Eun Sok Kim

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Education: University of California, Berkeley, California
Ph.D. EECS, Solid State Devices (Integrated Sensors), 11/90

University of California, Berkeley, California
M.S. EECS, Solid State Devices (IC-Processed Piezoelectric Microphone), 5/87

University of California, Berkeley, California
B.S. EECS with High Honors, Electronics Specialization, 6/82

Experience:

9/99-Present Ming Hsieh Department of Electrical and Computer Engineering, Univ. of Southern California, Los Angeles, CA
Professor: Research interests include microelectromechanical systems (MEMS) technology, acoustic and piezoelectric MEMS, electromagnetic vibration-energy harvesting, inertial sensing, resonant mass sensing, and their applications to biomedicine and information technology. Typically teaches a graduate-level course on MEMS and a senior-undergraduate-level course on analog integrated circuits.
Department Co-Chair (from 7/09 to 6/18): Chaired the Electrophysics division of the department, and oversaw a net tenure-track-faculty growth of 2.5 (from 15.25 to 17.75), 6.5 new tenure-track-faculty hires, a net non-tenure-track-faculty growth of 4 (from 4 to 8), a net Budget-Analysts growth of 2 (from 3 to 5), and lab space growth of 4,206 sq. ft. (from 26,833 to 31,039 sq. ft.). Additionally, made 4 new tenure-track-faculty offers and got 3 acceptances in the last year as the chair. During his tenure as the chair, US News' ranking raw score on USC EE's Graduate Program rose from 3.9 to 4.2 (out of 5.0). Faculty's anonymous evaluations on his overall chair performance in 2015 and 2018 were 4.58 and 4.60 (out of 5.00), respectively.

1/91-1/01 Electrical Engineering Department, University of Hawaii, Honolulu, Hawaii
Associate Professor (from 7/95): Taught Advanced Solid State Devices I and II (EE621 & EE625), Microsensors/Microactuators I and II (EE624 & EE626), Linear Electronics (EE326), Device Physics for IC (EE324), Field and Waves I (EE371), and Microfabrication Processing Technology (EE328). Proposed and developed two new graduate courses on microsensors and microactuators. Developed and established a well-funded research program on acoustic and piezoelectric MEMS.

8/84-12/90 University of California, Berkeley, California

Research Assistant: Developed and fabricated a miniature microphone using IC processes, which was reported in various news media including The Wall Street Journal and Business Week in 1987. Designed, laid out, fabricated, and demonstrated integrated microphones with CMOS amplifiers on a single chip for the first time.

Summer 1984 — Xicor, Inc., Milpitas, California
CMOS Device Engineer: Characterized newly developed CMOS devices.

8/83-5/84 — University of California, Berkeley, California
Teaching Assistant: Taught discussion sessions for Integrated-Circuit Devices course and laboratory sessions for Digital Integrated Circuits course.

7/82-8/83 — NCR Corp., San Diego, California
Associate Engineer-Design: Designed a control, monitor and maintenance panel for a fault-tolerant power system of a mainframe computer.

7/81-12/81 — IBM Research Lab., San Jose, California
College Student Engineer: Characterized experimental magnetic bubble memory chips and documented the measurement results.

Honors and Awards:

Fellow of IEEE, 2011

Fellow of the Institute of Physics (IOP), 1996

IEEE Transactions on Automation Science and Engineering 2006 Best New Application Paper Award on "In-situ DNA Synthesis on Glass Substrate for Microarray Fabrication Using Self-Focusing Acoustic Transducer," by J.W. Kwon, S. Kamal-Bahl and E.S. Kim, April 2006, pp. 152-158.

