

Soumyajit Mandal

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RESEARCH THRUSTS

Sensor Physics
Sensor Interfaces
Precision Instrumentation
Integrated Circuits and Systems
Analog and Mixed-Signal Electronics
IoT, Biomedical, and Bio-Inspired Systems

EDUCATION AND ACADEMIC EXPERIENCE

T. and A. Schroeder Assistant Professor. Case Western Reserve University, Department of Electrical Engineering and Computer Science, June 2018 - present.

Assistant Professor. Case Western Reserve University, Department of Electrical Engineering and Computer Science, July 2014 - May 2018.

Investigator. Advanced Platform Technology Center, Veterans Administration Medical Center, Cleveland, OH, January 2015 - present.

Research Scientist. Schlumberger-Doll Research, January 2012 - June 2014.
Manager: Dr. Yi-Qiao Song

Postdoctoral Research Scientist. Schlumberger-Doll Research, January 2010 - January 2012.
Project: Design and Construction of Novel Magnetic Resonance Sensors.
Supervisor: Dr. Yi-Qiao Song

Research Affiliate. Massachusetts Institute of Technology, January 2010 - June 2014.
Project: Integrated Circuits for Fast Simulations of Gene-Protein Networks
Collaborator: Prof. Rahul Sarpeshkar

Postdoctoral Associate. Massachusetts Institute of Technology, June 2009 - December 2009.
Supervisor: Prof. Rahul Sarpeshkar

Ph.D. Electrical Engineering. Massachusetts Institute of Technology, June 2009
Thesis: "Collective Analog Bioelectronic Computation"
Advisor: Prof. Rahul Sarpeshkar, GPA: 4.9/5.0.

M.S. Electrical Engineering. Massachusetts Institute of Technology, June 2004
Thesis: "Far-Field RF Power Extraction Circuits & Systems"
Advisor: Prof. Rahul Sarpeshkar, GPA: 5.0/5.0.

B.Tech. Electronics & Electrical Communication Engineering. Indian Institute of Technology, Kharagpur, May 2002
Thesis: "Spread Spectrum Communication using Chaotic Signals"
Advisor: Prof. Soumitro Banerjee, GPA: 9.79/10.00 (first in class of 450).

OTHER ACTIVITIES

- Founder and Chief Scientific Officer.** Mantra Scientific, LLC, 2017 – present
Collaborators: Drs. Priyanka Aggarwal, Arjuna Madanayake, and Makarand Deo
Pursuing a variety of scientific projects related to sensing and computing.
- Consultant.** Intwine Connect, LLC, 2014 – present
Collaborator: Mr. Dave Martin
Sensor interface design for a multi-gas indoor air quality monitoring system.
- Consultant.** NMR Services Australia (NM RSA), 2013 – present
Collaborators: Drs. Tim and David Hopper
Chief designer of the analog and digital electronics and signal processing required for a novel downhole nuclear magnetic resonance (NMR) instrument that is currently being used by the mining industry in Australia, South Africa, and other countries.
- Participant.** Telluride Neuromorphic and Cognition Engineering Workshop, Telluride, Colorado
2015: Studied multi-sensor fusion problems using neuromorphic auditory and vision sensors. Developed neuromorphic self-localization algorithms using radar and sonar data.
2009: Created a detailed, nonlinear, time-domain model of the mammalian cochlea. Implemented a model of binocular depth perception in real time using analog hardware.
- Participant.** New Kind of Science Summer School, University of Vermont, 2008
Used computer simulations to investigate the computational capabilities of a wide range of nonlinear partial differential equations.
- Summer Intern.** Georgia Institute of Technology, 2001
Research on microwave multi-chip modules under the supervision of Prof. Joy Laskar, Microwave Applications Group, Georgia Institute of Technology.
- Summer Intern.** Reliance Telecommunications Limited, 2000
Wrote software for performance evaluation of cellular networks.

REFEREED JOURNAL PUBLICATIONS

Student co-authors have been underlined.

Submitted

1. Yingying Wang, Jifu Liang, Leonid Belostotski, Arjuna Madanayake, and Soumyajit Mandal, **Δ - Σ Noise-Shaping in 3-D Space-Time for 2-D Wideband Antenna Array Receivers**, submitted to *Multidimensional Systems and Signal Processing*.
2. Mohammad S. Islam, Siddharth K. Singh, Jaesung Lee, Christian A. Zorman, Philip X.-L. Feng, and Soumyajit Mandal, **A Programmable Sustaining Amplifier for Flexible MEMS-Referenced Frequency Generation**, submitted to the *IEEE Transactions on Circuits and Systems - I*.
3. Haixiang Zhao and Soumyajit Mandal, **A Fast-Settling Phase-Locked Loop using Switched-Gain Control**, submitted to the *IEEE Transactions on Circuits and Systems - I*.
4. Jifu Liang, Yingying Wang and Soumyajit Mandal, **A Switched-Capacitor-Based Low-Power Receiver for Electrocardiogram and Respiration Rate Detection**, submitted to *Analog Integrated Circuits and Signal Processing*.
5. David Ariando, Cheng Chen, Mason Greer, and Soumyajit Mandal, **An Autonomous, Highly Portable NMR Spectrometer Based on a Low-Cost System-on-Chip (SoC)**, submitted to the *Journal of Magnetic Resonance*.
6. Xinyao Tang and Soumyajit Mandal, **Digital Communication using Synchronized Hyperchaotic Maps**, submitted to the *International Journal of Bifurcation and Chaos*.

2018

1. Mohammad S. Islam, Ran Wei, Jaesung Lee, Yong Xie, Soumyajit Mandal, and Philip Feng, **A Temperature-Compensated Single-Crystal Silicon-on-Insulator (SOI) MEMS Oscillator with a CMOS Amplifier Chip**, to appear in *Micromachines*, 2018.
2. Yingying Wang, Jifu Liang, Suranga Handagala, Arjuna Madanayake, and Soumyajit Mandal, **Δ - Σ Noise Shaping in 2-D Space-Time for Wideband Antenna Array Receivers**, to appear in the *IEEE Transactions on Circuits and Systems - I*, 2018.
3. Jarred Glickstein and Soumyajit Mandal, **An Automated Instrument for Polarization-Enhanced Broadband Nuclear Quadrupole Resonance (NQR) Spectroscopy**, *Review of Scientific Instruments*, Vol. 89, pg. 093106, 2018.
4. Naren V. R. Masna, Fengchao Zhang, Cheng Chen, Soumyajit Mandal, and Swarup Bhunia, **Authentication of Dietary Supplements through Nuclear Quadrupole Resonance (NQR) Spectroscopy**, *International Journal of Food Science and Technology*, 2018.
5. Mason Greer, Cheng Chen, and Soumyajit Mandal, **Automated Classification of Food Products Using 2D Low-Field NMR**, the *Journal of Magnetic Resonance*, Vol. 294, pp. 44-58, 2018.
6. Naren V. R. Masna, Shubhra Deb Paul, Cheng Chen, Soumyajit Mandal, and Swarup Bhunia, **Eat, but Verify: Low-Cost Portable Devices for Food Safety Analysis**, to appear in the *IEEE Consumer Electronics Magazine*, 2018.
7. Viduneth Ariyaratna, Arjuna Madanayake, Diego Coelho, Renato J. Cintra, Leonid Belostotski, Xinyao Tang, Soumyajit Mandal, and Theodore S. Rappaport, **Analog Approximate-FFT 8/16-Beam Algorithms, Architectures and CMOS Circuits for 5G Beamforming MIMO Transceivers**, the *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, Vol. 8, No. 3, pp. 466-479, 2018.
8. Sirani M. Perera, Viduneth Ariyaratna, Nilan Udayanga, Arjuna Madanayake, Ge Wu, Leonid Belostotski, Yingying Wang, Soumyajit Mandal, Renato J. Cintra, and Theodore S. Rappaport, **Wideband N-Beam Arrays using Low-Complexity Algorithms and Mixed-Signal Integrated Circuits**, the *IEEE Journal of Selected Topics in Signal Processing*, Vol. 12, No. 2, pp. 368-382, 2018.

