

Curriculum Vitae

Edwin C. Kan

March 2024

A. Contact Information:

Office: School of Electrical and
Computer Engineering, 325 Phillips Hall,
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B. Education:

Ph.D. 1992 Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
M.S. 1988 Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
B.S. 1984 Electrical Engineering, National Taiwan University

C. Professional Experience:

Dir. Graduate Studies	2010-2013	Electrical and Computer Engineering, Cornell Univ.
Professor	2009-present	Electrical and Computer Engineering, Cornell Univ.
Associate Professor	2002-2009	Electrical and Computer Engineering, Cornell Univ.
Visiting Professor	2004-2005	Electrical Engineering, Stanford University
Visiting Researcher	2004-2005	Intel Research, Santa Clara, CA
IBM Faculty Partner	Summer 2000 & 2001	IBM T. J. Watson Lab, Yorktown Heights, New York
Assistant Professor	1997-2002	Electrical and Computer Engineering, Cornell Univ.
Research Associate	1994-1997	Center for Integrated Systems, Stanford University
Senior CAD Engineer	1992-1993	Dawn Technology, Sunnyvale, CA
Second Lieutenant	1984-1986	Air Force, Taiwan, R. O. China

D. Research Interests:

1. RF biosensors: A new near-field coherent sensing (NCS) method to acquire vital signs and internal tissue/muscle motion such as breath efforts/rates, respiratory volume, heart rates, heart rate variability, blood pressure, muscle contraction, balance, and eye movement, onto multiplexed radio network. Implementation can be on a passive RFID platform or on a self-contained sensor node as wearables or furniture integration. We have successfully demonstrated the NCS sensor on human participants/patients ($N > 200$), as well as various animals from mice to elephant seals with different surface coverings. Multiple sensors can be operated together seamlessly with minimal inter-sensor interferences.
2. Passive RF tags for locating and sensing: mixed-signal waveform shaping by nonlinear transmission lines and active devices, ultra-low power oscillator-free millimeter-sized radio link, and harmonic backscattering for indoor locating.
3. Nanoscale CMOS systems: Device and interconnect scaling to the 10nm technology. New structures and materials for logic and memory devices. New low-voltage and low-power circuits to support further technology scaling and new system functions.
4. CMOS molecular interface biosensors: Integrated chemical, molecular and biological sensors and actuators based on charge-controlled surface electrochemistry. Functional specificity towards ion, molecules (DNA, mRNA, proteins and vesicles), action potential, pressure, impedance and morphology such as cell metastasis, and molecular folding.

5. Technology CAD for VLSI design: Device and process simulation, SPICE compact models, numerical methods and software engineering. Construction of model hierarchy for better analysis and synthesis of the complex design.

E. Honors and Awards:

E.1 Selected Awards

1. PECASE (Presidential Early-Career Award for Scientists and Engineers) Award (highest award for early careers from the US Government), the White House, October 2000.
2. Robert '55 and Vanne '57 Cowie Excellence in Teaching Award (highest award for teaching in Cornell Engineering College), November 2003.
3. Cornell Inventor Award, 2003, 2006 and 2016.
4. IEEE Best Chapter Chair Award (for most member growth in local Chapter), 2002.
5. NSF CAREER Award, "Self-assembly processes for practical nano-scale electronic devices and interconnect", May 2000.
6. James and Mary Tien Excellence in Teaching Award, College of Engineering, Cornell University, September 1999.
7. Graduate Teaching Award: List of Teachers Ranked as Excellent by Their Students (*ECE 344: IC Fabrication*), University of Illinois at Urbana-Champaign, 1987 and 1988.

E.2 Selected Media Coverage

1. "Vital signs without handling or animal prep", *Nature, LabAnimal, News and Views*, April 1, 2019. [\[Link\]](#)
2. "A special thesis that scores the full 10 mark: How to measure the heartbeat of a hamster without its notice" (in Chinese): *Scientific American*, Feb 27, 2019. [\[Link\]](#)
3. "No-touch sensor measures vital signs of small animals", *Cornell Chronicles*, Feb. 14, 2019. [\[Link\]](#)
4. "How do you take a hamster's pulse?" *American Association for the Advancement of Science (AAAS)*, Feb. 13, 2019. [\[Link\]](#)
5. "Contactless healthcare sensing", *Nature*, Nov. 27, 2017. [\[Link\]](#)
6. "Cornell University researchers seek partners for RFID vital signs device", *RFID Journal*, Dec. 12, 2017.
7. "Measuring vital signs just got easier", *Discover*, Nov. 27, 2017. [\[Link\]](#)
8. "First glance into the gut", *Discover*, Top 100 stories in 2016, Feb. 2017. [\[Link\]](#)
9. "Simultaneous touchless monitoring of several patients' vital signs", *IEEE Spectrum*, Nov. 28, 2017. [\[Link\]](#)
10. "Noninvasive RFID tag measures your vital signs without body contact", *Digital Trends*, Nov. 30, 2017. [\[Link\]](#)
11. "Buckyballs to boost flash memory", *IEEE Spectrum*, June, 2008. [\[Link\]](#) [\[PDF\]](#)
12. "Nanoelectronics: Flash at the end of the tunnel", *Nature Nanotechnology*, May 2, 2008. [\[Link\]](#)
13. "Buckyballs give flash a boost", *Nature News*, April 22, 2008. [\[Link\]](#)
14. "Buckyballs boost flash memory", Physics arXiv blog, April 1, 2008. [\[Link\]](#)
15. *Technology News Daily*, June 1, 2006; *TechNews*, vol. 24;
16. *Engineers on Line*, June 9, 2006, [\[Link\]](#)
17. "Researchers to develop ultra-miniature implantable sensors to measure blood flow", *Biology Newsnet*: June 7, 2006. [\[Link\]](#)

F. Selected Professional Service and Synergistic Activities:

F.1 (External Committee Service)

1. Associate Editor, J. RFID, 2020 – 2022.
2. Associate Editor, MDPI Sensors, 2020 – 2022.

3. Chair, Wireless MoCap Workshop, IEEE RFID Conference, 2021.
4. Member, Program Committee, *Nonvolatile Memory Workshop*, 2015 – 2020.
5. Member, Program Committee, *VLSI Symposium*, 2009 – 2012.
6. Board of Consulting Editors, *McGraw-Hill Encyclopedia of Science & Technology*, 2007 – 2010.
7. Guest Editor, *ACM J. Emerging Technology and Computing* on Application of emerging technologies in bio-inspired computing, 2011.
8. Senior Guest Editor, *IEEE Trans Nanotechnology* Special Issue on Nanoelectronic Interface to Biomolecules and Cells, March 2010.
9. Member, Program Committee, *IWCE (International Workshop on Computational Electronics)*, 2009.
10. Member (2005-2006), Chair (2007-2009), Nanotechnology Technical Committee, *Electron Device Society, IEEE*.
11. Voting Ex-Officio AdCom Member (2007-2009), *IEEE Electron Device Society*.
12. Member, Program Committee, *SISPAD (International Conference on Simulation of Semiconductor Processes and Devices)*, 2003, 2006 and 2009.
13. Panelist, *Forum on 2020 Semiconductor Memory Strategies*, Singapore, Oct. 20-21, 2009.
14. Editor, Physical Electronics, *McGraw-Hill Encyclopedia of Science & Technology*, 2005 – 2007, <http://www.accessscience.com>.
15. Associate Editor, *Journal of Nanoelectronics and Optoelectronics (JNO)*, American Scientific Publishers, 2005.
16. Member, Technical Committee, *MMM-Intermag Conference*, 2005.
17. Panelist, *SRC Forum on Non-Volatile Memories*, Nov. 2004.
18. Member, Program Committee, *IEDM (International Electron Device Meeting)*, Modeling and Simulation Session, 2001 and 2002.
19. Member, Program Committee, *Si Nanoelectronics Workshop*, VLSI Symposium, Honolulu, HI, 2002.
20. Panelist, *International Forum on Computational Electronics*, Seattle, WA, September 2000.

