

Fred S. Lee

OBJECTIVE

Collaborate in a multi-disciplinary, organic team on energy efficient RF and mixed-signal/analog systems & circuits, wireless sensor networks, and/or mixed-mode ultra-low power signal processing.

EDUCATION

- PhD **Massachusetts Institute of Technology** Cambridge, MA
Electrical Engineering and Computer Science, June 2007.
Dissertation: *Energy Efficient Ultra-Wideband (UWB) Radio Transceiver Architectures and Receiver Circuits*
Advisor: Prof. Anantha P. Chandrakasan
- MEng **Massachusetts Institute of Technology** Cambridge, MA
& SB Electrical Engineering and Computer Science, June 2002.
Thesis Title: *Analysis, Design, and Prototyping of a Narrowband Radio for Application in Wireless Sensor Networks*
Advisor: Prof. Anantha P. Chandrakasan

RESEARCH EXPERIENCE

- MIT Microsystems Technology Laboratory** Cambridge, MA
2004-present Designed a 2.5 nJ/bit 0–16 Mbps 3.1–5.0 GHz UWB RF receiver in 0.65 V, 90 nm CMOS. Mixed-signal BB achieved -99 dBm sensitivity for 10^{-3} BER at 100 kbps.
- 3/06–9/06* Led design/assembly of MIT's 3-chip and antenna UWB solution to a boxed receiver.
- 1/04–6/05* Designed a packaged 100 Mbps 3.1–10.6 GHz UWB RF front-end in 0.18 μm SiGe BiCMOS. Featured an un-matched LNA for bandwidth & improved NF, and an RF notch filter for interference mitigation. Demonstrated a 5 dB system NF at 10 GHz, and a BER of 10^{-3} at -84 dBm sensitivity. Co-developed a prototype UWB transceiver that allows algorithmic and full wireless system testing.
- 9/02–12/03* Designed 2 chips for a baseband UWB transceiver in 0.18 μm CMOS. Part of a 3 person graduate research team. Responsible for 1 GHz LNA, 1 GHz 4-phase PLL, 2 ns pulse transmitter, final integration, PCB design and testing. Demonstrated wireless reception at 193 kbps.
- 9/00–6/02* Designed 10 2.4 GHz radio systems from discrete components. The micro-Adaptive Multi-domain Power-aware Sensor (μAMPS) network using these radios demonstrated a three node beam-forming military "tank tracking" application.
- Texas Instruments, Inc.** Dallas, TX
6/00–8/00 Design engineer intern in mixed-signal analog baseband group for MIT VI-A program. Designed a fully-differential, folded-cascode op-amp.
- 6/99–8/99* Created a behavioral model for a capacitor averager in a sigma-delta ADC.
- MIT Media Lab, Audio Spotlight Project** Cambridge, MA
10/99–3/00 Designed discrete circuits that modulate audio signals onto an ultra-sonic wave so that sound can be beamed in a straight line and be used as an "audio spotlight."
- MIT Laboratory for Electronics and Electromechanical Systems** Cambridge, MA

- 2/00–6/00 Designed a prototype lab kit for an EE laboratory class, Microcomputer Project Laboratory (6.115). Awarded LEES Lab Award by Prof. Steven Leeb.
- 12/99–2/00 Designed the feedback compensator and driver of an electromechanical LVDT that allows precise position tracking over an “infinite” 1-D distance.
- 1/99–2/99 Debugged electromechanical robot arm circuit boards for a core undergraduate EE class Signals and Systems (6.003). Won 2nd place as a sophomore in a build-your-own-motor speed competition (3,600 RPM) with an unprecedented design approach among senior students completing bachelors degree projects.

Sensible Technologies, Inc.

Cambridge, MA

- 6/98–8/98 Constructed applications in C to test the bandwidth of precision-made five degrees-of-freedom 3-D haptic force-feedback human/computer interface units.

Flow Pro Corporation

Taipei, Taiwan/ Marietta, GA/ Köln, Germany

- 6/97–8/97 Worked in product design, patents, sales, marketing, and customer relations.

TEACHING EXPERIENCE

MIT, Department of Electrical Engineering and Computer Science

- Fall 2001 TA in Feedback Systems (6.302) for Prof. Jim Roberge. Rated 6.2/7.0 by students.

AWARDS AND HONORS

- February 2008 Jack Kilby Outstanding Student Paper Award at ISSCC 2007. *An Energy Efficient 2.5 nJ/bit 0.65 V 3 to 5 GHz Subbanded UWB Receiver in 90 nm CMOS.*
- March 2004 1st Place in Operational Category and Overall Winner of the 2004 DAC/ISSCC Student Design Contest. *A Single-Chip Ultra-Wideband Transceiver.*
- August 2002 Winner of the International Symposium on Low Power Electronics and Design (ISLPED) Low Power Design Contest. *A Power-Aware Wireless Micro-sensor Node.*
- January 2001 1st Place out of 60 teams at MIT’s LEGO Autonomous Robot Competition (6.270).
- July 2000 1st Place out of 150 at Texas Instruments’ summer intern poster session.
- April 2000 Built 1 of 3 best wideband amplifiers in grad-level course Solid-State Circuits (6.301).
- April 2000 1st Place of 20 teams at MIT’s BeaverDash Design Competition.
- 1997–1998 Received scholarship to study piano with David Deveau as an MIT music scholar.
- 1995–1997 1st Place (3 consecutive years) at Young Musicians’ Competition for southeast US. Judged by Atlanta Symphony Orchestra (ASO) conductor Yoel Levi and colleagues.
- 1996–1997 Pianist for state-wide Atlanta Symphony Youth Orchestra (ASYO).