2017

1. S. Mandal and R. Sarpeshkar, **A simple model for the thermal noise of saturated MOSFETs at all inversion levels**, to appear in the *IEEE Journal of the Electron Devices Society*, Vol. 5, No.6, pp. 458-465, 2017.
2. C. Chen, F. Zhang, S. Bhunia, and S. Mandal, **Broadband quantitative NQR of vitamins and dietary supplements**, *Journal of Magnetic Resonance*, Vol. 278, pp. 67-79, May 2017.

2016

1. M. Donaldson, D. Freed, S. Mandal, and Y.-Q. Song, **Chemical analysis using low-field magnetic resonance** (invited review article), *Trends in Analytical Chemistry*, Vol. 83, Part A, pp. 84-93, October 2016.
2. C. Chen, F. Zhang, J. Barras, K. Althoefer, S. Bhunia, and S. Mandal, **Authentication of medicines using nuclear quadrupole resonance spectroscopy**, *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, Vol. 13, No. 3, pp. 417-430, May-June 2016.

2015

1. S. Mandal, S. Oh, M. D. Hürlimann, **Absolute phase effects on CPMG-type pulse sequences**, *Journal of Magnetic Resonance*, Vol. 261, pp. 121132, December 2015.
2. S. Mandal and Y. Q. Song, **Heteronuclear J-coupling measurements in grossly inhomogeneous magnetic fields**, *Journal of Magnetic Resonance*, Vol. 255, pp. 15-27, April 2015.

2014

1. S. Mandal, V. D. M. Koroleva, T. Borneman, and M. D. Hürlimann, **Direct optimization of signal-to-noise ratio of CPMG-like sequences in inhomogeneous elds**, *Journal of Magnetic Resonance*, Vol. 247, pp. 54-66, October 2014.
2. J. Chen, J. Paulsen, S. Mandal, D. Freed, M. Hurlimann, and Y. Q. Song, **Dispersion of T_1 and T_2 NMR Relaxation in Crude Oils**, *ChemPhysChem*, Vol. 15, pp. 2676-2681, September 2014.
3. L. Casabianca, D. Mohr, S. Mandal, Y. Q. Song, and L. Frydman, **Chirped CPMG for Well-Logging NMR Applications**, *Journal of Magnetic Resonance*, Vol. 242, pp. 197-202, May 2014.
4. S. Mandal, S. Utsuzawa, D. G. Cory, M. Hürlimann, M. Poitzsch, and Y. Q. Song, **An Ultra-Broadband Low-Frequency Magnetic Resonance System**, *Journal of Magnetic Resonance*, Vol. 242, pp. 113-125, May 2014.
5. S. Mandal and Y. Q. Song, **Two-dimensional NQR using ultra-broadband electronics**, *Journal of Magnetic Resonance*, Vol. 240, pp. 16-23, March 2014.
6. Y. Tang, M. Hürlimann, S. Mandal, J. Paulsen, and Y. Q. Song, **Coaxial probe for nuclear magnetic resonance diffusion and relaxation correlation experiments**, *Journal of Applied Physics*, Vol. 115, 073903, February 2014.

2013

1. S. Mandal, V. D. M. Koroleva, T. Borneman, Y. Q. Song, and M. D. Hürlimann, **Axis-matching excitation pulses for CPMG-like sequences in inhomogeneous fields**, *Journal of Magnetic Resonance*, Vol. 237, pp. 1-10, December 2013.
2. S. Mandal, S. Utsuzawa, and Y.-Q. Song, **An extremely broadband low-frequency MR system**, *Microporous and Mesoporous Materials*, Vol. 178, pp. 53-55, September 2013.
3. V. D. M. Koroleva, S. Mandal, Y. Q. Song, and M. D. Hürlimann, **Broadband CPMG sequence with short composite refocusing pulses**, *Journal of Magnetic Resonance*, Vol. 230, pp. 64-75, May 2013.
4. S. Utsuzawa, S. Mandal, and Y. Q. Song, **Transformer-coupled NMR probe technology** (invited paper), *Encyclopedia of Magnetic Resonance*, July 2013.

2012

1. S. Utsuzawa, S. Mandal, and Y. Q. Song, **Transformer-coupled NMR probe**, *Journal of Magnetic Resonance*, Vol. 216, Issue 1, pp. 128-133, March 2012.

2011

1. S. Mandal and R. Sarpeshkar, **A Bio-Inspired Cochlear Heterodyning Architecture for an RF Fovea** (invited paper), *IEEE Transactions on Circuits and Systems-I*, Vol. 58, Issue 7, pp. 1647-1660, July 2011.
2. T. Hopper, S. Mandal, D. Cory, M. Hürlimann, and Y. Q. Song, **Low-frequency NMR with a non-resonant circuit**, *Journal of Magnetic Resonance*, Vol. 210, Issue 1, pp. 69-74, May 2011.

2010

1. S. Mandal, L. Turicchia, and R. Sarpeshkar, **A Low-Power Battery-Free Tag for Body Sensor Networks**, *IEEE Pervasive Computing*, Vol. 9, Issue 1, pp. 71-77, January 2010.

2009

1. S. Mandal, S. M. Zhak, and R. Sarpeshkar, **A Bio-Inspired Active Radio-Frequency Silicon Cochlea**, *IEEE Journal of Solid-State Circuits*, Vol. 44, Issue 6, pp. 1814-1828, June 2009.
2. S. Mandal, S. K. Arfin and R. Sarpeshkar, **Sub- μ Hz MOSFET $1/f$ Noise Measurements**, *Electronics Letters*, Vol. 45, Issue 1, pp. 81-82, January 2009.

2008

1. S. Mandal and R. Sarpeshkar, **Power-Efficient Impedance-Modulation Wireless Data Links for Biomedical Implants** (invited paper), *IEEE Transactions on Biomedical Circuits and Systems*, Vol. 2, Issue 4, pp. 301-315, December 2008.
2. R. Sarpeshkar, W. Wattanapanitch, B. I. Rapoport, S. K. Arfin, M. W. Baker, S. Mandal, M. Fee, S. Musallam and R. A. Andersen, **Low-Power Circuits for Brain-Machine Interfaces**, *IEEE Transactions on Biomedical Circuits and Systems*, Vol. 2, Issue 3, pp. 173-183, September 2008.