F.2 (Cornell Committee Service)

1. University Appeals Panel, Cornell University, 2020 – 2025.
2. ABET (Accreditation Board for Engineering and Technology) Coordinator, ECE, Cornell University, 2019 – 2023.
3. Faculty Senate, Cornell University, 2016 – 2020.
4. Curriculum and Standards Committee, School of Electrical and Computer Engineering, Cornell University, 1999-2001, 2003-2004, 2015 - 2018.
5. Director of Graduate Studies, Electrical and Computer Engineering, Cornell University, 2009 – 2012.
6. Graduate fields at Cornell University: Electrical Engineering, Applied Mathematics, and System Engineering.
7. Faculty Committee, Engineering Learning Initiative, Cornell University, 2007-2009.
8. Unit IV (Solid State) Chair, School of Electrical and Computer Engineering, Cornell University, 2002-2003, 2005-2006.
9. Policy Committee, School of Electrical and Computer Engineering, Cornell University, 2005-2006.
10. Undergraduate Admission Advisory Committee, College of Engineering, Cornell University, 1999-2004.
11. Graduate Committee, School of Electrical and Computer Engineering, Cornell University, 2001-2003, 2006-2007, 2009-2012.
12. Faculty Recruiting Committee, School of Electrical and Computer Engineering, Cornell, 2001-2003, 2005-2007.
13. Faculty Recruiting Committee, School of Mechanical and Aerospace Engineering, Cornell, 2002-2003.

F.3 (Outreach and Synergistic Activities)

1. Science teacher, Senior Physics Class, "Power module in microsystem design", May 2007, Ithaca High School, Ithaca, NY.
2. Most Athletic Professor, IEEE, Ithaca Chapter, 2007.
3. Project director, CURIE Academy, 2003 (one-week residential program for high school girls who excel in math and science sponsored by Cornell Engineering College), "Micro-robots for cancer detection".
4. Lecturer, Summer School for High School Science Teachers, CNS, Summer 2002 and 2003, "MEMS".
5. Science outreach, Cayuga Height Elementary School, Ithaca, NY, "Nanotechnology – small is cool", 2002-2003.
6. Advisor for 10 female, 1 Hispanic, 1 American Indian and 1 African American graduate students (past and present) out of 35.

F.4 (Panels, Review Board and Professional Society)

1. Journal reviewer: Publications of IEEE Electron Device Society, IEEE Circuit and System Society, IEEE Microwave Theory and Technology Society, Superlattice and Microstructures, Solid State Electronics, Applied Physics Society, Material Research Society, Magnetic Society, American Chemical Society, J. RFID, Nature, Science, and Nanoletters.
2. Panel reviewer: NSF (multiple programs), EPA (Environment Protection Agency), NIH (National Institute of Health), Kentucky Research Foundation, Hong Kong Croucher Foundation, Louisiana State Research Initiative, and Singapore Government Research Foundation.
3. IEEE membership (Student 1986, Member 1992, Senior Member 2005, Vice Chair of IEEE Ithaca Sector, NY, 2000, Chair of Ithaca Sector 2002).

G. Courses Taught:

1. EE 439, Fall 1997, *Digital Integrated Circuits Design*, co-taught with B. Minch.
2. EE 539, Fall 1997 and Spring 1998, *Advanced Digital Integrated Circuits Design*, co-taught with B. Minch.
3. EE 594, Spring 1998, *Advanced VLSI Devices*.
4. EE 306, Spring 1998, *Quantum and Solid-State Physics*, co-taught with Y. Lo.
5. EE 457, Fall 1998, *Silicon Electronics: Fundamentals to CMOS Devices*.
6. EE 439, Spring 1999, *Digital Integrated Circuits Design*.
7. EE 539, Spring 1999, *Advanced Digital Integrated Circuits Design*, co-taught with B. Minch.
8. EE 457, Fall 1999, *Silicon Electronics: Fundamentals to CMOS Devices*.
9. EE 438, Spring 2000, *VLSI Digital System Design*.
10. EE 311, Spring 2000, *Honors Seminar*.
11. EE 457, Fall 2000, *Silicon Electronics: Fundamentals to CMOS Devices*.
12. ChemE/EE/MSE 596, Fall 2000, *System on a Chip*, co-taught with P. Clancy, M. Thompson, G. Malliaras and A. Sin
13. ENGRI 150, Fall 2000, *Freshman Seminar*.
14. ECE 432, Spring 2001, *Introduction to Microelectromechanical Systems (MEMS)*.
15. ECE 457, Fall 2001, *Silicon Electronics: Fundamentals to CMOS Devices*.
16. ECE 695, Fall 2001, *Topics in Integrated Systems*, co-taught with B. Minch and R. Manohar.
17. ECE 432, Spring 2002, *Introduction to Microelectromechanical Systems (MEMS)*.
18. ECE 315, Spring 2002, *Introduction to Microelectronics*, lab assistant.
19. ECE 457, Fall 2002, *Silicon Electronics: Fundamentals to CMOS Devices*.
20. ECE 315, Fall 2002, *Introduction to Microelectronics*, course assistant.
21. ECE 432, Spring 2003, *Introduction to Microelectromechanical Systems (MEMS)*.
22. ECE 315, Spring 2003, *Introduction to Microelectronics*, lab assistant.
23. ECE 457, Fall 2003, *Silicon Electronics: Fundamentals to CMOS Devices*.
24. ECE 336/536, Spring 2004, *Nanofabrication*, co-taught with Dieter Ast of MSE.

25. ECE 315, Fall 2005, *Introduction to Microelectronics*.
26. ECE 457, Spring 2006, *Silicon Electronics: Fundamentals to CMOS Devices*.
27. ECE 315, Fall 2006, *Introduction to Microelectronics*.
28. ECE 457, Spring 2007, *Silicon Electronics: Fundamentals to CMOS Devices*.
29. ECE 315, Fall 2007, *Introduction to Microelectronics*.
30. ECE 457, Spring 2008, *Silicon Electronics: Fundamentals to CMOS Devices*.
31. ECE 306, Fall 2008, *Quantum and Statistical Mechanics*.
32. ECE 3150: Spring 2009, *Introduction to Microelectronics*.
33. ECE 3060, Fall 2009, *Quantum and Statistical Mechanics*.
34. ECE 5380: Spring 2010, *Memory Devices and Circuits*.
35. ECE 4740: Spring 2011, *VLSI Digital System Design*.
36. ECE 4740: Spring 2012, *VLSI Digital System Design*.
37. ECE 5990: Fall 2013, *RFID Systems*.
38. ECE 4360: Spring 2014, *Nanofabrication for Integrated Circuits*.
39. ECE 5990: Fall 2014, *RFID Systems*.
40. ECE 4360: Spring 2015, *Nanofabrication for Integrated Circuits*.
41. ECE 4880: Fall 2015, *RF Systems*.
42. ECE 4960: Spring 2016, *Computational and Software Engineering*.
43. ECE 4880: Fall 2016, *RF Systems*.
44. ECE 4960: Spring 2017, *Computational and Software Engineering*.
45. ECE 4880: Fall 2017, *RF Systems*.
46. ECE 4960: Spring 2018, *Scientific and Numerical Computation*.
47. ECE 4960: Spring 2019, *Scientific and Numerical Computation*.
48. ECE 4880: Fall 2019, *RF Systems*.
49. ECE 4880: Fall 2020, *RF Systems*.
50. ECE 4880: Fall 2022, *RF Systems*.
51. ECE 4740: Spring 2023, *Digital VLSI Design*.
52. ECE 4880: Fall 2023, *RF Systems*.
53. ECE 4740: Spring 2024, *Digital VLSI Design*.