Outstanding EE Faculty of the Year Award (voted by UH IEEE student chapter), 1996

Faculty Early Career Development (CAREER) Award from National Science Foundation (NSF), 1995

Research Initiation Award from National Science Foundation, 1991

Research & Training Revolving Fund Award from UH, 1991

University of California, Berkeley, California
B.S. EECS with High Honors, Electronics Specialization, 6/82

Member of Tau Beta Pi (Engineering Honor Society) and Eta Kappa Nu (Electrical Engineering Honor Society)

Editorial and Review:

Editor for IEEE/ASME Journal of Microelectromechanical Systems (from 2011)

Editor for Journal of Semiconductor Technology and Science (from 2000)

Editorial Board for Journal of Micromechanics and Microengineering (1995 - 2016)

Associate Editor for IEEE Transactions on Automation Science and Engineering (2006 – 2011)

Editorial Board for Micro and Nano Systems Letters (from 2013)

Reviewer of National Institute of Health, National Science Foundation, IEEE/ASME Journal of Microelectromechanical Systems, Sensors and Actuators, Applied Physics Letters, IEEE Transactions on Electron Devices, Applied Surface Science, Journal of Materials Research, and IEEE Trans. on Circuits and Systems II.

Guest Editor for Special Issue on Automation for the Life Sciences in IEEE Transactions on Automation Science and Engineering

Issued Patents:

[IP16] *Energy Harvester with Magnets and Self-assembled Ferrofluid Liquid Bearing*, E.S. Kim and Y. Wang, U.S. Patent Number 10,418,890

[IP15] *Acoustic Tweezers*, E.S. Kim, Y. Choe, J.W. Kim and K.K. Shung, U.S. Patent Number 10,106,397

[IP14] *Electromagnetic Energy Conversion through Coil and Magnet Arrays*, E.S. Kim and Q. Zhang, U.S. Patent Number 9.231.461.

[IP13] *Self Focusing Acoustic Transducers with Fresnel Reflector/Absorber Lens*, E.S. Kim, H. Yu and C. Lee, U.S. Patent Number 7,719,170.

[IP12] *MEMS Vascular Sensor*, T. K. Hsiai, G. Soundararajan, E. S. Kim, H. Yu, M. Rouhanizadeh, and T. Lin, U.S. Patent Number 8,216,434.

[IP11] *MEMS Vascular Sensor*, T. K. Hsiai, G. Soundararajan, E. S. Kim, H. Yu, M. Rouhanizadeh, and T. Lin, U.S. Patent Number 7,367,237.

[IP10] *Silicon Inertial Sensors Formed Using MEMS*, E.S. Kim and Q. Zou, U.S. Patent Number 7,481,112 B2.

[IP9] *Silicon Inertial Sensors Formed Using MEMS*, A. Madni, Q. Zou, E.S. Kim, L. Costlow, J. Voung, and R. Wells, U.S. Patent Number 7,360,422.

[IP8] *DNA Probe Synthesis on Chip on Demand by MEMS Ejector Array*, E.S. Kim and J.W. Kwon, U.S. Patent Number 7,332,127.

[IP7] *Method for Fabricating a Micromachined Piezoelectric Microspeaker*, S.H. Yi and E.S. Kim, U.S. Patent 7,089,638.

[IP6] *Micromachined Piezoelectric Microspeaker and Fabrication Method Thereof*, S.H. Yi and E.S. Kim, U.S. Patent Number 7,003,125.

[IP5] *Method of Forming Parylene-diaphragm Piezoelectric Acoustic Transducers*, C.H. Han and E.S. Kim, U.S. Patent Number 6,857,501.

[IP4] *Acoustic Wave Micromixer Using Fresnel Annular Sector Actuators*, V. Vivek, E.S. Kim and Y. Zeng, U.S. Patent Number 6,682,214.

[IP3] *Self-limiting Isotropic Wet Etching Process*, E.S. Kim and C.H. Han, U.S. Patent Number 6,379,573.

[IP2] *IC Processed Piezoelectric Microphone*, R.S. Muller and E.S. Kim, U.S. Patent Number 4,816,125.

[IP1] *IC Processed Piezoelectric Microphone*, R.S. Muller and E.S. Kim, U.S. Patent Number 4,783,821.

Pending Patents:

[PP7] *Pick and Placement of Semiconductor Chips Based on Nozzleless Self-Focusing Acoustic Droplet Ejector*, E.S. Kim and Y. Tang, U.S. Patent Pending.