Prior to 2008

1. S. Mandal and R. Sarpeshkar, **Low Power CMOS Rectifier Design for RFID Applications**, *IEEE Transactions on Circuits and Systems-I*, Vol. 54, Issue 6, pp. 1177-1188, June 2007.
2. S. Mandal and S. Banerjee, **Analysis and CMOS Implementation of a Chaos-based Communication System**, *IEEE Transactions on Circuits and Systems I*, Vol. 51, Issue 9, pp. 1708-1722, September 2004.
3. M. F. Davis, A. Sutono, S.-W. Yoon, S. Mandal, N. Bushyager, C.-H. Lee, K. Lim, S. Pinel, M. Maeng, A. Obatoyinbo, S. Chakraborty, J. Laskar, E. M. Tentzeris, T. Nonaka and R. R. Tummala, **Integrated RF Architectures in Fully Organic SOP Technology**, *IEEE Transactions on Advanced Packaging*, Vol. 25, Issue 2, pp. 1708-1722, May 2002.

REFEREED CONFERENCE PUBLICATIONS

Student co-authors have been underlined.

2018

1. V. Pashaei, A. Roman, and S. Mandal, **Conformal Ultrasound Transducer Array for Image-Guided Neural Therapy**, to be presented at the *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Cleveland, OH, October 2018.
2. X. Tang, J. Liang, Y. Wang, and S. Mandal, **Indoor Occupancy Awareness and Localization Using Passive Electric Field Sensing**, to be presented at the *IEEE Sensors Conference*, New Delhi, India, October 2018.
3. X. Tang, M. Sameer, and S. Mandal, **Acoustic Wireless Power and Data Telemetry for Structural Health Monitoring**, to be presented at the *IEEE Sensors Conference*, New Delhi, India, October 2018.
4. C. Chen, A. Srivastav, D. Ariando, S. Mandal, R. Tang, and Y.-Q. Song, **Real-Time Data Inversion Methods for Low-Field Nuclear Magnetic Resonance (NMR) (invited paper)**, to be presented at the *23rd International Conference on Digital Signal Processing (DSP 2018)*, Shanghai, China, November 2018.
5. M. T. Bin Tarek, S. Dharmasena, A. Madanayake, S. Choi, J. Glickstein, J. Liang, and S. Mandal, **Power-Efficient Data Modulation for All-Mechanical ULF/VLF Transmitters**, to be presented at the *Midwest Circuits and Systems Conference (MWSCAS)*, Windsor, Canada, August 2018.
6. J. Liang, X. Tang, and S. Mandal, **An Integrated Low-Power Multi-Modal Wide-Dynamic-Range Potentiostat**, to be presented at the *Midwest Circuits and Systems Conference (MWSCAS)*, Windsor, Canada, August 2018.
7. A. Roman, P. Dehghanzadeh, V. Pashaei, A. Basak, S. Bhunia, and S. Mandal, **An Open-Source Test-Bench for Autonomous Ultrasound Imaging**, to be presented at the *Midwest Circuits and Systems Conference (MWSCAS)*, Windsor, Canada, August 2018.
8. M. S. Islam and S. Mandal, **A Real-Time Automatic Phase-Noise-Locked Loop (PNLL) for MEMS-Referenced Oscillators**, to be presented at the *National Aerospace Electronics Conference (NAECON)*, Dayton, OH, July 2018.

9. S. Majerus, M. S. Damaser, G. Vince, G. Pinault, and S. Mandal, **Bruit-Enhancing Phonoanagram Filter Using Sub-Band Autoregressive Linear Predictive Coding**, to be presented at the *40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)*, Honolulu, HI, July 2018.
10. A. Srivastav, D. Ariando, and S. Mandal, **An FPGA-based Flexible and MIMO-capable GPR System**, to be presented at the *17th International Conference on Ground Penetrating Radar (GPR)*, Rapperswil, Switzerland, June 2018.
11. H. Zhao, S. Mandal, V. Ariyaratna, A. Madanayake, and R. Cintra, **An Offset-Canceling Approximate-DFT Beamforming Architecture for Wireless Transceivers**, to be presented at the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Florence, Italy, May 2018.
12. N. Akram, A. Madanayake, S. Mandal, S. Handagala, and L. Belostotski, **Multiport ADCs for Microwave Focal Plane Array Dish Receivers**, to be presented at the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Florence, Italy, May 2018.
13. X. Tang, H. Zhao, and S. Mandal, **A Programmable CMOS Transceiver for Structural Health Monitoring (invited paper)**, to be presented at the *IEEE Custom Integrated Circuits Conference (CICC)*, San Diego, CA, April 2018.
14. P. Dehghanzadeh, A. Roman, S. Majerus, and S. Mandal, **Towards a Wearable Ultrasonic Device for Real-Time and None-Invasive Estimation of Bladder Volume**, to be presented at the *International Conference on Wearable and Implantable Body Sensor Networks (BSN)*, Las Vegas, NV, March 2018.
15. X. Tang, J. Harley, K. Bi, T. Ozdemir, and S. Mandal, **Sparse Sensor Networks for Active Structural Health Monitoring using Highly Integrated CMOS Transceivers**, to be presented at *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems (part of SPIE Smart Structures + Nondestructive Evaluation)*, Denver, CO, March 2018.

2017

1. X. Tang, M.-C. Huang, and S. Mandal, **An “Internet of Ears” for Crowd-Aware Smart Buildings based on Sparse Sensor Networks**, to be presented at the *IEEE SENSORS Conference*, Glasgow, UK, October 2017.
2. F. Zhang, N. V. R. Masna, S. Bhunia, C. Chen, and S. Mandal, **Authentication and Traceability of Food Products through the Supply Chain using NQR Spectroscopy**, to be presented at the *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Turin, Italy, October 2017.
3. A. Madanayake, N. Akram, S. Mandal, J. Liang, and L. Belostotski, **Improving ADC Figure-of-Merit in Wideband Antenna Array Receivers using Multidimensional Space-Time Delta-Sigma Multiport Circuits (invited paper)**, presented at the *IEEE International Workshop on Multidimensional (nD) Systems (nDS)*, Zielona Góra, Poland, September 2017.
4. S. Majerus, S. Mandal, and A. Fleischman, **Catheter-Mounted CMOS Front-Ends for Broadband Intravascular Ultrasonic Imaging (invited paper)**, presented at the *IEEE Midwest Symposium on Circuits and Systems (MWSCAS)*, Boston, MA, August 2017.
5. A. Nikoofard, J. Liang, M. Twieg, A. Madanayake, S. Handagala, L. Belostotski, and S. Mandal, **Low-complexity N -port ADCs using 2-D Δ - Σ Noise-Shaping in N -Element Array Receivers**, presented at the *IEEE Midwest Symposium on Circuits and Systems (MWSCAS)*, Boston, MA, August 2017.
6. Y. Wang, A. Madanayake, S. Handagala, L. Belostotski, and S. Mandal, **Antenna Array N -port LNAs using 2-D Spatio-Temporal Δ - Σ Noise-Shaping**, presented at the *IEEE Midwest Symposium on Circuits and Systems (MWSCAS)*, Boston, MA, August 2017.

