

Rafael J. Betancourt

819 Creekside Place • Santa Clara, CA 95051-5296
(240) 359-7226 voice/fax • resume@betasoft.org

INDUSTRIAL EXPERIENCE

SIXTEEN YEARS OF EXPERIENCE AS A DIGITAL/ANALOG CMOS ENGINEER WITH OVER 10 TAPEOUTS. EXPERIENCED IN COMPLETE PRODUCT CYCLE, FROM INITIAL CONCEPTION THROUGH DESIGN, VERIFICATION, FABRICATION & TESTING.

- 3/02 – present **Senior Analog Designer. *Synaptics, Inc., San Jose, Calif.***
Designed analog circuits for low-power, low-cost capacitive and resistive sensing ASICs. Developed specifications for advanced mixed-signal capacitive sensing ASICs. Designed low-power oscillators and interfaced with layout contractor for post-layout verification. Technical lead responsible for project management; supervised and mentored junior designers and layout/mask design contractors. Technical representative to the Mobile Advisory Council and Trusted Computing Group.
- 7/99 – 10/01 **Senior Mixed-signal Design Engineer. *Innovative Semiconductors, Inc., Mountain View, Calif.***
- **USB 2.0:** Designed 480Mb/s analog transceivers for USB 2.0 including cable driver, receiver, squelch detector, and clock recovery DLL in TSMC's 0.25um and 0.18um CMOS processes. Wrote specifications for 480MHz PLL clock synthesizer and interfaced with PLL design contractor for post-layout verification and performance characterization. Supervised two junior analog designers and layout/mask design contractor.
 - **IEEE-1394:** Performed analog verification of 400Mb/s serial transceiver PHY using Mentor's Accusim simulator. Developed scripts in AMPLER to automate analog verification (PVT). Assisted with DRC and LVS of 1394 PHY chip in TSMC's 0.35um CMOS. Bench-tested, troubleshot, and characterized 1394 PHY. Assisted with porting of IEEE-1394 PHY to UMC's 0.18um CMOS.
- 6/93 – 10/93 **Architecture Verification Engineer. *Sun Microsystems Inc., Sunnyvale, Calif.***
Architecture verification of the UltraSPARC V.9 64-bit superscalar processor. Defined and implemented Architecture Verification to certify compliance with the SPARC V.9 specification.
- 6/92 – 9/92 **Digital Verification Engineer. *Silicon Graphics Inc., Mountain View, Calif.***
Performed functional verification of a high-performance 80K-gates I/O-DMA controller gate array. Assisted with prototype development and debugging of the R4400-based Onyx RISC multiprocessing graphics workstation.
- 6/91 – 12/91 **Micro-architecture Verification Engineer. *Intel Corp., Santa Clara, Calif.***
Architecture verification of the *Pentium* processor using Quickturn's Rapid Prototyping System. Implemented and debugged Pentium's caches using Quickturn's RPMs. Designed and built a Pentium prototype that ran successfully MS-DOS, Windows, UNIX and various applications in a PC environment.
- 7/87 – 9/90 **Member of the Technical Staff, MTS-I. *Hughes Aircraft Company, El Segundo, Calif.***
- **Electro-Optical & Data Systems Group.** Responsible for physical design and verification of a 5.2K-gates (41k transistors) 160MHz image processing chip (FIR filter) using Bell Labs' GaAs HEMT technology. Contributed to the development of HCAD - a toolset for GaAs LSI and VLSI design. Performed modeling and simulation of a bipolar switching power supply IC using Analogy's Saber.
 - **Industrial Electronics Group, *Torrance, Calif.*** Developed millimeter-wave (Ku-Band) Traveling Wave Tube (TWT) amplifiers. Designed and developed tuning fixture for production testing of 94GHz TWT amplifiers. Performed high frequency microwave testing and troubleshooting of TWTs.
 - **Radar Systems Group.** Performed technical support for the F-15 radar's APG-70 Transmitter Logic/Synchronizer module. Investigated and solved field problems with the transmitter power supply. Developed fault table for Receiver/Exciter Unit built-in test.
- 6/83 – 7/83 **Engineering Assistant. *Center for Energy and Environmental Research, San Juan, Puerto Rico.***
Hardware construction and assembly language programming for DataNet, a microcomputer-based network of weather and seismic data acquisition stations.
- 6/83 – 7/83 **Software Developer. *A. Krans & Associates, Inc., San Juan, Puerto Rico.***
Developed a check register program using CBASIC for a CP/M microcomputer. Wrote over 1000 lines of code.

