

Shantanu Chakrabartty

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Washington University in St. Louis.
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RESEARCH INTERESTS

Analog computing and Analog integrated circuits with focus on: (a) Energy scavenging and self-powered sensors, circuits and systems; (b) biomedical and implantable circuits and systems; (c) neuromorphic engineering; (d) neuromorphic systems; (e) floating-gate circuits and systems.

EDUCATION

The Johns Hopkins University, Baltimore, MD

Ph.D., Electrical and Computer Engineering, 2004.

Dissertation: Design and Implementation of Ultra-low-power Pattern Recognizers and Sequence Decoders;

Advisor: Gert Cauwenberghs

The Johns Hopkins University, Baltimore MD

M.S., Electrical and Computer Engineering, 2001.

Indian Institute of Technology, New Delhi

B.Tech, Electrical Engineering, 1996.

PROFESSIONAL EXPERIENCE

Washington University, St. Louis, MO

7/2015 – Present

Professor, Department of Electrical and Systems Engineering

Professor (by courtesy), Department of Biomedical Engineering

Professor (by courtesy), Department of Computer Science and Engineering

Michigan State University, East Lansing, MI

7/2010 – 6/2015

Associate Professor, Department of Electrical and Computer Engineering

Michigan State University, East Lansing, MI

1/2012 – 6/2015

Adjunct Professor, Department of Biosystems Engineering

Piezonix LLC., East Lansing, MI

5/2013 – Present

Co-founder and Chief Scientific Officer

Data Guild Inc., Palo Alto, California

7/2013 – Present

Affiliate

Michigan State University, East Lansing, MI

8/2004 – 6/2010

Assistant Professor, Department of Electrical and Computer Engineering

The Johns Hopkins University, Baltimore, MD

5/1999 – 8/2004

Research Assistant, Electrical and Computer Engineering

University of Tokyo, Tokyo, Japan

9/2002 - 12/2002

Visiting Researcher, Department of Informatics

Qualcomm Incorporated, San Diego, CA

1/1996 – 5/1999

Engineer, Network and Switching Subsystem Group

AWARDS AND HONORS

- *MSU Innovation of the Year Award, 2012.*
- *NSF CAREER Award, 2010.*
- *MSU Teacher-Scholar Award, 2011.*
- *Alumni, U.S. National Academy Frontiers of Engineering.*
- *Honorary Mention, Best Paper Award, IEEE ISCAS 2015.*
- *Best Paper Award in Sensory Systems, IEEE ISCAS 2014.*
- *Best Paper Award in Sensory Systems, IEEE ISCAS 2013.*
- *Honorary Mention, Best Paper Award, IEEE ISCAS 2012.*
- *Honorary Mention, Best Paper Award, IEEE ISCAS 2011.*
- *Invited Member, Defense Science Research Council, USA, 2006.*
- *Catalyst Foundation Fellow, 1999-2004.*
- *Academic Frontiers Student Exchange Scholarship (Japanese Govt.), 2002.*
- *Best Undergraduate Thesis, IIT Delhi, 1996.*
- *National Talent Search Scholarship Recipient, India, 1990.*
- *Junior Talent Search Scholarship Recipient, India, 1989.*

TEACHING

Average Student Instructional Rating Score (over last 3 years): 3.84/4.00

Courses:

- *Analog Integrated Circuits, Spring 2009, Spring 2010, 2012, 2014.*
- *Introduction to Mixed-signal Integrated Circuits, Fall 2007,2008,2009,2010,2011,2012,2014.*
- *Biomedical Instrumentation, Fall 2007.*
- *Low-power analog and mixed-signal VLSI systems, Michigan State University, Fall 2004, Spring 2006, Spring 2007. Spring 2008*
- *Mixed-signal Prototyping and Testing, Michigan State University, Spring 2005.*
- *Algorithms of Circuit Design, Michigan State University, Fall 2005, Fall 2006.*
- *Introduction to Electronic Instrumentation, Washington University, Spring 2016,2017.*
- *Analog Integrated Circuits, Washington University, Fall 2015,2016,2017.*

INVITED PRESENTATIONS

- *Towards a Universal Analog Computing Paradigm, Department of Mathematics and Computer Science Colloquium, University of Missouri, St. Louis, MO, Nov. 2017 (Host: Ravindra Giraviru).*

