine, and daughter, Jenny.

A public memorial service was held at 2 p.m. March 9 in the Vandenberg Room of the Michigan League. The Department of Chemistry has established the Richard D. Sacks Memorial Travel Award, which will be used to support yearly travel awards for analytical chemistry graduate students to present their research at technical conferences. For more information, call (734) 615-9852.

— Submitted by Alice Forney, Department of Chemistry. Reprinted from the University Record.

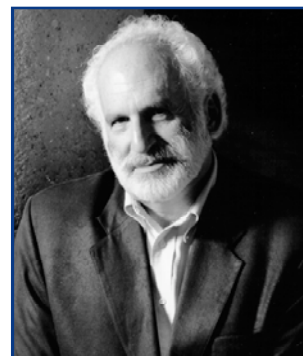


Photo by Bob Foran

**Professor Sacks will receive the prestigious ANACHEM award at the FACSS Conference in Orlando this September for his pioneering work on gas chromatography. It is the first time in the fifty-year history of this award that it will be given posthumously.**

## Industrial Liaison's Report



It is now spring in Michigan, and a sure sign of that here, as it probably is where you are, is the ubiquitous orange barrel on the road. Here at the WIMS ERC, we have no orange barrels; however, we do have quite a bit of construction. In particular, at the University of Michigan, the Michigan Nanofabrication Facility (MNF) is undergoing expansion.

The present MNF is a 6,000 square foot Class 1000/100/10 cleanroom for circuit and MEMS fabrication. The expansion will add 4,400 square feet of cleanroom, upgrade silicon processing to 6-inch wafers, improve all of the cleanroom and safety systems, and add new cleanroom space and equipment for nanotechnology and organic devices.

The link between the MNF and the WIMS ERC is a natural one because WIMS requires MNF capabilities to support both integrated circuits and MEMS, along with non-standard materials growth and sophisticated packages. Our web site ([www.wimserc.org](http://www.wimserc.org)) contains additional information on MNF. This information can be obtained by going to About WIMS

and then to Lab Facilities on the WIMS Home Page. The WIMS Annual Report also contains information on the capabilities available in the MNF.

The facilities of the MNF are provided to users across the country through the National Nanofabrication Infrastructure Network. WIMS members, to every extent possible, are given priority in using the MNF. Resident engineers from member companies are provided office space, and all general laboratory use charges are waived.

If you, or one of your colleagues, are interested in sharing your experiences with our students, please contact me, so that we can schedule a seminar.

My email address is [giachino@eecs.umich.edu](mailto:giachino@eecs.umich.edu), and my phone number is 734-615-3096.

As always, please visit when in the Ann Arbor area.

**Joseph M. Giachino**

Associate Director, Industry

**WIMS Fall IAB Meeting  
October 24-25, 2006**

## Presentations and Publications

### Conference Presentations

**IEEE International Conference on Micro Electro Mechanical Systems (MEMS), Istanbul, Turkey, January 2006**

S. W. Yoon, N. Yazdi, J. Chae, N. C. Perkins, and K. Najafi, "Shock Protection Using Integrated Nonlinear Spring Shock Stops"

M. T. Richardson, Y. B. Gianchandani, and D. S. Skala, "A Parametric Study of Dimensional Tolerance and Hydrodynamic Debris Removal in Micro-Electro-Discharge Machining"

C. K. Eun, R. Gharpurey, and Y. B. Gianchandani, "Controlling Ultra Wide Band Transmissions From a Wireless Micromachined Geiger Counter"

T. Li, R. Y. Gianchandani, and Y. B. Gianchandani, "A Bulk PZT Microsensor for In-Situ Tissue Contrast Detection During Fine Needle Aspiration Biopsy of Thyroid Nodules"

S. Wright and Y. B. Gianchandani, "A Micromachined Titanium Sputter Ion Pump for Cavity Pressure Control"

B. Mitra, B. Levey, T. C. Fung, and Y. B. Gianchandani, "A Handheld Microdischarge Spectroscopy System for High-Speed Chemical Analysis of Gaseous and Liquid Samples"

**IEEE International Symposium on Circuits and Systems (ISCAS), Kos Island, Greece, May 2006**

Z. Wang, H. S. Savci, and N. S. Dogan, "1-V Ultra-Low-Power CMOS LC VCO for UHF Quadrature Signal Generation"

H. S. Savci, Z. Wang, A. Sula, N. S. Dogan, and E. Arvas, "A 1-V UHF Low Noise Amplifier for Ultra-Low-Power Applications"

**IEEE International Solid-State Circuits Conference (ISSCC), San Francisco, CA, February 2006**

P. T. Bhatti, S. Lee, and K. D. Wise, "A 32-Site 4-Channel Cochlear Electrode Array"

S. Park, Y. Palaskas, and M. P. Flynn, "A 4GS/s 4bit Flash ADC in 0.18 $\mu$ m CMOS"

J. Chen, M. P. Flynn, and J. Hayes, "A Fully Integrated Auto-Calibrated Super-Regenerative Receiver"

### Other Conference Presentations

**1st IEEE International Conference on Nano/Micro Engineered and Molecular Systems, Zhuhai, China, January 2006**

X. Zhu, N. Sepulveda-Alancastro, D. M. Aslam, and J. P. Sullivan, "Diamond Thin-Film Micro-Package for MEMS Resonator"

### Publications

K. J. Otto, M. D. Johnson, and D. R. Kipke, "Bias Voltages Change Neural Interface Properties and Improve Unit Recordings With Chronically Implanted Microelectrodes," *IEEE Transactions on Biomedical Engineering*, vol. 53(2), pp. 333–340, February 2006.

