

# Taehwan Kim

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RESEARCH INTERESTS	Electronic-photonic integrated systems for communication/sensing Novel signal processing techniques for sensor systems	
EDUCATION	<b>University of California, Berkeley</b> Ph.D. Student in Electrical Engineering and Computer Sciences <b>Seoul National University</b> B.S. in Electrical and Computer Engineering B.A. in Economics (Double Major)	<i>Aug. 2014 to Aug. 2019 (Anticipated)</i> <i>Mar. 2007 to Feb. 2014</i>
RESEARCH EXPERIENCE	<b>Graduate Technical Intern</b> PHY Research Lab, Intel Labs, Santa Clara, CA <ul style="list-style-type: none"><li>• Polarization de-multiplexing schemes for intensity-modulated direct-detection (IM-DD) optical communication<ul style="list-style-type: none"><li>- US patent published</li></ul></li></ul> <b>Graduate Student Researcher</b> Integrated Systems Group, University of California, Berkeley (Advisor: Vladimir Stojanović) <ul style="list-style-type: none"><li>• Solid-state free-space coherent optical systems in electronic-photonic integration platform<ul style="list-style-type: none"><li>Project goal: realization of an single-chip solution for coherent LiDAR and free-space optical communication links leveraging wafer-scale 3D silicon photonics/CMOS integration technology</li><li>- System and circuit-level solutions for scalable beam-steering system based on optical phased array/focal plane array</li><li>- System-level trade-off analysis for realistic LIDAR/communication applications</li><li>- Constructed experimental setup for beam characterization and free-space system demonstration</li><li>- Experimental demonstration of single-chip optical phased array system for solid-state beam-steering, paper presented at the ISSCC</li><li>- First experimental demonstration of fully-integrated coherent LiDAR system, paper accepted to Symposium on VLSI</li></ul></li><li>• Circuit/system-level techniques for laser phase noise management<ul style="list-style-type: none"><li>Project goal: low-power, low-complexity solutions for enhancing laser linewidth-limited performance in coherent communications/LIDAR systems</li><li>- Performed system-level analysis about the impact of laser phase noise in coherent LiDARs/free-space communication links</li><li>- Developed active control systems for laser phase control leveraging tight integration of photonics and electronics</li><li>- Optical PLL for chirp linearization and coherence distance enhancement for FMCW LIDAR: chip tape-out done in 2017 in 45nm SOI, currently under testing</li></ul></li><li>• Signal processing techniques for sensing systems<ul style="list-style-type: none"><li>Project goal: exploring new algorithms for various sensors that can enhance the performance or extract overlooked information by leveraging known signal models</li><li>- Developed optimal detection algorithm for long-range FMCW LiDAR operating in the range beyond the coherence distance by exploiting known laser spectral characteristics: experimentally demonstrated, paper published at ICASSP &amp; CLEO</li><li>- Developed neural network-based framework for multi-dimensional super-resolution single-molecule localization fluorescent microscopy, experimentally demonstrated &amp; paper submitted</li></ul></li><li>• Model Predictive Control algorithm (MPC) based equalization of high-speed links<ul style="list-style-type: none"><li>Project goal: demonstration of transmitter-side equalization scheme based on channel models for flexible, energy-efficient equalization of asymmetric high-speed interfaces (e.g. processor-memory, switches)</li></ul></li></ul>	<i>May. 2017 to Aug. 2018</i> <i>Aug. 2014 to present</i>

- Built/measured chips in 28nm FDSOI & 45nm SOI, paper published at ASSCC

#### Undergraduate Researcher

Jun. 2012 to Feb. 2014

Mixed-Signal IC and System Group, Seoul National University (Advisor: Jaeha Kim)

- Formal verification of analog/mixed-signal circuits
  - Developed an algorithm to verify correctness of start-up behavior of ring oscillators in presence of variability
  - Implemented GCHECK: a Python-based tool for detection of start-up failures of coupled ring oscillators (transferred to Samsung Electronics, patent issued), paper published at ICCAD
- Variability-aware circuit optimization
  - Developed global optimizer for analog/mixed-signal circuits based on statistical metamodeling

