

Inhee Lee

Assistant Research Scientist
University of Michigan
2431 EECS, 1301 Beal Ave, Ann Arbor, Michigan 48109
734-353-2416, inhee@umich.edu

RESEARCH INTERESTS

- Internet-of-tiny-things (IoT²) system development (millimeter or sub-millimeter scale)
- Miniature sensor system development for biomedical, ecological, and industrial applications
- Low-power, energy-efficient analog/mixed-signal/digital circuit design
- Adaptive circuit design to tolerate environment and process variation
- Energy harvesting circuit, power/battery management circuit, sensor/sensor interface, voltage/current/timing reference

RESEARCH ACHIEVEMENT SUMMARY

- Key contributor to the development of the millimeter-scale Michigan Micro Mote (M³) IoT² system since 2010 (the world smallest computer until 2017)
- First successful use case of the M³ system: ecological study of snails in Tahiti
- Development of the current world's smallest computer in 2018 (360×400×150 μm)
- Author/co-author of 1 Book Chapter, 19 journal articles (8 JSSC (3 first-author) & 4 TCAS-I (2 first-author)), and 34 conference papers (8 ISSCC (1 first-author) & 10 *Symposium on VLSI Circuits* (SOVC) (4 first-author))

EDUCATION

- **Doctor of Philosophy** in Electrical Engineering, University of Michigan, Ann Arbor, Michigan
December 2014
Thesis: "Power Management Circuits for Miniature Sensor Systems"
Advisor: Professor David Blaauw
- **Master of Science** in Electrical and Electronic Engineering, Yonsei University, Seoul, South Korea
August 2008
Thesis: "The Design of an Inverter-based Time-Interleaved Band-Pass Delta-Sigma Modulator for a Digital-IF Receiver"
Advisor: Professor Gunhee Han
- **Bachelor of Science** in Electrical and Electronic Engineering, Yonsei University, Seoul, South Korea
August 2006

PROFESSIONAL EXPERIENCE

- November 2015–Present Assistant Research Scientist
Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, Michigan
- November 2014–November 2015 Research Fellow
Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, Michigan
- September 2012–December 2012 Student Program Employee (Intern)
Kilby Labs
Texas Instruments, Dallas, Texas

INVITED TALKS

1. IBM, “The World’s Smallest Computer: Michigan Micro Mote,” Yorktown Heights, NY, Nov. 2018.
2. Samsung, “Miniature Sensing System and Low-power Circuit Design Technique,” Suwon, Korea, May 2018.
3. SungKyunKwan University (SKKU), “Low-Power Energy Harvesting Techniques for Miniature IoT Systems,” Suwon, Korea, May 2016.
4. International Symposium on Quality Electronic Design (isQED), “Low-Power Circuit Techniques for IoT Energy Harvesting,” Santa Clara, CA, Mar. 2016.

HONORS & AWARDS

- Winner, WIMS2 2015 IAB Poster Contest, University of Michigan, October 2015: W. Lim, **I. Lee**, D. Sylvester, and D. Blaauw, “Batteryless Sub-nW Cortex-M0+ Processor with Dynamic Leakage-Suppression Logic”
- Bronze Prize, Human-Tech Thesis Prize, Samsung Electronics, February 2014: Y. Kim, W. Jeong, and **I. Lee**, “A Static Contention-Free Single-phase-Clocked 24T Flip-Flop in 45nm for Low-Power Applications”
- Silver Prize, Human-Tech Thesis Prize, Samsung Electronics, February 2012: Y. Lee, **I. Lee**, Y. Kim, S. Bang, and G. Kim, “A Modular 1mm³ Die-Stacked Sensing Platform”
- Best Student Poster Award, Multiscale Systems Center Annual Review, Multiscale Systems Center, November 2011: Y. Lee, G. Kim, S. Bang, Y. Kim, **I. Lee**, D. Sylvester, and D. Blaauw, “A Modular 1mm³ Die-Stacked Sensing Platform”
- Bronze Prize, Semiconductor Chip Design Contest, Korea intellectual Property Office, November 2007: Y. Chae, **I. Lee**, and G. Han, “Low-Power Audio $\Delta\Sigma$ Analog-to-Digital Converter”
- Best New Student Scholarships, Yonsei University, South Korea, September 2006

