

## ROBERT O. PERUZZI, PhD, PE

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### Summary

Licensed Professional Electrical Engineer with particular expertise in Mixed-Signal Integrated Circuits (MSICs). Experience and skills bridge the gap between methodologies used by the digital, analog and radio frequency circuit design teams. My subspecialty within this broad category is with integrated circuits (silicon chips) used for signal-processing, which

- Detect signals from a sensor (e.g. antenna, microphone, pixel, thermocouple and so forth)
- Amplify, filter, then convert the signal to the digital domain
- Perform further processing in the digital domain
- Convert the result back to the analog domain for further processing, and/or
- Deliver the final output to an actuator (e.g. antenna, speaker, LED, heater control-switch etc.).

Examples of these systems are

- Telephones, mobile phones and cell phones
- Data recording and retrieving systems for magnetic media such as disk drives or magnetic tape
- Radio transmitters/receivers and their building blocks such as low noise amplifiers, filters, automatic gain control and frequency mixers (down-converters, up-converters)
- Audio amplifiers
- Audio recording/reproduction systems
- Heat, ventilation and air conditioning controllers
- Data transmitting/receiving systems such as serializer/de-serializers (SERDES)

### PROFESSIONAL EXPERIENCE

**R. PERUZZI CONSULTING, INC.**  
**President and Independent Consultant**

**2008-Present**

Independently review and verify new mixed signal ICs before funds are committed to manufacture the design. Typical clients are small to medium size companies that do not maintain a permanent staff of mixed signal verification specialists. Provide the following services:

- Advising and providing solutions for top-down design methodologies, and the analysis, design, modeling and verification of RF, analog and digital circuits
- Creating behavioral models of electrical circuits, wireless system components and electro-mechanical units to be used for system simulation and design
- Designing algorithms, software and hardware for system self-tuning and calibration
- Forensic investigation and litigation support

Client products include Single-chip Transceivers for Products with Antenna Diversity, Hard-Disk-Drive READ-Channel integrated circuits, Single-Chip RF Receivers for Television Signals, High Speed Serializer/De-serializer (SERDES) Circuits and Analog/Mixed-Signal Computer-Aided Design (CAD) Programs.

Recent notable projects for clients

- Forensic investigation and report of an alleged failure in an Electronic Toll Collection (ETC) system
- Designed an optimal self-tuning algorithm for a local-oscillator generator's phase-locked-loop
- Designed a self-calibration mechanism for poly-phase filters used in a television receiver RF front end

**INFINEON TECHNOLOGIES** (*LSI, Agere Systems, Lucent, AT&T Bell Labs*), Allentown, PA 1990-2008  
Multiple positions as AT&T Bell Labs, which evolved into Lucent Technologies, Agere Systems, LSI and Infineon.

**Final Position: Senior Member of Technical Staff** 2007-2008

Department: Infineon, Allentown Location, Mobility Division

Duties:

- Create behavioral models in the VHDL language for new Infineon RF transceiver ICs as part of an existing design team based in Austria and Germany
- Create models, verification testbenches and testcases to troubleshoot existing mobility IC products and verify their revisions
- Create and write proposals for new IC products to be designed at the Allentown facility

Awards:

- Invited to Infineon Technologies Communication Tech Days Conference at Infineon headquarters in Munich: 2008

Invited Lecture:

- "High-level RF Behavioral Models with Time-Domain Noise", Infineon Technologies Communication Tech Days Conference, 2008

**Position: Senior Member of Technical Staff** 2006-2007

Department: LSI Mobility Division

Duties:

- Lead the top-down design and verification of test-chip ICs for evaluating competing receive and transmit circuit architectures
- Create models for RF front end and analog subcircuits for satellite radio receiver ICs
- Create models for mixed signal power-management subcircuits and touch-screen sensor subcircuits in cellular handset baseband ICs
- Design specialized testbenches for troubleshooting specific design faults in satellite radio receiver RF ICs and cellular handset baseband ICs
- Ensure zero functional errors in test-chips so that fair and accurate parametric comparisons can be made

Technical writing: In-Company Publications

- Full reports on trouble-shooting findings including suggested circuit revisions

**Position: Senior Member of Technical Staff** 2005-2006

Department: Agere Systems (Later LSI) Advanced RF Architectures Department

Department Charter: Research and develop novel RF circuits and architectures for ICs

Duties:

- Create prototypes and models of RF circuit alternative choices to compare relative merits of each choice
- Lead the top-down design and verification of test-chip ICs for evaluating competing receive and transmit circuit architectures
- Ensure zero functional errors in test-chips so that fair and accurate parametric comparisons can be made

Technical writing: In-Company Publications

- Full report on FM Receiver prototype and digital down converter/filter designs
- Top-down RF design methodology and HDL-Coder methodology

In-house Lectures and Seminars:

- Lecture at Agere Systems, circa 2006: "A method for choosing optimal test-tones and phases when designing multi-tone signals for simulation or hardware testing." A practical technique for both computer simulation and hardware test
- Lecture at LSI, circa 2007: "Extending the use of Lyrtech prototyping system" Demonstrated a systematic low-cost approach for early investigation of design feasibility

