ROBERT O. PERUZZI, PhD, PE, DFE

Peruzzi@RPeruzzi.com

719 Fourth Avenue
Bethlehem, PA, 18018

610.462.3939
www.RPeruzzi.com

SUMMARY

I am a Licensed Professional Electrical and Electronics Engineer and Expert Witness practicing forensic and technical electrical engineering consulting. My forensic engineering practice includes forensic investigation, advising, reporting and testimony in electrical, electronic, communication, and electro-mechanical control-system matters regarding intellectual property, patents, failure analysis, product liability, injuries, product requirements and specifications. My technical engineering practice includes the design, verification, measurement and testing of electronic signal processing hardware circuits and systems, both integrated circuits and electrical modules, which are used for communication and electro-mechanical control.

Examples of communication and control systems are:

- Internet of Things (IOT) systems
- Audio amplifiers
- Audio recording/play-back systems
- Telephones, mobile phones, and cell phones
- Voltage regulators and battery chargers
- Data transmitting/receiving systems such as serializer/de-serializers (SERDES)
- Power-management devices including switch-mode power converters
- Lithium-ion battery management systems
- Data recording/retrieving systems for magnetic media such as disk drives or magnetic tape
- Video systems, such as television and webcams making use of CCDs
- Radio transmitters/receivers and their building blocks such as low noise amplifiers, filters, automatic gain control, oscillators, frequency synthesizers and phase-locked loops, and frequency mixers (down-converters, up-converters)
- Heat, ventilation, and air conditioning controllers (HVAC)
- Traffic light control and emergency preemption systems
- Remote control systems for hobbyist aircraft and vehicles
- Pressure sensors for reading depth of fluid column
- Electrical equipment power and grounding

PROFESSIONAL EXPERIENCE

R. PERUZZI CONSULTING, INC., 2008-Present
President and Independent Consultant

As an expert witness, I offer the following services:

- Analysis of patents and advise on validity and/or infringement
- Forensic investigation regarding circuits and systems, communications and control, and electrically related personal injury matters
- Litigation support including deposition and testimony

Notable projects for clients:

Patents and Intellectual Property

- Review and analysis of mass storage hard disk drive patents
- Patent infringement case regarding high-speed SERDES
- Patent infringement case regarding IC packaging parasitic mitigation

- Patent infringement case regarding automatically self-adjusting audio equipment
- Patent infringement case regarding geo-location of mobile phone devices
- Patent review and analysis relating to
    - Electronic design automation (EDA) software programs
    - A/D, D/A converters and their calibration
    - Electronic control systems for HVAC systems

Circuits and Systems

- Business sale/purchase dispute over semiconductor test equipment manufacturing capability
- Dispute over product requirements, specifications, and quality for video screens

Communications and Control Systems

- Business dispute over repeated failures of packaging equipment
- Business dispute over design of two-way communication system for drive-thru restaurants
- Person injured when the control system of the rod handler of a construction drill rig malfunctioned
- Fatal collision between a police vehicle and a civilian vehicle
- Person injured by hot cleaning solution when pressure sensor was removed from tank
- Person injured by remote control hobbyist drone
- Wirelessly-remote-controlled drilling equipment tragic failure
- Electronic toll collection and traffic control lane accident investigation

Electrically Related Personal Injury

- Person injured because of industrial communication/control system failure
- Person injured by electric shock while servicing MRI main disconnect panel
- Person injured by electric shock while swimming in recreation center pool
- Investigated remains of electrical equipment recovered from fatal hotel fire
- Person injured by explosion of lithium-ion batteries in pocket
- Person injured by electrical shock in bathroom of rented beach unit
- Home electrical fire investigation

Specialized Continuing Education:

- Expert Witness SEAK Seminars, including patent-specific training
- Advanced Fire Investigation for Professional Engineers, NAFE educational seminar
- Fundamentals of Lightning Protection Systems, by CED Engineering
- Interior Electrical Distribution Systems
- Grounding and Bonding of Electrical Systems

As a technical consultant, I have broad and deep understanding of analog/mixed-signal (AMS) circuits and systems, as well as strong experience with design verification, especially for chip-level analog and mixed-signal ICs. I independently review and verify digital and analog/mixed-signal ICs using electronic design automation (EDA) software before funds are committed to manufacturing the design. My services:

- Advise and provide solutions for top-down design methodologies, and the analysis, design, modeling and verification of RF, analog and digital circuits. For design verification (DV) of Systems-on-Chip (SOC) with embedded AMS sub-systems I develop DV strategies, verification plans, create behavioral models and test-cases to execute the verification-plan (V-Plan)
- Create behavioral models of electrical circuits, wireless system components and electro-mechanical units to be used for DV. DV languages include universal verification methodology

(UVM), System Verilog (SV) using real-number modeling (RNM) of analog signals and systems, Verilog, Verilog- AMS, VHDL, VHDL-AMS, Verilog-A, Spice, Spectre, and others
- IC Circuit-Design and DV tools include those by Cadence and Mentor Graphics
- Design algorithms, software, and hardware for system self-tuning and calibration

Client products include:
- Lithium-ion battery management systems
- Single-chip transceivers for products with antenna diversity
- Hard-disk-drive read-channel integrated circuits
- Single-chip RF television receivers
- High speed serializer/de-serializer (SERDES) circuits
- Mixed-signal power management ICS comprising low drop-out (LDO) and switch-mode step-up (boost) and step-down (buck) converters intended for medical or general applications
- Magnetometers (for sensing magnetic field intensity and angle)
- Analog/mixed-signal computer-aided design (CAD) tools

Notable projects for clients:
- Examined lithium-ion battery schematics and algorithms, and advised on design process and methodology
- Taught in-house class “an introduction to mixed-signal behavioral modeling and verification” for engineering and engineering management staff of client company
- Designed electronic system components for a high-accuracy magnetic field sensor
- Created and validated Matlab/Simulink models for top-down design and verification of that complete magnetometer 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

Award:
- 2017 Engineer of the Year by the Pennsylvania Society of Professional Engineers - Lehigh Valley Chapter

XtremeEDA, 2015-2016
Principal Consultant
Duties:
- Provided design and consulting services to the company’s various clients
- Participated in industry conferences and seminars
- Supported sales and marketing efforts in general
- Provided guidance regarding the development of the AMS services practices within the company
- Created behavioral models of analog and mixed signal circuits, including event-driven real-number modeling (RNM) in System Verilog, UVM, Verilog-AMS (real and electrical), and Verilog (real, with out-of-module references for inter-block signal flow)
- Created, ran, and debugged directed and constrained-random test-cases in verification environments including UVM
- Developed automated regression infrastructure setup for functional verification of high complexity mixed-signal SOC designs
- Developed and used constrained-random transactors to validate functionality of system designs
- Debugged regression failures at the behavioral model, RTL, gate, and transistor level

- Used Cadence and Mentor Graphics (EDA) platforms

INFINEON TECHNOLOGIES *(LSI, Agere Systems, Lucent, AT&T Bell Labs)***, 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:

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

Award:

- 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:

- Led the top-down design and verification of test-chip ICs for evaluating competing receive and transmit circuit architectures
- Created models for RF front end and analog subcircuits for satellite radio receiver ICs
- Created models for mixed signal power-management subcircuits (including switch-mode voltage regulator and USB-connected battery charging subcircuits) and touch-screen sensor subcircuits in cellular handset baseband ICs
- Designed specialized testbenches for troubleshooting specific design faults in satellite radio receiver RF ICs and cellular handset baseband ICs
- Ensured zero functional errors in test-chips so that fair and accurate parametric comparisons could 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:

- Created prototypes and models of RF circuit alternative choices to compare relative merits of each choice
- Led the top-down design and verification of test-chip ICs for evaluating competing receive and transmit circuit architectures
- Ensured zero functional errors in test-chips so that fair and accurate parametric comparisons could 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:

- Created behavioral models of Analog and Mixed Signal circuits in Verilog-AMS modeling language
- Developed and executed plans for pre-manufacture verification of ICs
- Improved 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:

- Designed Analog and Mixed Signal (Analog/Digital) Circuits for mobile phone base-band ICs
- Created behavioral models of Analog and Mixed Signal circuits in Verilog-AMS modeling language
- Laboratory testing, validation and troubleshooting of ICs
- Improved 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 Bandgap 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 #20090275322 granted July 9, 2009
- 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:

- Designed digital and analog circuits and created behavioral models (in C-language) of analog circuits used in hard-disk and data-tape drive READ-channel ICs
- Developed and executed plans for pre-manufacture verification of ICs
- Laboratory testing, validation and troubleshooting 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&T Bell Labs Telecommunication Integrated Circuits Division
Duties:

- Developed and debugged custom hardware and software for automatic testing of telecommunication ICs
- Proved in hardware and software for wafer probing of devices and for packaged devices, and over temperature ranges -40 deg-C, ambient, and 100 deg-C

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
Hardware Engineer, 1988-1990
Duties:

- Interfaced with customers. Evaluated customer requirements and translated into hardware design specifications and software algorithms
- Designed, inspected and proved-in custom hardware to interface between company's tester product and customer's devices to be mass-production tested
- Wrote and debugged software modules to be executed with the company's tester
- Wrote documentation describing the custom hardware and software for customer's use in future maintenance and troubleshooting
- Delivered the tester application (custom hardware, software, and documentation) to the customer's premises. Installed, would troubleshoot (if necessary) and proved-in the application to the customer's satisfaction

Co-op Student Employee, 1986-1988
Duties:

- Assembled electrical products by placing and soldering components and wires and attaching hardware
- Constructed custom electrical products by attaching components to prototyping boards, hand-routing connecting wires and attaching hardware
- Visually inspected assembled electrical products
- Tested, troubleshot, and repaired electrical products
- Designed or modified and supervised the assembly of custom electrical products
- Wrote and modified software programs

UNITED STATES AIR FORCE, 1977-1984
Honorably discharged as E-5 (Staff Sergeant)

BOB PERUZZI ORCHESTRAS, 1974-1977
Professional Musician

EDUCATION

PhD, Electrical Engineering, Lehigh University, Bethlehem, PA, 2005
Dissertation: "A Novel Amplifier System Combining Class D D/A Conversion and Low-Power Class AB Operation"

MS, Electrical Engineering, Lehigh University, Bethlehem, PA, 1996
Thesis: "A Continuous-Time Analog Adaptive Bi-quadratic Filter – Design, Construction and Characterization"

BS, Electrical Engineering, Northeastern University, Boston, MA, 1988
Summa cum Laude: GPA: 3.94/4.0
Awards and Honors:

- Phi Kappa Phi award for outstanding Engineering first-year student, 1985
- Elected to Tau Beta Pi Electrical Engineering Honor Fraternity in junior year, 1987
- Academic distinction award from the Boston chapter of the IEEE Power Engineering Society in 1986

Bachelor of Music in Music Education, Boston Conservatory of Music, Boston, MA, 1974

- Dean's List, 1974

CURRENT PROFESSIONAL LICENSE AND AFFILIATIONS

- Professional Engineer (PE) Pennsylvania License Number PE078294
- National Academy of Forensic Engineers (NAFE), Member. Board Certified in Forensic Engineering (DFE)
  - Journal of the National Academy of Forensic Engineers: Associate Editor
  - NAFE Board of Directors: Delegate at Large
  - NAFE Public Relations Committee: Co-chair
  - NAFE Liaison to Pennsylvania Society of Professional Engineers
- Philadelphia Consultants Network (CONET), Former Chair
- National, Pennsylvania, and Lehigh Valley Societies of Professional Engineers (NSPE, PSPE, LVSPE)
- IEEE Senior Member. Society Memberships:
  - Solid State Circuits Society (SSCS): Founder and Former Chair, Lehigh Valley SSCS Chapter. Recipient of 2017 Outstanding Volunteer Award.
  - Alliance of IEEE Consultants Networks Coordinating Committee (AICNCC)
  - Product Safety Engineering Society (PSES)
  - Circuits and Systems Society (CSS)
  - Behavioral Modeling and Simulation Society: Member of 2010 BMAS Conference Committee
- American Bar Association Section of Intellectual Property Law (ABA-IPL), associate member
- American Bar Association Section of Science and Technology Law, associate member

PATENTS

- Patent Number 7498876: Amplifier having half-wave tracking power rails. March 3, 2009
- Patent Number 20090275322: Prevention of audio pop in a digital audio device. July 9, 2009