PUBLICATIONS	P. Bhargava*, <b>T. Kim</b> *, C. V. Poulton*, J. Notaros, A. Yaacobi, E. Timurdogan, C. Baiocco, N. Fahrenkopf, S. Kruger, T. Ngai, Y. Timalina, M. R. Watts, V. Stojanović, “Fully Integrated Coherent LiDAR in 3D-Integrated Silicon Photonics/65nm CMOS,” <i>IEEE Symposium on VLSI Circuits</i> , 2019. (*co-first authors)	
	<b>T. Kim</b> , P. Bhargava, C. V. Poulton, J. Notaros, A. Yaacobi, E. Timurdogan, C. Baiocco, N. Fahrenkopf, S. Kruger, T. Ngai, Y. Timalina, M. R. Watts, V. Stojanović, “A Single-Chip Optical Phased Array in a 3D-Integrated Silicon Photonics/65nm CMOS Technology,” <i>IEEE International Solid-State Circuits Conference (ISSCC)</i> , 2019.	
	<b>T. Kim</b> , S. Moon, K. Xu, “Information-Rich Localization Microscopy through Machine Learning,” <i>bioRxiv</i> , 2018.	
	<b>T. Kim</b> , P. Bhargava, V. Stojanović, “Overcoming the Coherence Distance Barrier in Long-Range FMCW LIDAR,” <i>Conference on Lasers and Electro-Optics (CLEO)</i> , 2018.	
	<b>T. Kim</b> , P. Bhargava, V. Stojanović, “Optimal Spectral Estimation and System Trade-Off in Long-Distance Frequency-Modulated Continuous-Wave LIDAR,” <i>IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)</i> , 2018.	
	<b>T. Kim</b> , P. Bhargava, V. Stojanović, “A Model Predictive Control Equalization Transmitter for Asymmetric Interfaces in 28nm FDSOI,” <i>IEEE Asian Solid-State Circuits Conference (ASSCC)</i> , 2016.	
PATENTS	<b>T. Kim</b> , D.-G. Song, S. Youn, J. Park, H. Park, and J. Kim, “Verifying Start-Up Failures in Coupled Ring Oscillators in Presence of Variability Using Predictive Global Optimization,” <i>IEEE/ACM International Conference on Computer-Aided Design (ICCAD)</i> , 2013.	
	J. Kim, J. Lee, D.-G. Song, <b>T. Kim</b> , K.-H. Kim, S. Jung, and S. Youn, “Discretization and Discrimination Methods for Design, Verification, and Testing of Analog/Mixed Signal Circuits,” <i>Custom Integrated Circuits Conference (CICC)</i> , 2013.	
PATENTS	<b>T. Kim</b> , G. Balamurugan, H. Li, H. Jayatilleka, “Polarization De-Multiplexing for Intensity-Modulated Direct-Detection (IM-DD) Optical Communications,” US Patent (Publication Number: 20190033630)	
COURSEWORK	Analog Integrated Circuits, Advanced Analog Integrated Circuits, Introduction to Digital Integrated Circuits, Integrated Circuits for Communications, Digital Signal Processing, Introduction to Optical Engineering	
TEACHING	Introduction to Digital Design and Integrated Circuits (EECS151/251A)	Spring 2018
	Designing Information Devices and Systems I (EE16A)	Spring 2019
HONORS & AWARDS	Kwanjeong Scholarship for Abroad Studies	2014-2019
	National Scholarship for Science and Engineering, Korea Science Foundation	2007-2013
SKILLS	Languages: C, C++, Python, Verilog, Verilog-AMS, MATLAB Tools: Custom IP block design and VLSI design/verification tools (Virtuoso, ADS, DC, ICC, RC, SOC-ENC, Calibre)	