Reid R. Harrison

President and Founder

Intan Technologies, LLC
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EDUCATION

Ph.D., Computation and Neural Systems, with additional study in **Electrical Engineering** 2000
California Institute of Technology – Pasadena, CA

B.S. with honors, Electrical Engineering 1994
University of Florida – Gainesville, FL

PROFESSIONAL EXPERIENCE

President and Founder, *Intan Technologies, LLC,* Los Angeles, CA 2003 – present
http://www.intantech.com

Adjunct Associate Professor, *University of Utah,* Salt Lake City, UT 2010 – 2015
Electrical & Computer Engineering Department

Associate Professor, *University of Utah,* Salt Lake City, UT 2006 – 2010
Electrical & Computer Engineering Department

Adjunct Associate Professor, *University of Utah,* Salt Lake City, UT 2006 – 2010
Bioengineering Department

Visiting Associate Professor, *Stanford University,* Palo Alto, CA 2007 – 2008
Electrical Engineering Department

Assistant Professor, *University of Utah,* Salt Lake City, UT 2000 – 2006
Electrical & Computer Engineering Department

Adjunct Assistant Professor, *University of Utah,* Salt Lake City, UT 2000 – 2006
Bioengineering Department

Doctoral Research Assistant, *California Institute of Technology,* Pasadena, CA 1995 – 2000
Advisor: Prof. Christof Koch

Graduate Research Assistant, *Los Alamos National Laboratory,* Los Alamos, NM 1995
Biophysics Group – Magnetoencephalographic (MEG) studies of human visual cortex

Academic Research Assistant, *Jet Propulsion Laboratory,* Pasadena, CA 1994
Rover Technology Group – Mars Pathfinder Mission / Sojourner Rover

AWARDS

- National Defense Science and Engineering Graduate (NDSEG) Fellowship 1995 – 1998
- National Science Foundation CAREER Award 2002 – 2007
- University of Utah College of Engineering Outstanding Teaching Award 2006
- Jack Raper Award for Outstanding Technology Directions Paper, ISSCC 2006 2007
- Special-Topic Session Award for Organizing "Implantable and Prosthetic Devices", ISSCC 2007 2008
- IEEE Circuits and Systems Society 2013 BioCAS Transactions Best Paper Award 2013

PROFESSIONAL MEMBERSHIP

- IEEE Solid State Circuits Society
- IEEE Circuits and Systems Society
- IEEE Engineering in Medicine and Biology Society
- Society for Neuroscience

PUBLICATIONS

JOURNAL ARTICLES

1. L. Matthies, E. Gat, R. Harrison, B. Wilcox, R. Volpe, and T. Litwin, "Mars microrover navigation: performance evaluation and enhancement," *Autonomous Robots* **2:**291-311, 1995.
2. H.W. Chen, C.J. Aine, E. Best, D. Ranken, R.R. Harrison, E.R. Flynn, and C.C. Wood, "Nonlinear analysis of biological systems using short m-sequences and sparse-stimulation techniques," *Annals of Biomedical Engineering* **24:**513-536, 1996.
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4. R.R. Harrison and C. Koch, "An analog VLSI implementation of a visual interneuron: enhanced sensory processing through biophysical modeling," *International Journal of Neural Systems* **9:**391-395, 1999.
5. R.R. Harrison and C. Koch, "A silicon implementation of the fly's optomotor control system," *Neural Computation* **12:**2291-2304, 2000.
6. R.R. Harrison and C. Koch, "A robust analog VLSI Reichardt motion sensor," *Analog Integrated Circuits and Signal Processing* **24:**213-229, 2000.
7. R.R. Harrison, J.A. Bragg, P. Hasler, B.A. Minch, and S.P. DeWeerth, "A CMOS programmable analog memory-cell array using floating-gate circuits," *IEEE Transactions on Circuits and Systems – II* **48:**4-11, January 2001.
8. R.R. Harrison and C. Charles, "A low-power, low-noise CMOS amplifier for neural recording applications," *IEEE Journal of Solid-State Circuits* **38**:958-965, June 2003. **(This paper is currently the most cited paper from the *IEEE Journal of Solid-State Circuits* since 2000 and the 9th most cited paper in the journal's history with 1,600+ citations.)**
9. A. Gopalan and R.R. Harrison, "A CMOS imager with on-chip temporal filtering for motion pre-processing," *Analog Integrated Circuits and Signal Processing* **37:**243-251, 2003.
10. C. Winstead, J. Dai, S. Yu, C. Myers, R.R. Harrison, and C. Schlegel., "CMOS analog MAP decoder for (8,4) Hamming code," *IEEE Journal of Solid-State Circuits* **39:**122-131, January 2004.