H. Present and Past External Contract Support:

1. PI, "Bed-integrated radio sensors for heartbeats, respiration and blood pressures", Ceva Santé Animale, June 2024 – March 2025, \$75,000.
2. PI, "Non-invasive measurements of central blood pressures by RF sensors", NIH Project 1R21EB034562-01, with Joaquin Araos, July 2023 – Dec. 2024, \$407,530.
3. PI, "CCSS: RF infrasonics for internal tissue characteristics", NSF Award 2211634, July 2022 – July 2025, \$390,000.
4. Co-PI, "Improving detection of respiratory distress in patients with advanced ADRD using radio sensors", NIH AI Pilot grant through U. Pennsylvania, with Veerawat Phongtankuel, July 2022 – July 2023, my part: \$73,284.
5. Co-PI, "MRI: Acquisition of a millimeter-wave vector network analyzer and a probe station capable of a single sweep from 70 kHz to 220 GHz", NSF, Instrument Grant, with James Hwang, \$800,000.
6. Co-I, "Collaborative research: Does responding to stressors prime greater resilience? Testing the long-term effects of challenges on behavior, physiology, epigenetic state, and fitness", NSF, with Dr. Maren N. Vitousek, Jan. 2022 – Dec. 2025, \$799,773 (my part: \$60,000).
7. Co-PI, "Usage outcomes on naloxone packages with wearable sensors for prevention of fatal opioid overdose", Emergent Biosolutions, with Dr. Julianne Imperato-McGinley of Weill Cornell Medical Center, Nov. 2020 – August 2021, \$186,805.

8. PI, "RAPID: Screening and prognosis of COVID-19 by a novel RF stethoscope", NSF Award 2033838, with Dr. Ana Krieger of Weill Cornell Medical Center, June 2020 – Aug. 2021, \$200,000.
9. Co-PI, "An innovative wearable sensor for the early detection and prevention of fatal opioid overdose," NIH R21 DA049566-01A1, with Dr. Julianne Imperato-McGinley of Weill Cornell Medical Center, Feb. 2020 – Feb. 2022, \$444,153.
10. PI, "NSF: CCSS: Precision positioning for structural monitoring by embedded RFID tags", NSF ECCS-CCSS Award 1945918, Feb. 2020 – Jan. 2023, \$368,729.
11. PI, "Long-term wearable touchless radio-frequency sensors for cardiopulmonary functions", CDMRP Peer-Reviewed Medical Research Program DoD Army Discovery Award PR-182496, April 2019 – Oct. 2020, \$332,000.
12. Co-PI, "RFID tags of near-field coherent sensing for vital signs of animals", Scale-up and Prototyping Awards Cornell Engineering College, Jan. 2019 – Sept. 2019, \$36,000.
13. PI, "Accurate and reliable scoring of alertness and sleep states in seats and beds", Cornell Technology Acceleration and Maturation (CTAM) Fund, June 2018 – May 2019, \$50,000.
14. PI, "Indoor occupant counting based on RF-backscattering", DoE ARPA-E SENSOR Project DE-AR0000946, Apr. 2018 – Mar. 2021, \$1,500,000.
15. Co-PI, "Prime Sleep: Automated patient evaluation and monitoring system, Phase II: Optimization of systems and subsystems for feasibility and affordability", CTSC Seed Funding, with Rana S. Zadeh and Al George. Sept. 1, 2016 – May 31, 2017, \$10,000.
16. PI, "Low-power security functions by embedded flash and DRAM", Samsung GRO, Oct. 2015 – Sept. 2016, \$100,000.
17. Co-PI, "Thermoregulatory clothing system for building energy saving", ARPA-E, Mar. 2015 – Feb. 2018, my part: \$616,000.
18. PI, "Accurate indoor positioning of small passive tags", Samsung GRO, Oct. 1 2014 – Sept. 30, 2016, \$199,687.
19. PI, "Beam forming to improve channel characteristics for indoor locating", Cornell–Technion Faculty Exchange Program, \$7,000, Aug. 2014 – July 2015.
20. Co-PI, "Improving methods to identify free-roaming dogs", Atkinson Center for a Sustainable Future, \$19,984, Aug. 2014 – July 2015.
21. Co-PI, "SBIR: Real-time locating system by RFID for human-machine interface", NSF, Jan. 2013 – June 2013, \$150,000.
22. PI, "Hybrid ferroelectric-charge nonvolatile memory", Samsung GRO, Oct. 1 2012 – Sept. 30, 2013, \$131,182.
23. Co-PI, "Flash memory based generation of security functions", NSF, Sept 2012 – Aug. 2015, with Edward Suh, my part: \$250,000.
24. PI, "Multiple-year biosensors and RFID fabrication", TSMC, August 2011 – July 2014, valued at \$200,000 per year.
25. Co-PI: "Self-amplifying DNA-polymers for POC diagnosis through a portable CMOS sensor", Gates Foundation, with Dan Luo, August 2011 – August 2013, my part: \$550,000.
26. Co-PI: "Integrated DC-DC conversion for energy-efficient multicore microprocessors", DOE, with Ken Shepard, Bruce van Dover and Alyssa Apsel, June 2010 – May 2012, my part: \$224,000.
27. Co-PI, "CPS: Nonvolatile computing for embedded cyber-physical systems", NSF, Sept. 2009 – Aug. 2012, with Edward Suh, my part: \$250,000.
28. PI, "Non-self-jamming passive telemetry with sensor integration", NSF, July 2009 – June 2012, single PI, \$260,000.
29. Co-PI, "New materials approaches for future graphene-based device", AFOSR MURI, with 12 Cornell and Columbia PIs, Aug 1, 2009 – July 31, 2012, my part: \$300,000.

30. Co-PI, "STTR Phase I: Fullerene molecule-silica hybrid dielectrics for the field-sensitive tunneling barriers in flash memory", NSF, June 15, 2009 – June 14, 2010, subcontract from Nano-C, \$74,061 for my part.
31. Co-PI, "Nonvolatile computing", SRC, with Edward Suh, \$40,000, September 2008 – August 2009.
32. PI, Summer Research Fellowship, NIST, Boulder, CO, \$14,680, June - September 2008.
33. Co-PI, "Trusted mixed-signal CMOS processes adapted to RF MEMS and sensor integration for defense applications", ARL, with Clif Pollock and Sunil Bhawe, October 2007 – September 2008, \$138,000 for my part.
34. Co-PI, "Single-electron control of molecules with interface to CMOS", NSF through Cornell Center for Material Research (CCMR) Interdisciplinary Research Group (IRG), with Dan Ralph, Tito Abruna, Dave Muller and Bob Burhman, Aug. 2007 – July. 2010, \$82,000 each year, renewable yearly.
35. PI, "Ultra-low-power wireless transmitter with passive Bragg oscillator", NSF ECS, September 2007 – August 2010, \$270,000.
36. PI, "Controlled orbital hybridization in the carbon nanotube quantum-modulated transistor (CNT-QMT)", NSF-NRI supplemental funding, March 2007 – Feb. 2010, \$300,000.
37. Co-PI, "Insect cyborg sentinels", DARPA for March. 2006 – Feb. 2010, 10 PI, my part: \$600,000 for the task: "Ultra low-power NLTL-based UWB two-way radio link".
38. PI, "Pressure, heat, chemical and flow rate sensors on universal CMOS substrate for *in vivo* biomedical applications", NYSTAR, Aug. 2006 – July 2008, \$510,000.
39. Co-PI, "Electret, magnetic and optical devices by metal-colloid-embedded polymers (MCEP)", NSF through Cornell Center for Material Research (CCMR) Seed Project, with Chekesha Liddel, Dec. 2004 – Nov. 2005, \$60,000.
40. PI, "NIRT: Molecular sensing and actuation by CMOS nonvolatile charges with independently addressed nanoscale resolution", NSF, with Amit Lal, Jim Engstrom, and Fernando Escobedo, Aug. 2003 – July 2007, \$1,200,000.
41. PI, "The silicon olfactory bulb: a neuromorphic approach to molecular sensing with chemoreceptive neuron MOS transistors (CvMOS)", EPA, May 2003 – April 2006, \$359,000.
42. Co-PI, "Integrated nanomechanically-regulated atomic clock", DARPA, with Amit Lal, Jan. 2003 – June 2005, \$70,000 per year for my part.
43. PI, "Novel applications based on attractive and repulsive electrostatic forces in nanoscale", NSF Nanotechnology Exploratory Research (NER), Aug. 2002 – July 2003, \$80,000.
44. PI, "Multi-scale modeling of semiconductor devices and circuits", IBM SUR University Collaboration Program, \$344,000, Jan. 2002.
45. PI, "Optimal double-gate MOSFET structure for mixed-signal circuits", NSF/SRC Mixed Signal program, June 2001 – May 2004, \$300,000.
46. Co-PI, "Nanoelectronic information processing", NSF Science and Technology Center, 2001 – 2008, \$85,000 per year for my part.
47. Co-PI, "Opto-electronic and interconnects hierarchical design automation system", DARPA MTO NeoCAD program, Sept. 2001 – Aug. 2004, my part: \$204,000.
48. PI, "Quantum well electron gain structures for improved infrared detector read noise", NASA Research, Jan. 2001 – June 2004, \$854,000 (3 Co-PIs).
49. PI, "Modeling of multi-dimensional tunneling effects in nano-CMOS technology", SRC, Nanostructure and Integration Sciences, Oct. 2000 – Sept. 2003, \$150,000.
50. PI, "Self-assembly processes for practical nano-scale electronic devices and interconnect", NSF CAREER/PECASE, April 2000 – March 2005, \$510,000.
51. Co-PI, "Simulation and modeling of organic and inorganic non-crystalline semiconductors", NSF Knowledge Distribution Initiative (KDI-NCC), Cornell, Sept. 1999 – Aug. 2002, \$250,000 for my part (six Co-PIs).