[PP6] *Contactless, Damage-Free, High-Precision Cell Extraction and Transfer through Acoustic Droplet Ejection*, E.S. Kim and Y. Tang, J.F. Zhong and X. Chen, U.S. Patent Pending.

[PP5] *Ultrasound Transducer with Electrically Controllable Focal-Point Location*, E.S. Kim and L. Zhao, U.S. Patent Pending.

[PP4] *Ultrasound Transducer with Electrically Controllable Focal Length*, E.S. Kim and L. Zhao, U.S. Patent Pending.

[PP3] *Electrical Tuning of Focal Size with Single-Element Planar Focused Ultrasonic Transducer*, E.S. Kim and Y. Tang, U.S. Patent Pending.

[PP2] *Wearable Respiratory Monitoring System Based on Resonant Microphone Array*, E.S. Kim and A. Shkel, U.S. Patent Pending.

[PP1] *Ferrofluid Liquid Spring for Vibration Energy Harvesting*, E.S. Kim and Y. Wang, U.S. Patent Pending.

Publications:

Refereed Journal Papers

[J90] H. Liu, S. Liu, A.A. Shkel and E.S. Kim, "*Active Noise Cancellation with MEMS Resonant Microphone Array*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 29, no. 5, pp. 839-845, 2020.

[J89] Y. Tang and E.S. Kim, "*Ring-Focusing Fresnel Acoustic Lens for Long Depth-of-Focus Focused Ultrasound and Multiple Trapping Acoustic Beams*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 29, no. 5, pp. 692-698, 2020.

[J88] L. Zhao and E.S. Kim, "*Analytical Dual-Charged-Surfaces Model for Permanent Magnet and Its Application in Magnetic Spring*," IEEE Transactions on Magnetics, vol. 56, no. 9, pp. 1 – 7, 2020.

[J87] A. Shkel and E.S. Kim, "*Continuous Health Monitoring with Resonant-Microphone-Array-Based Wearable Stethoscope*," IEEE Sensors Journal, vol. 19, no. 12, pp. 4629-4638, 2019.

[J86] L. Wang, A. Lin and E.S. Kim, "*Miniature Sensing System with FBAR-based Oscillators and Frequency Shift*," IEEE Sensors Journal, vol. 18, no. 18, pp. 7633 – 7637, 2018.

[J85] Y. Wang, Q. Zhang, L. Zhao and E.S. Kim, "*Non-Resonant, Electromagnetic Broad-Band Vibration-Energy Harvester Based on Self-Assembled Ferrofluid Liquid Bearing*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 26, no. 4, pp. 809 – 819, 2017.

[J84] Y. Wang, Q. Zhang, L. Zhao, Y. Tang, A. Shkel and E.S. Kim, "*Vibration Energy Harvester with Low Resonant Frequency Based on Flexible Coil and Liquid Spring*," Applied Physics Letter, 109, 203901 (2016); doi: 10.1063/1.4967498.

[J83] S. Cong, Y. Cao, X. Fang, Y. Wang, Q. Liu, H. Gui, C. Shen, X. Cao, E.S. Kim, and C. Zhou, "*Carbon Nanotube Macroelectronics for Active Matrix Polymer-Dispersed Liquid Crystal Displays*," ACS Nano, 10 (11), pp. 10068–10074, 2016.

[J82] Q. Zhang, Y. Wang, L. Zhao and E.S. Kim, "*Integration of Microfabricated Low Resistance and Thousand-turn Coils for Vibration Energy Harvesting*," Journal of Micromechanics and Microengineering, vol. 26, no. 2, 025019 (10pp), 2016.

[J81] Q. Zhang and E.S. Kim, "*Microfabricated Electromagnetic Energy Harvesters with Magnet and Coil Arrays Suspended by Silicon Springs*," IEEE Sensors Journal, vol. 16, no. 3, pp. 634 - 641, 2016.

[J80] D.A. Thomas, L. Wang, B. Goh, E.S. Kim, J. L. Beauchamp, "*Mass Spectrometric Sampling of a Liquid Surface by Nanoliter Droplet Generation from Bursting Bubbles and Focused Acoustic Pulses: Application to Studies of Interfacial Chemistry*," Analytical Chemistry, vol. 87, no. 6, pp 3336–3344, 2015.