C.-J. Lu, C. Jin, and E. T. Zellers, "Chamber Evaluation of a Portable GC with Tunable Retention and Microsensor-Array Detection for Indoor Air Quality Monitoring," *Journal of Environmental Monitoring*, vol. 8, pp. 270–278, February, 2006.

H. Kulah, J. Chae, N. Yazdi, and K. Najafi, "Noise Analysis and Characterization of a Sigma-Delta Capacitive Microaccelerometer," *Journal of Solid-State Circuits*, vol. 41, no. 2, pp. 352–361, February 2006.

B. Mitra, C. G. Wilson, L. Que, P. Selvaganapathy, and Y. B. Gianchandani, "Microfluidic Discharge-Based Optical Sources for Detection of Biochemicals," *IoP Journal of Micromechanics and Microengineering*, 6(1), pp. 60–65, January 2006.

Y. Shimamura, K. Udeshi, L. Que, J. Park, and Y. B. Gianchandani, "Impact Behavior and Energy Transfer Efficiency of Pulse-Driven Bent-Beam Electro-thermal Actuators," *IEEE/ASME Journal of Microelectromechanical Systems*

(JMEMS), 15(1), pp. 101–110, February 2006.

A. M. Sodagar and K. Najafi, "Extremely Wide-Range Supply-Independent CMOS Voltage References for Telemetry-Powering Applications," *Analog Integrated Circuits and Signal Processing*, 46, pp. 253–261, March 2006.

N. Behdad and K. Sarabandi, "Dual-Band Reconfigurable Antenna With a Very Wide Tunability Range," *IEEE Transactions on Antennas and Propagation*, 54, pp. 409–416, February 2006.

N. Behdad and K. Sarabandi, "A Varactor-Tuned Dual-Band Slot Antenna," *IEEE Transactions on Antennas and Propagation*, 54, pp. 401–408, February 2006.

### Doctoral Dissertations

**University of Michigan, 2006**

Hanseup Kim, "Integrated Peristaltic 18-Stage Electrostatic Gas Micro Pump With Active Microvalves"  
Postgraduate Position: Research Fellow at University of Michigan  
Advisor: Khalil Najafi

Asli Burcu Uçok, "Compact Modular Assembly and Packaging of Multi-Substrate Microsystems (WIMS Cube)"  
Postgraduate Position: Research Fellow at University of Michigan  
for Professor Najafi  
Advisor: Khalil Najafi



## Seminar Series

### \* January 10, 2006

Michael McCorquodale, PhD  
Mobius Microsystems  
"Entrepreneurship and the Commercialization of University Research in Engineering"

### \* January 17, 2006

Professor Clark T.-C. Nguyen  
University of Michigan  
"Vibrating RF MEMS Technology: Fuel for an Integrated Micro-mechanical Circuit Revolution?"

### \* January 24, 2006

Professor Amir Mortazawi  
University of Michigan  
"Extended Resonance Circuits for the Design of Efficient RF Power Amplifiers, Low Phase Noise Oscillators and Low Cost Phased Arrays"

### \* January 31, 2006

Sunghyun Park  
UM Graduate Student  
"A 4GS/s 4b Flash ADC in 0.18 $\mu$ m CMOS"

Pamela Bhatti  
UM Graduate Student  
"A 32-Site 4-Channel Cochlear Electrode Array"

Jia-Yi Chen  
UM Graduate Student  
"A Fully Integrated Auto-Calibrated Super-Regenerative Receiver"

### \* February 7, 2006

Professor Andrew Mason  
Michigan State University  
"Electrochemical Microsystems Utilizing Nanostructured Biomimetic Interfaces"

### \* February 14, 2006

Professor Karl Grosh  
University of Michigan  
"Cochlear Analog Transducers"

### \* February 21, 2006

Dr. Nader Najafi  
ISSYS  
"Transition from a Good Engineer to a Successful Business Person"

### \* March 7, 2006

Professor Luis P. Bernal  
University of Michigan  
"MEMS Actuators for Gas Flow Applications"

### \* March 14, 2006

Professor Kenneth K. O  
University of Florida  
"On-Chip Antennas in Silicon Integrated Circuits and Their Applications"

### \* March 21, 2006

Professor Frank Chang  
UCLA  
"Impact of CMOS Scaling on RF/Mixed-Signal Circuit Designs"

### \* March 28, 2006

Professor Chris Muhlstein  
Pennsylvania State University  
"The Myths, Misconceptions, and Mysteries of Structural Silicon"

*\* Available for viewing on website*

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