52. Co-PI, "Functionally differentiated interconnect for giga-scale integration", Microelectronics Advanced Research Corporation (MARCO) Focus Center Research on Interconnect, Cornell, 1999. Funding: \$3M for three years (six universities, 20 Co-PIs). My part: \$50,000 for only the first year.

I. Books and Book Chapters:

1. C. Lee and E. C. Kan, "Charge storage in metal nanocrystals", *Handbook of Semiconductor Nanostructures and Nanodevices*, ed. A. A. Balandin and K.L. Wang, American Scientific Publishers, Los Angeles, 2006.
2. R. W. Dutton, C.-H. Choi and E. C. Kan, "Device modeling – from physics to electrical parameter extraction", *Handbook of VLSI Design*, CRC Press, 2005.
3. Shantanu Rajwade and E. C. Kan, "Chap. 5: Material and geometrical design in nanocrystal flash memory", in *Nonvolatile Memories, Materials, Devices and Applications*, Ed. T. Y. Tseng, American Scientific Publishers, 2011.
4. Y. Ma and E. C. Kan, *Non-Logic Devices in Logic Processes*, Springer, 2017.
<http://www.springer.com/us/book/9783319483375>

J. Journal Publications in Chronological Order

1. E. C. Kan, U. Ravaioli and T. Kerkhoven, "A rigorous numerical implementation of augmented drift-diffusion equation for the simulation of velocity overshoot", pp. 47-50, *Computational Electronics*, K. Hess, J. P. Leburton and U. Ravaioli, eds., Boston: Kluwer Academic, 1990.
2. D. Chen, E. C. Kan and K. Hess, "Field-induced anisotropic distribution functions and semiconductor transport equations with tensor-form coefficients", *J. Appl. Phys.*, vol. 68, no. 10, pp. 5360-5362, Nov. 1990.
3. D. Chen, E. C. Kan and U. Ravaioli, "An analytical formulation of the length coefficient of the augmented drift-diffusion model including velocity overshoot", *IEEE Trans. Electron Devices*, vol. 38, no. 6, pp. 1484-1490, June 1991.
4. E. C. Kan U. Ravaioli and D. Chen, "Multidimensional augmented current equation including velocity overshoot", *IEEE Elec. Dev. Lett.*, vol. 12, no. 8, pp. 419-421, Aug. 1991.
5. E. C. Kan, U. Ravaioli and T. Kerkhoven, "Calculation of velocity overshoot in submicron devices using an augmented drift-diffusion model", *Solid-State Electron*, vol. 34, no. 9, pp. 995-999, Sept. 1991.
6. D. Chen, E. C. Kan, U. Ravaioli, C. Shu and R. W. Dutton, "An improved energy transport model including nonparabolicity and non-Maxwellian distribution effects", *IEEE Elec. Dev. Lett.*, vol. 13, no. 1, pp. 26-28, Jan. 1992.
7. E. C. Kan, D. Chen, U. Ravaioli, Z. Yu and R. W. Dutton, "Formulation of macroscopic transport models for numerical simulation of semiconductor devices", *VLSI Design*, vol. 3, no. 2, pp. 211-224, 1995.
8. D. W. Yergeau, E. C. Kan, M. Gander and R. W. Dutton, "ALAMODE: a layered model development environment," *Simulation of Semiconductor Devices and Processes*, H. Ryssel and P. Pichler, eds., 1995, p. 66.
9. Z. Hsiau, E. C. Kan, J. P. McVittie and R. W. Dutton, "Robust, stable and accurate boundary movement for physical etching and deposition simulation", *IEEE Trans. Electron Device*, vol. 44, no. 9, pp. 1375-1385, Sept. 1997.
10. E. C. Kan, G. Jin, Z. Yu and R. W. Dutton, "Observation of anomalous negative differential resistance in diode breakdown simulation using carrier temperature dependent impact ionization", *VLSI Design*, vol. 6, no. 1-4, pp. 199-202, 1998.
11. R. W. Dutton and E. C. Kan, "Hierarchical process simulation for nano-electronics", *VLSI Design*, vol. 6, no. 1-4, pp. 385-391, 1998.
12. E. C. Kan and R. W. Dutton, "Modeling of poly-silicon carrier transport with explicit treatment of grains and grain boundaries", *VLSI Design*, vol. 8, no. 1-4, pp. 533-537, 1998.

13. J. Jang, E. C. Kan, T. Arnborg, T. Johansson and R. W. Dutton, "Characterization of RF power BJT and improvement of thermal stability with nonlinear base ballasting", *IEEE J. Solid-State Circuits*, vol. 33, no. 9, pp. 1428-1432, Sept. 1998.
14. E. C. Kan and Z. Liu, "Directed self assembly process for nano-electronics and interconnect", *Superlattice and Microstructures*, vol. 27, No. 5/6, pp. 473-479, June 2000.
15. Z. Liu, M. Kim, V. Narayanan and E. C. Kan, "Process and device characteristics of self-assembled metal nano-crystal EEPROM", *Superlattice and Microstructures*, vol. 28, No. 5/6, pp. 393-399, Nov 2000.
16. G. Pei, J. Kedzierski, P. Oldiges, M. leong and E. C. Kan, "FinFET design considerations based on 3-D simulation and analytical modeling", *IEEE Trans. Electron Devices*, vol. 49, no. 8, pp. 1411-1419, Aug. 2002.
17. Z. Liu, C. Lee, V. Narayanan, G. Pei and E. C. Kan, "Metal nanocrystal memories, Part I: device design and fabrication", *IEEE Trans. Electron Devices*, vol. 49, no. 9, pp.1606-1613, Sept. 2002.
18. Z. Liu, C. Lee, V. Narayanan, G. Pei and E. C. Kan, "Metal nanocrystal memories, Part II: device characteristics", *IEEE Trans. Electron Devices*, vol. 49, no. 9, pp.1614-1622, Sept. 2002.
19. Z. Liu, C. Lee, G. Pei, V. Narayanan and E. C. Kan, "Eluding metal contamination in CMOS front-end fabrication by nanocrystal self assembly", *Material Issues in Novel Si-Based Technology*, ed., W. G. En et. al, Materials Research Society, vol. 686, pp. 147-152, 2002.
20. C. Lee, Z. Liu and E. C. Kan, "Investigation on process dependence of self-assembled metal nanocrystals", *Material Issues in Novel Si-Based Technology*, ed., W. G. En et. al, Materials Research Society, 2003, pp. 691-696.
21. Z. Liu, C. Lee, V. Narayanan, G. Pei and E. C. Kan, "A novel quad source/drain metal nanocrystal memory device for multi-bit-per-cell storage", *IEEE Electron Device Letters*, vol. 24, no. 5, pp. 345-347, May 2003.
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K. Referred Conference Publications in Chronological Order