PUBLICATIONS

- “Forensic Engineering Investigation of Electrical and Electronic Causes of an Industrial Equipment Failure.” Journal of the National Academy of Forensic Engineers, Vol 38 No. 2, December, 2021
- “FE Analysis of Communications Systems for Drive-Thru Restaurants in a Business Dispute Over Specifications and Design Process.” Journal of the National Academy of Forensic Engineers, Vol. 38 No. 1, July 2021
- “Forensic Engineering Analysis of Video Screens for a Dispute Over Requirements and Specifications.” Journal of the National Academy of Forensic Engineers, Vol. 38 No. 1, July 2021
- “Forensic Engineering Analysis of a Swimming Pool Electric Shock Injury.” Journal of the National Academy of Forensic Engineers, Vol. 38 No. 1, July 2021
- “Forensic Engineering Analysis of the Alleged Failure of an Emergency Vehicle Traffic Light Preemption System.” Journal of the National Academy of Forensic Engineers, Vol. 36 No. 1, June 2019
- “Forensic Engineering Analysis of Test Equipment Manufacturing Capability in a Business Purchase Dispute.” Journal of the National Academy of Forensic Engineers, Vol. 35 No. 1, June 2018
- “Forensic Engineering Analysis of Quadcopter Drone Personal Injury.” Journal of the National Academy of Forensic Engineers, Vol. 34, No. 2, December 2017
- “Professional & Forensic Engineering and Expert Witness Career Progression.” IEEE AICN Newsletter, 2nd Quarter, 2017
- “Professional Engineer: Rigorous Threshold but Often a Rewarding Career Will Result.” Lehigh Valley Business Journal, February 20, 2017
- “A Systematic Approach to Creating Behavioral Models.” White paper to accompany lecture of the same name, CDNLive, March 10, 2015. http://tinyurl.com/Xtreme-EDA-Customer-Resources
- "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
- “A 200 Mb/s CMOS EPRML channel with integrated servo demodulator for magnetic hard disks.” Proc. Int. Solid-State Circuits Conf., San Francisco, CA, February 1997. Co-author
- “A Median Peak Detecting Analog Signal Processor for Hard Disk Drive Servo,” IEEE Journal of Solid- State Circuits, Vol. 30, No. 4, April 1995. Co-author
- “A high-speed, low-power PRML read channel device.” IEEE Transactions on Magnetics, Vol. 31, No. 2, pp. 1186-1195, March 1995. Co-author

LECTURES

- Invited Lecture “Forensic Engineers as Expert Witnesses.” Bar Association of Lehigh County Continuing Legal Education Seminar, Allentown PA, October 29, 2021
- “Forensic Investigation of Electrical and Electronic Causes of an Industrial Equipment Failure.” National Academy of Forensic Engineers (NAFE) Conference, Providence, RI, July, 2021

- Invited Lecture “Professional & Forensic Engineering and Expert Witness Career Progression.” IEEE, Region 6, Foothill Section, CA, January 2020
- “Forensic Engineering Analysis of a Swimming Pool Electric Shock Injury.” National Academy of Forensic Engineers (NAFE) Conference, San Diego, CA, January 2020
- “Forensic Engineering Analysis of Video Screens for a Business Dispute over Requirements and Specifications.” National Academy of Forensic Engineers (NAFE) Conference, Buffalo, NY, July 2018
- “Forensic Engineering Analysis of the Alleged Failure of an Emergency Vehicle Traffic Light Preemption System.” National Academy of Forensic Engineers (NAFE) Conference, Phoenix, AZ, January 2018
- “Forensic Engineering Analysis of Test Equipment Manufacturing Capability in a Business Purchase Dispute.” National Academy of Forensic Engineers (NAFE) Conference, Atlanta, GA, July 2017
- “Forensic Engineering Analysis of Quadcopter Drone Personal Injury.” National Academy of Forensic Engineers (NAFE) Conference, New Orleans, LA, January 2017
- "Introduction to Intellectual Property and Patents." Guest lecturer for Lehigh University Senior Project Class, Bethlehem, PA, September 2016
- “Mixed-Signal UVM Demonstration using Real-Number Models and System Verilog.” CDNLive Conference, Boston, MA, September 2015
- “A Systematic Approach to Creating Behavioral Models.” CDNLive Conference, Silicon Valley, CA March 2015
- Invited Lecture “Consulting as a Solid-State Circuits Electrical Engineer – Panel Discussion.” IEEE Lehigh Valley Section Solid State Circuits Society Technical Meeting, November 2013
- 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
- Invited Lecture “An Overview of Mixed-Signal IC Verification with Behavioral Models.” IEEE Princeton Section, Solid-State Circuits Society Chapter Technical Meeting, December 2010
- Lecture in conjunction with poster exhibit: “High-level RF Behavioral Models with Time-Domain Noise.” Infineon Technologies Communication Tech Days Conference, 2008
- Lecture to accompany slideshow 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: “Using Class D digital to analog conversion to create signal-tracking power rails for a Class AB audio amplifier.” Audio Engineering Society Conference, 2004