CONNIE LIU

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SUMMARY

Ph.D. in Electrical Engineering with 5+ years of hands-on experience in deep submicron CMOS technologies. Proven expertise in designing and verifying high-performance analog, digital, and mixed-signal circuits from system-level concept to tape-out. Seeking a challenging role in circuit design to contribute to the development of cutting-edge processor technologies.

TECHNICAL SKILLS

Circuit Design: Analog & Mixed-Signal IC Design, Digital IC Design, SoC, RTL, FPGA, PCB
CAD Tools: Cadence Virtuoso, Spectre, HSPICE, Xilinx Vivado, Altium Designer
Analysis Tools: Spice Simulation (AC/DC/Transient), Static Timing Analysis, Xilinx Vivado
Programming Languages: Verilog, Python, C, MATLAB

RESEARCH EXPERIENCE

Hardware Engineer & **Researcher Assistant** | *University of Pittsburgh* Jan 2021 - Present
Programmable Pain Relief Device with Feedback Control

- Designed and implemented a mixed-signal SoC for a programmable pain relief device, delivering electrical stimulation to nerve cells with tissue–electrode impedance feedback for personalized, real-time threshold control.
- Replaced traditional square-wave stimulation with exponential-waveform generation via capacitor charge/discharge, enhancing user comfort compared to commercial devices.
- Developed a dual-channel 8-bit current DAC with 15.6 μA resolution, enabling high-precision bidirectional current control and addressing limitations in existing pain relief systems.
- Architected and verified system design from waveform modeling and power budgeting to RTL, FSM, and resource management, optimizing battery life to extend device operation from 30 to over 80 hours (2.7$\times$ improvement).
- Integrated analog and digital modules into a compact 2 mm $\times$ 1 mm CMOS chip (TSMC 180 nm), achieving portable form factor and low-power operation.

Hardware Engineer & **Researcher Assistant** | *University of Pittsburgh* Jan 2021 - Dec 2023
Neuromorphic Silicon Neural Network with Mixed-Feedback Control

- Implemented a neuromorphic chip based on theoretical novel neuron models, realizing a five-neuron spiking network that demonstrated hardware-level neural dynamics, validating the feasibility of low-power, large-scale neuromorphic ICs.
- Modeled and simulated neuron circuits using Cadence Virtuoso, performing extensive transient and multi-time-scale analysis to iteratively tune nonlinear parameters and achieve precise control of spike timing, morphology, and count.
- Overcame limitations of traditional models where spiking behavior was unstable or uncontrollable, enabling reproducible neuron responses suitable for hardware-level computation.
- Designed each neuron at the schematic and transistor level, integrated them into a five-neuron network, and verified selective excitation, inhibition, and inter-neuron interaction for inference and reasoning tasks.
- Applied the neuromorphic network to implement a Central Pattern Generator (CPG) for robotic locomotion control, demonstrating rhythmic motor coordination through biologically inspired spike patterns.
- Designed and validated a custom PCB for hardware-in-the-loop testing, integrating the neuromorphic chip with an FPGA to enable real-time experimentation and closed-loop robotic applications.
- Executed the full IC design flow—from schematic capture and transistor-level simulation through physical layout, tape-out, and post-silicon electrical testing—successfully demonstrating functional spiking behavior in silicon.
- Pioneered hardware-level spiking neural networks, highlighting a scalable path toward energy-efficient neuromorphic computing and real-world robotic intelligence.

EDUCATION

Ph.D. in Electrical and Electronic Engineering | University of Pittsburgh, Pittsburgh, USA Aug 2021 - Dec 2025
M.S. in Electrical Engineering| University of Pittsburgh, Pittsburgh, USA Aug 2019 - Dec 2020
B.S. in Automation | Beijing Institute of Technology, Beijing, China Sep 2015 - Jun 2019

SELECTED PUBLICATIONS

- K. Liu, A. Gormaley, K. Woeppel, T. Emerick, X. T. Cui, R. Kubendran, "Programmable Pulse Generator for Pain Relief Stimulation using Bioresorbable Electrodes", 2023. Link

- K. Liu, S. Hashemkhani, J. Rubin, and R. Kubendran, "BioNN: Bio-Mimetic Neural Networks on Hardware Using Nonlinear Multi-Timescale Mixed-Feedback Control for Neuromodulatory Bursting Rhythms," JETCAS, 2023. Link