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133. W.-K. Yu, Y. Wang, G. E. Suh, E. C. Kan, L. Grupp and S. Swanson, "Flash memory authentication through untrusted supply chains using per-chip wearout patterns", *Nonvolatile Memories Workshop (NVMW2011)*, San Diego, CA, March 7-9, 2011.
134. F. Yu, Y. Ma, K. G. Lyon and E. C. Kan, "Reflective nonlinear transmission lines for single-antenna non-self-jamming RFID", *IEEE MTT 2011 International Microwave Symp. (IMS)*, Baltimore, MD, June 5 – 10, 2011.
135. W.-K. Yu, R. Huang, S. Q. Xu, S.-E. Wang, G. E. Suh and E. C. Kan, "SRAM-DRAM hybrid memory with applications to efficient register files in fine-grained multi-threading", *38th Intl. Symp. Comp. Arch. (ISCA)*, San Jose, CA, June 4 – 8, 2011.
136. K. Jayant, M. R. Hartman, J. B. Phelps, P. H. Gordon, D. Luo, L. Pollack and E. C. Kan, "Electrolytic charge inversion at programmable CMOS sensor interface", *16th Intl. Conf. Solid-State Sensors, Actuators and Microsystems (Transducer '11)*, Beijing, China, June 5 – 9, 2011.
137. P. Prabhu, A. Akel, L. Grupp, W.-K. Yu, G. E. Suh, E. C. Kan and S. Swanson, "Extracting device fingerprints from flash memory exploiting physical variations", *4th Intl. Conf. Trust and Trustworthy Computing (TRUST)*, Pittsburgh, PA, June 22 – 24, 2011.
138. S. R. Rajwade, K. Auluck, J. T. Shaw, K. G. Lyon and E. C. Kan, "A hybrid ferroelectric and charge nonvolatile memory", *69th Device Research Conference*, Santa Barbara, CA, June 20 – 22, 2011.
139. W.-K. Yu, S. R. Rajwade, S.-E. Wang, B. Lian, G. E. Suh and E. C. Kan, "A nonvolatile microcontroller with integrated floating-gate transistors", *41st Intl. Conf. Dependable Systems and Networks (DSN)*, June 27 – 30, 2011, Hong Kong, China.
140. F. Yu, Y. Ma and E. C. Kan, "A passive wireless sensor with reflective nonlinear transmission lines with capacitive signal transduction", *Radio and Wireless Symp. (RWS)*, Santa Clara, CA, Jan. 15 – 18, 2012.
141. Y. Wang, S. Shuo, W.-K. Yu, G. E. Suh and E. C. Kan, "Flash memory for ubiquitous hardware security functions: True random number generation and device fingerprints", *IEEE Symp. Security and Privacy*, San Francisco, May 20 – 23, 2012.
142. K. Auluck, S. Rajwade and E. C. Kan, "Switching dynamics in ferroelectric-charge hybrid nonvolatile memory", *Device Research Conference*, University Park, PA, June 18 – 20, 2012.
143. L.-T. Tung, M. V. Mateus and E. C. Kan, "Transverse-field bandgap modulation on graphene nanoribbon transistors by double-self-aligned spacers", *Device Research Conference*, University Park, PA, June 18 – 20, 2012.
144. Y. Ma and E. C. Kan, "Multi-path interference reduction in passive NLTL RFID tags", *IEEE MTT-S International Wireless Symp. (IWS)*, Beijing, China, April 14 – 18, 2013.
145. Y. Ma and E. C. Kan, "Passive harmonic RFID for indoor localization", *IEEE RFID Conf.*, Orlando, FL, April 30 – May 2, 2013.
146. Y. Wang, W.-K. Yu, G. E. Suh and E. C. Kan, "Hiding information in Flash memory", *IEEE Symp. Security and Privacy*, San Francisco, CA, May 19 – 22, 2013.
147. Y. Ma and E. C. Kan, "Accurate indoor ranging by broadband passive NLTL tags", *IEEE MTT 2013 International Microwave Symp. (IMS)*, Seattle, WA, June 2 – 7, 2013.
148. K. Jayant, K. Auluck, S. Anwar and E. C. Kan, "Electrochemical gating: interplay of field, acidity and salinity on an electrolyte-insulator interface", *IEEE Transducers*, Barcelona, Spain, June 16 – 20, 2013.
149. S. R. Rajwade, K. Auluck, T. A. Naoi, K. Jayant, R. B. van Dover and E. C. Kan, "Towards DRAM–Flash hybrid: Dual–speed low–voltage ferroelectric and charge memory", *International Memory Workshop (IMW)*, Monterey, CA, June 2013.
150. K. Auluck, S. Rajwade and E. C. Kan, "Design considerations for FE-charge DRAM-Flash hybrid memory", *Device Research Conference*, Notre Dame, IN, June 23 – 26, 2013.

151. L.-T. Tung and E. C. Kan, "Side-gate-controlled dual-mode power gating device by graphene nanoribbon transistors", *Device Research Conference*, Notre Dame, IN, June 23 – 26, 2013.
152. K. Jayant, K. Auluck and E. C. Kan, "The DNA transistor interface: The interplay between pH, electric field and membrane screening dictates sensitivity", *IEEE Sensor Conf.*, Baltimore, MA, Nov. 3 – 6, 2013.
153. P. H. Gordon, K. Jayant and E. C. Kan, "Capacitive control of an ISFET using dielectric coated electrodes device considerations and experimental observations", *IEEE Sensor Conf.*, Baltimore, MA, Nov. 3 – 6, 2013.
154. K. Jayant, M. R. Hartman, E. J. Rice, D. Luo and E. C. Kan, "Non-Faradaic electrochemical detection of pathogenic DNA amplified by target driven self assembly on a CMOS platform", *17th Intl. Conf. Miniaturized Systems for Chemistry and Life Science (μ TAS)*, Freiburg, Germany, Oct. 27 – 31, 2013.
155. S. Q. Xu, W.-K. Yu, G. E. Suh and E. C. Kan, "Flash physical unclonable function for data encryption", *5th Nonvolatile Memories Workshop (NVMW2014)*, San Diego, CA, March 9 – 11, 2014.
156. S. Q. Xu, W.-K. Yu, G. E. Suh and E. C. Kan, "Understanding sources of variations in Flash memory for physical unclonable functions", *International Memory Workshop*, Taipei, Taiwan, May 17 – 19, 2014.
157. Y. Cao, N. Rakhilin, P. H. Gordon, X. Shen and E. C. Kan, "Nonamperometric CMOS sensing of intestinal action potential", *18th Intl. Conf. Miniaturized Systems for Chemistry and Life Science (μ TAS)*, Oct. 26 – 30, 2014.
158. K. Auluck, S. R. Rajwade and E. C. Kan, "A unified circuit model for ferroelectrics", *19th Intl. Conf. Simulation of Semiconductor Processes and Devices (SISPAD)*, Yokohama, Japan, Sept. 9 – 11, 2014.
159. Y. Ma, H. Rong and E. C. Kan, "Millimeter accuracy passive tag ranging via second harmonics RF backscattering against body movement interference", *IEEE GlobalCom*, Austin, TX, Dec. 8 – 12, 2014.
160. P. H. Gordon, K. Jayant, Y. Cao, K. Auluck, J. H. Phelps and E. C. Kan, "Circuit models for non-faradic CMOS electrochemical sensing", *IEEE Sensors Conf.*, Valencia, Spain, Nov. 2 – 5, 2014.
161. Y. Ma and E. C. Kan, "Passive ranging by low-directivity antennas with quality estimate", *IEEE MTT 2015 International Microwave Symp. (IMS)*, Pheonix, AZ, May 18 – 22, 2015. (Third place in Best Student Paper competition out of 150 accepted student papers)
162. E. C. Kan, "Hardware-oriented security: Single particle effects from flash memory for random numbers, unclonable ID, steganography and authentication", *CMOS Emerging Technology Research Conference*, Vancouver, Canada, May 22 – 24, 2015.
163. E. C. Kan, "Biosensors: Technological advances and commercial applications", invited talk, *Sensors Global Summit*, La Jolla, CA, Nov. 10 – 11, 2015.
164. Y. Ma and E. C. Kan, "Ubiquitous tagless object locating with ambient harmonic tags", *IEEE Intl. Conf. Computer Communications (Infocom)*, San Francisco, CA, Apr. 10 – 15, 2016.
165. P. H. Gordon and E. C. Kan, "Embroidered antenna characterization for passive UHF RFID tags", *IEEE RFID Conference*, Orlando, FL, May 3 – 5, 2016.
166. Y. Ma, X. Hui and E. C. Kan, "Harmonic-WISP: A passive broadband RFID platform", *IEEE MTT 2016 International Microwave Symp. (IMS)*, San Francisco, CA, May 22 – 27, 2016.
167. Y. Ma, X. Hui and E. C. Kan, "3D locating via broadband nonlinear backscatter in passive devices with centimeter precision", *22nd Intl. Conf. Mobile Computing and Networking (ACM Mobicom)*, New York, NY, Oct. 3 – 7, 2016.
168. X. Hui, Y. Ma and E. C. Kan, "Real-time 3D robotic arm tracking in indoor environment by RF nonlinear backscattering", *8th ACM Wireless S3 Workshop*, New York, NY, Oct. 7, 2016.
169. E. C. Kan, "Wearable electronics: Mapping RFID technology to opportunities", invited talk, *Sensors Global Summit*, La Jolla, CA, Dec. 6 – 8, 2016.
170. X. Hui, Y. Ma, and E. C. Kan, "Real-time code-division multi-tag localization with centimeter accuracy," *11th Intl. RFID Conf.*, Phoenix, AZ, May 9 – 11, 2017.

