

# Rajeevan Amirtharajah

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- Objective** To contribute directly to solving challenging problems in digital and mixed signal circuit design, electromagnetics, communications, signal processing, and system architecture.
- Education** **Massachusetts Institute of Technology**  
Doctor of Philosophy, Electrical Engineering and Computer Science, June 1999  
Thesis: Design of Low Power VLSI Systems Powered by Ambient Mechanical Vibration  
Master of Engineering, Electrical Engineering and Computer Science, May 1994  
Thesis: High Bandwidth Interchip Communication for Regular Networks  
Bachelor of Science, Electrical Science and Engineering, May 1994
- Experience** **University of California, Davis, ECE Dept.** July 2003—Present  
*Assistant Professor*  
Teaching and research in digital circuit design and VLSI. Research interests include micropower embedded systems, power electronics which convert ambient energy sources to electrical power for batteryless device operation, circuits and architectures for energy scalable signal processing of sensor data, and innovative I/O circuit and interconnect design.
- Independent Consulting** Oct 2002—June 2003  
Consulted on low power design, hardware feasibility studies, high performance I/O design, and digital ASIC and mixed-signal circuit design for several small companies and startups including SiCortex, BlueD Technologies, OcuNET Devices, and SMaL Camera Technologies.
- High Speed Solutions, an Intel Company** June 1999—Oct 2002  
*Senior Member of Technical Staff*  
One of two principal contributors on an engineering staff of six who brought an early venture startup company from initiating engineering development to successful acquisition by Intel in thirteen months. Half of a two designer team responsible for innovative signaling and circuit design and implementation of a chip set for a prototype high performance memory system. Also responsible for initial electromagnetic simulation of a novel connector concept. The prototype achieved 1.6 Gbps/pair bandwidth across an 8 load multidrop bus while dissipating peak power of 40 mW/transceiver. Performed initial work to extend performance to 3.2 Gbps for 8 loads and 5 Gbps for point-to-point links. Also developed two new interconnect concepts to enable multidrop peer-to-peer communication.  
Primary responsibilities included signaling theory, analysis, and design, circuit design, simulation, and custom layout, initial interconnect design and simulation, and post fabrication silicon testing. Further responsibilities involved intellectual property development, interaction with RF, mechanical, verification, and CAD engineers, test methodology development, documentation, support for technical marketing and product intercept planning, definition of R&D directions, and interviewing and training new hires.

**MIT Microsystems Technology Laboratory**

Jan 1995—June 1999

*Research Assistant*

Investigated techniques for top to bottom implementation of signal processing systems which scavenge energy from vibration sources in their environment. Developed, modeled, and tested an electromagnetic vibration-to-electric energy converter based on a moving-coil transducer. Designed, implemented, and tested a custom low power DC-DC converter IC for regulating transducer output voltage based on desired load performance. Developed a detection/classification algorithm for estimating heart rate from a novel acoustic sensor's output. Designed, implemented, and tested a full custom 250K transistor low power DSP with innovative features for sensor signal processing as part of a system incorporating a MEMS vibration-to-electric energy converter and voltage regulator for energy scavenging operation of the heartbeat detection algorithm. Also designed and implemented a low power dynamic comparator incorporated in several group test chips.

**MIT Department of EECS**

Fall 1998

*Teaching Assistant, 6.374 Analysis and Design of Digital Integrated Circuits*

Developed and graded problem sets, exams, labs, and design projects in addition to running one-on-one and small group tutorials.

**Lockheed Sanders Corp.**

Summer 1997

*Summer Intern*

Developed and tested algorithms for detection and classification of signals for cardiac monitoring from a novel acoustic sensor.

**MIT Artificial Intelligence Laboratory, Abacus Project**

Oct 1992—Jan 1995

*Research Assistant*

Designed circuits for high bandwidth interchip communication for a SIMD array.

*Undergraduate Researcher*

Designed and simulated the architecture of a microsequencing unit, memory controller, and i/o system for a large-scale SIMD multiprocessor. Contributed to architectural and VLSI circuit design and layout of a high performance processor chip.

**IBM Thomas J. Watson Research Center,  
Communication Circuits Group**

Summer 1992

*Summer Intern*

Designed a low-latency phase recovery circuit that uses transition detection to accelerate initial tracking.

