

## Jeffrey Alexander Cool

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ENGINEERING INTERESTS	Mixed signal IC design and CMOS layout, Modern and Classical control systems design, Analog and TTL circuit troubleshooting and repair, Nonlinear analog circuits, Digital filters, Digital system design with VHDL/Verilog.	
EDUCATION	<b>B.S in Electrical Engineering from CSU Long Beach</b> Graduated Magna Cum Laude in June 2016 Emphasis in Control and Microelectronics	
RELEVANT COURSEWORK	<b>Electronics:</b> Mixed Signal IC design, Solid State Devices, Analog Circuits I & II, Power Electronics and Motor Control <b>Control:</b> Classical Control, Digital Control, Modern Control Systems Design <b>Computation and Mathematics:</b> Digital System Design, Microprocessor Principals and Applications, C++ Programming, Linear Algebra, Differential Equations, Probability and Stochastic Modeling, Electromagnetic fields	
WORK EXPERIENCE	<b>Tyler Sports, Inc:</b> June 2004 - May 2007 Customer Service and Maintenance for a batting cage in Lakewood, Ca. <i>Contact Kevin Tyler:</i> tbcjarr@gmail.com · (310)320-2243 <ul style="list-style-type: none"><li>• Sales of baseball related products and services.</li><li>• Mechanical maintenance of pitching machines.</li></ul> <b>Self Employed Engineer/Assistant to Artists:</b> March 2012 - May 2017 Design and fabrication of custom electronic and mechanical devices and tools for two artists in the Los Angeles area. <i>Contact Mariah Csepanyi:</i> csepanyi@uci.edu · (562)761-4520 <ul style="list-style-type: none"><li>• Digital system design and fabrication for lighting displays using AVR and PICmicro MCUs.</li><li>• Analog circuit designs including capacitive touch sensors and motor controllers.</li><li>• CAD drawings and technical writings.</li><li>• Fabrication of various specialized tools and jigs for cutting polystyrene, making gears, etc.</li></ul> <b>NugenTech:</b> May 2017-Present Electrical engineer working in development of Bluetooth enabled consumer electronic devices. <i>Contact Peter Nguyen:</i> peter@nugen.io · (714)261-3361 <ul style="list-style-type: none"><li>• Embedded programming of state machines in C for ARM Cortex M0 MCU.</li><li>• Design of audio amplifiers.</li><li>• PCB layout including integrated antenna design.</li></ul>	
ACADEMIC PROJECTS	<b>Control System for Tuning a Vibrating String:</b> Fall 2014 Tuning a vibrating string by varying its length with a motorized slide – a nonlinear SISO system, controlled with linear feedback. <ul style="list-style-type: none"><li>• Digital PID compensator implemented in PBASIC.</li><li>• Frequency measurement using a magnetic pickup I made.</li><li>• Successful implementation of a tracking controller for a nonlinear plant.</li></ul> <b>Control of Inverted Pendulum with Fan Actuation:</b> 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. <ul style="list-style-type: none"><li>• Analytical system modeling and design of LQR SF controller for a linearized model.</li><li>• System modeling in Matlab and Simulink, and implementation on Atmel 32u4 in C.</li><li>• Design and fabrication of electronic interface and packaging.</li></ul> <b>4 bit Charge Redistribution DAC: Design, Layout and Simulation:</b> Fall 2015 Demonstration of CMOS layout techniques for a serial DAC. Layout designed in Microwind in a 0.12μm CMOS process. <ul style="list-style-type: none"><li>• Completely manual layout with Interdigitized MOS capacitors for improved matching.</li><li>• Use of pass transistor logic and dynamic D-latches to minimize layout area.</li><li>• Characterization of linearity, gain error, and transient response including crosstalk.</li></ul>	

ACADEMIC PROJECTS CONTINUED	<b>4 bit flash CMOS ADC Design, Layout and Simulation:</b> Fall 2015 A standard project to which I added some useful features. Layout designed in Microwind and DSCH in a 0.12 $\mu$ m CMOS process. <ul style="list-style-type: none"> <li>Hybrid manual (for analog front end) and automatic (for priority encoder) layout.</li> <li>BSIM4 Simulation and characterization of signal integrity: DNL, INL, gain error, crosstalk.</li> <li>Minimum delay output buffer – cascade of inverters with progressively wider channels.</li> <li>ESD protection clamps on the inputs, constructed from parasitic diode structures.</li> </ul>
	<b>FPGA based BLDC controller:</b> 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. <ul style="list-style-type: none"> <li>Digital Logic System implemented on a Spartan3E FPGA in VHDL</li> <li>Analog measurement/processing circuit for calculating flux in undriven coils.</li> <li>Bilinear PWM open loop speed control.</li> </ul>
PERSONAL PROJECTS	<b>Design and Manufacture of Custom Ribbon Microphones:</b> 2006-2011 I designed and built a series of velocity ribbon microphones for two audio engineers in Long Beach, CA. <ul style="list-style-type: none"> <li>Original transducer designs, fabricated from various materials.</li> <li>Trade off studies with various commercial and hand-made transformer designs.</li> <li>All by-hand metal and wood work.</li> </ul>
	<b>Troubleshooting and Repair of Automotive Engine Control Module:</b> June 2016 Diagnosed the source of a problem that was causing four injectors to remain in the on position using minimal tools and no circuit diagram. <ul style="list-style-type: none"> <li>Exercise in extracting schematic from PCB using minimal measurements.</li> <li>Problem identified as failure of lower output stage transistors of a 7404 quad nor gate.</li> <li>Revived a non-op automobile, allowing it to pass CA emissions tests.</li> </ul>
	<b>Control of "Flexible" Inverted Pendulum:</b> 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. <ul style="list-style-type: none"> <li>Modeling via Euler-Lagrange Equations of motion.</li> <li>Complete system modeling using hybrid approach involving signal flow graphs, transfer functions and state space representations.</li> <li>Verified Controllability, Observability for various measurement schemes.</li> </ul>
	<b>Autonomous landing controller for a RC paraglider:</b> March 2017 Designed for the CSULB USLI 2017 Aerospace team. <ul style="list-style-type: none"> <li>Nonlinear digital controller written in C controls payload weight distribution using GPS location.</li> <li>Design of novel pulse-width comparator circuit for manual override subsystem.</li> <li>Exercise in robust control system design for minimally modeled plant.</li> </ul>
	<b>Analog Circuit Design for Musical Signal Processors:</b> 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. <ul style="list-style-type: none"> <li>Analog and mixed signal design using mainly LTSpice and physical prototyping.</li> <li>Nonlinear designs include multipliers, VCOs, PLLs.</li> </ul>
RELEVANT SOFTWARE TOOLS	<ul style="list-style-type: none"> <li><b>Languages</b> C/C++, PBASIC, AVR Assembly, VHDL, VHDL-AMS, Verilog, SPICE</li> <li><b>Analytical Tools</b> Matlab/Octave, Mathematica, Minitab</li> <li><b>Design, Layout and Simulation</b> AutoCAD, Eagle, Microwind, DSCH, LTSpice, Simulink, Xilinx, hAMSter</li> <li><b>Documentation</b> Excel, Word, L<sup>A</sup>T<sub>E</sub>X, html</li> </ul>