171. E. C. Kan, "Indoor radio real-time localization and identification", invited talk, *Emerging Technologies*, Warsaw, Poland, May 28 – 30, 2017.
172. E. C. Kan, "Beyond CMOS: From Devices to Systems: Ferroelectric integration to CMOS electronics", invited talk, *Stephen and Sharon Seiden Frontiers in Engineering and Science Workshop*, Haifa, Israel, June 5 -6, 2017.
173. P. H. Gordon and E. C. Kan, "Dynamic modeling of steric effects on polarizable electrodes," *19th Intl. Conf. Solid-State Sensors, Actuators and Microsystems (Transducers)*, Kaohsiung, Taiwan, June 18 – 22, 2017.
174. X. Hui and E. C. Kan, "Mitigation of body movement interference in near-field coherent sensing for heartrate monitoring", *IEEE Intl. Conf. Wearable and Implantable Body Sensor Networks (BSN)*, Las Vegas, NV, Mar. 4 – 7, 2018.
175. E. C. Kan, "Non-contact multiplexed RF monitoring of vital signs and internal body movement", invited talk, *The First International Workshop on Challenges and Opportunities in the Next Generation Body Sensors & Systems, Analytics, Applications, and Interventions, IEEE Conference on Biomedical and Health Informatics (BHI) 2018 and the IEEE Conference on Body Sensor Networks (BSN)*, Las Vegas, NV, Mar. 4 – 7, 2018.
176. X. Hui and E. C. Kan, "Accurate extraction of heartbeat intervals with near-field coherent sensing", *IEEE Intl. Conf. Communications (ICC)*, Kansas City, MO, May 20 -24, 2018.
177. P. Sharma and E. C. Kan, "Sleep scoring with a UHF RFID tag by near-field coherent sensing", *IEEE MTT 2018 International Microwave Symp. (IMS)*, Philadelphia, Pennsylvania, June 10 – 15, 2018.
178. X. Hui and E. C. Kan, "Harmonic UHF RFID ranging with 50-micron accuracy and 1-kHz sampling rate", *13th IEEE Conf. RFID*, Phoenix, AZ, April 2 – 4, 2019.
179. X. Hui and E. C. Kan, "Seat integration of RF vital-sign monitoring", *International Microwave Biomedical Conf. (IMBioC)*, Nanjing, China, May 6 – 8, 2019.
180. X. Hui, P. Sharma and E. C. Kan, "Microwave stethoscope for heart sound by near-field coherent sensing", *International Microwave Symposium*, Boston, MA, June 2 – 7, 2019.
181. P. Sharma, X. Hui and E. C. Kan, "An RF sensor for monitoring respiratory patterns", *41st Annual Intl. Conf. IEEE Engineering in Medicine and Biology Society (EMBC'19)*, Berlin Germany, July 23 – 27, 2019.
182. E. C. Kan, "Radio ranging with ultra-high resolution with passive markers", invited talk, *5th Annual Sensor Summit, Manufacturing Stream*, San Diego, CA, Dec. 10 – 12, 2019.
183. E. C. Kan, "Ultra-high precision radio ranging of passive markers", invited talk, *IEEE RFID Conf. Workshop on Wireless Motion Capture and Fine-Scale Localization*, Orlando, FL, April 28 – 29, 2020.
184. G. Xu, P. Sharma and E. C. Kan, "Indoor object sensing using radio-frequency identification with inverse solutions", *IEEE Sensors 2020 Conf.*, Oct. 25 – 28, 2020.
185. E. C. Kan, "RFID-based sensors in smart buildings", invited talk, *Sensor Network, IEEE Sensors 2020 Conf.*, Oct. 25 – 28, 2020.
186. E. C. Kan, "Energy scavenging of passive tags with unspecified locations", invited talk on Energy Harvesting, *IEEE RFID Conf.*, April 27 – 29, 2021, Atlanta, GA.
187. E. C. Kan, X. Hui, P. Sharma, J. Zhou, Z. Zhang, T. B. Conroy and G. Xu, "Real-time cardiopulmonary monitoring for health alert by wearable RF sensors", *2021 Military Health System Research Symposium (MHSRS)*, Kissimmee, FL, Aug. 23 – 26, 2021.
188. E. C. Kan, "RFID for autonomous facilities: Grand challenges and frontiers", Keynote, *IEEE RFID Conf.*, Las Vegas, NV, May 17 - 19, 2022.
189. Z. Zhang, G. Xu and E. C. Kan, "3D geometry recognition by RFID box", *IEEE RFID Conf.*, Las Vegas, NV, May 17 - 19, 2022.

190. T. B. Conroy, J. Zhou and E. C. Kan, "Physiological interpretation of cardiac ventricle and valve dynamics from wearable radio-frequency sensors", *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Glasgow, Scotland, UK, July 11 – 15, 2022.
191. Z. Zhang and E. C. Kan, "Radiooculogram (ROG) for eye movement sensing with eyes closed", *IEEE SENSORS Conference*, doi: 10.1109/SENSORS52175.2022.9967173, Dallas, Texas, USA, Oct 30 - Nov 2, 2022.
192. G. Xu and E. C. Kan, "Ambiguity-free 3D millimeter-precision RFID tag localization inside building materials", *IEEE RFID Conf.*, Seattle, WA, June 13 – 15, 2023.
193. T. B. Conroy, J. Araos and E. C. Kan, "Systolic time interval extraction in hypertensive and hypotensive pig models using wearable near-field radio-frequency sensors", *45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Sydney, Australia, July 2023.
194. G. Xu and E. C. Kan, "Device-free occupant counting using ambient RFID and deep learning", *IEEE Radio & Wireless Week (RWW2024)*, San Antonio, TX, USA, Jan. 21 – 24, 2024.
195. G. Xu and E. C. Kan, "Phase offset calibration in multi-channel radio frequency transceivers", *IEEE Radio & Wireless Week (RWW2024)*, San Antonio, TX, USA, Jan. 21 – 24, 2024.
196. A. Kapoor, T. B. Conroy, K. Gangwar, and E. C. Kan, "Continuous monitoring of lung recruitment under PEEP titration with near-field radio sensors", *46th Intl. Conf. of IEEE Engineering on Medicine and Biology (EMBC)*, Orlando, FL, July 15 – 19, 2024.
197. U. Delay, Z. Zhang, and E. C. Kan, "Mapping of individual muscle actuation by forearm radio sensors", *46th Intl. Conf. of IEEE Engineering on Medicine and Biology (EMBC)*, Orlando, FL, July 15 – 19, 2024.
198. K. Gangwar, T. Park, V. Phongtaknuel, and E. C. Kan, "Continuous monitoring of respiratory distress in Alzheimer's patients using near-field RF sensors", *46th Intl. Conf. of IEEE Engineering on Medicine and Biology (EMBC)*, Orlando, FL, July 15 – 19, 2024.
199. A. Kapoor, U. Delay and E. C. Kan, "Detecting facial expressions with radio sensors", *46th Intl. Conf. of IEEE Engineering on Medicine and Biology (EMBC)*, Orlando, FL, July 15 – 19, 2024.
200. G. Xu and E. C. Kan, "Reducing reference points for millimeter-precision RFID tag localization in building structures", *IEEE Int. Conf. RFID*, Boston, MA, June 4 – 6, 2024.

