HYUNGJOO SEO

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INTERESTS RF/Wireless Integrated Circuits and Systems, Interference Management, Adaptive Filters and Beamformers, Signal Processing/Localization in Wireless/Acoustics, Sensor Fusion, Machine Learning in wireless

EDUCATION

The University of Illinois (UIUC), Urbana-Champaign, IL, USA (**CGPA**:3.57/4.00) Aug 2018-

- **Ph.D.** in Electrical and Computer Engineering (Advisors: Jin Zhou, Romit R. Choudhury)
  - Focus: Reconfigurable RF, Interference Cancellation, Non-Line-of-Sight Sensing/Tracking

The University of Michigan, Ann Arbor, MI, USA (**CGPA**:3.893/4.000) Sep 2016 – Jun 2018

- **M.S.** in Electrical and Computer Engineering (Advisors: Ehsan Afshari, David Blaauw)
  - Focus: Automatic Beamforming, Injection-locked Coupled Oscillators, RF Power Receiver

Tokyo Institute of Technology (Tokyo Tech), Tokyo, Japan (**CGPA**:94.3/100) Apr 2011 – Aug 2013,

- **B.Eng.** in Electrical and Computer Engineering (Summa Cum laude) Sep 2015 – Mar 2016
  - Early Graduation With Excellence (3-year Graduation) (Advisors: Makoto Ando, Jiro Hirokawa)
  - Korean Mandatory Military Service (2013 - 2015)

RESEARCH EXPERIENCE

Coordinated Science Laboratory (CSL), UIUC Jun 2020 –
(Advisors: Prof. Romit Roy Choudhury and Prof. Jin Zhou)

- Real-time Non-field-of-view tracking/sensing via sensor fusion algorithms.

Wireless Microsystems and Circuits Lab (WiMAC Lab), UIUC Aug 2018 –
(Advisor: Prof. Jin Zhou)

- Novel interference-tolerant receiver architecture for 5G & software-defined radios.
  - Impedance aliasing phenomenon: analysis and derivation on harmonically coupled feedback systems in frequency-translational time-varying mixers.
  - By avoiding impedance aliasing, a hybrid CMOS-acoustic design for widely-tunable blocker-tolerant RF bandpass filtering Rx front-end is proposed to substantially reduce acoustic filter count. [1, 4, 5] (TSMC65nm)
- Fully-integrated full-duplex/FDD receiver with self-adaptive self-interference cancellation. [2]
  - Software modelling of a wireless QAM transceiver with multi-stage RF and analog self-interference cancellation and hybrid-analog-digital autonomous adaptation loops.
  - Analysis and implementation of various gradient-descent algorithms on self-interference cancellation.
- Sub-Nyquist wideband spectrum sensing system using acoustic comb filters. [3]
  - Proposed structured sparse recovery algorithm enables accurate detection of densely-filled occupied bands across a wide spectrum sampled significantly below the Nyquist sampling rate.
- Exploring neural network distillation for direct-RF interference cancellation scheme in full-duplex wireless systems.

Research-oriented Course Projects, UIUC Aug 2018 –

- DNN Receiver: Replaced existing QAM receiver and decoder with deep neural network-based Rx (ECE598NS)
- Indoor localization using WLS algorithm for multiple voice assistants with MIC arrays (CS434)

Radiation Laboratory (RadLab), U Michigan Aug 2017 – Aug 2018
(Advisor: Prof. Ehsan Afshari)

- A 77-GHz retro-directive transceiver with inter-locked coupled oscillators for self-aligning and self-steering beams among two wireless nodes. (ST130nm)
- Analysis on human language efficiency as information code with entropy of English, Japanese, Korean, and Mandarin as a communication system by proposing M-PSK equivalent high-order Markov Chain.

Michigan Integrated Circuit Laboratory (MICL), U Michigan Dec 2016 – Aug 2017
(Advisor: Prof. David Blaauw)

- Multi-band RF harvester using a hybrid RF-DC & DC-DC converter adaptively controlled by VCO for optimal power delivery point. (TSMC180nm)
- Q-enhanced amplifier-based RF harvester and analysis on power conversion efficiency.

Millimeter-wave EM and Antenna Laboratory, Tokyo Tech Sep 2015 – Jun 2016
(Advisor: Prof. Makoto Ando and Prof. Jiro Hirokawa)

- Quadrupled beamforming antenna element number from 32x32 to 64x64 using diffusion-bonding half-etching technique through supportive bridge structures for suppressing structural distortions.