SKILLS

- RF, mixed-signal, digital systems and circuits, feedback systems, mechanical intuition.
- Software: Cadence tools, PCB tools, Matlab, SpectreRF, Verilog, CST Microwave Studio.
- Extremely proficient in the laboratory and RF/mixed-signal debugging environment.
- List of publications can be found at <http://web.mit.edu/fslee/www/research/index.html>.
- Overview of projects can be found at <http://web.mit.edu/fslee/www/projects/index.html>.
- US Citizen. Conversational Mandarin Chinese. References available upon request.

PUBLICATIONS

Journals and Magazine Articles

- [1] **F. S. Lee**, A. P. Chandrakasan, "A 2.5 nJ/bit 0.65 V Pulsed UWB Receiver in 90 nm CMOS," *IEEE Journal of Solid-State Circuits (JSSC)*, December 2007.
- [2] **F. S. Lee**, A. P. Chandrakasan, "A BiCMOS Ultra-Wideband 3.1–10.6 GHz Front-End," *JSSC*, August 2006.
- [3] R. Blazquez, P. P. Newaskar, **F. S. Lee**, A. P. Chandrakasan, "A Baseband Processor for Impulse Ultra-Wideband Communications," *JSSC*, September 2005.
- [4] D. D. Wentzloff, R. Blazquez, **F. S. Lee**, B. P. Ginsburg, J. Powell, A. P. Chandrakasan, "System Design Considerations for Ultra-Wideband Communication," *IEEE Communications Magazine*, August 2005.
- [5] E. Shih, S. Cho, **F. S. Lee**, B. H. Calhoun, A. P. Chandrakasan. "Design Considerations for Energy Efficient Radios in Wireless Microsensor Networks," *JVLSI for Signal Processing-Systems for Signal, Image, and Video Technology*, May 2004.

Book Chapter

- [1] **F. S. Lee**, R. Blazquez, B. P. Ginsburg, J. D. Powell, D. D. Wentzloff, A. P. Chandrakasan, "Pulse Based, 100 Mbps UWB Transceiver," Ed. Ranjit Gharpurey, *Kluwer Academic Pub.*

Conferences

- [1] P. P. Mercier, D. C. Daly, M. Bhardwaj, D. D. Wentzloff, *F. S. Lee*, A. P. Chandrakasan, "Ultra-Low-Power UWB for Sensor Network Applications," (invited) *IEEE International Symposium on Circuits and Systems (ISCAS)*, May 2008.
- [2] D. D. Wentzloff, **F. S. Lee**, D. C. Daly, M. Bhardwaj, P. P. Mercier, A. P. Chandrakasan, "Energy Efficient Pulsed-UWB CMOS Circuits and Systems," (invited) *IEEE International Conference on Ultra-Wideband (ICUWB)*, September 2007.
- [3] **F. S. Lee**, A. P. Chandrakasan, "An Energy Efficient 2.5 nJ/bit 0.65 V 3 to 5 GHz Sub-banded UWB Receiver in 90 nm CMOS," *IEEE International Solid-State Circuits Conference (ISSCC)*, February 2007.
- [4] **F. S. Lee**, R. Blazquez, B. P. Ginsburg, J. D. Powell, M. Scharfstein, D. D. Wentzloff, A. P. Chandrakasan, "A 3.1 to 10.6 GHz 100 Mb/s Pulse-Based Ultra-Wideband Radio Receiver Chipset," *ICUWB*, September 2006.
- [5] **F. S. Lee**, A. P. Chandrakasan, "A BiCMOS Ultra-Wideband 3.1–10.6 GHz Front-End," *IEEE Custom Integrated Circuits Conference (CICC)*, September 2005.
- [6] R. Blazquez, **F. S. Lee**, D. D. Wentzloff, B. Ginsburg, J. Powell, A. P. Chandrakasan, "Direct Conversion Pulsed UWB Transceiver Architecture," *IEEE Design, Automation and Test in Europe (DATE)*, March 2005.
- [7] R. Blazquez, P. P. Newaskar, **F. S. Lee**, A. P. Chandrakasan, "A Baseband Processor for Pulsed Ultra-Wideband Signals," *CICC*, October 2004.
- [8] **F. S. Lee**, D. D. Wentzloff, A. P. Chandrakasan, "An Ultra-Wideband Baseband Front-End," *IEEE Radio Frequency Integrated Circuits Symposium (RFIC)*, June 2004.
- [9] R. Blazquez, **F. S. Lee**, D. D. Wentzloff, P. P. Newaskar, J. D. Powell, A. P. Chandrakasan, "Digital Architecture for an Ultra-Wideband Radio Receiver," *IEEE Transactions on the Vehicular Technology Conference (VTC)*, October 2003.