L. Patents:

1. *Use of source/drain asymmetry MOSFET in dynamic and analog circuits*, lead inventor (co-inventors: M. leong and P. Wong), US Patent No. 6,466,489, 2002.
2. *Electrostatically charged microstructures*, single inventor, US Patent No. 6,597,048, July 2003.
3. *Embedded metal nanocrystals*, lead inventor (co-inventors: Z. Liu and C. Lee), US Patent No. 6,646,302, Nov. 2003.
4. *Silicon olfactory bulb: chemoreceptive neuron MOS transistors (CvMOS) for chemical and molecular sensing*, (co-inventor: B. A. Minch), US Patent No. 7,053,439, May 2006.
5. *Multibit metal nanocrystal memories and fabrication*, (co-inventor, C. Lee and Z. Liu), US Patent No. 7,259,984, July 2007.
6. *Permalloy loaded transmission lines for high-speed interconnect applications*, (co-inventor: P. Wang), US Patent No. 7,304,555, Dec. 2007.
7. *Nanotube and nanocrystal based nonvolatile memory* (co-inventors: Y. Zhang and U. Ganguly), US Patent 7,262,991, 2007.
8. *Molecular engineered tunnel barrier* (co-inventor: T.-H. Hou), US Patent No. 8,542,540, 2013.
9. *Capping layer design for electrical probe-based phase change memory* (co-inventor: R. X. Murali), Intel patent application.
10. *Bragg frequency pulse generator* (co-inventor: Keith G. Lyon), provisional patent by Cornell Research Foundation.

11. *Secure data storage based on physically unclonable functions*, US 0,110,130 A1, Jan. 2016.
12. *Data storage based on rank modulation in single-level Flash memory*, US 0,077,765 A1, March 2016.
13. *Use of aborted program and erase for hardware-oriented security functions* (co-inventor: Edward Suh, KK. Yu, Yinglei Wang), US Patent US 865,709, April 2016.
14. *RFID Device, Methods and Applications* (co-inventor: Yunfei Ma), US 9,645,234 B2, May 2017.
15. Floating gate based sensor apparatus and related floating gate based sensor applications, US 10,309,924 B2, June 2019 (co-inventor: Krishna Jayant).
16. *Methods and systems for in vivo electromagnetic near-field coherent sensing* (co-inventor: Xiaonan Hui), US patent: US 20,230,371,823A1, 2023.
17. *Collaborative reader code division multiple access in the harmonic RFID system* (co-inventor: Xiaonan Hui), Provisional patent by Cornell Research Foundation, February 2018.
18. *High spatial and temporal ranging resolution of passive RFID tags*, (co-inventor: Xiaonan Hui), US patent 11,914,018, Feb. 2024.
19. *Microwave stethoscope for heart sound using near-field coherent sensing*, (co-inventor: Xiaonan Hui), Provisional patent by Cornell Research Foundation, December 2018.
20. *Seat integration of RF vital-sign monitoring*, (co-inventor: Xiaonan Hui), Provisional patent by Cornell Research Foundation, December 2018.
21. Technologies for radiomyography gesture recognition for human-computer interaction, (co-inventor: Zijiang Zhang), WO2023244649A2, Provisional patent by Cornell Research Foundation, 2024.

M. Large-scale CAD System Development:

1. System architect and project lead: Stanford SprintCAD programs (advanced 3D device and process simulation programs with open architecture to encompass PISCES, SUPREM, SPEEDIE, ALAMODE and PROPHET).
2. Software co-developer and principal engineer: SemiCAD (advanced device simulation with model callback from front-end extension language), PISCES-2ET, ALAMODE.

N. Postdoctorate Researcher Supervised:

1. Hassan Raza, Transistors with quantum modulation and phase transition, May 2007 – April 2010. Ph.D. under Prof. Supriyo Datta of Purdue University. Now at University of Iowa as a professor.
2. Chungho Lee, Gate stack engineering in metal nanocrystal memories, May 2004 – June 2005, group leader during sabbatical leave.

O. Graduate Students Supervised:

O.1 Former M.S./Ph.D. Students:

1. Zengtao Liu, M.S./Ph.D., Novel applications of metal nanocrystals in CMOS technology, graduation: 1/2002, employed by *Micron Technology*, Boise, IA. Now at Intel.
2. Yu-min Nick Shen, M.Eng./Ph.D., CMOS integrated chemoreceptive sensors based on nonvolatile charges, graduation: 1/2004, employed by *Taiwan Semiconductor Manufacturing Company (TSMC)*, Hsinchu, Taiwan.
3. Pingshan Wang, Ph.D., Novel interconnect schemes for CMOS technology, graduation: 1/2004, professor in *Clemson University*, SC.
4. Gen Pei, M.S./Ph.D., Novel circuit modules in independently driven double-gate MOSFET, graduation: 5/2004, employed by *AMD*, *Sandisk*, and then by *IBM Research*.
5. Anirudh Gorur-Seetharam, M.S., Material analysis for integrated nanocrystal process, graduation: 5/2004, employed by *Spansion*, Sunnyvale, CA.
6. Chungho Lee, Ph.D., Charge storage in nanocrystals, graduation: 5/2004, employed by *Spansion*, Sunnyvale, CA, then by *First Solar*.