7. Mohammad S. Islam, Siddharth K. Singh, and Soumyajit Mandal, **Design and Experimental Verification of a Low-Noise Sustaining Amplifier for Reconfigurable MEMS/NEMS based Oscillators**, presented at the *IEEE Midwest Symposium on Circuits and Systems (MWSCAS)*, Boston, MA, August 2017.
8. A. Madanayake, S. Choi, M. Tarek, S. Dharmasena, S. Mandal, J. Glickstein, and A. Sehirlioglu, **Energy-Efficient ULF/VLF Transmitters Based on Mechanically-Rotating Dipoles**, presented at the *IEEE Moratuwa Engineering Research Conference (MERCon)*, Moratuwa, Sri Lanka, May 2017.
9. S. Majerus, X. Tang, J. Liang, and S. Mandal, **Embedded Silicon Odometers for Monitoring the Aging of High-Temperature Integrated Circuits** (invited paper), presented at the *National Aerospace Electronics Conference (NAECON)*, Dayton, OH, June 2017.
10. Y. Wang and S. Mandal, **A Dense Monopole Array for Spatial Noise Shaping**, presented at the *International Applied Computational Electromagnetics Society (ACES) Symposium*, Suzhou, China, August 2017.
11. Y. Wang and S. Mandal, **Cochlear signal analysis for broadband spectrum sensing**, presented at the *IEEE Cognitive Communications For Aerospace Applications Workshop*, Cleveland, OH, June 2017.
12. H. Zhao and S. Mandal, **Phase-Locked Loops using Switched-Gain Control**, presented at the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Baltimore, MD, May 2017.
13. T. Hopper, S. Summers, B. Birt, and S. Mandal, **Borehole Magnetic Resonance in Coal Seams**, presented at the *Environmental and Engineering Geophysical Society's Annual Meeting (SAGEEP)*, Denver, CO, March 2017.
14. L. Belostotski, P. Ahmadi, A. Madanayake, V. Ariyaratna, N. Udayanga, S. Mandal, and A. Nikoofard, **Analog 65nm CMOS 5GHz Sub-Arrays with ROACH-2 FPGA Beamformers for Hybrid Aperture-Array Receivers**, presented at *GOMACTech-17*, Reno, NV, March 2017.

2016

1. S. Shomaji, A. Basak, S. Mandal, R. Karam, and S. Bhunia, **A Wearable Carotid Ultrasound Assembly for Early Detection of Cardiovascular Diseases**, to be presented at the *IEEE-NIH 2016 Special Topics Conference on Healthcare Innovations and Point-of-Care Technologies (HI-POCT'16)*, Cancun, Mexico, November 2016.
2. S. Shomaji, A. Basak, S. Mandal, and S. Bhunia, **A Wearable Carotid Ultrasound Assembly for Early Detection of Cardiovascular Diseases**, the *38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)*, Orlando, FL, August 2016.
3. X. Tang, H. Zhao, and S. Mandal, **A Highly-Integrated CMOS Transceiver for Active Structural Health Monitoring**, the *National Aerospace Electronics Conference & Ohio Innovation Summit (NAECON-OIS)*, Dayton, OH, July 2016.
4. Y. Wang and S. Mandal, **Automated Design and Optimization of Integrated Inductors and Transformers** (invited paper), the *National Aerospace Electronics Conference & Ohio Innovation Summit (NAECON-OIS)*, Dayton, OH, July 2016.
5. H. Khanmohammad, P. Wang, C. Babecki, P. X.-L. Feng, and S. Mandal, **A Programmable CMOS Feedback IC for Reconfigurable MEMS-Referenced Oscillators**, the *IEEE International NEWCAS Conference*, Vancouver, June 2016.
6. H. Zamani, C. Chen, X. Tang, P. Mohseni, and S. Mandal, **A Current-Controlled Transceiver IC for Structural Health Monitoring** (invited paper), the *IEEE International NEWCAS Conference*, Vancouver, June 2016.

7. J. Liang, A. Nikoofard, and S. Mandal, **A Low-Power Receiver for Simultaneous Electrocardiogram and Respiration Rate Detection**, the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Montreal, May 2016.
8. A. Nikoofard and S. Mandal, **An 11.5 nW Broadband Wake-up RF Receiver with -60 dBm Sensitivity at 50 MHz** (invited paper), the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Montreal, May 2016.
9. R. Erfani, F. Marefat, S. Mandal, and P. Mohseni, **A 1.3 mA Biphasic Current Stimulator IC with Active Charge Balancing for Nerve Interfacing Applications** (invited paper), the *IEEE International Symposium on Circuits and Systems (ISCAS)*, Montreal, May 2016.

2015

1. Y. Wang and S. Mandal, **Output Encoding for Cochlear Signal Analysis**, the *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Atlanta, GA, October 2015.
2. S. Mandal, **Switched-Gain Feedback Amplifiers**, the *58th IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, Fort Collins, CO, August 2015.

2010

1. S. Mandal and R. Sarpeshkar, **A Cochlear Heterodyning Architecture for an RF Fovea**, the *IEEE International Symposium on Circuits and Systems*, Paris, May 2010.
2. S. Mandal, B. Shi and P. Dudek, **Binocular Disparity Calculation on a Massively-Parallel Analog Vision Processor**, *International Workshop on Cellular Nanoscale Networks and Applications (CNNA)*, Berkeley, CA, February 2010.

2009

1. S. Mandal and R. Sarpeshkar, **Circuit Models of Stochastic Genetic Networks**, *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Beijing, China, November 2009.
2. S. Mandal, M. Tavakoli, L. Fay, V. Misra, J. Bohorquez, W. Sanchez, R. Sarpeshkar, **Ultra-low-power Electronics for Non-invasive Medical Monitoring**, L. Turicchia, *Custom Integrated Circuits Conference (CICC)*, San Jose, CA, September 2009.
3. S. Mandal, L. Turicchia, R. Sarpeshkar, **A Battery-Free Tag for Wireless Monitoring of Heart Sounds**, *Body Sensor Networks Conference*, Berkeley, CA, June 2009.
4. S. K. Arfin, S. Mandal, R. Sarpeshkar, **Dynamic-Range Analysis and Maximization of Micropower Gm-C Bandpass Filters by Adaptive Biasing**, *IEEE International Symposium on Circuits and Systems*, Taipei, Taiwan, May 2009.
5. S. Mandal, R. Sarpeshkar, **Log-Domain Circuit Models of Chemical Reactions**, *IEEE International Symposium on Circuits and Systems*, Taipei, Taiwan, May 2009.

Prior to 2008

1. S. Mandal and R. Sarpeshkar, **A Bidirectional Wireless Link for Neural Prostheses that Minimizes Implanted Power Consumption**, *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Montreal, Canada, November 2007.
2. R. Sarpeshkar, W. Wattanapanitch, B. I. Rapoport, S. K. Arfin, M. W. Baker, S. Mandal, M. Fee, S. Musallam and R. A. Andersen, **Low-Power Circuits for Brain-Machine Interfaces**, *IEEE International Conference on Circuits and Systems (ISCAS)*, New Orleans, May 2007.
3. B. Kim, S. Mandal and R. Sarpeshkar, **Power-Adaptive Operational Amplifier with Positive-Feedback Self Biasing**, *IEEE International Conference on Circuits and Systems (ISCAS)*, Kos, Greece, May 2006.