- *Expeditions in Self-powered Sensing*, Air Force Research Laboratory, Dayton, OH, Oct. 2017 (Host: Jeremy Ward).
- *Zero-power Dynamic Signature for Trust Verification of Passive Sensors and Tags*, Internet2 Cybersecurity Symposium, Indianapolis, Oct. 2017 (Host: Emily Nichols).
- *Zero-power Dynamic Signature for Trust Verification of Passive Sensors and Tags*, Global Research Consortium, Bangalore, India, Jan. 2016 (Host: William Joyner Jr.).
- *Expeditions in Self-powered Sensing, Computing and Imaging*, Department of Biomedical Engineering, Washington University in St. Louis, MO, Nov. 2015 (Host: Prof. Baranidharan Raman).
- *Expeditions in Floating-gate Circuits and Systems: Self-powered sensing and computing*, Department of Electrical and Computer Engineering, Stony Brook University, NY, Dec. 2013 (Host: Prof. Milutin Stanacevic).
- *Expeditions in Floating-gate Circuits and Systems: Self-powered sensing and computing*, Department of Electrical and Computer Engineering, Tufts University, MA, Nov. 2013 (Host: Prof. Valencia Koomson).
- *Expeditions in Floating-gate Circuits and Systems: From Self-powered sensors to nano-watt analog processors*, Department of Electrical and Computer Engineering, University of Toronto, Canada, Nov. 2013 (Host: Prof. Roman Genov).
- *Expeditions in Floating-gate Circuits and Systems: From Self-powered sensors to nano-watt analog processors*, Department of Computer Science and Engineering, Washington University, St. Louis, Oct. 2013 (Host: Prof. Viktor Gruev).
- *Approaching limits of sensing using neuromorphic noise-exploitation principles*, SPIE, San Diego, Mar. 2013 (Host: Prof. R.J. Martin-Palma)
- *Reproducing Kernel-based Methods for Extracting and Identifying Noise-robust Speech Features*, IEEE Asilomar Conference on Signal, Systems and Computers, Nov. 2012. (Host: Ghassan Alregib)
- *Noise-exploitation and Adaptation in Neuromorphic Sensors*, SPIE, San Diego, Mar. 2012 (Host: Prof. Akhlesh Lakhtakia).
- *Grand Challenge: Sensing-to-learn and Learning-to-sense – Exploiting biological symbiosis of sensing, computing, memory and adaptation for designing the next-generation of smart sensors*, NSF sponsored US-Japan Joint Workshop on Bioinspired Sensing and Actuation, Berkeley, Nov 12-13, 2011.
- *Morphing, Synthesis and Monitoring: Exploring the trinity of Hybrid Analog Integrated Circuits*, Department of Engineering Mechanics, Penn State University, Apr. 2011 (Host: Prof. Akhlesh Lakhtakia).
- *CMOS Integrated Circuits for Energy Scavenging and Self-powered Sensors*, IEEE Biomedical Circuits and Systems Conference, Paphos, Cyprus, Nov, 2010 (Host: Dr. Jennifer Blain)
- *Designing Microsystems that Learn: Algorithms and Hardware, Pattern Recognition and Machine Intelligence (PReMI09)*, Indian Institute of Technology, Delhi, Dec. 2009 (Host: Prof. Jayadeva).

- *Forward error-correcting biosensors: Hybrid bio-CMOS circuits and systems*, CMOS Emerging Technologies Workshop, Sep. 2009 (Host: Dr. Kris Iniweski).
- *Design of Neuromorphic Data Converters*, Telluride Neuromorphic and Cognitive Workshop, Telluride, Colorado, Jul. 2009 (Host: Prof. John G. Harris).
- *Sigma-Delta Learning: Bridging the gap between neuromorphic systems, machine learning and mixed-signal processing*, Department of Informatics, University of Tokyo, Japan, June 2009 (Host: Prof. Toshihiko Yamasaki).
- *Sensors and Processors for Structural Health Monitoring*, VDEC, University of Tokyo, Japan, June 2009 (Host: Prof. Tadashi Shibata).
- *Operating below the sub-microwatt barrier – Explorations in Analog Computing*, Invited Presentation, Wireless Integrated Microsystems (WIMS), University of Michigan, Ann Arbor, April 2009 (Host: Prof. Jerome K. Lynch).
- *CMOS Circuits for Biomechanical Implants*, Invited Presentation, CMOS Emerging Technologies Workshop, Vancouver, August 2008 (Host: Dr. Kris Inieweski).
- *Sub-microwatt Sensors for Structural Health Monitoring of Biomechanical Implants*, Invited Presentation, Department of Bioengineering, University of California, San Diego, August 2008 (Host: Prof. Gert Cauwenberghs).
- *Towards Reliable Multi-pathogen Biosensors using High-dimensional Encoding and Decoding Techniques*, Invited Presentation, SPIE Symposium on NanoScience+Engineering, CA 2008 (Host: Prof. Gert Cauwenberghs, UCSD) .
- *High-dimensional Encoding-Decoding Techniques for Reliable Pathogen Detection*, Invited Presentation, Hunter College, City University of New York, Feb 2008 (Host: Prof. Hiroshi Matsui).
- *Mixed-signal data mining on microphone array hearing aids*, Invited Presentation, Radio-Frequency Integrated Circuits Symposium, Atlanta Georgia, July, 2008 (Host: Sudipto Chakraborty, Texas Instruments).
- *Trainable Mixed-signal Interfaces*, Invited Presentation, Defense Science Research Council (DSRC) Adaptive Electronics Workshop, Arlington VA, Nov 28th 2006 (Host: Prof. Peter Asbeck, UCSD).
- *Micro-power Speaker Verification System-on-chip*, Invited Presentation, Applied Physics Laboratory, Laurel, MD, July 2005 (Host: Dr. Chris P. Diehl).
- *Sequence Learning and Decoding in Margin Propagation Networks*, Invited Presentation, Snowbird Learning Workshop, Snowbird, Utah, April 2005 (Host: Dr. Yoshua Bengio).
- *Hardware-Algorithm Tradeoffs in Implementing Support Vector Machines in Silicon*, PRIP Seminar Series, Michigan State University, 2004 (Host: Prof. Anil Jain).
- *Design of a floating-gate CMOS kernel machine for speech recognition*, Tutorial on Floating Gate Technology, IEEE International Symposium on Circuits and Systems, Phoenix AZ, 2002 (Host: Prof. Paul Hasler, Georgia Tech).
- *A hybrid HMM/SVM speech recognition system*, IEEE Midwest Symposium on Circuits and Systems, Lansing MI, 2000.