- Highest Honors at Graduation, Yonsei University, South Korea, August 2006

TEACHING EXPERIENCE

- Winter 2018 EECS 627: VLSI Design II Ann Arbor, MI
- Guest lecturer
- Fall 2016 EECS 427: VLSI Design I Ann Arbor, MI
- Guest lecturer
- Winter 2015 EECS 312: Digital Integrated Circuits Ann Arbor, MI
- Assisted in developing homework and exams
- Guest lecturer
- Spring 2007 Electrical Engineering Experiments: Applications Seoul, Korea
Fall 2007 - Teaching Assistant
Spring 2008
- Winter 2007 Introduction to Electric Circuits Seoul, Korea
- Teaching Assistant
- Winter 2006 Electronic Circuits Seoul, Korea
- Teaching Assistant

PUBLICATIONS

- 1 book chapter
- 19 journal articles: 8 JSSC (3 first-author) and 4 TCAS-I (2 first-author) articles
- 34 conference papers: 8 ISSCC (1 first-author) & 10 Symposium VLSI Circuits (SOVC) (4 first-author) papers

A. BOOK CHAPTERS

- B1. **I. Lee** and Y. Lee, “Circuit Design in mm-Scale Sensor Platform for Future IoT Applications,” Chapter in Smart Sensors and Systems, C.-M. Kyung, H. Yasuura, Y. Liu, and Y.-L. Lin, editors, Springer Publishing Company, 2017.

B. JOURNAL ARTICLES

- Jp1. C. S. Bick, **I. Lee**, D. Blaauw, T. Coote, and D. Ó. Foighil, “Surviving a Mass Extinction: mm-Sized Smart Sensors Reveal a Tree Snail’s Solar Refuge,” *under preparation*.
- J1. M. Gamella*, **I. Lee***, N. Guz, D. Blaauw, and E. Katz, “Bioelectronic Interface between Biomolecular Logic Systems and microelectronics,” *International Journal of Unconventional Computing*, (* equally contributed), *accepted*.

