Allan C. Ecker

FLEXIBLE, CREATIVE, & ACCOMPLISHED DESIGNER FOR HARDWARE & SOFTWARE

360.340.4042 | github.com/dr-ecker | allan@AllansEEPage.com

PROFILE

Hardware and Software Engineer with Outstanding Skills in Digital Signal Processing, Embedded Engineering Including Printed Circuit Board Fabrication and Integrated Circuit Design

Results oriented, resourceful, and enthusiastic Engineering Professional with 5 years of well-rounded experience in contributing to research, design, and knowledge advancement in industry. Expert problem solver with proven track record for design success and improving analytical and operational processes. Excellent design skills in multiple fields combined with strong abilities to communicate and implement solutions.

Technical Skills

Digital Signal Processing:	Spectral Analysis, Filter Design, and System Analysis using Matlab, C, and Verilog. Publications in ITC 2012 and VST 2014 concerning DSP techniques for integrated Built-In Self-Test systems.
Embedded Engineering:	Hardware Prototyping of PCB with Altium Actuation: stepper and gear motors, thermal heaters, Proportional Integral Differential control of heater/thermocouple Sensors: 100Watt RF Monitoring, mA-scale current monitoring and oscilloscope front-end, optical, thermal, and RF detectors. Design for hostile RF environments such as near 100Watt, 1GHz sources Board Bring-Up and Software Design: Of custom AVR and MSP-based boards via ISP and interfacing TI Code Composer, IAR Workbench and AVRDude. Complete, operational hardware and software designs including CNC Additive Manufacturing (3D Printing) Machines, Mobile Robotics Platforms, Wireless Power Transmission Systems and Electronic Musical Instruments.
Integrated Circuits:	Analog and Digital Circuit Design on IBM SiGE BiCMOS and TSMC ASICs and Altera FPGAs. Integrated circuit design using Cadence ICFB, HSPICE, Berkeley SPICE, Monte Carlo and HSMC, Verilog, VerilogA, System Verilog Fault Tolerance, Fault Coverage, and Interference Detection with Built-In Self-Test; Modeling Interconnect of RF Digital Communications (designing with linear and non-linear RF blocks) Subcircuit design including ADC, DAC, Mixers, PLL, LNA, TDC, Triggers, SRAM, BIST core, JTAG, CPU, MUX, DMUX, Operational Amplifiers, and Filters.
Software Development:	Scripting: Asset processing with Python, build tooling with GNU make, image processing in Python Image Library Applications: Live Data Visualization with Java, Color Visualization with PIL Low Level: Software drivers using device tree, LKM and Virtual Serial Ports, Embedded software, bare metal and with RTOS, frameworks including Atmel AVR (Arduino and standalone), ARM (TI Stellaris, Raspberry Pi, and Beaglebone), and TI MSP (RF detectors and monitoring equipment)
Programming Languages:	Primary: C, Python, Matlab and Verilog Secondary: ARM Assembly, C++, Java, LabView and BASH Some use: Perl, LiSP, HTML5/Javascript, Lua and x86 Assembly IDEs including VSCode, IAR Workbench, and TI Code Composer Source control using Git or SVN

Professional Experience

Content Creator **2017 – Present**

Allan's EE Page | Seattle, WA

Currently in development: a multi-track set of training materials for undergraduate and graduate level courses in Digital Signal Processing, Embedded Engineering and Integrated Circuit Engineering. Now available on the website allanseepage.com:

- **Verilog Tutorials** Using the open source tools Icarus Verilog and GTKWave to illustrate the advantages of using a lightweight digital simulation in lieu of full SPICE simulations and provide training for digital engineers
- **Course Notes** on nonlinear silicon devices such as polysilicon resistors, diodes and MOSFETs.

A course regarding a practical approach to nonlinear integrated circuits is currently in development, along with materials regarding a wide variety of topics including embedded development and digital signal processing.