11. B. Webb, R.R. Harrison, and M.A. Willis, "Sensorimotor control of navigation in arthropod and artificial systems," *Arthropod Structure and Development* **33:**301-330, 2004.

12. N.M. Neihart and R.R. Harrison, "Micropower circuits for bidirectional wireless telemetry in neural recording applications," *IEEE Transactions on Biomedical Engineering* **52:**1950-1959, November 2005.

13. R.R. Harrison, "A biologically-inspired analog IC for visual collision detection," *IEEE Transactions on Circuits and Systems – I* **52:**2308-2318, November 2005.

14. R.J. Kier, J.C. Ames, R.D. Beer, and R.R. Harrison, "Design and implementation of multipattern generators in analog VLSI," *IEEE Transactions on Neural Networks* **17:**1025-1038, July 2006.

15. C.J. Myers, R.R. Harrison, D. Walter, N. Seegmiller, and S. Little, "The case for analog circuit verification," *Electronic Notes in Theoretical Computer Science* **153:**53-63, 2006.

16. C.A. Chestek, P. Samsukha, M. Tabib-Azar, R.R. Harrison, H.J. Chiel, and S.L. Garverick, "Microcontroller-based wireless recording unit for neurodynamic studies in saltwater," *IEEE Sensors Journal* **6:**1105-1114, Oct. 2006.

17. R.R. Harrison, P.T. Watkins, R.J. Kier, R.O. Lovejoy, D.J. Black, B. Greger, and F. Solzbacher, "A low-power integrated circuit for a wireless 100-electrode neural recording system," *IEEE Journal of Solid-State Circuits* **42:**123-133, January 2007. **(This paper currently has 900+ citations and is the most cited paper in the *IEEE Journal of Solid State Circuits* since 2007.)**

18. C.R. Sharma, C. Furse, and R.R. Harrison, "Low-power STDR CMOS sensor for locating faults in aging aircraft wiring," *IEEE Sensors Journal* **7:**43-50, January 2007.

19. S. Kim, K. Zoschke, M. Klein, D. Black, K. Buschick, M. Toepper, P. Tathireddy, R. Harrison, H. Oppermann, and F. Solzbacher, "Switchable polymer-based thin film coils as a power module for wireless neural interfaces," *Sensors & Actuators A*, **136:**467-474, 2007.

20. R.R. Harrison, "The design of integrated circuits to observe brain activity," *Proceedings of the IEEE* **96:**1203-1216, July 2008.

21. R.R. Harrison, R.J. Kier, C.A. Chestek, V. Gilja, P. Nuyujukian, S.I. Ryu, B. Greger, F. Solzbacher, and K.V. Shenoy, "Wireless neural recording with single low-power integrated circuit," *IEEE Transactions on Neural Systems and Rehabilitation Engineering* **17:**322-329, August 2009.

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23. S. Kim, R. Harrison, and F. Solzbacher, "Influence of system integration and packaging on its inductive power link for an integrated wireless neural interface," *IEEE Transactions on Biomedical Engineering* **56:**2927-2936, December 2009.

24. B.K. Thurgood, D.J. Warren, N.M. Ledbetter, G.A. Clark, and R.R. Harrison, "A wireless integrated circuit for 100-channel charge-balanced neural stimulation," *IEEE Transactions on Biomedical Circuits and Systems* **3:** 405-414, December 2009.

25. A. Sharma, L. Rieth, P. Tathireddy, R. Harrison, and F. Solzbacher, "Long term *in vitro* stability of fully integrated wireless neural interfaces based on Utah slant electrode array," *Applied Physics Letters* **96:** 073702, 2010.

26. H. Fotowat, R.R. Harrison, and F. Gabbiani, "Multiplexing of motor information in the discharge of a collision detecting neuron during escape behaviors," *Neuron* **69:** 147-158, 2011.

27. A. Sharma, L. Rieth, P. Tathireddy, R. Harrison, H. Oppermann, M. Klein, M. Töpper, E. Jung, R. Normann, G. Clark, and F. Solzbacher, "Long term *in-vitro* stability and recording longevity of fully integrated wireless neural interfaces based on Utah Slant Electrode Array," *Journal of Neural Engineering* **8:** 045004, 2011.