4. S. Mandal, S. K. Arfin and R. Sarpeshkar, **Fast Start-up CMOS Current References**, *IEEE International Conference on Circuits and Systems (ISCAS)*, Kos, Greece, May 2006.
5. S. Mandal, S. Zhak and R. Sarpeshkar, **Circuits for an RF Cochlea**, *IEEE International Conference on Circuits and Systems (ISCAS)*, Kos, Greece, May 2006.
6. S. Zhak, S. Mandal and R. Sarpeshkar, **A Proposal for an RF Cochlea**, *Asia Pacific Microwave Conference, APMC 2004 (invited paper)*, New Delhi, December 2004.
7. S. Mandal and S. Banerjee, **An Integrated CMOS Chaos Generator**, *National Conference on Nonlinear Systems & Dynamics, NCNSD 2003*, Kharagpur, India, December 2003 (**Best student paper award**).
8. S. Mandal and S. Banerjee, **A Chaos-based Spread Spectrum Communication System**, *National Conference on Nonlinear Systems & Dynamics, NCNSD 2003*, Kharagpur, India, December 2003.
9. S. Mandal and S. Banerjee, **Performance of Differential Chaos Shift Keying Communication over Multipath Fading Channels**, *National Conference on Nonlinear Systems & Dynamics, NCNSD 2003*, Kharagpur, India, E85A (12), pp. 1-4, 2003.
10. M. F. Davis, S.-W. Yoon, S. Mandal, N. Bushyager, M. Maeng, K. Lim, S. Pinel, A. Sutono, J. Laskar, M. Tentzeris, T. Nonaka, V. Sundaram, F. Liu and R. Tummala, **RF-Microwave Multi-band Design Solutions for Multilayer Organic System on Package Integrated Passives**, *IEEE MTT-S 2002 Digest*, Vol. 3, pp. 2217-2200.
11. S. Pinel, S. Chakraborty, S. Venkataraman, R. Bhatia, S. Mandal, S. Nuttinck, B. Larson and J. Laskar, **Development of SOI based MMICs for Wireless LAN applications**, *IEEE MTT-S 2002 Digest*, Vol. 2, pp. 1053 1056.
12. S. Pinel, S. Chakraborty, M. Roellig, R. Kunze, S. Mandal, H. Liang, C.-H. Lee, R. Li, K. Lim, G. White, M. Tentzeris and J. Laskar, **3D Integrated LTCC Module using μ BGA Technology for Compact C-band RF Module**, *IEEE MTT-S 2002 Digest*, Vol. 3, pp. 1553 1556.

CONFERENCE POSTERS AND ORAL PRESENTATIONS

Student co-authors have been underlined.

2018

1. V. Pashaei, A. Roman, P. Dehghanzadeh, and S. Mandal, **Live Demonstration: an Open-Source Test-Bench for Autonomous Ultrasound Imaging**, to be presented at the *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Cleveland, OH, October 2018.
2. M. S. Islam, J. Lee, R. Wei, P. X.-L. Feng, and S. Mandal, **Programmable & Reconfigurable Sustaining Amplifiers for MEMS/NEMS Referenced Multimode Oscillators**, to be presented at the *Hilton Head Solid-State Sensors, Actuators and Microsystems Workshop*, Hilton Head, SC, June 2018.
3. N. V. R. Masna, F. Zhang, C. Chen, S. Mandal, and S. Bhunia, **Authentication and Traceability of Food Products using NQR Spectroscopy**, to be presented at the *IEEE International Symposium on Hardware Oriented Security and Trust (HOST)*, Washington, DC, April 2018.
4. J. Glickstein and S. Mandal, **An Automated Setup for Polarization-Enhanced Broadband Nuclear Quadrupole Resonance (NQR) Spectroscopy**, to be presented at the *Experimental NMR Conference (ENC)*, Orlando, FL, April 2018.
5. M. Greer, C. Chen, and S. Mandal, **Automated Discrimination and Verification of Cooking Oils with Portable Low-Field NMR**, to be presented at the *Experimental NMR Conference (ENC)*, Orlando, FL, April 2018. Selected for a talk in the special Young Scientist Session.

2017

1. Jifu Liang, David Ariando, Yingying Wang, Daniel Scherson, Kenneth Loparo, and Soumyajit Mandal, **A Wireless, Portable, and Inexpensive Open-Source Potentiostat**, presented at the *Annual Meeting of the International Society of Electrochemistry*, Providence, RI, August 2017.
2. David Ariando, David Mirando, Junyi Shi, Mason Greer, Cheng Chen, and Soumyajit Mandal, **A Low-Cost Miniature NMR Spectrometer for Active Learning**, presented at the *Experimental NMR Conference (ENC)*, Asilomar, CA, March 2017.
3. Mason Greer, Cheng Chen, and Soumyajit Mandal, **Design and Optimization of Gradients for 3D Low-Field Imaging Sensors**, presented at the *Experimental NMR Conference (ENC)*, Asilomar, CA, March 2017.
4. Mohammad S. Islam, Soumyajit Mandal, Shin Utsuzawa, and Yi-Qiao Song, **A Broadband and High-Power Nuclear Magnetic Resonance (NMR) System**, presented at the *Experimental NMR Conference (ENC)*, Asilomar, CA, March 2017.
5. C. Chen, F. Zhang, S. Bhunia, and S. Mandal, **Broadband quantitative NQR of vitamins and dietary supplements**, presented at the *Practical Applications of NMR in Industry Conference (PANIC)*, Hilton Head, SC, Feb 2017.

2016

1. C. Chen, F. Zhang, S. Bhunia, and S. Mandal, **A Low-Cost Portable Spectroscopic Device for Authentication of Medicines and Food Products**, the *IEEE International Symposium on Hardware Oriented Security and Trust (HOST)*, McLean, VA, May 2016.
2. C. Cheng, M. Greer, M. Twieg, M. Griswold, and S. Mandal, **Integration of Miniaturized Ultrasound and Single-Sided, Low-Field MRI**, the *International Society for Magnetic Resonance in Medicine (ISMRM) meeting*, Singapore, May 2016.
3. M. Twieg, S. Mandal, and M. Griswold, **N-path receivers for ultra-high density receive arrays**, the *International Society for Magnetic Resonance in Medicine (ISMRM) meeting*, Singapore, May 2016.

2015

1. C. Cheng, F. Zhang, S. Bhunia, and S. Mandal, **Authentication of pharmaceutical products using nuclear quadrupole resonance spectroscopy**, *Great Lakes Regional NMR Symposium*, Cleveland, OH, September 2015.