Lecturer **2014 – 2017**
UNIVERSITY OF WASHINGTON | Seattle, WA

Taught undergraduate courses in the Engineering Department. Provided tutoring or support for graduate and undergraduate students. Courses included:

- **Fundamentals of Electrical Engineering** (Circuit and Systems Concepts, Resistors, Sources, Capacitors, Inductors, And Operational Amplifiers, etc.)
- **Circuit Theory** (Circuit Analysis with Sinusoidal Signals, Frequency Response, Power and Energy)
- **Devices and Circuits I & II (**Circuit Design, Bipolar Transistors, Linear Circuit Applications)
- **Digital Circuits and Systems** (Digital Computer Systems, Logic, Boolean Algebra)
- **Design of Digital Circuits and Systems** (Modeling Complex Digital Systems with Verilog)
- **Introduction to Embedded Systems** (Specification, Design, Development, and Test of Embedded System Software)
- **VLSI I, II, and III: Digital Integrated Circuit Design** (Design, layout, and Layout-vs-Schematic checking of digital IC)

Designed and implemented a new course on Embedded Linux. Students developed software that ran on Yocto and Debian Linux, interfaced hardware and developed custom drivers, and compiled and installed kernel modules.

Mentored many student projects during this time, including:

- **UW Hyperloop:** Provided guidance and support to the controls and power system teams. A large team (30+) of undergraduates bootstrapped themselves with no official university support in 2016 to create the university's first pod for SpaceX's Hyperloop competition in Hawthorne California. The controls team was instrumental in this rookie team achieving a top-ten ranking against competitors like MIT and WARR. Aided in development of communications, power and stability management systems.
- **Husky Robotics RoboMasters:** Mentored students at a variety of stages in designing and fabricating a complex robotics platform including power systems and embedded software.
- **Drone Control:** Students constructed a motion detecting drone capable of detecting movement of a user employing OpenCV, Bluetooth, and an accompanying Android app. Students used WireShark to decode the communications of the system.
- **VR Optimizations:** Students used a prototype Oculus Rift to develop a 3D pipeline with a then-novel approach to frame delay management using real time programming techniques

Co-Founder / Software Engineer (Part-Time) **2014 – 2015**
HPP Games, LLC | Seattle, WA

Co-Created a humorous card game with an original play style and strong niche appeal.

- Developed a content management system leveraging Python and the Python Image Library to automatically assemble print-ready assets.
- Supported the graphic artist of the team with rapid updates to mission-critical software.
- Closed in 2015 with substantial net payout.

Engineering Intern, Memory Core **2011 – 2012**
BROADCOM | Federal Way, WA

Engineered memory subcircuits for use in the integrated circuits manufacturing process. Prepared test programs for complex memory circuits using Verilog. Hand-tuned logic gates for optimized delay as needed. Analyzed overall yield situation regarding SRAM.

- Simulated and analyzed yield in SRAM with importance sampling and Solido's High-Sigma Monte Carlo tools. Developed Verilog code to ensure that all necessary sub-circuits were utilized and valid. Generated statistics on memory usage through custom Monte Carlo analysis.
- Evaluated yield issues caused by process variation in SRAM sub-circuits of internet routing hardware. Connected process variation to overall final yield of SRAM circuits.
- Hand-tuned logic gates for optimized delay, resulting in improved performance of approximately 20%.

Research Assistant **2009 – 2010**
INTEL RESEARCH LABS | Seattle, WA

Researched innovative applications of wireless power transmission systems with the objective of inventing new ways to charge laptop computers wirelessly. Delivered demonstrations and design refinements to the principal researcher.

- Wrote firmware code in C, connected to applications written in Java, MatLab and LabView, operating in framework using communication standards RS232 and TCP/IP to perform a frequency sweep on emitted energy and evaluate the full waveform of the energy reflecting off of the load for computing

the device's S parameters. The resulting program could self-adjust the frequencies of wirelessly transmitted power to optimize power transfer efficiency.

