Taehwan Kim

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RESEARCH INTERESTS

Electronic-photonic integrated systems for communication/sensing
Novel signal processing techniques for sensor systems

EDUCATION

University of California, Berkeley *Aug. 2014 to Present*
Ph.D. Student in Electrical Engineering and Computer Sciences

Seoul National University *Mar. 2007 to Feb. 2014*
B.S. in Electrical and Computer Engineering
B.A. in Economics (Double Major)

RESEARCH EXPERIENCE

Graduate Technical Intern *May. 2017 to Aug. 2018*
PHY Research Lab, Intel Labs, Santa Clara, CA

- Advanced system-level techniques for integrated optical links
  - US patent filed

Graduate Student Researcher *Aug. 2014 to present*
Integrated Systems Group, University of California, Berkeley (Advisor: Vladimir Stojanović)

- Free-space optical systems in electronic-photonic integration platform
  - Project goal: realization of an monolithic solution for high-resolution LIDAR and free-space optical communication links leveraging advanced silicon photonics/CMOS technology
  - System and circuit-level solutions for scalable beam-steering system based on optical phased array/focal plane array
  - System-level trade-off analysis for realistic LIDAR/communication applications
  - Large-scale optical phased array system for monolithic beam-steering
  - Constructed experimental setup for beam characterization and free-space system demonstration
- Circuit/system-level techniques for laser phase noise management
  - Project goal: low-power, low-complexity solutions for enhancing laser linewidth-limited performance in coherent communications/LIDAR systems
  - Developing active control systems for laser phase control leveraging tight integration of photonics and electronics
  - Optical PLL for chirp linearization and coherence distance enhancement for FMCW LIDAR: chip tape-out done in 2017 in 45nm SOI (currently under testing)
- Signal processing techniques for sensing systems
  - Project goal: exploring new algorithms for various sensors that can enhance the performance or extract overlooked information by leveraging signal priors
  - 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
  - Developed neural network-based framework for multi-dimensional super-resolution single-molecule localization fluorescent microscopy, experimentally demonstrated
- Model Predictive Control algorithm (MPC) based equalization of high-speed links
  - 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)
  - Built/measured chips in 28nm FDSOI & 45nm SOI, paper published

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)
- Variability-aware circuit optimization
  - Developed global optimizer for analog/mixed-signal circuits based on statistical metamodeling

PUBLICATIONS

T. Kim, P. Bhargava, C. V. Poulton, J. Notaros, A. Yaacobi, E. Timurdogan, C. Baiocco, N. Fahrenkopf, S. Kruger, T. Ngai, Y. Timalsina, M. R. Watts, V. Stojanović, "A Single-Chip Optical Phased Array in a 3D-Integrated Silicon Photonics/65nm CMOS Technology," *IEEE International Solid-State Circuits Conference (ISSCC)*, to appear.

T. Kim, S. Moon, K. Xu, "Information-Rich Localization Microscopy through Machine Learning," *bioRxiv*, 2018.

T. Kim, P. Bhargava, V. Stojanović, "Overcoming the Coherence Distance Barrier in Long-Range FMCW LIDAR," *Conference on Lasers and Electro-Optics (CLEO)*, 2018.

T. Kim, P. Bhargava, V. Stojanović, "Optimal Spectral Estimation and System Trade-Off in Long-Distance Frequency-Modulated Continuous-Wave LIDAR," *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2018.

T. Kim, P. Bhargava, V. Stojanović, "A Model Predictive Control Equalization Transmitter for Asymmetric Interfaces in 28nm FDSOI, *IEEE Asian Solid-State Circuits Conference (ASSCC)*, 2016.

T. Kim, 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," *IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, 2013.

J. Kim, J. Lee, D.-G. Song, **T. Kim**, K.-H. Kim, S. Jung, and S. Youn, "Discretization and Discrimination Methods for Design, Verification, and Testing of Analog/Mixed Signal Circuits," *Custom Integrated Circuits Conference (CICC)*, 2013.

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-A

Tools: Custom IP block and VLSI design/verification tools (Virtuoso, ADS, DC, ICC, RC, SOC-ENC, Calibre), MATLAB