[J79] Q. Zhang, Y. Wang and E.S. Kim, "*Electromagnetic Energy Harvester with Flexible Coils and Magnetic Spring for 1 – 10 Hz Resonance*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 24, no. 4, pp. 1193 - 1206, 2015.

[J78] Q. Zhang and E.S. Kim, "*Micromachined Energy-Harvester Stack with Enhanced Electromagnetic Induction through Vertical Integration of Magnets*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 24, no. 2, pp. 384 - 394, 2015.

[J77] Q. Zhang and E.S. Kim, "*Vibration Energy Harvesting Based on Magnet and Coil Arrays for Watt-Level Handheld Power Source*," Proceedings of the IEEE, vol. 102, no. 11, pp. 1747 – 1761, 2014.

[J76] Q. Zhang, Y. Wang, and E.S. Kim, "*Power Generation from Human Body Motion through Magnet and Coil Arrays With Magnetic Spring*," Journal of Applied Physics, vol. 115064908 (5pp), 2014.

[J75] Y. Choe, S.-J. Chen and E.S. Kim, "*Peptide Synthesis on Glass Substrate Using Acoustic Droplet Ejector*," IEEE Transactions on Biomedical Engineering, vol. 61, no. 3, pp. 705-710, March 2014. Selected to be one of the journal's three featured articles in March 2014

[J74] Y. Choe and E.S. Kim, "*Valveless Micropump Driven by Acoustic Streaming*," Journal of Micromechanics and Microengineering, vol. 23, 045005 (8pp), 2013.

[J73] L. Wang, Y.-J. Li, A. Lin, Y. Choe, M.E. Gross, and E.S. Kim, "*A Self Focusing Acoustic Transducer that Exploits Cytoskeletal Differences for Selective Cytolysis of Cancer Cells*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 22, no. 3, pp. 542-552, 2013.

[J72] K.H. Lam, H.-S. Hsu, Y.Li, C. Lee, A. Lin, Q. Zhou, E.S. Kim, K.K. Shung, "*Ultrahigh Frequency Lensless Ultrasonic Transducers for Acoustic Tweezers Application*," Biotechnology and Bioengineering, vol. 110, no. 3, pp. 881-886, 2013.

[J71] L. Baumgartel, A. Vafanejad, S.-J. Chen, and E.S. Kim, "*Resonance Enhanced Piezoelectric Microphone Array for Broadband or Pre-filtered Acoustic Sensing*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 22, pp. 107-114, 2013.

[J70] S.C. Ur, E.S. Kim, and S.H. Yi, "*The Effects of Residual Stresses in the Composite Diaphragm on the Performance of Piezoelectric Microspeakers*," Electronic Materials Letters, vol. 9, no. 1, pp. 119-123, 2013.

[J69] F. Yu, J. Lee, N. Jen, X. Li, Q. Zhang, R.Tang, Q.Zhou, E.S. Kim, T.K.Hsiai, "*Elevated Electrochemical Impedance in the Endoluminal Regions with High Shear Stress:*

Implication for Assessing Lipid-rich Atherosclerotic Lesions," Biosensors and Bioelectronics, vol. 43, pp. 237-244, 2013

[J68] S.-J. Chen, Y. Choe, L. Baumgartel, A. Lin, and E.S. Kim, "*Edge-released, Piezoelectric MEMS Acoustic Transducers in Array Configuration*," Journal of Micromechanics and Microengineering, vol. 22, 025005 (2012).

[J67] W. Pang, H. Zhao, E.S. Kim, H. Zhang, and H. Yu, "*Piezoelectric Microelectromechanical Resonant Sensors for Chemical and Biological Detection*," Lab on a Chip, vol. 12, pp. 29-44, 2012.

[J66] Y. Choe, J.W. Kim, K.K. Shung, and E.S. Kim, "*Microparticle Trapping in An Ultrasonic Bessel Beam*," Applied Physics Letter, vol. 99, 233704 (2011).

