Jeffrey Alexander Cool

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ENGINEERING INTERESTS

Mixed signal IC design and CMOS layout, PCB layout, Modern and Classical control systems design, Power electronic system design, Nonlinear and current-mode analog design for VLSI, Audio electronics, Digital system design with VHDL/Verilog, Technical writing.

EDUCATION

B.S. in Electrical Engineering from CSU Long Beach
 Graduated Magna Cum Laude in June 2016
 Emphasis in Control and Microelectronics

RELEVANT COURSEWORK

Electronics: Mixed Signal IC design, Solid State Devices, Analog Circuits I & II, Power Electronics and Motor Control
Control: Classical Control, Digital Control, Modern Control Systems Design
Computation and Mathematics: Digital System Design, Microprocessor Principals and Applications, C++ Programming, Linear Algebra, Differential Equations, Probability and Stochastic Modeling, Electromagnetic fields

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WORK EXPERIENCE

NugenTech Inc: May 2017-Present
Electrical engineer at a tech startup producing consumer electronics.
Contact *Tim Kray: tim@nugen.io · (808)594-9698*
- Responsible for design/fabrication/verification of product prototypes and test equipment.
- Mixed signal and RF circuit design and PCB layout.
- SPICE modeling/simulation, analytical scripting (Matlab/Octave) and technical writing.
- CNC programming/tooling, copper and tin plating, SMD soldering.
- Design/implementation of automated test fixtures and analog instrumentation.

Self Employed Engineer/Assistant to Artists: March 2012 - May 2017
Design and fabrication of custom electronic and mechanical devices and tools for two artists
in the Los Angeles area.
Contact *Mariah Csepanyi: csepanyi@uci.edu · (562)761-4520*
- Concept to Product engineering – translation of artist's vision into usable devices.
- Designs include: programmable automated pipe organ, novel capacitive touch sensors, solenoid valve controllers, motor controllers, programmable lighting displays, temperature controlled foam cutting tools, audio system and transducer designs.
- Responsibilities also included the generation of 3D CAD drawings and technical writings used to demonstrate conformity to safety standards of certain art installations to aid in procuring spaces.

ACADEMIC PROJECTS

Control System for Tuning a Vibrating String: Fall 2014
A single string musical instrument with an electronically controlled slide.
- Digital PID compensator implemented in PBASIC, tuned using Ziegler/Nichols method.
- Frequency measurement with a handmade magnetic pickup, and op amp based analog signal conditioning circuit.
- Device amounts to the successful implementation of a classical tracking controller for a nonlinear plant.

Control of Inverted Pendulum with Fan Actuation: Spring 2015
State Space modeling and Design of LQR controller for a modification of the standard inverted
pendulum problem – a single input, double output situation.
- Analytical linearized system modeling and design of LQR SF controller.
- Simulation in Matlab and Simulink, and implementation on Atmel 32u4 in C.
- Design and fabrication of electronic measurement interface and packaging.

4 bit Charge Redistribution DAC: Design, Layout and Simulation: Fall 2015
Demonstration of CMOS layout techniques for a serial DAC. Layout designed in Microwind
in a $0.12\mu m$ CMOS process.
- Completely manual layout with Interdigitized MOS capacitors for improved matching.
- Use of pass transistor logic and dynamic D-latches to minimize layout area.
- Characterization of linearity, gain error, and transient response including crosstalk.

ACADEMIC PROJECTS CONTINUED	**4 bit flash CMOS ADC Design, Layout and Simulation**: Fall 2015

4 bit flash CMOS ADC Design, Layout and Simulation: Fall 2015

A standard project to which I added some useful features. Layout designed in Microwind and DSCH in a 0.12μm CMOS process.
- Hybrid manual (for analog front end) and automatic (for priority encoder) layout.
- BSIM4 Simulation and characterization of signal integrity: DNL, INL, gain error, crosstalk.
- Minimum delay output buffer – cascade of inverters with progressively wider channels.
- ESD protection clamps on the inputs, constructed from parasitic diode structures.

FPGA based BLDC controller: Fall 2015

Design inspired by commercial BLDC controller. Commutation sequence determined using measurements of the time integral of the back EMF in the un-driven coils.
- Digital Logic System implemented on a Spartan3E FPGA in VHDL
- Analog measurement/processing circuit for calculating flux in undriven coils.
- Bilinear PWM open loop speed control.

PERSONAL PROJECTS

Design and Manufacture of Custom Ribbon Microphones: 2006-2011

I designed and built a series of velocity ribbon microphones for two audio engineers in Long Beach, CA.
- Original transducer designs, fabricated from various scrap materials.
- Trade off studies with various commercial and hand-made transformer designs.
- All by-hand metal and wood work.

Troubleshooting and Repair of Automotive Engine Control Module: June 2016

Diagnosed the source of a problem that was causing four injectors to remain in the on position using minimal tools.
- Exercise in extracting schematic from PCB using minimal measurements.
- Problem identified as failure of lower output stage transistors of a 7404 quad nor gate.
- Revived a non-op automobile, allowing it to pass CA emissions tests.

Control of "Flexible" Inverted Pendulum: July 2016

Investigated a variation on an inverted pendulum of n-segments in which actuation is applied at the union of the segments via servomotors.
- Modeling via Euler-Lagrange Equations of motion.
- Complete system modeling using hybrid approach involving signal flow graphs, transfer functions and state space representations.
- Verified Controlability, Observability for various measurement schemes.

Autonomous landing controller for a RC paraglider: March 2017

Designed for the CSULB USLI 2017 Aerospace team.
- Nonlinear digital controller written in C controls payload weight distribution using GPS location.
- Design of novel pulse-width comparator circuit for manual override subsystem.
- Exercise in robust control system design for minimally modeled plant.

Analog Circuit Design for Musical Signal Processors: April 2017-Present

A friend and I have been designing various guitar pedals and noisemakers with the goal of releasing a product in the near future.
- Analog and mixed signal design using mainly LTSpice and physical prototyping.
- Nonlinear designs include multipliers, VCOs, PLLs.

RELEVANT SOFTWARE TOOLS

- **Languages**
    C/C++, PBASIC, AVR & ARM Assembly, VHDL, VHDL-AMS, Verilog, SPICE
- **Analytical Tools**
    Matlab/Octave, Mathematica, Minitab
- **Design, Layout and Simulation**
    AutoCAD, Eagle, Microwind, DSCH, LTSpice, Simulink, Xilinx, hAMSter
- **Documentation**
    Excel, Word, LaTeX, html