

# Matthew Spencer

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## EDUCATION

University of California, Berkeley. Berkeley, CA

Doctor of Philosophy in Electrical Engineering

Aug 2008-Aug 2015

Dissertation: "Design Considerations for Nanoelectromechanical Relay VLSI"

Advisor: Elad Alon

Massachusetts Institute of Technology, Cambridge, MA

Master of Engineering in Electrical Engineering

Jun 2007-Jun 2008

Bachelor of Science in Electrical Engineering with Minor in Materials Science

Sep 2003-Jun 2007

## EXPERIENCE

**Harvey Mudd College**, Claremont, CA

Jul 2014-present

Taught a total of 27 undergraduate courses, preparing new laboratory experiments for seven of them. Topics included radio frequency circuit design, analog circuit design, microprocessor applications, experimental engineering and introduction to systems engineering. Used modern teaching methods including flipped classrooms, project based learning and active learning. Advised undergraduate project groups working for external companies. Pursued research on nanomechanical switches, marine electronics and engineering education.

**Blue Cheetah Analog Design**, San Francisco, CA

Jul 2021-present

Senior design engineer role, responsible for behavioral modeling of a high-speed link PHY in an advanced process node. Wrote software for automating design process in Python.

**University of California Berkeley**, Berkeley, CA.

Aug 2008-Aug 2014

Designed digital circuits comprised of emerging microelectromechanical devices, taping out ten chips each in a different MEMS technology. Developed mixed-physics simulation model of MEMS relays to assist circuit design. Designed a wide variety of digital circuits including adders, memory arrays and novel sequential logic. Led test and characterization to reveal complicated device behaviors (catastrophic pull-in, ILD breakdown, etc.) that manifested at the circuit level. Designed probe station modifications, probe card interfaces and semiconductor parameter analyzer controls.

**Texas Instrument Digital Light Projection**, Plano, TX.

May 2012-Aug 2012

Wrote circuit-level simulation models for emerging MEMS devices that reduced simulation time from hours to seconds while still capturing complex dynamics. Wrote visualization software for a laser doppler vibrometer to assist in characterization of the devices.

**Intel Components Research**, Portland, OR

May 2011-Aug 2011

Wrote models and simulation scripts to integrate atomistic simulation of tunnel FETS with industrial tool flow. Used modelling results to compared performance of tunnel FET SRAM against CMOS SRAM.

**MIT Research Laboratory for Electronics**, Cambridge, MA

Sep 2006-Jun 2008

Designed transimpedance amplifier and data acquisition unit for imaging system based on optoelectronic fibers. Used the data acquisition unit to build a lensless camera. Explored chemical processes for connecting fibers to circuit boards.

**Analog Devices High Speed Interfaces Applications Engineering**, Wilmington, MA

Jun 2006-Sep 2006

Designed hardware, firmware and software for a USB-I2C interface used in HDMI multiplexer evaluation boards.

**A123 Systems**, Watertown, MA

Jun 2005-Sep 2005

Developed a protocol for using an inductively coupled plasma optical emission spectrometer to measure metal impurities in battery cathodes.

Used in-situ atomic force microscopy to select materials for self-assembling battery electrodes. Used impedance spectroscopy to characterize electrochemical cells.

## PUBLICATIONS

### **A Normalized Model of a Microelectromechanical Relay Calibrated by Laser-Doppler Vibrometry**

*Micromachines (Open Access Journal) 2022*

Jessica Marvin, Michael Jang, Daniel Contreras, Matthew Spencer

### **Low-Cost Underwater Ultrasonic Phased Array Research Platform**

*International Ultrasound Symposium 2022*

Tejus Rao, Alec Vercruyse, Rhea Zaverchand, Matthew Spencer

### **An Implementation of Competency-Based Learning in a Laboratory Focused Analog Design Course**

*American Society for Engineering Education Annual Conference 2022*

Matthew Spencer

### **Breakdown and Healing of Tungsten-Oxide Films on Microelectromechanical Relay Contacts**

*Journal of Microelectromechanical Systems 2022*

Ethan Falicov, Jessica Marvin, Alice Ye, Sergio Almeida, Daniel Contreras, Tsu-Jae King-Liu, Matthew Spencer

### **Engineering Identity, Slackers and Goal Orientation in Team Engineering Projects**

*American Society for Engineering Education Annual Conference 2021*

Yaqub Mahsud, Alexandra Loumidis, Kobe Rico, An Nguyen, Laura Palucki-Blake, Matthew Spencer

### **Measurement of the Effects of Interactive Questions in Lab Manuals on Learning**

*American Society for Engineering Education Annual Conference 2020*

Sabrina Griffith, Spencer Rose, Elaeonor Byrnes, Laura Palucki-Blake, Matthew Spencer

### **A Survey of the Proportion of Classes in Undergraduate Engineering Curricula that Include Labs**

*American Society for Engineering Education Annual Conference 2020*

Eleanor Byrnes, Yaqub Mahsud, Spencer Rosen, Matthew Spencer

### **Relating Level of Inquiry in Laboratory Instructions to Student Learning Outcomes**

*American Society for Engineering Education Annual Conference 2019*

Spencer Rose, Sabrina Griffith, Eli Byrnes, Steven Santana, Laura Palucki-Blake, Matthew Spencer