CONSULTING EXPERIENCE

ACTIVELY INVOLVED IN TECHNOLOGY CONSULTING FOR OVER A DECADE, PARTICIPATING IN THE CONCEPTION, DEVELOPMENT AND EVALUATION OF SEVERAL ELECTRONIC PRODUCTS. PARTICIPATED IN ALL ASPECTS OF PRODUCT DEVELOPMENT INCLUDING BRAINSTORMING, PROTOTYPING, INTELLECTUAL PROPERTY ISSUES, MANUFACTURABILITY, TESTABILITY, SALES AND MARKETING.

- 1/99 – 9/00 **Principal. Zamora Medical Instruments, San Juan, Puerto Rico.**
A sole proprietorship dedicated to product development, manufacturing, sales and marketing of medical devices to Latin America. Designed, and implemented a fully e-commerce enabled website for X-Caliper, including shopping cart and on-line credit card authorization and settlement.
- Assisted the Mexican Institute of Astrophysics, Optics and Electronics (INAOE) with fabrication of ABS plastic enclosures for hearing aid device (HearMex). Interfaced with injection-molded plastic vendors and established web site for project management.
- 11/98 – 11/99 **General Partner. Betasoft Consulting Group, Menlo Park, Calif.**
A partnership dedicated to the design and maintenance of web sites for commercial customers. Specialized in database and multi-lingual solutions. Used PageMill, FileMaker Pro and CDML (Claris), to implement a database-driven web site and catalog for Task2, Inc., a San Carlos, Calif., manufacturer and supplier of ergonomic computer furniture and accessories.
- 8/99 – 9/99 **Mixed-signal Consultant. Celeritek, Inc., Santa Clara, Calif.**
Analyzed erratic behavior of PLL synthesizer and traced problem to noise injection from PIC microcontroller. Reversed engineered firmware to correct offending behavior.
- 7/97 – 10/98 **IC Design Consultant. Pennie & Edmonds, LLP, Palo Alto, Calif.**
Analyzed technical patents for infringement, and reviewed technical documents to elucidate and explain operation of complex digital ICs to legal staff. Worked closely with attorneys to prepare for patent application filing and infringement litigation. Specialized in all aspects of digital ASIC intellectual property.
- 7/96 – 5/99 **Hardware Design Consultant. Eisenlohr Technologies, Inc., Davis, Calif.**
Designed a portable battery-operated instrument used to measure X-ray films (X-Caliper). Designed all digital, analog and power supply circuits for X-Caliper. Design was based on 68HC11, custom LCD's, keypad, EL-backlighting, and triple regulated power supplies running off three AA batteries. Incorporated novel inclinometer circuit based on MEMs accelerometers. Participated in all aspects of product development for X-Caliper.
- 1/96 – 3/97 **RF Engineer. Jefferson Laboratories, Inc., Palo Alto, Calif.**
Fabricated prototypes, tested, and performed experimental research in antennas for biotelemetry under a NASA contract. Developed experimental technique for measuring performance of implantable telemetry link. Performed modeling of electrically short loop antennas for biotelemetry. Assisted in development of biotelemetry antennas for the Rodent Advanced Flight Habitat (RAHF) flown in the Space Shuttle in May 1998.
- 9/94 – 12/95 **Hardware Design Consultant. SmartPad, Inc., San Francisco, Calif.**
Designed a portable battery-operated laptop computer for educational use. Designed all digital, analog and power supply circuits for PowerPad product based on x86 processor using embedded MS-DOS and Datalight's ROM-DOS. Participated in all aspects of product development for PowerPad including product definition, circuit design, prototyping, integration, assembly language programming, BIOS/DOS configuration and troubleshooting.
- 9/90 – 6/96 **Principal. Betasoft Computers, Menlo Park, Calif.**
Custom-built PC systems to customers' specifications. Sales and service of Macintosh computer upgrades and peripherals. Specialized in Point-of-Sale (POS) systems using SCO UNIX (x86 platform), Synchronics' POS, and RealWorld accounting software.
- Designed, configured, installed, maintained and serviced three multi-user, PC/UNIX-based POS systems for Franmara's Inc., Salinas, Calif. Supported 10 cash registers with barcode scanning and printing, and fully integrated credit card authorization and settlement.
- 10/87 – 9/90 **Principal. Betasoft Computer Products, Hawthorne, Calif.**
Owner of sole proprietorship dedicated to the assembly, sales and service of IBM-PC compatible computers and peripherals. Custom-built PC systems to customers' specifications.