**Skills**

Programming Languages: HSPICE, MATLAB, C, Verilog HDL, Skill, Scheme/Lisp  
CAD: Cadence, Mentor Graphics, LINPAR

**Journal  
Publications**

R. Amirtharajah and A. Chandrakasan, "A Micropower Programmable DSP Using Approximate Signal Processing Based on Distributed Arithmetic," *IEEE Journal of Solid-State Circuits*, to appear.

J. R. Benham, R. Amirtharajah, J. Critchlow, T. Simon, and T. F. Knight, Jr., "An Alignment Insensitive Separable Electromagnetic Coupler for High Speed Digital Multidrop Bus Applications," *IEEE Transactions on Microwave Theory and Techniques*, to appear.

S. Meninger, J.-O. Mur-Miranda, R. Amirtharajah, A. Chandrakasan, and J. Lang, "Vibration-to-Electric Energy Conversion," *IEEE Transactions on VLSI Systems*, Vol. 9, No. 1, Feb. 2001, pp. 64-76.

A. Dancy, R. Amirtharajah, and A. Chandrakasan, "High-Efficiency Multiple-Output DC-DC Conversion for Low-Voltage Systems," *IEEE Transactions on VLSI Systems*, Vol. 8, No. 3, June 2000, pp. 252-63.

R. Amirtharajah and A. Chandrakasan, "Self-Powered Signal Processing Using Vibration-Based Power Generation," *IEEE Journal of Solid-State Circuits*, Vol. 33, No. 5, May 1998, pp. 687-695.

## Conferences

- J. R. Benham, R. Amirtharajah, J. Critchlow, T. Simon, and T. F. Knight, Jr., "An Alignment Insensitive Separable Electromagnetic Coupler for High Speed Digital Multidrop Bus Applications," *2003 International Microwave Symposium*, June 2003.
- T. Simon, R. Amirtharajah, J.R. Benham, J. Critchlow, and T.F. Knight, Jr., "A 1.6 Gb/s/pair Electromagnetically Coupled Multidrop Bus Using Modulated Signaling," *2003 ISSCC Digest of Technical Papers*, Feb. 2003, pp. 184-5, 487.
- R. Amirtharajah, S. Meninger, J.-O. Mur-Miranda, A. Chandrakasan, and J. Lang, "A Micropower Programmable DSP Powered Using a MEMS-Based Vibration-to-Electric Energy Converter," *2000 ISSCC Digest of Technical Papers*, 2000, pp. 362-3, 469.
- R. Amirtharajah, T. Xanthopoulos, and A. Chandrakasan, "Power Scalable Processing Using Distributed Arithmetic," *1999 International Symposium on Low Power Electronics and Design*, 1999, pp. 170-5.
- S. Meninger, J.-O. Mur-Miranda, R. Amirtharajah, A. Chandrakasan, and J. Lang, "Vibration-to-Electric Energy Conversion," *1999 International Symposium on Low Power Electronics and Design*, 1999, pp. 48-53.
- A. Chandrakasan, R. Amirtharajah, S.-H. Cho, J. Goodman, G. Konduri, J. Kulik, W. Rabiner, and A. Wang, "Design Considerations for Distributed Microsensor Systems," *1999 Proceedings of the IEEE Custom Integrated Circuits Conference*, 1999, pp. 279-86.
- A. Chandrakasan, R. Amirtharajah, J. Goodman, and W. Rabiner, "Trends in Low Power Digital Signal Processing," *1998 International Symposium on Circuits and Systems*, Vol. 4, 1998, pp. 604-7.
- R. Amirtharajah and A. Chandrakasan, "Self-Powered Low Power Signal Processing," *1997 Symposium on VLSI Circuits Digest of Technical Papers*, June 1997, pp. 25-26.
- M. Bolotski, T. Simon, C. Vieri, R. Amirtharajah, and T.F. Knight, Jr., "Abacus: A 1024 Processor 8 ns SIMD Array," *Proc. Sixteenth Conference on Advanced Research in VLSI*, March 1995, pp. 28-40.
- M. Bolotski, et al., "Abacus: A High-Performance Architecture for Vision," *Proc. of ICPR*, 1994.