7. Myongseob Kim, Ph.D., Process integration of MEMS and electret for novel functional structures, graduation: 12/2004, employed by *Cypress Semiconductors*, San Jose, CA. Now at Xilinx.
8. Jami A. Meter, M.S./Ph.D., Application of quantum effects in CMOS and photodetector devices, graduation: 12/2004, employed by *Intel*, Portland, OR.
9. Venkatasubramanian Narayanan, M.S./Ph.D., Device physics and applications of multi-dimensional tunneling effects in nano-CMOS technology, graduation: 1/2006, employed by *Micron*, and then Qualcomm.
10. Udayan Ganguly, Ph.D., Integration of carbon and silicon-based electronics, graduation: 5/2006, employed by *Applied Materials*, Santa Clara, CA. Now at EE, India Institute of Technology, Bombay.
11. Jinsook Kim, Ph.D., Nonlinear interconnect for high-speed applications, graduation: 5/2006, employed by *Spansion*, Sunnyvale, CA.
12. Weiping Ni, M.S./Ph.D., Interconnect design and modeling by nonlinear elements and ferromagnetic materials, 8/2006, employed by *Kionix*, Ithaca, NY.
13. Blake C. Jacquot, M.S./Ph.D., Chemical/molecular sensing and low current detection in microfluidic systems, 5/2007, employed by *JPL*. Now at Google Smart Buildings.
14. Tuo-Hung (Alex) Hou, Ph.D., Theory and design of nanoscale nonvolatile memories, 5/2008, employed by *National Chiao-Tung University*.
15. Jaegoo Lee, Ph.D., Planar TFT nonvolatile memory, 5/2009, employed by *Samsung Electronics*.
16. Keith G. Lyon, M.S./Ph.D., Mixed-signal VLSI by nonlinear transmission lines and Bragg lattice, 5/2010, employed by *KLA*.
17. Xiaoyang Li, M.S., Low-range drift-free pressure sensor, 8/2010, employed by *Beijing Electronics*.
18. Jonathan T. Shaw, M.S./Ph.D., Hybrid materials and processes for Flash memory gate stack, 12/2011, employed by *IBM*, Fishkill, NY. Now at *TSMC*.
19. Fan Yu, M.S./Ph.D., A passive RFID transponder using harmonic generation of nonlinear transmission lines, 8/2012, employed by *Intel*, Santa Clara, CA. Now at *Google*.
20. Shantanu R. Rajwade, Ph.D., Hybrid approaches towards high-speed, low-voltage Flash memory design, 12/2012, employed by *Intel*, Santa Clara, CA.
21. Krishna Jayant, CMOS Biosensors, 1/2014, employed by Columbia University, and now at Purdue University.
22. Yinglei Wang, M.S., Flash Memory for Ubiquitous Hardware Security Functions, 1/2014, employed by Oracle, Sunnyvale, CA.
23. Sarah Q. Xu, Ph.D., Process Variation in CMOS Memory Devices: Analysis, Mitigation and Application, 5/2014, employed by Intel, Portland, OR.
24. Lieh-ting (Adrian) Tung, Ph.D., Field-effect band modulation graphene transistors, 1/2015, employed by Intel, Santa Clara, CA.
25. Kshitij Auluck, Ph.D., Analysis and design of hybrid ferroelectric-CMOS circuits, 8/2015, employed by Intel, Portland, OR.
26. Wing-Key Yu, Ph.D., Nonvolatile computing system, 12/2016, co-advised with E. Such, employed by Oracle, CA.
27. Yunfei Ma, Ph.D., Indoor locating by broadband harmonic RF backscattering, 5/2016, employed by MIT Media Lab, now at Alibaba USA.
28. Philip H. Gordon, Ph.D., Dynamic models of non-faradic electrochemical sensors for polyelectrolytes, 8/2016, employed by Diversified Technologies, Boston, MA.
29. Yingqui Cao, Ph.D., Variation mitigation in microsystems, 5/2018, employed by Google.
30. Pragya Sharma, Ph.D., Wireless monitoring of vital signs and physiological states, 12/2020, employed by Biofourmis, MA.
31. Xiaonan Hui, Ph.D., RF sensors, 5/2021, employed by Zhejiang University as an Assistant Professor.
32. Jianlin Zhou, Near-field coherent sensing system integration, 5/2023.

33. Zijing Zhang, Radio sensors for biomedical, biological and cyberphysical intelligence, 5/2023.
34. Guoyi Xu, Microwave imaging by RFID network, 12/2023.

O.2 Current Ph.D. Students, Topics and Expected Degree Dates:

1. Thomas B. Conroy, RF sensing for diagnostics and biometrics, 5/2024.
2. Kapil Gangwar, TBD, 5/2007.
3. Aakash Kapoor, TBD, 5/2027.
4. Upekha H. Delay, TBD, 5/2027.
5. Anusha Muralidharan, TBD, 5/2028.

O.3 Master of Engineering Students, Thesis Topic, and Expected Degree Dates:

1. Brian Wong, "Switched capacitor AC/DC rectification for micropower, chip-based generation systems", graduation: 8/2000, employed by Altera.
2. Tim Yi, "Design and verification of low-power rectifiers and charge pumps", graduation: 8/2000, employed by Altera.
3. Daniel Chen, "Characterization and modeling of an asymmetric double-gate MOSFET", graduation: 8/2001, employed by Hitachi.
4. David Lwu, "Temperature dependence of MEMS in-operation stiction", graduation: 8/2002, employed by TSMC.
5. Ava Wan, "Mixed-mode simulation for nonlinear transmission lines", graduation, 8/2006, employed by IBM Fishkill.
6. Ebenezer Kwame Amponsah, "Process integration of CMOS sensors", graduation: 8/2008.
7. Sung En Wang, "Hybrid SRAM-DRAM memory for context switching without bandwidth limitation", graduation: 5/2011, employed by SanDisk.
8. Bob Lian, "Circuits for nonvolatile computing systems", graduation: 5/2011, employed by Intel.
9. Sumbo Akinfolarin, "Cellular phones as RFID reader", graduation: 5/2012.
10. Yu-Yuen Kuo, "Nonvolatile microcontrollers", graduation: 5/2012.
11. Hongqian Rong, "Cognitive RFID receiver", graduation: 5/2014.
12. Shuang Wu, "Tagless target locating by RF backscattering", graduation: 5/2015.
13. Haijing Fu, "Multi-channel RFID reader", graduation: 5/2015.
14. Kevin Wang, "WISP-based harmonic RFID tags", graduation: 12/2015.
15. Po-Jen Hsieh, "Analysis of process variation impacts on NAND Flash memory performance", graduation: 8/2015.
16. Rex Chen, "CDMA for UHF RFID tags", graduation: 5/2016.
17. Hui Xu, "Hardware-oriented security functions from microcontroller embedded flash memory", graduation: 12/2016.
18. Bowen Gao, "Physically unclonable functions in embedded flash memory", graduation: 12/2016.
19. Sophia Yan, "Superheterodyne coherent transceivers in software defined radios", graduation: 5/2017.
20. Jonathan Lo, "Polygraph testing with near-field coherent sensing (NCS)", graduation: 12/2017.
21. Ruizhi Zhang, "Pressure sensor based on nanofibers", graduation: 5/2018.
22. Nicolas F. Casazzone, "Contact lens antenna design for harmonic RFID integration", graduation: 5/2020.
23. Joaquin B. Jerez, "Robotic eye for the eyeball tracking platform", graduation: 5/2020.
24. Tejas Advait, "Eyeball tracking for virtual and augmented reality", graduation: 1/2021.
25. Brian Hsu, "Notched biosensor development", graduation: 5/2022.
26. Hannah L. Goldstein, "Radiomyography sensor design", graduation: 12/2022.
27. Jichao Yang, "Bluetooth-based radio near-field sensors", graduation: 12/2024.
28. Yanxing Zhang, "Bluetooth-based radiomyography", graduation: 12/2024.

P. Undergraduate Research Assistants, Department, School and Expected B.S. Degree Date:

1. Timothy Hu, ECE, Cornell, 5/1999.
2. Phillip Choi, ECE, Cornell, 5/2002, CNF Summer REU, VLSI interconnect characterization.
3. Kenneth Vampola, MSE, UC Santa Barbara, 5/2003, CNF Summer REU, Metal nanocrystal memories, Cornell Ph.D. program.
4. Ian Block, ECE, Cornell, 5/2004, Microwave device measurement.
5. Selina Cai, ECE, Cornell, 5/2005, Statistical data collection and analysis.
6. Kerry Cheung, AEP, Cornell, 5/2003, EEPROM/MEMS integration, MIT Ph.D. program.
7. De-en Ni, ECE, Cornell, 5/2003, Integrated transformer, Stanford MS program.
8. Michael Miranda, ECE, Notre Dame, 5/2004, CNF Summer REU, Metal nanocrystal injection structures, UCSB Ph.D. program.
9. Pratik Patel, ECE, Cornell, 5/2004, CNS Summer REU, Multi-dimensional tunneling formalism in CMOS, UC Berkeley Ph.D. program.
10. Evan Haas, SUNY Buffalo, 5/2004, CNS Summer REU, Quantum mechanical effects in CMOS.
11. Sergey Sarkisov, U. Alabama Huntsville, 5/2006, CNS Summer REU, High-k dielectric on CNT.
12. Felix Lee, ECE, Cornell, 5/2007, Cornell MEng program.
13. Ravneet Bajwa, ECE, Berkeley, 5/2008, Berkeley Ph.D. program.
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