2014

1. S. Mandal, Y. Q. Song, **A Miniature NMR Sensor Suitable for High-Temperature High-Pressure Fluid Analysis**, *Experimental NMR Conference (ENC)*, Boston, MA, March 2014.
2. S. Sheldon, S. Mandal, M. Hürlimann, **Properties of Axis-Matching Excitation Pulses in Inhomogeneous Magnetic Fields**, *Experimental NMR Conference (ENC)*, Boston, MA, March 2014.
3. S. Mandal, T. Borneman, V. Koroleva, M. Hürlimann, **Performance Limits of CPMG-like Sequences in Inhomogeneous Fields**, *Experimental NMR Conference (ENC)*, Boston, MA, March 2014.
4. S. Mandal, M. Hürlimann, Y. Q. Song, **Optimizing low-frequency NMR measurements**, *Magnetic Resonance in Porous Media Conference (MRPM)*, Wellington, NZ, February 2014.

2013

1. S. Mandal, Y. Q. Song, **Two-dimensional NQR using ultra-broadband electronics**, *Magnetic Resonance for the Detection of Explosives (MRDE) workshop*, London, UK, July 2013.

2012

1. S. Mandal, S. Utsuzawa, Y. Q. Song, **Completely Non-Resonant Low-Frequency MR**, *Magnetic Resonance in Porous Media Conference (MRPM)*, Surrey, UK, September 2012.
2. S. Mandal, Y. Q. Song, **J-coupling Measurements in Inhomogeneous Magnetic Fields**, *Experimental NMR Conference (ENC)*, Miami, FL, April 2012.
3. S. Mandal, S. Utsuzawa, Y. Q. Song, **A Completely Non-Resonant MR System**, *Experimental NMR Conference (ENC)*, Miami, FL, April 2012.
4. S. Mandal, V. Do, M. Hürlimann, Y. Q. Song, **Power-Efficient Broadband CPMG Excitation and Refocusing Pulses**, *Experimental NMR Conference (ENC)*, Miami, FL, April 2012.
5. S. Mandal, Y. Q. Song, **NQR with an Ultra-Broadband MR System**, *Experimental NMR Conference (ENC)*, Miami, FL, April 2012.

2011

1. S. Mandal, Y. Q. Song, **Amplitude-modulated CPMG refocusing pulses**, *International Conference on Magnetic Resonance Microscopy (ICMRM)*, Beijing, China, August 2011.
2. S. Utsuzawa, S. Mandal, Y. Q. Song, **Non-Resonant NMR Detection Using an Untuned Coil and a Transformer**, *Experimental NMR Conference (ENC)*, Asilomar, CA, February 2011.
3. T. Hopper, S. Mandal, D. Cory, M. Hürlimann, Y. Q. Song, **NMR with a non-resonant transmitter circuit**, *Experimental NMR Conference (ENC)*, Asilomar, CA, February 2011.

Prior to 2008

1. S. Mandal, A. Kumar, R. Mukhopadhyay, A. Makharia and S. N. Mishra, **CMOS RF Front End for 120-600 MHz receivers**, *Asia Pacific Design Automation VLSI Design Conference, ASPDAC-VLSI*, Bangalore, India, 2002.

INVITED TALKS

1. IEEE Biomedical Circuits and Systems Conference (BioCAS) (*keynote lecture*), Cleveland, OH, 2018.
2. University of Florida, Gainesville, FL, 2018.
3. Indiana University, Bloomington, IN, 2018.
4. Florida International University, Miami, FL, 2018.
5. Texas Tech University, Lubbock, TX, 2018.
6. Columbia University, New York, NY, 2017.
7. Northeastern University, Boston, MA, 2017.
8. University of Michigan, Ann Arbor, MI, 2017.
9. Cleveland Clinic, Cleveland, OH, 2016.
10. Draper Labs, Cambridge, MA, 2016.
11. University of British Columbia, Vancouver, BC, Canada, 2016.
12. University of Calcutta, Calcutta, India, 2016.
13. Visva-Bharati University, Santiniketan, India, 2014.
14. Analog Devices, Cambridge, MA, 2014.

15. University of Massachusetts, Amherst, MA, 2014.
16. University of Notre Dame, South Bend, IN, 2014.
17. Case Western Reserve University, Cleveland, OH, 2014.
18. Stanford University, Palo Alto, CA, 2009.
19. Rice University, Houston, TX, 2009.
20. University of Texas, Austin, TX, 2009.
21. University of Alberta, Edmonton, AB, Canada, 2009.
22. Princeton University, Princeton, NJ, 2009.

PATENTS ISSUED

1. **Methods and Apparatuses for Echo Processing of Nuclear Magnetic Resonance (NMR) Data**, J. L. Paulsen, M. D. Hürlimann, J. Kusuma, B. E. Boling, S. Mandal, B. Gaddis, *U.S. Patent 10,088,594, issued October 2018.*
2. **Method for Identifying Chemical Species in a Substance using NQR**, Y. Q. Song, S. Mandal, *U.S. Patent 10,088,540, issued October 2018.*
3. **System and Method for Processing Magnetic Resonance Signals**, S. Mandal, Y. Q. Song, S. Utsuzawa, M. Thompson, *U.S. Patent 10,024,938, issued July 2018.*
4. **Nuclear Magnetic Resonance Refocusing Pulses for Inhomogeneous Magnetic Fields**, S. Mandal, V. D. M. Koroleva, T. Borneman, M. D. Hürlimann, *U.S. Patent 10,001,578, issued June 2018.*
5. **Method and System for Applying NQR Pulse Sequences**, S. Mandal, Y. Q. Song, *U.S. Patent 9,927,550, issued March 2018.*
6. **Methods and Apparatus for Oil Sample Analysis using J-edit Nuclear Magnetic Resonance**, S. Mandal, Y. Q. Song, *U.S. Patent 9,863,246, issued January 2018.*
7. **Method and Apparatus for Determining Mud Contamination of Formation Fluid**, A. B. Andrews, S. Betancourt, A. E. Pomerantz, S. Mandal, Y. Q. Song, *U.S. Patent 9,759,830, issued September 2017.*
8. **Non-resonant Magnetic Resonance Transmitter with Power Factor Correction**, Y. Q. Song, S. Mandal, *U.S. Patent 9,689,937, issued June 2017.*
9. **System and Method for Processing Magnetic Resonance Signals**, S. Mandal, S. Utsuzawa, Y. Q. Song, *U.S. Patent 9,678,182, issued June 2018.*
10. **Refocusing Pulses and Excitation Pulses for NMR Logging**, M. Hürlimann, S. Mandal, V. Do, Y. Q. Song, *U.S. Patent 9,658,358, issued May 2017.*
11. **Integrated NMR Transceiver Array**, S. Mandal, Y. Q. Song, *U.S. Patent 8,988,076, issued March 2015.*
12. **Wearable System for Monitoring Physiological Signals**, S. Mandal, L. Turicchia, R. Sarpeshkar, *U.S. Patent 8,708,923, issued April 2014.*
13. **Advanced Coding Strategies for Visual Prostheses**, L. Turicchia, S. Mandal, R. Sarpeshkar, *U.S. Patent 8,700,166, issued April 2014.*
14. **Low-Power Analog Architecture for Brain-Machine Interfaces**, R. Sarpeshkar, B. I. Rapoport, W. Wattanapanitch, S. Mandal, *U.S. Patent 8,332,024, issued December 2012.*

15. **Electronic System for Modeling Chemical Reactions and Biochemical Processes**, S. Mandal, R. Sarpeshkar, *U.S. Patent 8,285,523, issued October 2012.*
16. **Architectures for Universal or Software Radio**, S. Mandal, S. Zhak and R. Sarpeshkar; *U.S. Patent 8,121,223, issued February 2012.*
17. **RF Power Extracting Circuit and Related Techniques**, S. Mandal and R. Sarpeshkar; *U.S. Patent 8,045,947, issued November 2011.*
18. **Far-Field RF Power Extraction Circuits and Systems**, S. Mandal and R. Sarpeshkar; *U.S. Patent 7,167,090, issued January 2007.*

PATENT APPLICATIONS

CWRU co-authors are *underlined*.