- J2. M. Choi, Y. Sui, **I. H. Lee**, Ryan Meredith, Y. Ma, G. Kim, D. Blaauw, Y. B. Gianchandani, and T. Li, "Autonomous Microsystems for Downhole Applications: Design Challenges, Current State, and initial Test Results," *Sensors*, vol. 17, Sep. 2017.
- J3. **I. Lee**, S. Bang, Y. Kim, G. Kim, D. Sylvester, D. Blaauw, and Y. Lee, "A Wire-overhead-free Reset Propagation Scheme for Millimeter-scale Sensor Systems," *J. Semiconductor Technology and Science*, vol. 17, no. 4, pp 524-533, Aug. 2017.
- J4. **I. Lee**, D. Sylvester, and D. Blaauw, "A Subthreshold Voltage Reference With Scalable Output Voltage for Low-Power IoT Systems," *IEEE J. Solid-State Circuits*, vol. 52, no. 5, pp. 1443-1449, May. 2017.
- J5. X. Wu, Y. Shi, S. Jeloka, K. Yang, **I. Lee**, Y. Lee, D. Sylvester, and D. Blaauw, "A 20-pW Discontinuous Switched-Capacitor Energy Harvester for Smart Sensor Applications," *IEEE J. Solid-State Circuits*, vol. 52, no. 4, pp. 972-984, Apr. 2017 (**Invited**).
- J6. **I. Lee**, Y-S Kuo, P. Pannuto, G. Kim, Z. Foo, B. Kempke, S. Jeong, Y. Kim, P. Dutta, D. Blaauw, and Y. Lee, "MBus: A Fully Synthesizable Low-power Portable Interconnect Bus for Millimeter-scale Sensor Systems," *J. Semiconductor Technology and Science*, vol. 16, no. 6, pp 745-753, Dec. 2016.
- J7. **I. Lee**, Y. Lee, D. Sylvester, and D. Blaauw, "Battery Voltage Supervisors for Miniature IoT Systems," *IEEE J. Solid-State Circuits*, vol. 51, no. 11, pp. 2743-2756, Nov. 2016.
- J8. S. Teran, E. Moon, W. Lim, G. Kim, **I. Lee**, D. Blaauw, and J. D. Phillips, "Energy Harvesting for GaAs Photovoltaics Under Low-Flux Indoor Lighting Conditions," *IEEE Tran. Electron Devices*, vol. 63, no 7, pp. 2820-2825, Jul. 2016.
- J9. **I. Lee**, D. Sylvester, and D. Blaauw, "A Constant Energy-Per-Cycle Ring Oscillator Over a Wide Frequency Range for Wireless Sensor Nodes," *IEEE J. Solid-State Circuits*, vol. 51, no. 3, pp. 697-711, Mar. 2016.
- J10. S. Jeong, **I. Lee**, D. Blaauw, and D. Sylvester, "A 5.8 nW CMOS Wake-Up Timer for Ultra-Low-Power Wireless Applications," *IEEE J. Solid-State Circuits*, vol. 50, no. 8, pp. 1754-1763, Aug. 2015 (**Invited**).
- J11. **I. Lee**, G. Kim, S. Bang, A. Wolfe, R. Bell, S. Jeong, Y. Kim, J. Kagan, M. Arias-Thode, B. Chadwick, D. Sylvester, D. Blaauw, and Y. Lee, "System-on-Mud: Ultra-Low Power Oceanic Sensing Platform Powered by Small-Scale Benthic Microbial Fuel Cells," *IEEE Tran. Circuits Syst. I*, vol. 62, no. 4, pp 1126-1135, Apr. 2015.
- J12. **I. Lee**, G. Han, and Y. Chae, "A 2mW, 50 dB DR, 10 MHz BW $5 \times$ Interleaved Bandpass Delta-Sigma Modulator at 50MHz IF," *IEEE Tran. Circuits Syst. I*, vol. 62, no. 1, pp. 80-89, Jan. 2015.
- J13. Y. Chen, D. Jeon, Y. Lee, Y. Kim, Z. Foo, **I. Lee**, N. B. Langhals, G. Kruger, H. Oral, O. Berenfeld, Z. Zhang, D. Blaauw, and D. Sylvester, "An Injectable 64 nW ECG Mixed-Signal SoC in 65 nm for Arrhythmia Monitoring," *IEEE J. Solid-State Circuits*, vol. 50, no. 1, pp. 375-390, Jan. 2015 (**Invited**).
- J14. Jeon, M. B. Henry, Y. Kim, **I. Lee**, Z. Zhang, D. Blaauw, D. Sylvester, "An Energy Efficient Full-Frame Feature Extraction Accelerator With Shift-Latch FIFO in 28 nm CMOS," *IEEE J. Solid-State Circuits*, vol. 49, no. 5, pp. 1271-1284, May 2014.
- J15. M. H. Ghead, G. Chen, R. Haque, M. Wieckowski, Y. Kim, G. Kim, Y. Lee, **I. Lee**, D. Fick, D. Kim, M. Seok, K. D. Wise, D. Blaauw, and D. Sylvester, "Circuits for a Cubic-Millimeter Energy-Autonomous Wireless Intraocular Pressure Monitor," *IEEE Tran. Circuits Syst. I*, vol. 60, no. 12, pp. 3152-3162, Dec. 2013.
- J16. Z. Foo, D. M Devescery, M. Hassan, **I. Lee**, A. Madhavan, Y. S. Park, A. S. Rao, Z. Renner, N. E. Roberts, A. D. Schulman, V. S. Vinay, M. Wieckowski, D. Yoon, C. Schmidt, T. Schmid, P. Dutta,

- P. M. Chen, and D. Blaauw, "A Low-Cost Audio Computer for Information Dissemination Among Illiterate People Groups," *IEEE Tran. Circuits Syst. I*, vol. 60, no. 8, pp. 2039-2050, Aug. 2013 **(Invited)**.
- J17. Y. Lee, S. Bang, **I. Lee**, Y. Kim, G. Kim, Mohammad G., Pat G, P. Dutta, D. Sylvester, and D. Blaauw, "A Modular 1 mm³ Die-Stacked Sensing Platform With Low Power I²C Inter-Die Communication and Multi-Modal Energy Harvesting," *IEEE J. Solid-State Circuits*, vol. 48, no. 1, pp. 229-243, Jan. 2013 **(Invited)**.
- J18. J. Cheon, Y. Chae, D. Kim, S. Lim, **I. Lee**, H.-K Lee, D J. Kim, and G. Han, "Smart CMOS Image Sensor With High SBR and Subpixel Resolution for Light-Section-Based Range Finding," *IEEE Trans. Electron Devices (T-ED)*, vol. 56, no. 11, pp. 2546-2555, Nov. 2009.
- J19. J. Cheon, J. Lee, **I. Lee**, Y. Chae, Y. Yoo, and G. Han, "A Single-Chip CMOS Smoke and Temperature Sensor for an Intelligent Fire Detector," *IEEE Sensors journal*, vol. 9, no. 8, pp.914-921, Aug. 2009.