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29. J. Du, T.J. Blanche, R.R. Harrison, H.A. Lester, and S.C. Masmanidis, "Multiplexed, high density electrophysiology with nanofabricated neural probes," *PLoS ONE* **6**(10):e26204, Oct. 2011.

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1. S. Caselli, K.L. Doty, R.R. Harrison, F. Zanichelli, "Mobile robot navigation in enclosed large-scale space," In: *Proceedings of the 1994 IEEE Industrial Electronics Conference (IECON),* **2:**1043-1047, 1994.

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4. R.R. Harrison, "Floating-gate current mirror for gain correction in CMOS translinear circuits," In: *Proceedings of the 1999 IEEE International Symposium on Circuits and Systems (ISCAS '99),* **2:**404-407, Orlando, FL, 1999.

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16. R.R. Harrison, "A low-power integrated circuit for adaptive detection of action potentials in noisy signals," In: *Proceedings of the 2003 International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2003),* pp. 3325-3328, Cancún, Mexico, 2003.
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18. R.R. Harrison, "A low-power analog VLSI visual collision detector," In: *Advances in Neural Information Processing Systems 16,* Eds: S. Thrun, L.K Saul, and B. Schölkopf, pp. 987-994, Vancouver, Canada, 2004.
19. R.R. Harrison, "A single-chip CMOS visual orientation sensor," In: *Proceedings of the 2004 IEEE International Symposium on Circuits and Systems (ISCAS 2004),* **4:**944-947, Vancouver, Canada, 2004.
20. R.J. Kier, R.R. Harrison, and R.D. Beer, "An MDAC synapse for analog neural networks," In: *Proceedings of the 2004 IEEE International Symposium on Circuits and Systems (ISCAS 2004),* **5:**752-755, Vancouver, Canada, 2004.
21. N.M. Neihart and R.R. Harrison, "A low-power FM transmitter for use in neural recording applications," In: *Proceedings of the 2004 International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2004),* pp. 2117-2120, San Francisco, CA, 2004.
22. P.T. Watkins, G. Santhanam, K.V. Shenoy, and R.R. Harrison, "Validation of adaptive threshold spike detector for neural recording," In: *Proceedings of the 2004 International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2004),* pp. 4079-4082, San Francisco, CA, 2004.
23. R.R. Harrison, G. Santhanam, and K.V. Shenoy, "Local field potential measurement with low-power analog integrated circuit," In: *Proceedings of the 2004 International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2004),* pp. 4067-4070, San Francisco, CA, 2004.

24. C. Chestek, P. Samsukha, M. Tabib-Azar, R. Harrison, H. Chiel, and S. Garverick, "Wireless multi-channel sensor for neurodynamic studies," In: *Proceedings of the 3rd IEEE Conference on Sensors,* pp. 915-918, Vienna, Austria, 2004.

25. R. Harrison, P. Watkins, R. Kier, R. Lovejoy, D. Black, R. Normann, and F. Solzbacher, "A low-power integrated circuit for a wireless 100-electrode neural recording system," In: *IEEE International Solid-State Circuits Conference (ISSCC 2006) Digest of Technical Papers,* pp. 554-555, San Francisco, CA, 2006. (Invited paper)

26. S. Kim, O. Scholz, K. Zoschke, R. Harrison, F. Solzbacher, M. Klein, and M. Toepper, "FEA simulation of thin film coils to power wireless neural interfaces," *2006 NSTI Nanotechnology Conference and Trade Show (Nanotech 2006),* Boston, MA, 2006.

27. S. Chakravarty, P. Tathireddy, L. Rieth, R.A. Normann, R. Harrison, F. Solzbacher, M. Klein and H. Oppermann, "Biocompatible hybrid system integration of silicon based neural interface device," *2006 NSTI Nanotechnology Conference and Trade Show (Nanotech 2006),* Boston, MA, 2006.

28. D.J. Black and R.R. Harrison, "Power, clock, and data recovery in a wireless neural recording device," In: *Proceedings of the 2006 IEEE International Symposium on Circuits and Systems (ISCAS 2006),* pp. 5083-5086, Kos, Greece, 2006.

29. R.J. Kier and R.R. Harrison, "Power minimization of a 433-MHz *LC* VCO for an implantable neural recording system," In: *Proceedings of the 2006 IEEE International Symposium on Circuits and Systems (ISCAS 2006),* pp. 3225-3228, Kos, Greece, 2006.