## Book Chapters

A. Chandrakasan, R. Amirtharajah, A. Dancy, J. Goodman, W. Rabiner, and T. Xanthopoulos, "Future Directions in Energy Efficient Computing," in *Low-Power, High-Speed VLSI Circuits and Technology*, Realize, Inc., Japan, 1998.

## Patents

- T. Simon, R. Amirtharajah, T. F. Knight, Jr., N. Marketkar, and J. R. Benham, "Electromagnetically Coupled Bus System," U.S. Patent No. 6,625,682 (2003).
- N. Marketkar, J. R. Benham, T. F. Knight, Jr., and R. Amirtharajah, "An Electromagnetic Coupler Circuit Board Having at Least One Angled Conductive Trace," U.S. Patent No. 6,611,181 (2003).
- J. R. Benham, N. Marketkar, and R. Amirtharajah, "An Electromagnetic Coupler," U.S. Patent No. 6,573,801 (2003).
- T. Simon and R. Amirtharajah, "Clock Reshaping," U.S. Patent No. 6,498,512 (2002).
- R. Amirtharajah, T. Simon, J. R. Benham, J. Critchlow, and M. Naylor, "Interconnecting of Digital Devices," U.S. Patent application, April 2002.
- T. Simon, R. Amirtharajah, and J. R. Benham, "Signaling Through Electromagnetic Couplers," U.S. Patent application, Feb. 2002.
- T. Simon, R. Amirtharajah, and J. R. Benham, "Bus Signaling Through Electromagnetic Couplers," U.S. Patent application, Feb. 2002.

T. Simon, R. Amirtharajah, and J. R. Benham, "Controlling Coupling Strength in Electromagnetic Bus Coupling," U.S. Patent application, Feb. 2002.

J. R. Benham and R. Amirtharajah, "Digital Network," U.S. Patent application, Dec. 2001.

T. Simon, R. Amirtharajah, N. Marketkar, T. F. Knight, Jr., and J. R. Benham, "Symbol-Based Signaling for an Electromagnetically-Coupled Bus System," U.S. Patent application, Nov. 2000.

T. Simon, R. Amirtharajah, T. F. Knight, Jr., N. Marketkar, and J. R. Benham, "Electromagnetically-Coupled Bus System," U.S. Patent application, Nov. 2000.

T. Simon, R. Amirtharajah, N. Marketkar, T. F. Knight, Jr., and J. R. Benham, "Symbol-Based Signaling Device for an Electromagnetically-Coupled Bus System," U.S. Patent application, Feb. 2001.

T. Simon, R. Amirtharajah, N. Marketkar, and T. F. Knight, Jr., "Symbol-Based Signaling Device for an Electromagnetically-Coupled Bus System," U.S. Patent application, Feb. 2001.

T. Simon and R. Amirtharajah, "Generating and Using Calibration Information," U.S. Patent application, Feb. 2001.

T. Simon and R. Amirtharajah, "Calibrating Return Time," U.S. Patent application, Feb. 2001.

T. Simon and R. Amirtharajah, "Mechanism for Combining Signals to Provide Consistent Output Behavior," U.S. Patent application, Feb. 2001.

N. Marketkar, T. F. Knight, Jr., J. R. Benham, and R. Amirtharajah, "An Electromagnetic Coupler Flexible Circuit," U.S. Patent application, Feb. 2001.

#### **Talks**

R. Amirtharajah, "A 1.6 Gb/s/pair Electromagnetically Coupled Multidrop Bus Using Pulse-Based Modulated Signaling," 6.976 Invited Guest Lecture, Massachusetts Institute of Technology, May 9, 2003 (Cambridge, MA).

R. Amirtharajah, "Micropower Energy Scalable DSP Systems Powered From Vibration-to-Electric Energy Conversion," Invited Seminar, Brown University, Nov. 20, 2002 (Providence, RI).

#### **Professional**

IEEE Solid-State Circuits Society  
IEEE Computer Society  
IEEE Microwave Theory and Techniques Society  
Sigma Xi, The Scientific Research Society  
American Association for the Advancement of Science

#### **References**

Available upon request.