1. **Multi-Modal Spectroscopic Analysis**, C. Chen, S. Mandal, S. Bhunia, F. Zhang, and N. V. R. Masna, *U.S. Patent application filed September 2017.*
2. **Downhole Diffusion Coefficient Measurement**, T. A. J. Hopper, M. D. Schubert, B. J. Birt, and S. Mandal, *World Patent application filed June 2017.*
3. **System and Method for Improved RF System Performance in MRI Systems**, M. Twieg, M. A. Griswold, and S. Mandal, *U.S. Patent application filed April 2017.*
4. **NMR Probe and Methods of use**, Y.-Q. Song, S. Mandal, Y.-Q. Tang, M. D. Hürlimann, J. L. Paulsen, *U.S. Patent application filed November 2014.*
5. **Configurable ASIC for NMR Measurement**, S. Mandal, Y. Q. Song, *U.S. Patent application filed August 2014.*
6. **Method and System for Applying NMR Pulse Sequences using Different Frequencies**, S. Mandal, S. Utsuzawa, Y. Q. Song, *U.S. Patent application filed March 2013.*

HONORS AND AWARDS

2018	Learning Fellowship, Case Western Reserve University
2018	Indian Institute of Technology, Kharagpur Young Alumni Achiever Award
2018	Timothy E. and Allison L. Schroeder Professorship in Computer Science and Engineering, Case Western Reserve University
2018	Case School of Engineering Graduate Teaching Award
2018	John S. Diekhoff Graduate Student Mentorship Award Nominee, Case Western Reserve University
2016	T. Keith Glennan Fellowship, Case Western Reserve University
2016	John S. Diekhoff Graduate Student Mentorship Award Nominee, Case Western Reserve University
2015	Mentor Fellowship, Case Western Reserve University
2014	Senior Member, IEEE
2014	Schlumberger Patent Award
2009	Microsystems Technology Laboratories (MTL) Best Doctoral Dissertation Award
2009	MGH-MIT Postdoctoral Fellowship in Translational Research Finalist
2007 – 2008	Poitras Pre-doctoral Fellowship, Harvard/MIT Division of Health Sciences & Technology.

- 2002 – 2003 Presidential Fellow, Massachusetts Institute of Technology.
- 2002 President's Gold Medal, Indian Institute of Technology, Kharagpur.
- 2002 Departmental Silver Medal, Indian Institute of Technology, Kharagpur.
- 2002 Departmental Award for Best Undergraduate Thesis, Indian Institute of Technology, Kharagpur.
- 1998 – 2002 Jagadish Bose National Science Talent Search Scholarship.

TEACHING

Instructor Case Western Reserve University, 2014 – present

EECS 398/399: Senior Design Project (*existing course*).

EECS 309: Electromagnetic Fields (*existing course*): This is a basic undergraduate course on electromagnetic fields and waves. It is a requirement for all electrical engineering (EE) majors, and is taken mostly by sophomores and juniors.

EECS 526: Mixed-Signal Integrated Systems (*new course*): A hands-on introduction to modern mixed-signal (analog/digital) integrated circuit (IC) design. The course is structured around a series of laboratory exercises that use the simulation and testing of a custom CMOS IC as a vehicle in order to understand important IC design principles.

EECS 600: Advanced Integrated Circuit Design (*new course*): An in-depth look at modern mixed-signal (analog/digital) integrated circuit (IC) design. The course begins with a discussion of the relevant physics of integrated semiconductor devices. It then covers feedback circuit design, noise mechanisms and analysis, device mismatch and reliability, and principles for low-noise and energy-efficient design. Circuit and system-level simulation methods and software are also discussed. The second half of the course is focused on one or two particular topical areas, which vary from year to year. Examples include RF and high-speed circuits, biomedical electronics, bio-inspired and neuromorphic systems, data converters, sensor interfaces, current-mode circuits, and integrated power electronics. Students also design, simulate, and layout a submicron CMOS IC as their class project. The best of these designs are fabricated through the Mosis Educational Program (MEP).

EECS 326/600: Measurement and Instrumentation (*new course*): A second course in instrumentation with emphasis on sensor physics and sensor interface electronics. General concepts in measurement systems, including accuracy, precision, sensitivity, linearity, and resolution. The physics and modeling of resistive, reactive, self-generating, and direct-digital sensors, including emerging nanosensors. Signal conditioning for these sensors, including bridge circuits, coherent detectors, and a variety of amplifier topologies including differential, instrumentation, charge, and transimpedance. Noise and drift in amplifiers and resistors. Practical measurement issues, including external interference, grounding, shielding, power supplies, and signal isolation.

Teaching Assistant. Massachusetts Institute of Technology, 2004, 2007, 2008

MIT course “6.376: Low Power Analog VLSI”. Held recitations, graded problem sets, prepared and delivered several class presentations, prepared draft copies of a textbook, advised on final project.

Teaching Assistant. Massachusetts Institute of Technology, 2006

MIT course “6.121: Bioelectronics Project Lab”. Held lab sessions, graded labs and pre-labs, worked on class presentations, advised on final project.

Teaching Assistant. Massachusetts Institute of Technology, 2006

MIT course “6.021J: Quantitative Physiology: Cells and Tissues”. Held office hours and exam review sessions, graded exams, helped with labs.

SERVICE

Program Committee: Asia and South Pacific Design Automation Conference (ASP-DAC), Biomedical Circuits and Systems (BioCAS).

Session Chair: IEEE Midwest Circuits and Systems Conference (MWSCAS), National Aerospace & Electronics Conference (NAECON).

Review Panelist: National Science Foundation (NSF): 2016, 2017 (2 times); Department of Veterans Affairs: 2015, 2016.

Paper Reviewer: Several IEEE journals, including the Transactions on *Circuits and Systems (TCAS) I and II*, *Biomedical Circuits and Systems (TBCAS)*, *Instrumentation and Measurement, Communications (TCOM)*, *Multi-Scale Computing Systems (TMSCS)*, *Power Electronics (TPE)*, as well as the *Power Electronics Letters (PEL)*, *Journal of Solid-State Circuits (JSSC)*, *Reviews in Biomedical Engineering (RBME)*, *Internet of Things Journal*, and related conferences. Also a reviewer for other international journals, such as *Circuits, Systems, & Signal Processing*, the *Annals of Biomedical Engineering*, *Frontiers in Neuroscience*, *International Journal of Bifurcations and Chaos*, *Microelectronics Journal*, *Diffusion Fundamentals*, *Journal of Magnetic Resonance*, *Microporous and Mesoporous Materials*, and *Acta Geophysica*

Academic: Undergraduate advisor, EECS Department, CWRU (2017-present); Graduate committee member, EECS Department, CWRU (2017-present); Research committee member, Case School of Engineering, CWRU (2018-present).