### **Evaluating Electromechanical Sequential Logic**

*Emerging Technology in Complementary Metal Oxide Semiconductors 2018*

Matthew Spencer

### **Erasing a Gender Gap in Performance in a Multidisciplinary Introductory Engineering Course.**

*Proceedings of the CoNECD Conference 2018.*

Nancy Lape, Christopher Clark, Lori Bassman, Matthew Spencer, Angela Lee, Erik Spjut, Albert Dato, Laura Palucki Blake, TJ Tsai

### **Integrating Theory and Hands-On Practice using Underwater Robotics in a Multidisciplinary Introductory Engineering Course.**

*Proceedings of the American Society of Engineering Education Conference, 2017.*

Nancy Lape, Lori Bassman, Christopher Clark, Albert Dato, Angela Lee, Matthew Spencer, Erik Spjut, Laura Palucki Blake

### **Exploitation of the Coffee-Ring Effect to Realize Mechanically Enhanced Inkjet-Printed Microelectromechanical Relays with U-Bar-Shaped Cantilevers.**

*Applied Physics Letters, 2014, Vol. 105, Iss. 26, pp. 261-271.*

Seungjun Chung, Muhammad Ahsan Ul Karim, Matthew Spencer, Hyuk-Jun Kwon, Costas P. Grigoropoulos, Elad Alon, Vivek Subramanian.

### **Recent Progress and Challenges for Relay Logic Switch Technology,**

*Very Large System Integration Symposium on Technology, 2012.*

Tsu-Jae King Liu, Louis Hutin, I-Ru Chen, Rhesa Nathanael, Yen hao Chen, Matthew Spencer, Elad Alon.

### **Multiple-Input Relay Design for More Compact Implementation of Digital Logic Circuits.**

*IEEE Electron Device Letters, 2012, Vol. 33, Iss. 2, pp. 281-283.*

Jaeseok Jeon, Louis Hutin, Ruzica Jevtic, Nathaniel Liu, Yen hao Chen, Rhesa Nathanael, Wookhyun Kwon, Matthew Spencer, Elad Alon, Borivoje Nikolic, Tsu-Jae King Liu.

### **Demonstration of Integrated Micro-Electro-Mechanical Relay Circuits for VLSI Applications.**

*IEEE Journal of Solid State Circuits, Vol. 46, Iss. 1, Jan. 2011.*

Matthew Spencer, Fred Chen, Cheng C. Wang, Rhesa Nathanael, Hossein Fariborzi, Abhinav Gupta, Hei Kam, Vincent Pott, Jaeseok Jeon, Tsu-Jae King Liu, Dejan Markovic, Elad Alon, Vladimir Stojanovic.

### **Analysis and Demonstration of MEM-Relay Power Gating.**

*Custom Integrated Circuits Conference, 2010.*

Hossein Fariborzi, Matthew Spencer, Vaibhav Karkare, Jaeseok Jeon, Rhesa Nathanael, Chengcheng Wang, Fred Chen, Hei Kam, Vincent Pott, Tsu-Jae King Liu, Elad Alon, Vladimir Stojanovic, Dejan Markovic.

### **Demonstration of Integrated Micro-Electro-Mechanical Switch Circuits for VLSI Applications.**

*International Solid State Circuits Conference, 2010.*

Fred Chen, Matthew Spencer, Rhesa Nathanael, Chengcheng Wang, Hossein Fariborzi, Abhinav Gupta, Hei Kam, Vincent Pott, Jaeseok Jeon, Tsu-Jae King Liu, Dejan Markovic, Vladimir Stojanovic, Elad Alon.

### **Exploiting Collective Effects of Multiple Optoelectronic Devices Integrated in a Single Fiber.**

*Nano Lett., 2009, 9 (7), pp 2630-2635.*

Fabien Sorin, Ofer Shapira, Ayman F. Abouraddy, Matthew Spencer, Nicholas D. Orf, John D. Joannopoulos and Yoel Fink.

## **PATENTS**

**AUTOMATIC PATH TRACKING FOR POWER MACHINES**

2022, US Patent App 17/739,690

## **RECENT PROJECTS**

### **12GHz Phased Array Test Signal Generation**

Managed team of undergraduate engineers in developing a phased array signal generator for testing MIMO receivers. Achieved 7ps of resolution channel-to-channel timing for signals from 100MHz-12GHz.

### **Multi-Use Single Coax Cable Development**

Managed team of undergraduates developing a multiplexer/demultiplexer board for an RF test stand that combined DC power, digital communication, intermediate frequency and local oscillator signals. Achieved 80dB isolation from 0-6GHz.

## **AWARDS**

2022	ASEE	Best paper award from Electrical and Computer Engineering Division
2017	ASEE	Best presentation and 2 <sup>nd</sup> best paper of First Year Division
2013	Berkeley EECS	Demetri Angelakos Award for Altruism
2012	Intel	Intel Fellowship
2011	ISSCC	Jack Raper Outstanding Technical Directions Paper
2011	Berkeley	Outstanding Graduate Student Instructor
2011	Berkeley EECS	Outstanding Graduate Student Instructor