RESEARCH GRANTS AND CONTRACTS

Current Grants and Contracts

- [G1] Principal Investigator and Project Lead, *Self-powered Sensing and Data-logging for Large-scale In-vivo Monitoring of Neural Ensemble Activity*, **National Institute of Health R21**, 09/01/2017-08/31/2019, \$457,000.
- [G2] Multi-Principal Investigator, *Development of a Wireless Biosensor to Track Bone Resorption in Periodontitis*, **National Institute of Health R01**, 09/01/2017-08/31/2021, \$1,525,000 (Credit 30%).
- [G3] Principal Investigator and Project Lead, *CPS:TTP Option: Synergy: Collaborative Research: Internet of Self-powered Sensors - Towards a Scalable Long-term Condition-based Monitoring and Maintenance of Civil Infrastructure*, **National Science Foundation**, 09/01/2016-08/31/2020, \$1,100,000.
- [G4] Co-Principal Investigator, *Hybrid Chemical Sensing with bio-electronic nose*, **Office of Naval Research**, 06/01/2016-05/31/2019, \$750,000 (Credit: 30%).
- [G5] Principal Investigator and Project Lead, *STARSS: Small: Collaborative: Zero-Power Dynamic Signature for Trust Verification of Passive Sensors and Tags*, **National Science Foundation / Semiconductor Research Corporation**, 8/16/2015 - 8/15/2018, \$450,000.
- [G6] Principal Investigator, *Scavenging Thermal-noise Energy and Quantum Fluctuations for Self-powered Time-stamping and Sensing*, **National Science Foundation**, 8/16/2015 - 8/15/2018, \$344,387.
- [G7] Co-Principal Investigator, *CSR: Medium: Self-organizing Cyber Substrates: Exploring a Modular Computing and Communications Architecture for Structural Health Monitoring*, **National Science Foundation**, 08/01/14-07/30/18, \$1,000,000 (Credit 30%).

Completed Grants and Contracts

- [G8] Co-Principal Investigator, *Ultra-low Power Wireless Sensing System for Multi-metric Self-Powered Monitoring of Bridge Components*, **United States Department of Transportation**, 08/01/13-07/30/17, \$937,135 (Credit 30%).
- [G9] Principal Investigator, *SHF:FAST: A Simulation and Analysis Framework for Designing Large-Scale Biomolecular-Silicon Hybrid Circuits*, **National Science Foundation**, 09/01/11-08/30/17, \$386,602.
- [G10] Principal Investigator, *CAREER: Integrated Research and Education in Self-powered Microsensing for Embedded and Implantable Structural Health Monitoring*, 04/01/10-03/31/16, **National Science Foundation**, CMMI:0954752, \$406,000.
- [G11] Principal Investigator, *Motion Artifact Cancelling MIMO method for Ambulatory Respiratory-rate Monitoring*, National Institute of Health/General Electrical Global Research, 08/01/13-07/31/16, \$164,000.
- [G12] Principal Investigator, *Trusted Verification of CMOS Integrated Circuits using Zero-power Timers and Synchronization Circuits*, **Defense Advanced Research Projects Agency (DARPA)**, 9/1/2014 - 8/31/2015, 133,564.
- [G13] Senior Personnel, *Mechanically-Equivalent Response Amplifiers and Frequency Modulators for Energy-harvesting Devices*, **National Science Foundation**, 8/16/2014 - 8/15/2017,

\$324,309.00 (Credit 10%)

- [G14] Principal Investigator, *STTR Phase I: Health Monitoring of Orthopedic Implants using Self-powered Piezo-floating-gate Sensing Technology*, **Piezonix LLC/National Science Foundation**, 07/01/14-12/31/14, \$72,253.
- [G15] Principal Investigator, *Self-powered RFID Sensing for Monitoring Complex Product Supply-chain*, **Midland Research Institute for Value Chain Creation**, 05/20/14-05/19/17, \$300,000.
- [G16] Principal Investigator, *Design and Evaluation of Self-powered Time-stamped Event-logger*, **Johns Hopkins Applied Physics Laboratory/US Department of Navy**, 04/01/14-09/30/14, \$68,000.
- [G17] Co-Principal Investigator, *Smart Pavement Monitoring System*, **Federal Highway Administration** (Contract: DTFH61-13-C-00015), 08/15/13-08/14/16, \$444,944 (Credit 25%).
- [G18] Co-Principal Investigator, *Center for Cyber-enabled Cognitive Structures*, **Strategic Partnership Grant, Michigan State University**, 08/01/13-07/31/16, \$481,000 (Credit 35%).
- [G19] Principal Investigator, *Development of Self-powered Age-monitoring Sensor*, **Targeted Support Grant for Technology Development (TSGTD)**, MSU Foundation, 09/01/12-08/01/13, \$60,000.
- [G20] Principal Investigator, *Fabrication and Testing of Gen-II Age-monitoring Sensors*, **Johns Hopkins Applied Physics Laboratory**, 03/01/12-08/30/12, \$47,574.
- [G21] Principal Investigator, *AIR: Development and Evaluation of Self-Powered Piezo-Floating-Gate Sensor Chipsets for Embedded and Implantable Structural Health Monitoring*, **National Science Foundation**, 08/01/11-07/31/14, \$258,000.
- [G22] Principal Investigator, *Self-powered Age Monitoring Sensors*, **Johns Hopkins Applied Physics Laboratory**, 04/15/11-08/30/11, \$65,000.
- [G23] Principal Investigator, *Low-power Speaker Identification System (LPSIS)*, **Johns Hopkins Applied Physics Laboratory** (sub-contract through MSU Foundation), 10/01/09-07/30/11, \$286,046.
- [G24] Co-Principal Investigator, *Smart Pavement Monitoring System*, **Federal Highway Administration**, Contract: DTFH61-08-C-00015, 08/15/08-08/14/11, \$375,000 (Credit 25%)
- [G25] Principal Investigator, *SGER: Cooperative Learning-Unlearning Algorithms for Identifying Noise Robust Auditory Manifolds*, **National Science Foundation**, IIS: 0836278, 08/01/08-07/31/09, \$62,010.
- [G26] Principal Investigator, *Investigation into non-conventional analog decoders for low-density parity check codes*, **National Science Foundation**, CCF: 0728996, 01/01/07-09/30/10, \$250,000.
- [G27] Principal Investigator, *A sub-microwatt self-powered fatigue sensor*, CMMI: 0700632, **National Science Foundation**, 05/01/07-04/30/10 \$295,999.
- [G28] Principal Investigator, *Development of forward error-correcting biosensor based on*