30. P. Watkins, R. Kier, R. Lovejoy, D. Black, and R.R. Harrison, "Signal amplification, detection and transmission in a wireless 100-electrode neural recording system," In: *Proceedings of the 2006 IEEE International Symposium on Circuits and Systems (ISCAS 2006),* pp. 2193-2196, Kos, Greece, 2006.

31. M. Töpper, L. Dietrich, K. Orth, O. Ehrmann, S. Kim, M. Klein, R. Harrison, P. Tathireddy, F. Solzbacher, and H. Reichl, "Wafer level packaging based on electroplating for medical implantable devices," In: *Proceedings of the Second PEAKS Conference on Electrochemical Processing for Microelectronics,* Whitefish, MT, 2006.

32. S. Kim, R. Normann, R. Harrison, and F. Solzbacher, "Preliminary study of thermal impact of a microelectrode array implanted in the brain," In: *Proceedings of the 2006 International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2006),* pp. 2986-2989, New York, NY, 2006.

33. R.R. Harrison, P.T. Watkins, R.J. Kier, D.J. Black, R.O. Lovejoy, R.A. Normann, and F. Solzbacher, "Design and testing of an integrated circuit for multi-electrode neural recording," In: *Proceedings of the 20th International Conference on VLSI Design (VLSID 2007),* Bangalore, India, 2007.

34. R.R. Harrison, "Designing efficient inductive power links for implantable devices," In: *Proceedings of the 2007 IEEE International Symposium on Circuits and Systems (ISCAS 2007),* pp. 2080-2083, New Orleans, LA, 2007.

35. R.R. Harrison, "A versatile integrated circuit for the acquisition of biopotentials," In: *IEEE 2007 Custom Integrated Circuits Conference (CICC 2007) Digest of Technical Papers,* San Jose, CA, pp. 115-122, 2007. (Invited paper)

36. C. Furse, R. Harrison, and F. Solzbacher, "Recent advances in biomedical telemetry," In: *International Conference on Electromagnetics in Advanced Applications (ICEAA 2007),* Torino, Italy, 2007. (Invited paper)

37. R.R. Harrison, R.J. Kier, C.A. Chestek, V. Gilja, P. Nuyujukian, S.I. Ryu, B. Greger, F. Solzbacher, and K.V. Shenoy, "Wireless neural signal acquisition with single low-power integrated circuit," In: *Proceedings of the 2008 IEEE International Symposium on Circuits and Systems (ISCAS 2008),* Seattle, WA, pp. 1748-1751, 2008.

38. C.A. Chestek, V. Gilja, P. Nuyujukian, R.J. Kier, F. Solzbacher, S.I. Ryu, R.R. Harrison, and K.V. Shenoy, "HermesC: RF wireless low-power neural recording for freely behaving primates," In: *Proceedings of the 2008 IEEE International Symposium on Circuits and Systems (ISCAS 2008),* Seattle, WA, pp. 1752-1755, 2008.

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4. R.R. Harrison, "Systems and methods for a current sensing patch-clamp amplifier," *U.S. Patent #9,071,209,* June 30, 2015.
5. R.R. Harrison, "Multi-channel reconfigurable systems and methods for sensing biopotential signals," *U.S. Patent #9,351,653,* May 31, 2016.
6. R.R. Harrison, "Multi-channel reconfigurable systems and methods for sensing biopotential signals," *U.S. Patent #10,702,183,* July 7, 2020.

INVITED PRESENTATIONS

1.	1997 NSF Workshop on Neuromorphic Engineering, Telluride, CO	1997
2.	Neuroscience Seminar, Max Planck Institute, Tübingen, Germany	1997
3.	Institute for Neuroinformatics Seminar, ETH Zürich, Switzerland	1997
4.	Neurobiology Seminar, University of Bielefeld, Germany	1997
5.	IEEE/RSJ Workshop on Biomorphic Robots, IROS '98, Victoria, BC, Canada	1998
6.	Biological Computation Group Seminar, Bell Labs, Murray Hill, NJ	1998