C. CONFERENCE PAPERS

- Cp1. **I. Lee**, and D. Blaauw, "31pW voltage reference with 3.6% 3 σ -Inaccuracy for 0–170°C," *under preparation*.
- Cp2. **I. Lee**, E. Moon, Y. Kim, J. Phillips, and D. Blaauw, "A 38-to-339nW 3-to-300klx Light-Dose-to-Digital Converter Integrated in a 10mm³ Fully-Autonomous IoT² system," *under preparation*.
- C1. Y. Peng, D. Choo, S. Oh, **I. Lee**, T. Jang, Y. Kim, J. Lim, D. Sylvester, and D. Blaauw, "An Adiabatic Sense and Set Rectifier for Improved Maximum Power Point Tracking in Piezoelectric Harvesting with 541% Energy Extraction Gain," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2019, accepted.
- C2. **I. Lee**, G. Kim, E. Moon, S. Jeong, D. Kim, J. Phillips, and D. Blaauw," A 179lux Energy-Autonomous Fully-Encapsulated 17mm³ Sensor Node with Initial Charge Delay Circuit for Battery Protection," *IEEE Symposium on VLSI Circuits (SOVC)*, Jun. 2018.
- C3. X. Wu, **I. Lee**, Q. Dong, K. Yang, D. Kim, J. Wang, Y. Chen, Y. Zhang, M. Saligane, T. Ema, R. Nanjo, A. Harada, M. Yasuda, K. Kumeno, S. Miyoshi, M. Kawaminami, D. Sylvester, and D. Blaauw, "A 0.04mm³ 16nW Wireless and Batteryless Sensor System with Integrated Cortex-M0+ Processor and Optical Communication for Intra-cellular Temperature Measurement," *IEEE Symposium on VLSI Circuits (SOVC)*, Jun. 2018.
- C4. **I. Lee**, D. Sylvester, and D. Blaauw, "Subthreshold Voltage Reference With Nwell/Psub Diode Leakage Compensation for Low-Power High-Temperature Systems," *IEEE Asian Solid-State Circuits Conference (ASSCC)*, Nov. 2017.
- C5. Q. Dong, **I. Lee**, K. Yang, D. Blaauw, and D. Sylvester, "A 1.02nW PMOS-only, Trim-Free Current Reference with 282ppm/°C from -40°C to 120°C and 1.6% within-Wafer Inaccuracy," *IEEE European Solid-State Circuits Conference (ESSCIRC)*, Sep. 2017.
- C6. M. Cho, S. Oh, S. Jeong, Y. Zhang, **I. Lee**, Y. Kim, L.-X. Chuo, D. Kim, Q. Dong, Y.-P. Chen, M. Lim, M. Daneman, D. Blaauw, D. Sylvester, and H.-S. Kim, "A 6×5×4mm³ general purpose audio sensor node with a 4.7 μ W audio processing IC," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2017.