molecular biowires, **National Science Foundation**, ECCS: 0622056, 09/01/06-08/30/10 \$270,000.

- [G29] Principal Investigator, *Development of micro-power VLSI devices*, **Johns Hopkins Applied Physics Laboratory** (sub-contract through MBI International), Contract No: 0905899, 04/01/08-03/31/09, \$75,300.
- [G30] Co-Principal Investigator, *Advanced Microsystems for Neural Information Processing*, **National Institute of Health**, 04/01/06-03/31/08 \$375,000 (Credit 25%).
- [G31] Principal Investigator, *Micropower speaker verification systems*, **Johns Hopkins Applied Physics Laboratory** (sub-contract through MBI), Contract No: 0939031, 12/01/2005-11/30/2006, \$75,000.
- [G32] Principal Investigator, *Development of ultra-low power acoustic sensors*, **Intramural Research Grant Program**, Michigan State University, 12/01/2005-12/14/2007, \$50,000.

PATENTS

Issued Patents

- [P1] N. Lajnef, S. Chakrabartty, R. Burgueno, W. Borchani ``*Self-Powered Sensing System for the Monitoring of Quasi-static Structural Response*”, US patent: 9,793,830, 10/17/2017
- [P2] S. Chakrabartty, ``*Temperature Compensation Method for High-density Floating-gate Memory*”, US patent: 9,437,602, 09/06/2016
- [P3] S. Chakrabartty, ``*Self-powered Strain-gauge*”, US patent: 9,331,265, Issued: 05/03/2016.
- [P4] S. Chakrabartty, ``*Self-powered Timer Apparatus*’’, US patent: 8,963,647 , Issued Feb. 24, 2015.
- [P5] S. Chakrabartty, ``*Margin Decoding Communication System*’’, US patent: 8,060,810 , Issued Nov. 15, 2011.
- [P6] S. Chakrabartty, N. Lajnef, N. Elvin, A.Gore, ``*Self-powered Sensor*”, US Patent: 8,056,420, Issued Nov. 15, 2011.
- [P7] S. Chakrabartty, ``*Self-powered Strain-rate Sensor*”, US Patent: 7,757,565, Issued Jul. 20, 2010.
- [P8] S. Chakrabartty, ``*Multiple-input Multiple-output Analog-to-digital Converter*’’, US Patent no: 7,479,911, Issued Jan. 20, 2009.

Pending Patents

- [P9] S. Chakrabartty, A. Gangopadhyay, ``*Growth Transform Neural Network, Neuromorphic Processors and Analog-to-digital Converters*”, Washington University in St. Louis, Disclosure Reference Number, 016836, 2017.
- [P10] S. Chakrabartty, L. Zhou, ``*Self-powered Sensors for Long-term Monitoring*”, Washington University in St. Louis, Disclosure Reference Number, PCT/US2017/019967, 2017.
- [P11] S. Chakrabartty, L. Zhou, ``*Method and Apparatus for Robust Long-term Self-powered Time-keeping*”, Washington University in St. Louis, Disclosure Reference Number, 016736, 2017.
- [P12] S. Chakrabartty, S. Kondapalli, X. Zhang, ``*Variance-Based Logic and Self-Powered Microprocessor*”, Washington University in St. Louis, Disclosure Reference Number,

016445, 2016.

- [P13] S. Chakrabartty, W.A. Qureshi, ``*Method and Apparatus for On-Chip Optical Spectroscopy*”, Michigan State University Disclosure Reference Number, TEC2011-0020, 2010.
- [P14] A. Fazel, S. Chakrabartty, ``*Sparse Auditory Reproducing Kernel (SPARK) Features for Noise-robust Speech and Speaker Recognition*”, US provisional patent: 61/643,550, Filed: 05/07/2012.