[J65] Z. Wang, X. Qiu, J. Zhu, J. Oiler, S.-J. Chen, J. Shi, E.S. Kim, and H. Yu, "*Directional Acoustic Underwater Thruster*," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency, vol. 58, no. 6, pp. 1114-1117, 2011.

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[J63] F. Yu, R. Li, L. Ai, C. Edington, H. Yu, M. Barr, E.S. Kim, and T.K. Hsiai, "Electrochemical Impedance Spectroscopy to Study Vascular Oxidative Stress," Annals of Biomedical Engineering, vol. 39, no. 1, pp. 287-296, 2011.

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[J60] W. Pang, H. Zhang, R.C. Ruby, H. Yu, and E.S. Kim, "*Analytical and experimental study on the second harmonic mode of bulk acoustic wave resonator*," Journal of Micromechanics and Microengineering, vol. 20, no. 11, pp. 115015 (10pp), 2010.

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[J56] L. Ai, H. Yu, A. Paraboschi, F. Yu, E.S. Kim, R. Li and T.K. Hsiai, *"Optimization of Intravascular Shear Stress Assessment in Vivo,"* Journal of Biomechanics, vol. 42, no. 10, pp. 1429-1437, 2009.

[J55] J. Lo, S.-J. Chen, Q. Fang, T. Papaioannou, E.S. Kim, M. Gundersen and L. Marcu, "Performance of Diaphragmed Microlens for a Packaged Microspectrometer," Sensors, vol. 9, no. 2, pp. 859-868, 2009.

[J54] H. Yu, C. Lee, W. Pang, H. Zhang, A. Brannon, J. Kitching, and E.S. Kim, "*HBAR-Based 3.6 GHz Oscillator with Low Power Consumption and Low Phase Noise*," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency, vol. 56, no. 2, pp. 400 – 403, 2009.

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[J51] H. Yu, L. Ai, M. Rouhanizadeh, D. Patel, E.S. Kim, and T.K. Hsiai, "*Flexible Polymer Sensors for In Vivo Intravascular Shear Stress Analysis*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 17, no. 5, pp. 1178 – 1186, 2008.

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[J48] C.Y. Lee, H. Yu, and E.S. Kim, "*Droplet-Based Microreactions with Oil Encapsulation*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 17, no. 1, pp. 147 - 156, 2008.

[J47] Q. Zou, W. Tan, E.S. Kim and G.E. Loeb, "*Single-axis and Tri-axis Piezoelectric Bimorph Accelerometer*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 17, no. 1, pp. 45 – 57, 2008.

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[J45] H. Yu, W. Pang, H. Zhang and E.S. Kim, "*Ultra Temperature-Stable Bulk-Acoustic-Wave Resonators with SiO2 Compensation Layer*," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency, vol. 54, no. 10, pp. 2102 – 2109, 2007.

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[J43] C.Y. Lee, S. Kamal-Bahl, H. Yu, J.W. Kwon and E.S. Kim, "*On-Demand DNA Synthesis on Solid Surface by Four Directional Ejectors on a Chip*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 16, no. 5, pp. 1130-1139, 2007.

[J42] H. Zhang, M.S. Marma, E.S. Kim, C.E. McKenna and M.E. Thompson, "*Mercuric Ion Sensing by Film-Bulk-Acoustic-Resonator*," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, vol. 54, no. 9, pp. 1723-1725, 2007.

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[J40] H. Yu, Q. Zou, J.W. Kwon, D. Huang and E.S. Kim, "*Liquid Needle*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 16, no. 2, pp. 445 - 453, 2007.

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[J35] C.Y. Lee and E.S. Kim, "*Piezoelectrically Actuated Tunable Capacitor,"* IEEE/ASME Journal of Microelectromechanical Systems, vol. 15, no. 4, pp. 745-755, 2006.

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[J22] G.-H. Feng and E.S. Kim, "*Piezoelectrically Actuated Dome-Shaped-Diaphragm Micropump*," IEEE/ASME Journal of Microelectromechanical Systems, vol. 14, no.2, pp. 192-199, 2005.

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