- C7. Q. Dong, Y. Kim, **I. Lee**, M. Choi, Z. Li, J. Wang, K. Yang, Y-P. Chen, J. Dong, M. Cho, G. Kim, W-K. Chang, Y-S. Chen, Y-D. Chih, D. Blaauw, and D. Sylvester, "A 1Mb Embedded NOR Flash Memory with 39 μ W Program Power for mm-Scale High-Temperature Sensor Nodes," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2017.
- C8. X. Wu, Y. Shi, S. Jeloka, K. Yang, **I. Lee**, D. Sylvester, and D. Blaauw, "A 66pW discontinuous switch-capacitor energy harvester for self-sustaining sensor applications," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2016.
- C9. W. Lim, T. Jang, **I. Lee**, H.-S. Kim, D. Sylvester, and D. Blaauw, "A 380pW dual mode optical wake-up receiver with ambient noise cancellation," *IEEE Symposium on VLSI Circuits (SOVC)*, June 2016.
- C10. T. Jang, M. Choi, Y. Shi, **I. Lee**, D. Sylvester, and D. Blaauw, "Millimeter-scale computing platform for next generation of Internet of Things," *IEEE Int. Conf. RFID*, May. 2016.
- C11. **I. Lee**, W. Lim, A. Teran, J. Phillips, D. Sylvester, and D. Blaauw, "A >78%-Efficient Light harvester over 100-to-100klux with Reconfigurable PV-Cell Network and MPPT Circuit," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2016, pp. 370-371.
- C12. **I. Lee**, W. Jung, H. Ha, S. Jeong, Y. Kim, G. Kim, Z. Foo, J.-Y. Sim, D. Sylvester, and D. Blaauw, "An Ultra-Low-Power Biomedical Chip for Injectable Pressure Monitor," *IEEE Biomedical Circuits and Systems Conference (BIOCAS) (Invited)*, Oct. 2015.
- C13. S. Bang, J.-S. Seo, **I. Lee**, S. Jeong, N. Pinckney, D. Blaauw, D. Sylvester, and L. Chang, "A Fully-Integrated 40-Phase Flying-Capacitance-Dithered Switched-Capacitor Voltage Regulator with 6mV Output Ripple," *IEEE Symposium on VLSI Circuits (SOVC)*, June 2015.
- C14. W. Lim, **I. Lee**, D. Sylvester, and D. Blaauw, "Batteryless Sub-nW Cortex-M0+ Processor with Dynamic Leakage-Suppression Logic," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2015.
- C15. M. Choi, **I. Lee**, T.-K. Jang, D. Blaauw, and D. Sylvester, "A 23pW 780ppm/ $^{\circ}$ C Resistor-Less Current Reference Using Subthreshold MOSFETs," *IEEE European Solid-State Circuits Conference (ESSCIRC)*, Sep. 2014.
- C16. Y.-S. Kuo, P. Pannuto, G. Kim, Z. Foo, **I. Lee**, B. Kempke, P. Dutta, D. Blaauw, and Y. Lee, "MBus: A 17.5 pJ/bit/chip Portable Interconnect Bus for Millimeter-Scale Sensor Systems with 8 nW Standby Power," *IEEE Custom Integrated Circuits Conference (CICC)*, Sep. 2014.
- C17. S. Jeong, **I. Lee**, D. Blaauw, and D. Sylvester, "A 5.8nW, 45ppm/ $^{\circ}$ C On-Chip CMOS Wake-up Timer Using a Constant Charge Subtraction Scheme" *IEEE Custom Integrated Circuits Conference (CICC)*, Sep. 2014.
- C18. **I. Lee**, Y. Kim, S. Bang, G. Kim, H. Ha, Y.-P. Chen, D. Jeon, S. Jeong, W. Jung, M. Ghaed, Z. Foo, Y. Lee, J.-Y. Sim, D. Sylvester, and D. Blaauw, "Circuit Techniques for Miniaturized Biomedical Sensors," *IEEE Custom Integrated Circuits Conference (CICC)*, Sep. 2014 (**Invited**).
- C19. **I. Lee**, Y. Lee, D. Sylvester, and D. Blaauw, "Low Power Battery Supervisory Circuit with Adaptive Battery Health Monitor," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2014, pp. C17-C18 (**Selected as Symposium Technical Highlight**).
- C20. D. Blaauw, D. Sylvester, P. Dutta, Y. Lee, **I. Lee**, S. Bang, Y. Kim, G. Kim, P. Pannuto, Y.-S Kuo, D. Yoon, W. Jung, Z. Foo, Y.-P. Chen, S. Oh, S. Jeong, M. Choi, "IoT Design Space Challenges: Circuits and Systems," *IEEE Symposium on VLSI Technology (SOVT)*, June, 2014 (**Invited**).

