

# Jim Salvia

jsalvia@stanford.edu ■ 795 Roble Ave, Apt. 6, Menlo Park, CA 94025 ■ (650) 353-0245

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## EDUCATION:

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### Stanford University, Stanford, CA

#### PhD in Electrical Engineering, Mar. 2010 (anticipated)

- Thesis: Interface Circuits and Temperature Compensation for Micromechanical Resonator Based Oscillators

#### MS in Electrical Engineering, Mar. 2008

- Ranked 1<sup>st</sup> / 160 in Stanford EE PhD Qualifying Exam (2006)
- National Science Foundation Graduate Research Fellow
- National Defense Science and Engineering Graduate Research Fellow
- Honorary Stanford Graduate Fellow

### Carnegie Mellon University, Pittsburgh, PA

#### BS in Electrical and Computer Engineering, Dec. 2004

- Undergraduate Research Symposium Award Winner 2001-2005
- Peer Tutor and Eta Kappa Nu Undergraduate Student Mentor

## PROFESSIONAL INTERESTS:

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- Micro-Electromechanical Systems (MEMS)
- Micromechanical resonators and oscillators
- Analog, RF, and mixed signal circuits
- Sensors and sensor interface circuits
- Microscale energy harvesting
- Implantable biomedical devices

## ACADEMIC EXPERIENCE:

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### Graduate Research Assistant

2006 - Present

Stanford University

Advisors: Dr. Thomas Kenny (Mech. Eng.) and Dr. Boris Murmann (Elec. Eng.)

Stanford, CA

- ▶ *Temperature Compensated MEMS Oscillators*
  - Developed printed circuit board interface circuits for high Q MEMS resonators
  - Designed micromechanical structure for thermal isolation and heating of MEMS resonators
  - Built phase lock loop based temperature compensation system with sub-ppm long term stability
- ▶ *High Gain Integrated CMOS Transimpedance Amplifiers for MEMS Resonator Interface*
  - Designed integrated oscillator electronics for high impedance MEMS devices
  - Used new architecture to achieve higher gain and lower noise than more traditional designs
- ▶ *Other MEMS Circuit and System Development*
  - Designed a differential low phase noise MEMS oscillator for a high Q ring resonator
  - Helped develop an acceleration compensation system for MEMS oscillators
  - Advised in the development and measurement of piezoelectric vibration energy harvesters
- ▶ *Wireless Power Delivery Systems*
  - Worked as consultant in the design of a wirelessly powered automobile accessory
  - Studied magnetic options for power delivery to biomedical implants
- ▶ *Student Advising*
  - Assisted non-native English speaking colleagues with papers and presentations
  - Mentored junior group members in our advisor's absence

### Research Assistant

2004 - 2005

Carnegie Mellon University

Advisors: Dr. James Bain, Dr. C. Patrick Yue, and Dr. James Hoburg

Pittsburgh, PA

- Developed tunable on-chip inductors with magnetic cores
- Deposited (sputtering) and patterned (photolithography) permalloy laminations for GHz operation
- Modeled magnetic recording media to investigate susceptibility of degradation from external magnetic fields

### Teaching Assistant

Spring 2005

Carnegie Mellon University

- Supervised student lab sections of 18-321 (Analysis and Design of Analog Circuits)
- Conducted lectures and review sessions in instructor's absence

Pittsburgh, PA

**INTERNSHIP EXPERIENCE:** \_\_\_\_\_

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| <b>RF Device Characterization Intern</b>   | Summer 2006 | <b>Atheros Communications</b><br>Santa Clara, CA     |
| <ul style="list-style-type: none"> <li>▪ Measured S-parameters and developed models of passive RF devices</li> <li>▪ Characterized and modeled CMOS transistors</li> <li>▪ Designed thermal noise based switched capacitor random bit generator for encryption applications</li> </ul> |             |  |
| <b>Signal Processing Intern</b>  | Summer 2003 | <b>Robert Bosch RTC</b><br>Pittsburgh, PA            |
| <ul style="list-style-type: none"> <li>▪ Optimized algorithms for microwave/infrared intruder detection systems</li> <li>▪ Developed and tested embedded software for a PIC microcontroller</li> </ul>   |             |  |
| <b>Instrumentation and Control Intern</b>  | Summer 2002 | <b>Bechtel Bettis Atomic Lab</b><br>West Mifflin, PA |
| <ul style="list-style-type: none"> <li>▪ Obtained security clearance from US Department of Energy</li> <li>▪ Tested and troubleshot systems for monitoring naval nuclear reactors</li> </ul>   |             |  |

**JOURNAL PUBLICATIONS:** \_\_\_\_\_

G. Bahl, R. Melamud, B. Kim, S. Chandorkar, J. Salvia, M.A. Hopcroft, R.G. Hennessy, R.N. Candler, R.T. Howe, and T.W. Kenny, "**Model and observations of dielectric charge in thermally oxidized silicon resonators**," *Journal of Microelectromechanical Systems*, Submitted for peer review April 2009.

J. Salvia, R. Melamud, S. Chandorkar, S. F. Lord, T. W. Kenny, "**Real-Time Temperature Compensation of MEMS Oscillators Using an Integrated Micro-Oven and a Phase Lock Loop**," *Journal of Microelectromechanical Systems*, Submitted for peer review March 2009.

R. Melamud, S. Chandorkar, B. Kim, J. Salvia, H.K. Lee, T.W. Kenny, "**Temperature Insensitive Composite Micromechanical Resonators**," *Journal of Microelectromechanical Systems*, Accepted for publication, May 2009.