PROFESSIONAL ACTIVITIES

- *Senior Member, IEEE*
- *Member, American Society for Engineering Education (ASEE)*
- *Associate Editor, IEEE Transactions of Biomedical Circuits and Systems.*
- *Associate Editor, Advances in artificial neural systems, Hindawi Publications.*
- *Review Editor, Frontiers in Neuromorphic Engineering.*
- *Chair, IEEE Circuits and Systems Society, Neural Systems and Applications Technical Committee.*
- *Panelist :*
 - National Science Foundation, ECCS, 2006, 2008.
 - National Science Foundation, CISE, 2014, 2015, 2016.
 - National Science Foundation, CMMI, 2007, 2010, 2012.
 - National Science Foundation, IIP, 2011, 2012, 2013, 2014,2015.
- *Panelist :*
 - American Society of Engineering Education, SMART Scholarship, 2012.
 - American Society of Engineering Education, NDSEG Scholarship, 2012.
- *International Panel Reviewer :*
 - Natural Sciences and Engineering Research Council of Canada (NSERC), 2008.
 - Dutch Technology Foundation STW, 2009.
- *Keynote Panel:*
 - Pattern Recognition and Machine Intelligence (PReMI09), IIT Delhi, 2009.
- *Organizing Committee :*
 - IEEE Biomedical Circuits and Systems Conference, San Diego, 2011.
 - IEEE Electro-Information Technology Conference, East Lansing, MI, 2006.
- *Technical Committee Member :*
 - IEEE Circuits and Systems: Sensory Systems
 - IEEE Circuits and Systems: Biomedical circuits and systems
 - IEEE Circuits and Systems: Neural systems and applications.
- *Program Committee Member :*
 - 20th Symposium on Integrated Circuits and Systems Design, 2007.
 - 22nd Symposium on Integrated Circuits and Systems Design, 2009
 - IEEE Biomedical Circuits and Systems Conference, 2006-2011.
 - IEEE Statistical Signal Processing Workshop, Ann Arbor, 2012.
- *Session Chair/Co-chair:*
 - Neural Systems and Applications, ISCAS 2012, Seoul, Korea.
 - Analog Circuits and IC Technology, ISCAS 2009, Taipei, Taiwan.
 - Sensor Networks and Algorithms, ISCAS 2009, Taipei, Taiwan.

- Image Sensors, ISCAS 2009, Taipei, Taiwan
- Biomedical Instrumentation and Bioanalysis, BIOCAS 2008, Baltimore, MD, USA.
- Sigma-Delta Modulators, ISCAS 2007, New Orleans, USA.
- *Reviewer*
 - IEEE Journal of Solid-State Circuits.
 - IEEE transactions on Circuits and Systems I and II (TCAS).
 - IEEE transactions on Signal Processing (TSP).
 - IEEE transactions on Very Large Scale Integration (TVLSI).
 - IEEE transactions on Neural Networks (TNN)
 - IEEE sensor journal
 - IEEE transactions on Biomedical Engineering (TBME)
 - IEEE transactions on Biomedical Circuits and Systems (TBioCAS)
 - IEEE transactions on Neural Systems and Rehabilitation Engineering
 - Pattern Recognition Journal
 - IEEE Communication Letters
 - Advances in fuzzy systems, Hindawi.
 - Fuzzy sets and systems, Elsevier.
 - Sensors and Actuators, Elsevier.
 - Analytical Chemistry
 - IEEE Int. Symp. On Circuits and Systems (ISCAS).

INSTITUTIONAL SERVICES

- *Chair*, Graduate Studies Committee (Michigan State Univ.), 2011 – 2013
- *Publicity Chair*, (MSU Electrical and Computer Engineering), 2013 – 2015.
- *Member*, Department Advisory Committee (MSU Electrical and Computer Engineering), 2011-2013, 2014 – 2015.
- *Member*, Strategic Research Task force Committee (MSU Electrical and Computer Engineering), 2011- 2015.
- *Member*, College Graduate Studies Committee (Michigan State Univ.), 2011-2012.
- *Advisor*, Computer Engineering, 2015 - current

GRADUATE ADVISEES

Past Graduate Advisees

- Tao Feng, (Ph.D. Fall 2016) Currently Research Engineer, Skyworks Inc., Ames, IA. (Thesis: Design and Implementation of Efficient Energy Harvesting Circuits for Ultra-low-power and Impact Energy Applications).
- Hassan Aqeel Khan, (Ph.D. Fall 2015) Currently Assistant Professor, National University of Sciences and Technology, Islamabad. (Thesis: Kernel Methods for Biosensing Applications).
- Ming Gu, (Ph.D. Spring 2012) Currently Principal Engineer, Fairchild Semiconductors, California. (Thesis: Theory, synthesis and implementation of current-mode CMOS piecewise-linear circuits using margin propagation).
- Pikul Sarkar, (M.S. Summer 2012). Currently Senior Engineer, LSI Corp., Bangalore, India (Thesis: Programmable and Reconfigurable Strain-powered Micro-data-loggers based on Linear Piezo-Floating-Gate Injectors).