**Position: Member of Technical Staff**

2003-2005

Department: Agere Systems Mass Storage Integrated Circuits Division

Duties:

- Create behavioral models of Analog and Mixed Signal circuits in Verilog-AMS modeling language
- Develop and execute plans for pre-manufacture verification of ICs
- Improve the design and verification methodology of the division

Technical Writing:

- Internal guide for the creation and validation of behavioral models in Verilog-AMS
- Company-wide guide for improving models of digital cells by making models aware of power supply faults

In-house Lectures and Seminars:

- Lecture at Agere Systems, circa 2004: "Guidelines for choosing the right level of detail in Verilog-AMS behavioral models" Taught practical circuit analysis and behavioral modeling techniques.
- Lecture at Agere Systems, circa 2004: "Motivation for adding power-supply awareness to the standard libraries of digital gates" Taught practical circuit analysis and behavioral modeling techniques.

Awards:

- Multiple instances of monetary and honorary departmental awards for performance excellence
- Company award for patent submission: "Amplifier having half-wave tracking power rails", based upon PhD research. Co-filed with one of my thesis advisors Patent #7498876 granted March 3, 2009

Promotion: To Senior Member of Technical Staff**Position: Member of Technical Staff**

2000-2003

Department: Lucent Technologies (later Agere Systems) Mobile Communications Integrated Circuits Division

Duties:

- Designing Analog and Mixed Signal (Analog/Digital) Circuits for mobile phone base-band ICs
- Creating behavioral models of Analog and Mixed Signal circuits in Verilog-AMS modeling language
- Laboratory testing, validation and trouble-shooting of ICs
- Improving the design and verification methodology of the division

Circuit Designs:

- Band-gap reference voltage and bias current generator
- Voice-band up-link path including

- Microphone pre-amplifier
- Variable gain amplifier
- Anti-aliasing filter
- Delta-sigma A/D converter
  
- Voice-band down-link path including
  - Delta-sigma D/A converter
  - Switched-capacitor reconstruction-filter
  - Continuous-time smoothing filter
  - Audio speaker driver amplifier

Technical Writing:

- Design, User and Test Specification documents for Band-gap and Voice-band subsystems
- Application notes which show customers how to program and electrically interface to the Voice-band

In-house Lectures and Seminars:

- Lecture at Lucent Technologies, circa 2000: "Silicon band-gap voltage references in CMOS technology – theory and design techniques to ensure start-up and optimize voltage temperature coefficient" Taught theory and design technique.
- Lecture at Lucent Technologies, circa 2001: "Delta-sigma analog to digital converters, theory and optimization for small area and low power consumption" Theory and design technique.
- Lecture at Lucent Technologies, circa 2001: "A method for deriving, by analysis, the frequency response of switched-capacitor filters as a function of component values" Theory and design technique.

Awards:

- Company award for patent submission "A software/hardware solution to prevent audible pops during cell phone operating mode transitions" Patent pending
- Selected for Lucent Technologies and then Agere Systems' tuition assistance program for PhD study

**Position: Member of Technical Staff**

**1995-2000**

Department: AT&T Bell Labs (later Lucent Technologies) Mass Storage Integrated Circuits Division

Duties:

- Designing digital and analog circuits and creating behavioral models (in C-language) of analog circuits used in hard-disk-drive READ-channel ICs
- Developing and executing plans for pre-manufacture verification of ICs
- Laboratory testing, validation and trouble-shooting of ICs

Circuit Designs:

- Temperature sensor circuit
- Test-port gateway (for monitoring digital output of analog front end or for injecting a digital test signal which bypasses the analog front end)
- Multi-function test-access I/O ports
- Power-fault tolerant digital I/O ports

Technical writing:

- READ-Channel Specification Document
  - Wrote individual chapters of document
  - Edited, compiled and maintained entire document
- User application notes

- For test-port gateway
- For power-fault tolerant digital I/O port features and limitations
- In-Company Technical Memorandum
  - "Guide for Writing Analog Behavioral Models in the C Programming Language"

In-house Lectures and Seminars:

- Seminar at AT&T Bell Labs, circa 1995: "An overview of computer hard-disk-drive technology and introduction to AT&T READ-Channel ICs" Full-day seminar for new hires held periodically.
- Lecture at AT&T Bell Labs, circa 1995: "Writing Analog Behavioral Models in the C Programming Language" Lecture taught advanced modeling concepts targeted toward company approach to verification.
- Lecture at Lucent Technologies, circa 1999: "A procedure for creating mathematical models of dynamically tunable continuous-time biquadratic filters using analog and digital controlled time-varying coefficients in differential or integral state equations" How to model a very specific circuit type.