K.L. Chen, J. Salvia, R.C. Potter, R.T. Howe, T.W. Kenny, "**Performance Evaluation and Equivalent Model of Silicon Interconnects for Fully-Encapsulated RF MEMS Devices**", *IEEE Transactions on Advanced Packaging*, vol. 32, no. 2, pp. 402-409, May 2009.

C. M. Jha, J. Salvia, S.A. Chandorkar, R. Melamud, E. Kuhl, and T. W. Kenny, "**Acceleration insensitive encapsulated silicon microresonator**," *Applied Physics Letters*, 93, 234103, December 2008.

C.M. Jha, M.A. Hopcroft, S.A. Chandorkar, J.C. Salvia, M. Agarwal, R.N. Candler, R. Melamud, B. Kim, T.W. Kenny, "**Thermal Isolation of Encapsulated MEMS Resonators**," *Journal of Microelectromechanical Systems*, vol. 17, no. 1, pp. 175-184, February 2008.

C.M. Jha, G. Bahl, R. Melamud, S. A. Chandorkar, M. A. Hopcroft, B. Kim, M. Agarwal, J. Salvia, H. Mehta, and T. W. Kenny, "**High Resolution Microresonator-based Digital Temperature Sensor**," *Applied Physics Letters*, 91, 074101-3, August 2007.

M.A. Hopcroft, B. Kim, S. Chandorkar, R. Melamud, M. Agarwal, C.M. Jha, G. Bahl, J. Salvia, H. Mehta, H.K. Lee, R.N. Candler and T.W. Kenny, "**Using the temperature dependence of resonator quality factor as a thermometer**," *Applied Physics Letters*, 91, 1, pp. 013505-3, July 2007.

**CONFERENCE PUBLICATIONS:** \_\_\_\_\_

J. Salvia, P. Lajevardi, M. Hekmat, and B. Murmann, "**A 56M $\Omega$  CMOS TIA for MEMS applications**," *Proc. IEEE 2009 CICC*, San Jose, CA, USA, pp. 199-202, Sept 13-16, 2009.

K.L. Chen, S. Wang, J. Salvia, R.T. Howe, T.W. Kenny, "**Encapsulated Out-Of-Plane Differential Square-Plate Resonator With Integrated Actuation Electrodes**," *Proc. Transducers 2009*, Denver, CO, USA, pp. 1421-1424, June 21-25, 2009.

J. Salvia, R. Melamud, S. Chandorkar, H.K. Lee, Y.Q. Qu, S.F. Lord, B. Murmann and T.W. Kenny., "**Phase Lock Loop Based Temperature Compensation for MEMS Oscillators**," *Proc. 22<sup>nd</sup> IEEE MEMS 2009*, Sorrento, Italy, pp. 661-664, Jan. 25-29, 2009.

S. Yoneoka, G. Bahl, J. Salvia, K. L. Chen, A. B. Graham, H. K. Lee, G. Yama, R. N. Candler, and T. W. Kenny, "**Acceleration Compensation of MEMS Resonators Using Electrostatic Tuning**," *Proc. 22<sup>nd</sup> IEEE MEMS 2009*, Sorrento, Italy, Jan. 25-29, 2009.

- J. Salvia, M. Messana, M. Ohline, M.A. Hopcroft, R. Melamud, S. Chandorkar, H.K. Lee, G. Bahl, B. Murmann, and T.W. Kenny, "**Exploring the limits and practicality of Q-based temperature compensation for silicon resonators**" *IEDM 2008 Tech. Digest*, San Francisco, CA, USA, pp. 671-674, Dec. 15-17, 2008.
- H. K. Lee, M. A. Hopcroft, R. Melamud, B. Kim, J. Salvia, S. Chandorkar, and T. W. Kenny, "**Electrostatic-Tuning of Hermetically Encapsulated Composite Resonator**," *Solid-State Sensors, Actuators, and Microsystems Workshop, Hilton Head '08*, Hilton Head, SC, USA, pp 48-51, June 1-5, 2008.
- G. Bahl, R. N. Candler, R. Hennessy, D. Elata, R. Melamud, S. Chandorkar, B. Kim, M. Hopcroft, J. Salvia, C. M. Jha, S. Yoneoka, G. Yama, R. T. Howe, and T. W. Kenny, "**Observation of Fixed and Mobile Charge in Composite MEMS Resonators**," *Solid-State Sensors, Actuators, and Microsystems Workshop, Hilton Head '08*, Hilton Head, SC, USA, pp 102-105, June 1-5, 2008.
- M.A. Hopcroft, H.K. Lee, B. Kim, R. Melamud, S. Chandorkar, M. Agarwal, C.M. Jha, J. Salvia, G. Bahl, H. Mehta and T.W. Kenny, "**A High-Stability MEMS Frequency Reference**", *Proc. Transducers 2007*, Lyon, France, pp. 1307-1309, June 10-14, 2007.
- C. M. Jha, G. Bahl, R. Melamud, S.A. Chandorkar, M.A. Hopcroft, B. Kim, M. Agarwal, J. Salvia, H. Mehta, and T.W. Kenny, "**CMOS-Compatible Dual-Resonator MEMS Temperature Sensor with Millidegree Accuracy**," *Proc. Transducers 2007*, Lyon, France, pp. 229-232, June 10-14, 2007.
- J. Salvia, J.A. Bain, and C.P. Yue, "**Tunable on-chip inductors up to 5 GHz using patterned permalloy laminations**," *IEDM 2005 Tech. Digest*, Washington, DC, USA, pp. 943-946, Dec. 5-7, 2005.

**COURSEWORK FOCUS:** \_\_\_\_\_

Analog and RF Circuit Design, Electronic and Micromechanical Devices, Electromagnetics, Control Systems