EDUCATION

RIGOROUS ACADEMIC TRAINING IN CMOS INTEGRATED CIRCUIT DESIGN

- Expected 8/04 **Engineers in Electrical Engineering, Stanford University, Stanford, Calif.**
Emphasis in Circuits, Architecture, VLSI & low-power CMOS radio frequency circuits. Additional courses in Engineering Management, Entrepreneurship, and Intellectual Property Law. Designed, built, and tested analog instrumentation for biopotential recordings from implantable microelectrode array neural interface. Supervised independent research of Masters' students in PLL design, low-power ADC and low-power RF.
- Thesis: Injection-locked ring oscillator frequency dividers. Advisor: Thomas H. Lee
 - Experience with CMOS ring oscillator VCOs (phase noise theory), PLL, super-regenerative receivers, and injection-locked frequency dividers.
- 8/87 – 5/89 **MSEE, University of Southern California, Los Angeles, Calif.** Specialized in analog and digital IC design.
- 8/83 – 5/87 **BSEE, University of Puerto Rico, Mayagüez, Puerto Rico.** Completed a 5-year program in 4 years. Graduated *magna cum laude* with a specialization in electronics. GPA: 3.75/4.00

SHORT COURSES

PROFESSIONAL TRAINING IN CMOS, MIXED-SIGNAL, AND RF CIRCUITS

- **RF IC Design for Wireless Communication Systems, MEAD Microelectronics, Inc., San Francisco, Calif., April 22-26, 1996.**
- **Presenting Data and Information, Edward R. Tufte, Palo Alto, Calif., July 24, 1995.**
- **Practical Aspects of Analog & Mixed-mode IC Design, Oregon Center for Advanced Technology Education, Portland State University, Portland, Oregon, July 10-14, 1995.**
- **Logic Synthesis 2 Workshop, Synopsys, Inc., Mountain View, Calif., March 1992.**
- **Saber Simulator Training, Analogy, Inc., Newport Beach, Calif., May 15-18, 1990.**
- **IC Design: Place & Route, Cadence Design Systems, San Jose, Calif., October 27, 1988.**

