XILIN LIU

Staff Engineer, Qualcomm Inc.

Address: 9085 Judicial Dr. APT 2208, San Diego, CA, 92122, USA
Website: https://xilinliu.github.io/ | Tel: +1 (215) 407-1668 | E-mail: xilinliu@alumni.upenn.edu
Google Scholar: https://scholar.google.com/citations?user=xkQM_9UAAAAJ&hl=en

Research Interests

- Analog/Mixed-Signal Integrated Circuits (IC) and System
- Brain-Machine Interface (BMI) and Bioelectronics
- Machine Learning On-the-Edge

Education

09/2011 – 01/2017 **University of Pennsylvania (Penn)** **PA, USA**
Ph. D. in Electrical and Systems Engineering
M. S. in Electrical Engineering (09/2011 – 05/2013)
- Advisor: Prof. Jan Van der Spiegel
- Topic: Brain-Machine Interface IC and System

01/2014 – 06/2014 **Princeton University** **NJ, USA**
Exchange Student in Electrical Engineering
- Advisor: Prof. Naveen Verma
- Topic: Electronic Circuits for Biomedical Application

09/2007 – 07/2011 **Harbin Institute of Technology (HIT)** **Harbin, China**
Bachelor of Engineering in Electrical Engineering

Professional Experience

05/2016 – Present **Qualcomm Inc.** **CA, USA**
Staff Engineer, Analog/Mixed-Signal IC Design
Senior Engineer (02/2017 – 10/2019), Intern (05/2016 – 09/2016)
- High-performance Analog/Mixed-Signal IC design
- Experience in the latest FinFET technologies (5nm, 10nm, 14nm, etc.)
- Contributions to multiple top-tier products including the Industry's **first** 5G chipset, the Industry's **first** 14nm mmWave/sub-6 transceivers, etc.
- Completed designs for high-volume products integrated in over 395 smartphone models, shipping an estimated total of 910 million devices globally

Awards & Honors

- **Qualstar,** Outstanding Contribution Award, Qualcomm Inc., Jan. 2020
- **Finalist of International Brain-Computer Interface (BCI) Award**, *International BCI Award Foundation & Stanford University*, 2018
- **Best Student Paper Award (as the 1st author)**, received at the 50th *IEEE International Symposium on Circuits and Systems (ISCAS)*, 2017
- **Pre-doctoral Achievement Award** of IEEE Solid-State Circuit Society (SSCS), received at the 63rd *International Solid-State Circuit Conference (ISSCC)*, 2016
- **1st Place Best Paper Award (as the 1st author)**, received at the 11th *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, 2015
- **ISSCC Student Research Preview Award (as the 1st author)**, received at the 61st *International Solid-State Circuit Conference (ISSCC)*, 2014

- **Best Paper Award (as the 1st author)**, BioCAS Track of the 47th *IEEE International Symposium on Circuits and Systems (ISCAS)*, 2014
- **No. 1 Most Popular Paper** among all articles published on the *IEEE Transactions on Circuits and Systems II: Express Briefs (TCAS-II),* listed by the IEEE Xplore website, Nov. 2017
- **Student Travel Grant Award**, IEEE Solid-State Circuits Society, 2013
- **Travel Grant for Student**, IEEE Circuits and Systems Society, 2012
- **Ph.D. Fellowship Award**, Department of ESE, University of Pennsylvania
- **Excellent Graduation Project (Thesis)**, Top 1%, Harbin Institute of Technology
- **First-rank People's Scholarship in China**, Top 1%

Publications

Book:

- [B1] **X. Liu** and J. Van der Spiegel, "Brain-Machine Interface: Closed-loop Bidirectional System Design", *Springer International Publishing AG*, ISBN: 978-3319679396, 2018.

Journals:

- [J1] **X. Liu**, H. Zhu, T. Qiu, S. Y. Sritharan, D. Ge, S. Yang, M. Zhang, A. G. Richardson, T. H. Lucas, N. Engheta, and J. Van der Spiegel, "A Fully Integrated Sensor-Brain-Machine Interface System for Restoring Somatosensation", *IEEE Sensors Journal*, vol. 21, no. 4, Feb. 2021. **IF: 3.073**
- [J2] M. Zhang, Z. Tang, **X. Liu**, J. Van der Spiegel, "Electronic Neural Interfaces", *Nature Electronics*, vol. 3, pp. 191-200, April 2020. **IF: 27.50**
- [J3] A. G. Richardson, Y. Ghenbot, **X. Liu**, H. Hao, C. Rinehart, S. DeLuccia, S. Torres Maldonado, G. Boyek, M. Zhang, F. Aflatouni, J. Van der Spiegel, and Timothy H. Lucas, "Learning active sensing strategies using a sensory brain–machine interface", *Proceedings of the National Academy of Sciences (PNAS)*, vol. 116, no. 35, Aug. 2019. **IF: 9.58**
- [J4] **X. Liu**, M. Zhang, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "Design of a Closed-loop, Bi-directional Brain Machine Interface System with Energy Efficient Neural Feature Extraction and PID control", *IEEE Transactions on Biomedical Circuits and Systems (TBCAS)*, vol. 11, no. 4, Aug. 2017. **IF: 4.252**
- [J5] A. G. Richardson, **X. Liu**, P. K. Weigand, E. D. Hudgins, J. M. Stein, S. R. Das, A. Proekt, M. B. Kelz, M. Zhang, J. Van der Spiegel, T. H. Lucas. "Hippocampal gamma-slow oscillation coupling in macaques during sedation and sleep." *Hippocampus*, Jan. 2017. **IF: 3.267**
- [J6] T. H. Lucas, **X. Liu**, M. Zhang, S. Sritharan, I. Planell-Mendez, Y. Ghenbot, S. Torres-Maldonado, C. Brandon, J. Van der Spiegel, A. G. Richardson, "Strategies for Autonomous Sensor–Brain Interfaces for Closed-Loop Sensory Reanimation of Paralyzed Limbs", *Neurosurgery,* vol. 64, Sept. 2017. **IF: 4.605**
- [J7] **X. Liu**, M. Zhang, T. Xiong, A. G. Richardson, T. H. Lucas, P. S. Chin, R. Etienne-Cummings, T. D. Tran, and J. Van der Spiegel, "A Fully Integrated Wireless Compressed Sensing Neural Signal Acquisition System for Chronic Recording and Brain Machine Interface", *IEEE Transactions on Biomedical Circuits and Systems (TBCAS)*, vol.10, No.4, August 2016. **IF: 4.252**
- [J8] **X. Liu**, J. Sacks, M. Zhang, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "The Virtual Trackpad: an Electromyography-based, Wireless, Real-time, Low-Power, Embedded Hand Gesture Recognition System using an Event-driven Artificial Neural Network," *IEEE Transactions on Circuits and Systems II: Express Briefs (TCAS-II),* Dec. 2016. **IF: 3.25**
- [J9] A. G. Richardson, M. A. Attiaha, J. I. Bermanb, H. I. Chena, **X. Liu**, M. Zhang, J. Van der Spiegel, T.H. Lucas, "The effects of acute cortical somatosensory deafferentation on grip force control", *Cortex*, vol. 74, pp. 1-8, Jan. 2016. **IF: 4.275**
- [J10] **X. Liu**, M. Zhang, B. Subei, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "The PennBMBI: Design of a General Purpose Wireless Brain-Machine-Brain Interface System", *IEEE Transaction on Biomedical Circuits and System (TBioCAS),* vol. 9, no. 2, pp. 248-258, 2015. **IF: 4.252**

- [J11] **X. Liu**, M. Zhang, J. Van der Spiegel, "A Low-Power Multifunctional CMOS Sensor Node for an Electronic Facade," *IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I)*, vol.61, no.9, pp. 2550-2559, Sept. 2014. **IF: 3.934**
- [J12] X. Wu, **X. Liu**, M. Zhang, J. Van der Spiegel, "Current Mode Image Sensor With Improved Linearity and Fixed Pattern Noise," *IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I)*, vol.61, no.6, pp.1666-1674, June 2014. **IF: 3.934**

Conferences:

- [C1] Y. Ghenbot, **X. Liu**, H. Hao, C. Rinehart, S. Deluccia, S. T. Maldonado, G. Boyek, M. Zhang, F. Aflatouni, J. Van der Spiegel, T. H. Lucas, A. G. Richardson, "Goal-Directed BCI Feedback Using Cortical Microstimulation", *Brain-Computer Interface Research*, 2020.
- [C2] **X. Liu**, M. Zhang, H. Hao, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "Wireless Sensor Brain Machine Interfaces for Closed-loop Neuroscience Studies," *IEEE International Conference on ASIC (ASICON)*, Oct 2019.
- [C3] **X. Liu**, H. Zhu, M. Zhang, X. Wu, A. G. Richardson, S. Y. Sritharan, D. Ge, Y. Shu, T. H. Lucas, and J. Van der Spiegel, "A Fully Integrated Wireless Sensor-Brain Interface System to Restore Finger Sensation", *Circuits and Systems, IEEE International Symposium on (ISCAS)*, May 2017. *Best Student Paper Award*
- [C4] **X. Liu**, M. Zhang, X. Wu, A. G. Richardson, S. T. Maldonado, S. Deluccia, Y. Ghenbot, T. H. Lucas, and J. Van der Spiegel, "A Wireless Neuroprosthetic for Augmenting Perception Through Modulated Electrical Stimulation of Somatosensory Cortex", *Circuits and Systems, IEEE International Symposium on (ISCAS)*, May 2017.
- [C5] J. Van der Spiegel, M. Zhang, and **X. Liu**, "The next-generation brain machine interface system for neuroscience research and neuroprosthetics development", *IEEE International Conference on ASIC (ASICON)*, 2017. *Invited keynote*
- [C6] S. Sritharan, A. Richardson, P. Weigand, I. Planell-Mendez, **X. Liu**, H. Zhu, M. Zhang, J. Van der Spiegel, T. Lucas, "Somatosensory Encoding with Cuneate Nucleus Microstimulation: Detection of Artificial Stimuli", *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2016.
- [C7] J. Van der Spiegel, M. Zhang, **X. Liu**, "System-on-a-chip Brain-Machine-Interface design-a review and perspective", *IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT)*, Oct. 2016. *Invited talk*
- [C8] **X. Liu**, M. Zhang, H. Zhu, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "Design of a Low-Noise, High Power Efficiency Neural Recording Front-end with an Integrated Real-Time Compressed Sensing Unit", *Circuits and Systems, IEEE International Symposium on (ISCAS)*, May 2015.
- [C9] **X. Liu**, M. Zhang, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "A 12-Channel Bidirectional Neural Interface Chip with Integrated Channel-level Feature Extraction and PID Controller", *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Oct. 2015. *Best Paper Award (1st Place)*
- [C10] **X. Liu**, B. Subei, M. Zhang, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "The PennBMBI: A general purpose wireless Brain-Machine-Brain Interface system for unrestrained animals," *Circuits and Systems, 2014 IEEE International Symposium on (ISCAS)*, Jun. 2014. *Best Paper Award*
- [C11] **X. Liu**, M. Zhang, H. Sun, A. G. Richardson, T. H. Lucas, and J. Van der Spiegel, "Design of a Net-Zero Charge Neural Stimulator with Feedback Control," *2014 IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Oct. 2014.
- [C12] W. Chen, **X. Liu**, B. Litt, "Logistic-weighted regression improves decoding of finger flexion from electrocorticographic signals", *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Aug. 2014.
- [C13] **X. Liu**, M. Zhang, and J. Van der Spiegel, "A low power multi-mode CMOS image sensor with integrated on-chip motion detection," *Circuits and Systems, IEEE International Symposium on (ISCAS)*, pp. 2416-2419, May 19-23, 2013.
- [C14] J. Gong, W. Liu, **X. Liu**, and T. Cui, "A Simulation-based Performance Comparison between Multi-

model Assembly Lines and Assembly Cells In a Just-in-time Environment", *Chinese Control and Decision Conference (CCDC)*, May 2010.

Patents/Invention Disclosures:

- [P1] **X. Liu**, P. Mahoudidarayan, N. Rashidi, S. M. Taleie, and D. Seo, "Mismatch and Timing Correction Technique for Mixing-mode DACs", Qualcomm Technologies, Inc., Provisional Patent, 2020.
- [P2] **X. Liu**, N. Saputra, B. Sedighi, A. Swaminathan, D. Seo, "Adaptive Biasing Scheme for DAC Performance Enhancement", Qualcomm Technologies, Inc., Provisional Patent, 2020.
- [P3] S. Yang, A. Wei, N. Saputra, **X. Liu**, "Stacked Switch for High-Speed Current Steering Digital-to-Analog Converters", Qualcomm Technologies, Inc., Provisional Patent, 2020.
- [P4] S. M. Taleie, **X. Liu**, A. Swaminathan, S. Kanagaraj, N. Rashidi, et al. "Time-Interleave DAC Image Calibration Scheme", Qualcomm Technologies, Inc., US Patent 10,516,412, 2019.

Under Review:

- [S1] **X. Liu**, and A. G. Richardson, "Edge Deep Learning for Neural Implants", minor revision for *Journal of Neural Engineering (JNE)*, 2021. **IF: 4.81**
  Preprint link: https://arxiv.org/pdf/2012.00307.pdf
- [S2] **X. Liu**, A. G. Richardson, and J. Van der Spiegel, "An Energy-efficient Wireless Neural Recording System with Compressed Sensing and Encryption", minor revision for *IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS)*, 2021. **IF: 3.03**
  Preprint link: https://arxiv.org/pdf/2009.06532.pdf
- [S3] P. Unegbu, **X. Liu**, and F. Vitale, "A portable, fast scan cyclic voltammetry system with impedance spectroscopy functionality for neuromodulation", under review, *IEEE EMBS Conference on Neural Engineering (NER)*, 2021.
- [S4] **X. Liu**, and A. G. Richardson, "A System-on-Chip for Closed-loop Optogenetic Sleep Modulation", under review, *IEEE Engineering in Medicine and Biology Society (EMBC)*, 2021.