PUBLICATIONS

[1] H. Seo and J. Zhou, "A 2.5-to-4.5-GHz Switched-LC-Mixer-First Acoustic-Filtering RF Front-End Achieving <6dB NF, +30dBm IIP3 at 1xBandwidth Offset," *IEEE Radio Frequency Integrated Circuits Symposium (RFIC '20)*, Los Angeles, CA, USA, Jun 2020.

[2] Y. Cao, X. Cao, H. Seo, and J. Zhou, "An Integrated Full-Duplex/FDD Duplexer and Receiver Achieving 100MHz Bandwidth 58dB/48dB Self-Interference Suppression Using Hybrid-Analog-Digital Autonomous Adaptation Loops," *IEEE International Microwave Symposium (IMS '20)*, Los Angeles, CA, USA, Jun 2020.

[3] J. Guan, J. Zhang, R. Lu, H. Seo, J. Zhou, S. Gong, and H. Hassanieh, "Efficient Wideband Spectrum Sensing Using MEMS Acoustic Resonators," *The 18th USENIX Symposium on Networked Systems Design and Implementation (NSDI '21)*, Boston, MA, USA, Apr 2021.

[4] H. Seo and J. Zhou, "A Mixer-First Acoustic-Filtering Superheterodyne RF Front-End," to appear at *IEEE Journal of Solid-State Circuits (JSSC)*, May 2021. (Invited from RFIC 2020 paper).

[5] H. Seo, M. Sha, and J. Zhou, "A 3.5-to-6.2-GHz Mixer-First Acoustic-Filtering Receiver Chipset with Mixed-Domain Asymmetric IF and Complex BB Recombination Achieving 170MHz BW and +27dBm IIP3 at 1xBW offset," to appear at *IEEE Radio Frequency Integrated Circuits Symposium (RFIC '21)*, Atlanta, GA, USA, Jun 2021.

AWARDS & SCHOLARSHIPS

- Recipient of PhD Student Sponsorship Initiative by IEEE RFIC/IMS 2019 at Boston — 2019
- Recipient of Kwanjeong Educational Foundation Scholarship (17th) — 2018– 2022
- Recipient of U Michigan ECE Departmental Fellowship for 3 semesters — 2016– 2017
- Selected as a representative of Tokyo Tech, Academic Excellence Award upon graduation. — 2016
- 3-Year Graduation with Excellence at Tokyo Tech — 2016
  (One of the very few achieved cases in Tokyo Tech history.)
- Recipient of Korea-Japan Joint Government Scholarship (11th). — 2010 – 2016

PROFESSIONAL AFFILIATIONS & ACTIVITIES

- Teaching Assistant (TA): Electronic Circuits (ECE342) at UIUC — Spring 2020
- Teaching Assistant (TA): Radio-frequency IC design (ECE498JZ) at UIUC — Fall 2020
- Vice president of University of Michigan Korean EECS student association. **[Link]** — 2016 – 2017
- Co-organizer of the 1st ASPIRE League E-Olympics at KAIST, South Korea. **[Link]** — Aug 2014
- Member of Team Tokyo Tech, BIOMOD 2013 (Biomolecular Design Competition) — Jun 2013
- Director and Editor of a Youtube video clip of 170K views of Tokyo Tech **[Link]** — Feb 2013
- President of Tokyo Tech International Student Association (TISA) **[Link]** — Feb 2012 – Jul 2013

KEY COURSES

UIUC
- Mobile Computing, Advanced Wireless Networks & Sensing, Random Process
- Machine Learning, Deep Learning in HW, Detection and Estimation Theory
- Advanced Analog IC Design, Radio-Frequency IC & System Design, Advanced Signal Integrity

U Michigan
- Analog/Digital Interfaces, Analog IC Design, VLSI Design I
- Electromagnetic Theory, Digital Communication & Coding

LANGUAGE &SKILLS

Language
- Korean(Native), English(Fluent), Japanese(Bilingual), Chinese(Beginner), German(Limited)

Programming
- Python, MATLAB, C++, LaTeX, CSS/HTML

Framework
- PyTorch, TensorFlow, Scipy, SciKit(DSP, Comm), pandas

Tools/Equipment
- Cadence Virtuoso, HFSS, ADS, PCB Design tools, VNA, Signal/Spectral Analyzer