- Amin Fazel, (Ph.D. 2012) Currently Research Staff, *CRS Inc., Auburn Hills, Michigan*. (Thesis: Robust Signal Processing Methods for Miniature Acoustic Sensing, Separation and Recognition).
- Chenling Huang, (Ph.D. 2011) Currently Staff Engineer, *Qualcomm Incorporated, San Diego*. (Thesis: Design and Implementation of Integrated Self-powered Sensors, Circuits and Systems).
- Ravi Shaga, (M.S. 2011) Currently Senior Engineer, *Apple., Cupertino, CA*. (Thesis: Noise-shaping Stochastic Optimization and Online Learning with Applications in Digitally-assisted Analog Circuits).
- Yang Liu, (Ph.D. 2010) Currently CEO and co-founder, *Piezonix LLC, East Lansing*. (Thesis: Forward Error-Correcting Biosensors: Design, Modeling and Fabrication).
- Amit Gore, (Ph.D. 2008) Currently Research Scientist, *General Electric Corporate Research, New York, USA*. (Thesis: Design of High-dimensional Oversampling Converters with On-chip Learning: Theory, Design and Hardware Realization).
- Nizar Lajnef, (Ph.D. 2008) Currently Associate Professor, *Department of Civil and Environmental Engineering, Michigan State University, East Lansing, MI, USA*. (Thesis: Self-powered sensing in structural health and usage monitoring)
- Paul Kucher, (M.S. 2007), Currently Research Scientist, *Johns Hopkins University, Applied Physics Laboratory, Laurel, MD, USA*. (Thesis: Design and evaluation of an automated test platform for large-scale analog floating-gate programming.)
- Cheong Kun, (M.S. 2006) Currently Senior Engineer, *Qualcomm Incorporated, San Diego, CA, USA*. (Thesis: Design, implementation and testing of hybrid algorithmic sigma-delta A/D converters).

Current Graduate Advisees

- Kenji Aono, *Ph.D. Candidate* (Expected Fall 2017)
- Mingquan Yuan, *Ph.D. Candidate* (Expected Fall 2018)
- Liang Zhou, *Ph.D. Candidate* (Expected Fall 2018)
- Yarub Alazzawi, *Ph.D. Candidate* (Expected Fall 2019)
- Oindrila Chatterjee, *Ph.D. Candidate* (Expected Fall 2019)
- Ahana Gangopadhyay, *Ph.D. Candidate* (Expected Fall 2019)
- Sri Harsha Kondapalli, *Ph.D. Candidate* (Expected Fall 2019)
- Darshit Mehta, *Ph.D. Candidate* (Expected Fall 2019)

PUBLICATIONS

Book Chapters

- [B1] S.Chakrabartty, N. Lajnef, N.Elvin, A.Elvin, "Toward Self-powered Sensors and Circuits for Biomechanical Implants", *VLSI Circuits for Biomedical Applications*, eds. Krzysztof Iniewski, Artech House, 2008.
- [B2] S.Chakrabartty, E.C. Alocilja, Y.Liu, "Integrated Nano-Bio-VLSI Approach for Designing Error-free Biosensors", *Nano-biosensors*, eds. Sandro Carrara, Springer, 2010.
- [B3] T. Hindo, S. Chakrabartty, "Noise-exploitation in Neuromorphic Sensors", *Engineered*

Biomimicry: Bioinspiration, Biomimetics and Bioreplication, eds. A. Lakhtakia, R.J. Martin-Palma, Elsevier, 2013.

- [B4] S. Chakrabartty, "Asynchronous Self-powered Sensing, Computation and Data-logging", *Advances in Energy Harvesting Methods*, eds. A. Ertuk, N. Elvin, Springer, 2013.

Journal Publications in Chronological order (* denotes corresponding author)

- [J1] H. A. Khan, A. Gore, J. Ashe and S. Chakrabartty*, "Virtual Spirometry and Activity Monitoring using Multi-channel Electrical Impedance Plethysmographs in Ambulatory Settings", *IEEE Transactions of Biomedical Circuits and Systems*, 2017 (in press).
- [J2] M. Ibrahim, L. Zhou, S. Chakrabartty, J. Ren, "Dynamic Authentication Protocol Using Self-powered Timers for Passive Internet of Thing", *IEEE Internet of Things Journal*, 2017 (in press).
- [J3] H. Hasni, A.H. Alavi, N. Lajnef, M. Abdelbarr, S.F. Masri, S. Chakrabartty, "Self-Powered Piezo-Floating-Gate Sensors for Health Monitoring of Steel Plates", *Engineering Structures*, 2017 in press. DOI: 10.1016/j.engstruct.2017.06.063.
- [J4] S. Kondapalli, Y. Alazzawi, M. Malinowski, T. Timek, S. Chakrabartty*, "Multi-access In-vivo Biotelemetry using Sonomicrometry and M-scan Ultrasound Imaging", *IEEE Transactions on Biomedical Engineering*, 2017, DOI: 10.1109/TBME.2017.2697998
- [J5] H. Hasni, A.H. Alavi, P. Jiao, N. Lajnef, K. Chatti, K. Aono, S. Chakrabartty, "A new approach for damage detection in asphalt concrete pavements using battery-free wireless sensors with non-constant injection rates", *Measurement*, 2017, DOI: 10.1016/j.measurement.2017.06.035
- [J6] A. Gangopadhyay, S. Chakrabartty*, "Spiking, Bursting and Population Dynamics in a Network of Growth Transform Neurons", *IEEE Transactions of Neural Networks and Learning Systems*, 2017, DOI: 10.1109/TNNLS.2017.2695171.
- [J7] A. Gangopadhyay, O. Chatterjee, S. Chakrabartty*, "Extended Polynomial Growth Transforms for Design and Training of Generalized Support Vector Machines", *IEEE Transactions of Neural Networks and Learning Systems*, 2017, DOI: 10.1109/TNNLS.2017.2690434.
- [J8] L. Zhou, S. Chakrabartty*, "Self-Powered Timekeeping and Synchronization Using Fowler–Nordheim Tunneling-Based Floating-Gate Integrators", *IEEE Transactions on Electron Devices*, vol. 64, no:3, pp.1254-1260, 2017.
- [J9] L. Zhou, S. Chakrabartty*, "Linearization of CMOS Hot-electron Injectors for Self-powered Monitoring of Biomechanical Strain Variations", *IEEE Transactions of Biomedical Circuits and Systems*, vol 11, no:2, 2017.
- [J10] S Das, H Salehi, Y Shi, S Chakrabartty, R Burgueno, S Biswas, "Towards packet-less ultrasonic sensor networks for energy-harvesting structures", *Computer Communications* 101, 94-105, 2016.
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Refereed Conference Publications in Chronological Order