- C21. G. Kim, Y. Lee, Z. Foo, P. Pannuto, Y.-S. Kuo, B. Kempke, M. Ghaed, S. Bang, **I. Lee**, Y. Kim, S. Jeong, P. Dutta, D. Sylvester, and D. Blaauw, "A Millimeter-Scale Wireless Imaging System with Continuous Motion Detection and Energy Harvesting," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2014, pp. C141-C142.
- C22. G. Kim, A. Wolfe, R. Bell, S. Bang, Y. Lee, **I. Lee**, Y. Kim, L. Hsu, J. Kagan, M. Arias-Thode, B. Chadwick, D. Sylvester, and D. Blaauw, "Chip-On-Mud: Ultra-Low Power ARM-Based Oceanic Sensing System Powered by Small-Scale Benthic Microbial Fuel Cells," *IEEE International Symposium on Circuits and Systems (ISCAS)*, May 2014.
- C23. Y. Kim, W. Jung, **I. Lee**, Q. Dong, M. Henry, M. D. Sylvester, and D. Blaauw, "27.8 A static contention-free single-phase-clocked 24T flip-flop in 45nm for low-power applications," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2014, pp. 466-467.
- C24. **I. Lee**, S. Bang, D. Yoon, M. Choi, S. Jeong, D. Sylvester, and D. Blaauw, "A Ripple Voltage Sensing MPPT Circuit for Ultra-Low Power Microsystems," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2013, pp. C228-C229.
- C25. S. Bang, Y. Lee, **I. Lee**, Y. Kim, G. Kim, D. Blaauw, and D. Sylvester, "A fully integrated switched-capacitor based PMU with adaptive energy harvesting technique for ultra-low power sensing applications," *IEEE International Symposium on Circuits and Systems (ISCAS)*, May 2013, pp.709-712.
- C26. D. Jeon, Y. Kim, **I. Lee**, Z. Zhang, D. Blaauw, and D. Sylvester, "A 470mV 2.7mW Feature Extraction-Accelerator for Micro-Autonomous Vehicle Navigation in 28nm CMOS," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2013, pp.166-167.
- C27. Z. Foo, D. Devescary, M. Ghaed, **I. Lee**, A. Madhavan, Y. Park, A. Rao, Z. Renner, N. Roberts, A. Schulman, V. Vinay, M. Wieckowski, D. Yoon, C. Schmidt, T. Schmid, P. Dutta, P. Chen, and D. Blaauw, "A Low-Cost Audio Computer for Information Dissemination among Illiterate People Groups," *IEEE Custom Integrated Circuits Conference (CICC)*, Sep. 2012.
- C28. G. Kim, Y. Lee, S. Bang, **I. Lee**, Y. Kim, D. Sylvester, and D. Blaauw, "A 695pW Standby Power Optical Wake-up Receiver for Wireless Sensor Nodes," *IEEE Custom Integrated Circuits Conference (CICC)*, Sep. 2012.
- C29. **I. Lee**, S. Bang, Y. Lee, Y. Kim, G. Kim, D. Sylvester, and D. Blaauw, "A 635pW Battery Voltage Supervisory Circuit for Miniature Sensor Nodes," *IEEE Symposium on VLSI Circuits (SOVC)*, June, 2012, pp. 202-203.
- C30. Y. Lee, G. Kim, S. Bang, Y. Kim, **I. Lee**, P. Dutta, D. Sylvester, and D. Blaauw, "A Modular 1mm³ Die-stacked Sensing Platform with optical Communication and Multi-Modal Energy Harvesting," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2012, pp.772-775.
- C31. Z. Foo, D. Devescary, T. Schmid, N. Clark, R. Frank, M. Ghaed, Y. Kuo, **I. Lee**, Y. Park, Z. Renner, N. Slottow, V. Vinay, M. Wieckowski, D. Yoon, C. Schmidt, D. Blaauw, P. Chen, and P. Dutta, "A Case for Custom Silicon in Enabling Low-Cost Information Technology for Developing Regions," *ACM Symposium on Computing for Development*, Dec. 2010.
- C32. J. Cheon, **I. Lee**, J. Lee, Y. Chae, Y. Yoo, and G. Han, "An Analog Front-End of a Fire Detection SOC for a Fire Alarm System," *IEEE Sensors Conf.*, Oct, 2008, pp. 772-775.
- C33. Y. Chae, **I. Lee**, and G. Han, "A 0.7V 36 μ W 85dB-DR Audio $\Delta\Sigma$ Modulator Using Class-C Inverter," *IEEE International Solid-State Circuits Conference (ISSCC)*, Feb. 2008, pp. 490-491.