Thesis Supervisor: 11 Ph.D. (ongoing), 4 M.S. (ongoing), 4 M.S. (completed) (2014 - date).

Ph.D. and M.S. Committee Member: 9 Ph.D., 5 M.S. (2014 - date).

Outreach: Writer of popular science books for children, including *Scholastic Quiz Biology* (2008), *World In My Pocket* (2009), and *103 Everyday Inventions, Discoveries, Creations and Stuff* (with Avinanda Mukherjee, 2013), all published by Scholastic India Private Limited.

CURRENT RESEARCH FUNDING

Note: In the case of collaborative projects, the budget numbers below refer only to Mandal's portion of the total project budget.

HCL Technologies Ltd., Mandal (PI), 10/18-06/19, \$97,500

Inductive Power and Data Transfer for Cochlear Implants

This project is developing integrated circuits and modeling methods for inductive power and data delivery to cochlear implants.

Role: PI

Quality Electrodynamics, LLC, Mandal (PI), 10/18-06/19, \$47,500

Digital RF-over-fiber Links for MRI

This project is developing digital RF links over optical fiber for multi-channel MRI coils.

Role: PI

DARPA SBIR Phase-1, Chodavarapu (PI), 04/18-06/19, \$67,500

Flexible Conformal Ultrasound Arrays for Imaging and Modulation

This project is developing flexible conformal ultrasound arrays for simultaneous imaging and modulation of tissues.

Role: co-PI

Schlumberger grant, Mandal (PI), 01/18-05/18, \$20,800

Design and Testing of Miniaturized NMR Transmitters

The goal of this project is to design and test miniaturized high-power transmitters for a custom magnetic resonance (MR) IC.

Role: PI

Multi-Pharma, LLC, Mandal (PI), 08/17-07/19, \$193,694

NQR Technology Pre-Commercialization Development

This project is developing devices for automated screening of pharmaceutical products based on nuclear quadrupole resonance (NQR) spectroscopy.

Role: PI

NSF CCSS, Madanayake (PI), 7/17 - 6/20, \$175,000

Collaborative Research: Wideband Multi-Beam Antenna Arrays: Low-Complexity Algorithms and Analog-CMOS Implementations

This project is exploring low-complexity algorithms and circuits for multi-beam antenna arrays.

Role: co-PI

NSF SpecEES, Madanayake (PI), 7/17 - 6/20, \$187,500

Collaborative Research: Spatially Oversampled Dense Multi-Beam Millimeter-Wave Communications for Exponentially Increased Energy-Efficiency

This project is exploring spatio-temporal extensions of Δ - Σ modulation and associated beam-forming and channel-modeling algorithms for mm-wave wireless communications.

Role: co-PI

DARPA STTR Phase-2, Mugler (PI), 11/17-10/20, \$190,000

Analog Co-Processors for Complex System Simulation & Design

This project is developing analog co-processors for massively-parallel simulations of complex partial differential equations.

Role: co-PI

Air Force STTR Phase-1, Ozdemir (PI), 12/16-09/17, \$70,561

Flexible Smart Sensor Network for Structural Health Monitoring

This project is developing physically-flexible sensor networks for structural health monitoring of aerospace structures.

Role: co-PI

NSF CNS-1629790, Madanayake (PI), 08/16-02/18, \$50,000

CI-P: Collaborative Project: Massively-Parallel Analog Co-Processors for Simulating Complex Systems

This project is developing community infrastructure for high-speed analog integrated circuit design.

Role: co-PI

NSF SHF-1563688, Mandal (PI), 07/16-06/20, \$650,000

SHF: Medium: Collaborative Research: Materials authentication using nuclear quadrupole resonance spectroscopy

This collaborative project is exploring novel spectroscopic methods for reliable low-cost authentication of medicines and other pharmaceutical products.

Role: PI

NSF CCF-1525162, Mandal (PI), 06/15-05/18, \$439,733

SHF:Small:Bio-inspired ultra-broadband RF scene analysis

The goal of this project is to understand the universal information processing principles used by the auditory system to analyze natural sounds, and then adapting them to analyze man-made radio frequency (RF) signals. In particular, it focuses on developing electronics and algorithms to emulate some of the amazing capabilities of the biological cochlea (inner ear) and auditory pathway.

Role: PI

NSF ECCS-1509721, Feng (PI), 6/15-05/18, \$187,120

Self-Sustaining Tunable Multi-Frequency Oscillators Using Atomically-Thin Semiconducting Multimode Resonators

The goal of this project is to develop and study the properties of tunable multi-frequency oscillators using two-dimensional nanoscale resonators and low-noise integrated feedback electronics. Such mechanical oscillators are essential and ubiquitous in many critical applications in areas ranging from

fundamental scientific exploration to communication and sensing technologies.

Role: co-PI

COMPLETED RESEARCH FUNDING

CWRU ACES grant, Mandal (PI), 05/16-04/17, \$4,000

Utilizing the Case Amateur Radio Station for Experiential Learning and Wireless Systems Research

The goal of this project is to develop educational resources (course lectures, equipment, etc.) for teaching wireless systems at both the undergraduate and graduate levels.

Role: PI

Ohio Third Frontier Technology Validation and Start-up Fund, Feng (PI), 01/16-12/16, \$15,000

Low Cost, Self-Powering Wireless Sensors and Sensor Networks for Enabling Energy- Efficient Smart Buildings

Role: co-PI

Schlumberger grant, Mandal (PI), 01/16-12/16, \$19,500

Design and Testing of Non-Resonant MR Front-Ends

The goal of this project is to design and test novel high-power broadband front-ends for low-frequency magnetic resonance (MR) spectrometers.

Role: PI

CWRU Nord grant, Mandal (PI), 07/15-05/16, \$5,200

Learning how to build a real scientific instrument

The goal of this project is to develop educational hardware and software for students to use in a combined undergraduate/graduate class on “Measurement and Instrumentation” to learn about fundamental concepts in scientific instrumentation by building the hardware, data acquisition, and signal processing necessary for a complete pulsed NMR spectrometer.

Role: PI

REFERENCES

Rahul Sarpeshkar

Thomas E. Kurtz Professor
Professor of Engineering
Professor of Microbiology & Immunology
Professor of Physics
Professor of Molecular & Systems Biology
Chair, Neukom Cluster of Computational Science
Dartmouth College
Vail 507A, Geisel School of Medicine
Email: rahul.sarpeshkar@dartmouth.edu

Swarup Bhunia

Preeminence Professor & Steven Yatauro Faculty Fellow
Department of Electrical & Computer Engineering
University of Florida
216 Larsen Hall, Gainesville FL 32611-6200
Phone: 1-352-392-5989
Email: swarup@ece.ufl.edu

Yi-Qiao Song

Scientific Advisor
NMR/Fluid Analysis program manager
Schlumberger-Doll Research
1 Hampshire Street, Cambridge, MA 02139
Phone: 1-617-768-2333
Email: yqsong@mailaps.org, ysong@slb.com