- Analyzed methods for boosting the radiant energy captured by client nodes of a wireless power solution, created working demonstrations of the power transmission technology, and documented work for the benefit of future research. Successfully demonstrated the possibility of capturing 100 watts of energy wirelessly transmitted from a base station, communicating over local wireless internet to tune RF output frequency. Avoided issues involving breakdown of a standard network analyzer to avoid damage to expensive electronics.
- Designed and fabricated equipment for monitoring the electrical properties of systems while they were being stimulated with 100 watts of energy. Utilized a hybrid of existing instruments (antennas, transmit/receive coils, power harvesting/monitoring boards, a Vector Network Analyzer, etc.) to reduce costs and speed development time of the wireless resonant energy link (WREL). Utilized a systems integration approach to refine designs.

Engineer II **2005 – 2008**
TEKTRONIX | Beaverton, OR

Performed vital design engineering in support of testing for integrated circuits. Ensured smooth functioning of testing architecture setup for quality control. Design engineering position. Designed Phase-Locked Loops (PLLs) to stabilize and modulate signals. Designed necessary subsystems such as a Dual Level Schmitt trigger. Utilized Bipolar Transistor Logic.

- Designed and modeled integrated circuits and performed IC interconnect analysis for high-speed mixed signal equipment. Facilitated closure between field simulator and circuit simulator models.
- Created built-in self-test designs for improved efficiency of high-end test equipment, much of which drives current consumer-facing technology.

Education

Doctor of Philosophy, Electrical Engineering (EE) **2014**
UNIVERSITY OF WASHINGTON | Seattle, WA

Dissertation: "A Digital Method for Phase Noise Measurement"

In this work, a Digital Signal Processing (DSP) approach relying on Infinite Impulse Response Filters (IIR) implemented with fixed-point math is used to replace some of the signal evaluation properties of the Fast Fourier Transform (FFT), resulting in low-cost test capabilities for Integrated Circuits.

Master of Science, Electrical Engineering (EE) **2005**
UNIVERSITY OF WASHINGTON | Seattle, WA

Master's Thesis: "Online Calibration of Sigma Delta Converters"

In this work, the topology of Sigma Delta DACs is exploited to inject calibration signals without introducing noise to the output. A technique of simulated annealing is used to calibrate coefficients and reduce overall final error.

Bachelor of Science, Electrical Engineering (EE) **2003**
UNIVERSITY OF WASHINGTON | Seattle, WA

Publications

A. Ecker, K. Blakkan, M. Soma, "A Digital Method for Phase Noise Measurement", International Test Conference, 2012
Describes the use of Digital Signal Processing (DSP) to perform evaluations of radio-spectrum signals (Wi-Fi, etc.)
A. Ecker, M. Soma, "A Method for Phase Noise Extraction from Data Communication", VLSI Test Conference, 2014
Evaluates high-frequency digital signals such as USB, HD TV (HDMI) and networking standards for radio-spectrum signals.

Side Projects

FixedPoint (2014): DSP demo in fixed-point math. Constructed to show IIR filters can cope with quantization errors. Demo contains signal generators and a narrowband 2-tap IIR filter. The library demonstrates both a working IIR and failure modes caused by quantization and overflow errors. [github.com/dr-ecker/fixedpoint]

CardMachine (2014): A content management system for building print-ready assets from text markup and graphic assets. Enables the manufacture of card games without much individual attention paid to cards.

SimpleSlice/SuperSkein (2011): SimpleSlice is a low-complexity tool for 3D printing. Because it eliminates infill steps, it can create tool paths for fused deposition modeling (FDM) 3D Printers. Written in Java, it also offered performance improvement over then-state-of-the-art SkeinForge, at least on limited tasks.

AVR (2008): Assorted embedded software projects using microcontrollers including RTOS, robotics, & simple music generation in C. [github.com/dr-ecker/AVRProgs]