- [C1] L. Zhou, S. Chakrabartty, `` Self-powered Continuous Time-Temperature Monitoring for Cold-Chain Management'', IEEE Mid-west Symposium of Circuits and Systems (MWSCAS 2017), Boston, USA, 2017.

- [C2] Y. Alazzawi, S. Chakrabartty, `` Self-powered System-on-Chip for Substrate Computing and Ultrasonic Communications'', EEE Mid-west Symposium of Circuits and Systems (MWSCAS 2017), Boston, USA, 2017.
- [C3] B. Scheid, S. Chakrabartty, ``Feasibility of Hybrid Ultrasound-Electrical Nerve Stimulation for Electroceuticals'', IEEE Symposium of Circuits and Systems (ISCAS 2017), Baltimore, USA, 2017.
- [C4] L. Zhou, S. Chakrabartty, `` Secure Dynamic Authentication of Passive Assets and Passive IoTs Using Self-Powered Timers'', IEEE Symposium of Circuits and Systems (ISCAS 2017), Baltimore, USA, 2017.
- [C5] D. Mehta, A. Ege, B. Raman, S. Chakrabartty, `` Behaving Cyborg Locusts for Standoff Chemical Sensing'', IEEE Symposium of Circuits and Systems (ISCAS 2017), Baltimore, USA, 2017.
- [C6] M. Yuan, S. Singamaneni, S. Chakrabartty, `` Analyte Sampling in Paper Biosensors Powered by Graphite-Based Light Absorption'' IEEE Symposium of Circuits and Systems (ISCAS 2017), Baltimore, USA, 2017.
- [C7] S. Kondapalli, X. Zhang, S. Chakrabartty, `` Variance-Based Digital Logic for Energy Harvesting Internet-of-Things'' IEEE Symposium of Circuits and Systems (ISCAS 2017), Baltimore, USA, 2017.
- [C8] L. Zhou, A. Abraham, S. Tang, S. Chakrabartty ``Approaching the Limits of Piezoelectricity Driven Hot-Electron Injection for Self-Powered in-Vivo Monitoring of Micro-Strain Variations'', IEEE Symposium of Circuits and Systems (ISCAS 2016), Montreal, Canada, 2016.
- [C9] Y. Alazzawi, S. Chakrabartty, ``Design of CMOS Telemetry Circuits for In-vivo Wireless Sonomicrometry'', IEEE Symposium of Circuits and Systems (ISCAS 2016), Montreal, Canada, 2016.
- [C10] L. Zhou, S. Chakrabartty `` Self-powered Sensing and Time-stamping of Rare Events using CMOS Fowler-Nordheim Tunneling Timers'', IEEE Symposium of Circuits and Systems (ISCAS 2016), Montreal, Canada, 2016.
- [C11] K.Aono, N. Lajnef, F.Faridazar, S.Chakrabartty, `` Infrastructural Health Monitoring Using Self-Powered Internet-of-Things'', IEEE Symposium of Circuits and Systems (ISCAS 2016), Montreal, Canada, 2016.
- [C12] H. Salehi, R. Burgueño, S. Das, S. Biswas, S. Chakrabartty, ``Structural health monitoring from discrete binary data through pattern recognition'', Proceedings of the 6th International Conference on Structural Engineering, Mechanics and Computation, SEMC 2016, 2016.
- [C13] M. Yuan, E.C. Alocilja, S. Chakrabartty, `` Self-powered Wireless Biosensing based on Integration of Paper-based Microfluidics with Self-assembling RFID Antennas'', IEEE Conference on Biomedical Circuits and Systems (BioCAS 2015), Atlanta, USA, 2015.
- [C14] Y. Alazzawi, C. Qian, S. Chakrabartty, `` Feasibility of Non-Contact Ultrasound Generation using Implanted Metallic Surfaces as Electromagnetic Acoustic Transducers'', IEEE Conference on Biomedical Circuits and Systems (BioCAS 2015), Atlanta, USA, 2015.
- [C15] L. Zhou, S. Chakrabartty, `` Design of Low-Gm Transconductors using Varactor-based

Degeneration and Linearization Technique”, IEEE Conference on Biomedical Circuits and Systems (BioCAS 2015), Atlanta, USA, 2015.