TEACHING & ACADEMIC EXPERIENCE

EXTENSIVE TEACHING EXPERIENCE IN ACADEMIC AND LAY ENVIRONMENTS

- 4/92 – 12/92 **Head Teaching Assistant. Stanford University, Stanford, Calif.**
Teaching and grading of the Advanced Analog Electronics (EE-122) laboratory course. Developed two new experiments to measure op-amp parameters and non-ideal behavior. Wrote PSpice quick reference card for students, and edited lab newsletter. Assisted students with design, fabrication, and troubleshooting of final projects.
- 9/90 – 4/92 **Course Assistant. Stanford University, Stanford, Calif.**
Tutoring of minority students in undergraduate Electrical Engineering classes. Gave seminars at local middle schools, teaching 7th and 8th graders how computers work, assembling an IBM-PC clone in the classroom.
- 4/88 – 7/90 **Lecturer. The Information Exchange, Los Angeles, Calif.**
Taught evening course no. 238, "Build, improve and repair your computer," that showed ordinary people how to assemble and upgrade IBM-PC compatible computers.
- 1/87 – 5/87 **Teaching/Research Assistant. University of Puerto Rico, Mayagüez, Puerto Rico.** Taught the INEL-4212 Electronics laboratory course. Developed experiments introducing fiber optics to the curriculum. Developed assembly programs for TMS32010 DSP board (IBM-PC platform) for a pattern recognition project.

PUBLICATIONS

- **1-GHz and 2.8-GHz CMOS Injection-locked Ring Oscillator Prescalers, Symposium on VLSI Circuits, June 14-16, 2001, Kyoto, Japan.**
- **CMOS VCOs for Frequency Synthesis in Wireless Biotelemetry, International Symposium on Low Power Electronics**

and Design, August 10-12, 1998, Monterey, California.

- **Low Phase Noise CMOS Ring Oscillator VCOs for Frequency Synthesis**, 2nd International Workshop on Design of Mixed-Mode Integrated Circuits, July 27-29, 1998, Guanajuato, Mexico.
- **A Low Power Frequency Synthesizer for Wireless Biotelemetry**, 33rd. International Telemetry Conference, October 27-30, 1997, Las Vegas, Nevada.
- **A 1.5mW, 200MHz CMOS VCO for Wireless Biotelemetry**, First International Workshop on Design of Mixed-Mode Integrated Circuits and Applications, July 28-30, 1997, Cancun, Mexico.
- **Low-Cost, High-Performance Multi-Channel Amplifier for Extracellular Recording from Microelectrode Arrays**, submitted to the Journal of Neuroscience Methods, 1994.
- **A High-speed GaAs Transversal Filter Circuit for Clutter Rejection Systems**, SPIE's Tech. Symp. Optical Eng. & Photonics in Aerospace Sensing, April 1990.
- **Text-to-speech Voice Synthesis for the Spanish Language**, Proc. 34th Int'l Science & Engineering Fair, 1983.
- **Pulse Width Modulation as Speed Control in Radio Control Systems**, Proc. 33th Int'l Science & Engineering Fair, 1982.

PRESENTATIONS & LECTURES

- **CMOS Injection-locked Ring Oscillator Frequency Dividers**, Texas A&M University, College Station, Texas. Lecture given on March 29, 2001.
- **A Low-power Frequency Synthesizer for Wireless Biotelemetry**, Texas A&M University, College Station, Texas. Lecture given on October 28, 1997.
- **Engineering Graduate Studies at Stanford University**, University of Puerto Rico, Mayagüez, Puerto Rico. Lecture given on September 19, 1995.
- **Telemetría y Sensores Biológicos**, University of Puerto Rico, Mayagüez, Puerto Rico. Lecture given on October 25, 1994.
- **Telemetría y Sensores Exóticos**, Universidad Veracruzana, Xalapa, Veracruz, Mexico. Lecture given on June 10, 1994.
- **Pentium and Power PC – An Architectural Comparison**, University of Puerto Rico, Mayagüez, Puerto Rico. Lecture given on November 27, 1993.