Teaching Experience

09/2016 – 01/2017	**Teaching Assistant** ESE568 – Mixed-Signal Design and Modeling, University of Pennsylvania *Instructor: Prof. Tania Khanna* Assisted in preparing course and project materials on this first-time offered course.
01/2016 – 05/2016	**Teaching Assistant** ESE319 - Fundamentals of Solid-State Circuits, University of Pennsylvania *Instructor: Prof. Jan Van der Spiegel* Gave tutorial lectures, taught laboratory sessions and recitations. Co-developed course and laboratory materials, especially course final project.
09/2015 – 01/2016	**Teaching Assistant** ESE572/419 - Analog Integrated Circuits, University of Pennsylvania *Instructor: Prof. Firooz Aflatouni* Held office hours, graded quizzes, homework assignments and course projects.
09/2012 – 01/2013	**Teaching Assistant** ESE572/419 - Analog Integrated Circuits, University of Pennsylvania *Instructor: Prof. Dale Nelson* Taught laboratory sessions, held office hours and graded quizzes.

Mentoring Experience

I worked as a mentor/co-mentor for an intern at Qualcomm and several undergraduate and graduate students in the

Center for Sensor Technologies at the University of Pennsylvania.

Students	Projects	Current Affiliation
Jocab Sacks	Machine-learning based gesture recognition	PhD Candidate at Georgia Tech
Hyunseok Park	Compressive sensing neural recording	PhD Candidate at UCLA
Rohit Dureja	Wireless BMI system integration	Apple Inc.
Basheer Subei	Bidirectional wireless BMI system integration	Uber Inc.
Biaou Carlos	FPGA based programmable time division system	PhD Candidate at UC Berkeley
Tian Qiu	Low-power UWB transceiver design and testing	Intel Inc.
Hanfei Sun	Digital design of a neural stimulator	MediaTek Inc.
Yuanfei Huang	Class-AB dgitial-to-analog converter design	Qualcomm Inc.

Academic Services

- **Guest Editor**:
  Frontiers in Neuroscience **IF: 3.707**
- **Journal Reviewer**:
  IEEE Journal of Solid-State Circuits (JSSC) **IF: 5.173**
  IEEE Internet of Things Journal (IoT) **IF: 9.515**
  IEEE Transactions on Biomedical Circuits and Systems (TBCAS) **IF: 4.252**
  IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I) **IF: 3.934**
  IEEE Transactions on Circuits and Systems II: Express Briefs (TCAS-II) **IF: 3.25**
  IEEE Sensors Journal **IF: 3.076**
- **Conference Technical Program Committee Member:**
  IEEE International System-on-Chip Conference (SOCC), 2017
  IEEE Computer Society Annual Symposium on VLSI (ISVLSI), 2017
- **Conference Reviewer:**
  IEEE International Symposium on Circuits and Systems (ISCAS), 2020
  IEEE Biomedical Circuits and Systems Conference (BioCAS), 2019
  IEEE International Symposium on Circuits and Systems (ISCAS), 2018
  IEEE Biomedical Circuits and Systems Conference (BioCAS), 2017
  IEEE International Midwest Symposium on Circuits and Systems (MWSCAS), 2017
  Ph.D. Research in Microelectronics and Electronics Conference (PRIME), 2017

References

Prof. Jan Van der Spiegel
(Ph.D. Advisor)
Professor of Electrical and Systems Engineering,
University of Pennsylvania, PA
Email: jan@seas.upenn.edu

Prof. Timothy H. Lucas, M.D., Ph.D.
Associate Professor of Neurosurgery,
University of Pennsylvania, PA
Neurosurgeon, Pennsylvania Hospital
Email: Timothy.Lucas@pennmedicine.upenn.edu

Prof. Naveen Verma
Professor of Electrical Engineering,
Princeton University, NJ, U.S.
Email: nverma@princeton.edu

Prof. Andrew G. Richardson
Assistant Professor of Neurosurgery
University of Pennsylvania, PA, U.S.
Email: Andrew.Richardson@pennmedicine.upenn.edu

Prof. Firooz Aflatouni
Associate Professor of Electrical and Systems Engineering
University of Pennsylvania, PA, U.S.
Email: firooz@seas.upenn.edu