Awards:

- Multiple instances of monetary and honorary departmental awards for performance excellence

**Initial position: Member of Technical Staff Level One****1990-1995**

Department: AT&amp;T Bell Labs Telecommunication Integrated Circuits Division

Duties:

- Developing custom hardware and software for automatic testing of telecommunication ICs

Award:

- Selected for AT&T and then Lucent Technologies' tuition assistance program for Master's Degree study

Promotion:

- To Member of Technical Staff (MTS)

**LTX CORPORATION, Westwood, MA****Hardware Engineer****1988-1990**Duties:

- Interface with customers. Evaluate customer requirements and translate into hardware design specifications and software algorithms
- Design, inspect and prove-in custom hardware to interface between company's tester product and customer's devices to be mass-production tested
- Write and debug software modules to be executed with the company's tester
- Write documentation describing the custom hardware and software for customer's use in future maintenance and troubleshooting
- Deliver the tester application (custom hardware, software and documentation) to the customer's premises. Install, troubleshoot (if necessary) and prove-in the application to the customer's satisfaction

**Co-op Student Employee****1986-1988**Duties:

- Assemble electrical products by placing and soldering components and wires and attaching hardware
- Construct custom electrical products by attaching components to prototyping boards, hand-routing connecting wires and attaching hardware
- Visually inspect assembled electrical products
- Test, troubleshoot and repair electrical products

- Design or modify and supervise the assembly of custom electrical products
- Write or modify software programs

UNITED STATES AIR FORCE Honorably discharged as E-5 (Staff Sergeant)	1977-1984
BOB PERUZZI ORCHESTRAS Professional Musician	1975-1977

### EDUCATION

PhD, <b>Electrical Engineering</b> , Lehigh University, Bethlehem, PA Dissertation: "A Novel Amplifier System Combining Class D D/A Conversion and Low-Power Class AB Operation"	2005
MS, <b>Electrical Engineering</b> , Lehigh University, Bethlehem, PA Thesis: "A Continuous-Time Analog Adaptive Bi-quadratic Filter – Design, Construction and Characterization"	1996
BS, <b>Electrical Engineering</b> , Northeastern University, Boston, MA Summa cum Laude: GPA: 3.94/4.0 Awards and Honors: <ul style="list-style-type: none"> <li>• Phi Kappa Phi award for outstanding Engineering freshman, 1985.</li> <li>• Elected to Tau Beta Pi Electrical Engineering Honor Fraternity in junior year, 1987</li> <li>• Academic distinction award from the Boston chapter of the IEEE Power Engineering Society in 1986</li> </ul>	1988
Bachelor of Music in Music Education, Boston Conservatory of Music, Boston, MA <ul style="list-style-type: none"> <li>• Dean's List, 1974</li> </ul>	1974

### Current Professional License and Affiliations

- **Professional Engineer (PE)** Pennsylvania License Number PE078294
- **Philadelphia Consultants Network (CONET)** Chair, Program Chair, Corresponding Secretary
- **National, Pennsylvania and Lehigh Valley Societies of Professional Engineers (NSPE,PSPE,LVSPE)**
- **IEEE Senior Member Society Memberships:**
  - **Solid State Circuits Society (SSCS):** Founder and Secretary, Lehigh Valley SSCS Chapter
  - **Product Safety Engineering Society (PSES)**
  - **Circuits and Systems Society (CSS)**
  - **Behavioral Modeling and Simulation Society:** Member of 2010 BMAS Conference Committee
- **Audio Engineering Society**
- **American Bar Association Section of Intellectual Property Law (ABA-IPL)**
- **American Bar Association Section of Science and Technology Law**

### PATENT AND PATENT PENDING

- Patent Number 7498876: Amplifier having half-wave tracking power rails. March 3, 2009
- Patent Pending: A software/hardware solution to prevent audible pops during cell phone operating mode transitions

### PUBLICATIONS

- "Efficient Verification and Virtual Prototyping of Analog and Mixed-Signal IP and SOCs Using Behavioral Models" <http://www.design-reuse.com/articles/23018/verification-virtual-prototyping-ams-behavioral-model.html>
- "High-level RF Behavioral Models with Transient Noise", Infineon Technologies Communication Tech Days Conference, 2008
- "Verification of Digitally calibrated analog systems with Verilog-AMS Behavioral Models", IEEE Behavioral Modeling and Simulation (BMAS) Conference, 2006
- "A Novel Amplifier System Combining Class D D/A Conversion and Low-Power Class AB Operation" Audio Engineering Society Conference, 2004

### LECTURES

- Lecture in conjunction with poster exhibit: "Using Class D digital to analog conversion to create signal-tracking power rails for a Class AB audio amplifier," Audio Engineering Society Conference, 2004
- Lecture to accompany slide-show and paper presentation: "Verification of Digitally calibrated analog systems with Verilog-AMS Behavioral Models," IEEE Behavioral Modeling and Simulation (BMAS) Conference, 2006
- Lecture in conjunction with poster exhibit: "High-level RF Behavioral Models with Time-Domain Noise," Infineon Technologies Communication Tech Days Conference, 2008
- Invited Lecture "An Overview of Mixed-Signal IC Verification with Behavioral Models," IEEE Princeton Section, Solid-State Circuits Society Chapter Technical Meeting, December, 2010
- Invited Lecture "Reducing the Risk of Human Error in Digitally Calibrated Analog Circuits with Mixed-Signal Simulation Techniques," IEEE Philadelphia Section Technical Meeting, October, 2011

Most Recent Update: August 13, 2012