- C34. **I. Lee**, Y. Chae, and G. Han, "A Low Power Dual-Mode Sigma-Delta Modulator for GSM/WCDMA Receivers," *IEEE International Conference on Electronics, Circuits and Systems (ICECS)*, Dec. 2007, pp. 1151-1154.

PATENTS

1. D. Blaauw, D. Sylvester, M. Choi, **I. Lee**, and T. Jang, "Ultra low power temperature insensitive current source with line and load regulation," U.S., grant (US 9,639,107 B2, May. 2, 2017)
2. **I. Lee**, Y. Lee, D. Sylvester, and D. Blaauw, "Electronic device with supervisor circuit for detecting resistance parameter of an energy storage device," U.S., grant (US 9,429,627 B2, Aug. 30, 2016).
3. G. Han, Y. Chae, **I. Lee**, D. Lee, S. Lim, J. Cheon, "Switched capacitor circuit," Korea, Registered (101087246, Nov. 21. 2011).
4. G. Han, **I. Lee**, Y. Chae "Inverter and inverter based system," Korea, Registered (101069377, Sep. 26. 2011).
5. **I. Lee**, Y. Chae, G. Han, Korea, "Hysteretic analog to digital converter," Korea, Registered (10093385, Dec. 15. 2009).
6. Y. Chae, **I. Lee**, G. Han, "Cardiac pacemaker and method of co-using amplifier using the same," Korea, Registered (100933281, Dec. 14. 2009).
7. Y. Chae, **I. Lee**, M. Kwon, G. Han, "Time-interleaved sigma-delta modulator using single amplifier architecture," Korea, Registered (100933280, Dec. 14. 2009).
8. Y. Chae, **I. Lee**, J. Choen, G. Han, S.Ham, "Decimation filter, analog to digital converter including the same, and image sensors including the converters," U.S., grant (US 8,233,068 B2, Jul. 31, 2012).
9. Y. Chae, **I. Lee**, G.Han, S. Ham, "Sigma-delta analog to digital converters and solid state image pickup device," U.S., grant (US 7,773,018 B2, Aug. 10, 2010).
10. Y. Chae, **I. Lee**, J. Choen, G. Han, S. Ham, "Apparatus and method for sigma-delta analog to digital conversion," U.S., grant (US 7,916,061 B2, Mar. 29. 2011).

PROFESSIONAL ACTIVITY

Reviewer of IEEE Journals

- IEEE Journal of Solid-State Circuits (JSSC)
- IEEE Trans. Circuits and Systems-I (TCAS-I)
- IEEE Trans. Circuits and Systems-II (TCAS-II)
- IEEE Trans. Biomedical Circuits and Systems (TBioCAS)
- IEEE Trans. Very Large Scale Integrated Systems (TVLSI)

PRESS COVERAGE

1. The Michigan Engineer New Center
An even smaller world's smallest 'computer'
Link: <https://news.engin.umich.edu/2018/06/an-even-smaller-worlds-smallest-computer/>
2. Computer History Museum

The World's Smallest Computer

Link: <http://www.computerhistory.org/atchm/the-worlds-smallest-computer/>

3. IEEE spectrum magazine

Millimeter-Scale Computers: Now With Deep-Learning Neural Networks on Board

Link: http://spectrum.ieee.org/tech-talk/robotics/artificial-intelligence/millimeterscale-computers-now-with-deep-learning-neural-networks-on-board?bt_ee=Zm+mEAgiWFx+fznxXQS9TH0ynKlwtCEg5M2jCIV82Uk=&bt_ts=1487272087525

4. IEEE spectrum magazine

Mud-Fueled Smart Sensors for the Bottom of the Ocean

Link: <http://spectrum.ieee.org/energywise/computing/networks/mudfueled-smart-sensors-for-the-bottom-of-the-ocean>

5. U of M EECS Homepage

Seed-sized U-M computers pumped into oil wells featured at the Houston Museum of Natural Science

Link: <http://eecs.umich.edu/eecs/about/articles/2017/m3-in-oil-wells-houston-museum.html>