7. Machine Intelligence Laboratory Seminar, University of Florida, Gainesville, FL 1999
8. Center for Integrated Space Microelectronics Seminar, Jet Propulsion Laboratory, Pasadena, CA 1999
9. Micro Flying Insect Group Seminar, University of California, Berkeley, CA 1999
10. Electrical Engineering & Computer Science Seminar, Case Western Reserve University, Cleveland, OH 1999
11. DARPA Conference on Neurotechnology for Biomimetic Robotics, Nahant, MA 2000
12. 19th Conference on Advanced Research in VLSI (ARVLSI 2001), Salt Lake City, UT 2001
13. 2001 NSF Workshop on Neuromorphic Engineering, Telluride, CO 2001
14. 2002 NSF Workshop on Neuromorphic Engineering, Telluride, CO 2002
15. 2004 NSF Workshop on Neuromorphic Engineering, Telluride, CO 2004
16. 2004 International Congress of Neuroethology, Nyborg, Denmark 2004
17. Caltech Center for Neuromorphic Systems Engineering 10th Anniversary Symposium, Pasadena, CA 2004
18. Analog Devices VLSI Seminar Series, Cornell University, Ithaca, NY 2005
19. DARPA Defense Sciences Research Council Workshop, Arlington, VA 2005
20. IEEE International Solid-State Circuits Conference (Invited Paper), San Francisco, CA 2006
21. Medtronic, Inc. Technical Forum, Minneapolis, MN 2006
22. 20th International Conference on VLSI Design, Bangalore, India 2007
23. Low Power Analog IC Seminar Series, University of Washington, Seattle, WA 2007
24. Wireless Integrated Microsystems ERC Seminar Series, University of Michigan, Ann Arbor, MI 2007
25. IEEE Custom Integrated Circuits Conference (Invited Paper), San Jose, CA 2007
26. 1st Global COE International Symposium, Electronic Devices Innovation (Plenary Talk), Osaka, Japan 2008
27. GCOE Global Seminar, Advances in Neuroengineering, Osaka, Japan 2008
28. IC NeuroTech Workshop, University of California, Los Angeles, CA 2008
29. Mixed-Signal, RF, and Microwave Seminar Series, Caltech, Pasadena, CA 2008
30. Integrated Neural Interfaces Forum, IEEE ISSCC, San Francisco, CA 2009
31. Biomedical Engineering Seminar Series, Purdue University, West Lafayette, IN 2009
32. Technical Challenges in Extracellular Electrophysiology Workshop, HHMI Janelia Farm, Ashburn, VA 2009
33. Analog Challenges for Biomedical Applications Workshop, University of Texas, Dallas, TX 2009
34. Advanced Topics Tutorial, Custom Integrated Circuits Conference (CICC), San Jose, CA 2009
35. Biomedical Electronics Forum, Custom Integrated Circuits Conference (CICC), San Jose, CA 2009
36. Electrical Engineering Seminar Series, University of California, Los Angeles, CA 2010
37. Microsystems Seminar Series, University of Maryland, College Park, MD 2010
38. IEEE Biomedical Circuits and Systems Conference (Tutorial), San Diego, CA 2011
39. Integrated Systems Seminar Series, University of Southern California, Los Angeles, CA 2011
40. International Workshop on Bio-Inspired Systems and Prosthetic Devices, Taichung, Taiwan 2012
41. EMBS Chapter Meeting of IEEE Orange County Section, Irvine, CA 2012
42. Long-Term Cortical Neuro-Interfaces Workshop, Hanse-Wissenschaftskolleg, Delmenhorst, Germany 2013
43. IGERT Neuroengineering Symposium, University of Illinois, Urbana-Champaign, IL 2013

44. Computation and Neural Systems Seminar, California Institute of Technology, Pasadena, CA 2013
45. Houston Center for NeuroEngineering 3rd Annual Symposium, Houston, TX 2013
46. ECE Department Colloquium, University of California, San Diego, CA 2014
47. Neural Implant Engineering Lecture, University of Southern California, Los Angeles, CA 2014
48. Technical Seminar, HHMI Janelia Farm, Ashburn, VA 2015
49. Electrical Engineering Spring Colloquium, University of Washington, Seattle, WA 2016
50. Next-Generation Ephys Workshop, University College London, UK 2016
51. Facebook Brain-Computer Interfaces Industry Day, Menlo Park, CA 2016
52. Computation & Neural Systems 30th Anniversary Celebration, Caltech, Pasadena, CA 2017
53. Kavli Futures Symposium: Toward Next-Gen Open-Source Neurotech Dissemination, Santa Monica, CA 2017
54. IEEE International Symposium on Circuits and Systems (Plenary Talk), Florence, Italy 2018

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