- [C16] M. Yuan, P. Chahal, E.C. Alocilja, S. Chakrabartty, “Sensing by Growing Antennas: A Novel Approach for Designing Passive RFID based Biosensors”, IEEE Symposium on Circuits and Systems (ISCAS 2015), Lisbon, Portugal, 2015.
- [C17] L. Zhou, S. Chakrabartty, “A Continuous-time Varactor-based Temperature Compensation Circuit for Floating-gate Multipliers and Inner-product Circuits”, IEEE Symposium on Circuits and Systems (ISCAS 2015), Lisbon, Portugal, 2015 (Honorary mention for best paper award).
- [C18] B. Fang, T. Feng, M. Zhang, S. Chakrabartty, “Feasibility of B-mode Diagnostic Ultrasound Energy Transfer and Telemetry to a cm² sized Deep-tissue Implant”, IEEE Symposium on Circuits and Systems (ISCAS 2015), Lisbon, Portugal, 2015.
- [C19] N. Lajnef, R. Burgueno, W. Borchani, S. Chakrabartty, “Sub-Hz Self-Powered Sensing Based on Mechanical-Buckling Driven Hot-Electron Injection”, IEEE Symposium on Circuits and Systems (ISCAS 2014), Melbourne, Australia, 2014 (Best paper award).
- [C20] L. Zhou, S. Chakrabartty, “A 7-Transistor-Per-Cell, High-Density Analog Storage Array with 500 μ V Update Accuracy and Greater Than 60dB Linearity”, IEEE Symposium on Circuits and Systems (ISCAS 2014), Melbourne, Australia, 2014.
- [C21] M. Gu, S. Chakrabartty, “A Bias-Scalable Current-Mode Analog Support Vector Machine Based on Margin Propagation”, IEEE Symposium on Circuits and Systems (ISCAS 2014), Melbourne, Australia, 2014.
- [C22] K. Aono, T. Covassin, S. Chakrabartty, “Monitoring of Repeated Head Impacts Using Time-Dilation Based Self-Powered Sensing”, IEEE Symposium on Circuits and Systems (ISCAS 2014), Melbourne, Australia, 2014.
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- [C25] M. Gu, S. Chakrabartty, “A 120dB Input Dynamic Range, Current-Input Current-Output CMOS Logarithmic Amplifier with 230ppm/K Temperature Sensitivity”, IEEE Midwest Symposium on Circuits and Systems (MWSCAS 2013), Columbus, Ohio, 2013.
- [C26] M. Gu, S. Chakrabartty, “Bias-Scalable Inner-Product Approximation Circuit Using Analog Margin Propagation”, IEEE Midwest Symposium on Circuits and Systems (MWSCAS 2013), Columbus, Ohio, 2013.
- [C27] L. Zhou, P. Sarkar, S. Chakrabartty, “Scavenging Thermal-Noise Energy for Implementing Long-Term Self-Powered CMOS Timers”, IEEE Symposium on Circuits and Systems (ISCAS 2013), Beijing, China, 2013.
- [C28] P. Sarkar, S. Chakrabartty, “A Compressive Piezoelectric Front-End Circuit for Self-Powered Mechanical Impact Detectors”, IEEE Symposium on Circuits and Systems (ISCAS 2013), Beijing, China, 2013.
- [C29] S. Chakrabartty, “Approaching limits of sensing using neuromorphic noise-exploitation

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- [C30] S. Chakrabartty, T. Feng, K. Aono, “Gen-2 RFID compatible, zero down-time, programmable mechanical strain-monitors and mechanical impact detectors”, SPIE Smart Structures and Materials + Nondestructive Evaluation and Health Monitoring, San Diego, California, 2013.
- [C31] S. Chakrabartty, “Reproducing Kernel-based Methods for Extracting and Identifying Noise-robust Speech Features”, IEEE Asilomar Conference on Signal, Systems and Computers, Nov. 2012.
- [C32] K. Aono, R. Shaga, S. Chakrabartty, “Exploiting Jump-Resonance Hysteresis in Silicon Cochlea for Formant Trajectory Encoding”, IEEE Proc. Of 55th International Midwest Symposium on Circuits and Systems, Boise, Idaho, 2012.
- [C33] F. Tao, S. Chakrabartty, “Analysis and Design of High-Efficiency Inductive Power-links Using a Novel Matching Strategy”, IEEE Proc. Of 55th International Midwest Symposium on Circuits and Systems, Boise, Idaho, 2012.
- [C34] M. Gu, S. Chakrabartty, “Varactor-Driven Temperature Compensation of CMOS Floating-Gate Current Memory”, *Proc. of IEEE Symposium of Circuits and Systems (ISCAS 2012)*, Seoul, South Korea, 2012.
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- [C39] C. Huang, S. Chakrabartty, “A Hybrid Energy Scavenging Sensor for Long-Term Mechanical Strain Monitoring”, *Proc. of IEEE Symposium of Circuits and Systems (ISCAS 2011)*, Rio de Janeiro, 2011.
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- [C42] C. Huang, S. Chakrabartty, “A miniature batteryless health and usage monitoring system based on hybrid energy harvesting”, *Proc. of SPIE Smart Structures + NDE*, San Diego, 2011.
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- [C68] Y. Liu, A. Gore, S. Chakrabartty, E. C. Alcilja, "A Molecular Bio-wire based Multi-array Biosensor with Integrated potentiostats," *IEEE Biomedical Circuits and Systems Conference*, Montréal, Canada, Nov.2007.
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