ENGINEERING TOOLS, LANGUAGES, AND OTHER SKILLS

- CAD: Cadence (Spectre, Spectre RF, Analog Artist, Aptivia, Virtuoso, Place&Route, Dracula & Assura DRC/LVS) & Mentor Graphics (Design Architect, Accusim, IC Station), Intel's HDL, Verilog and Synopsys, Tektronix ADS, SUE, Magic, Protel (Schematics and PCB), OrCAD (Schematics)
- Processes: TSMC 0.18/0.25/0.35um, UMC 0.18/0.25/0.50um, National 0.24um, HP 0.5um CMOS
- Simulators: Spectre, Eldo, HSpice, TekSpice & Saber
- Standards: IEEE-1394 (Electrical/PHY), USB 2.0 (Electrical), IEEE-754
- Languages: Perl, Maple, Matlab, Ample (Mentor), C, C++, BASIC, FORTRAN & Pascal, Assembly (MIPS, Sparc, x86, 68k, 68HC11, PIC, Z80, 6502); some Skill (Cadence), Lisp and Ada
- Web: PHP, JavaScript, HTML 4.0, MySQL, Dreamweaver, Fireworks, Apache
- Operating Systems: Windows, Mac OS, Solaris, Linux, Aegis (Apollo), CP/M, UCSD-Pascal, TRSDOS

AWARDS & SCHOLARSHIPS

- NASA-Ames Research Center ; Graduate Training Grant 1995-98
- National Consortium for Educational Access, Inc. Fellowship, 1994-97
- General Electric Foundation; Faculty for the Future Fellowship 1993-94
- Hughes Masters' Fellowship; 1987-89
- Tau Beta Pi Engineering Honor Society; 1987
- Phi Kappa Phi National Honor Society; 1986
- Engineering Dean's List; 1985, 1986
- National Dean's List Award; 1985, 1986
- International Science & Engineering Fair (ISEF), finalist 1983, 1982; IEEE Computer Society ISEF 2nd Math & Computers Award 1983; US Navy ISEF 2nd Math & Computers Award 1983
- Puerto Rico Junior Science & Humanities Symposium; top five finalist, 1983
- Puerto Rico Junior Academy of Science Symposium; top ten finalist, 1983

MEMBERSHIPS & AFFILIATIONS

- Institute of Electrical and Electronics Engineers (IEEE); IEEE Solid-state Circuits Society, student member
- IEEE-Stanford Student Chapter, Vice-President 1993-94
- Stanford Society of Chicano/Latino Engineers and Scientists (SSCLES), student member 1990-98
- Society of Hispanic Professional Engineers (SHPE), student member 1990-98

COMMUNITY SERVICE

- 9/95 **University of Puerto Rico, Mayagüez Campus, Mayagüez, Puerto Rico.** Recruitment visit encouraging Puertorrican students to apply to Stanford's graduate programs in engineering.
- 10/94 **University of Puerto Rico, Mayagüez Campus, Mayagüez, Puerto Rico.** Recruitment visit encouraging Puertorrican students to apply to Stanford's graduate programs in engineering.
- 5/94 **Stanford Society of Chicano/Latino Engineers & Scientists (SSCLES) First Annual Engineering Day, Stanford University, Calif.** Gave seminars to high school students on how computers work, assembling an IBM-PC clone in the classroom.
- 2/94 **Society of Hispanic Professional Engineers (SHPE), National Career Conference, Austin, Texas.** Represented Stanford at the Job Fair encouraging minority students to apply to Stanford's graduate programs in engineering.
- 11/93 **University of Puerto Rico, Mayagüez Campus, Mayagüez, Puerto Rico.** Recruitment visit encouraging Puertorrican students to apply to Stanford's graduate programs in engineering.
- 10/93 - 5/94 **Volunteer Computer Coordinator, St. Elizabeth Seton School, Palo Alto, Calif.** Teach children K-8 grade how to use Apple-II computers. Helped configure, repair, and maintain more than 12 computers in the classroom.
- 10/93 - 5/94 **Vice-President IEEE Stanford Student Chapter, Stanford University, Calif.** Organized speaker series, conference field trip, and represented the student chapter at the Santa Clara Valley section meetings.
- 9/93 **National Hispanic Scholarship Fund, Western Region Review Committee.** Volunteer reviewer of scholarship applications. Evaluation and ranking of applicants to scholarship program.