Song Noh

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EXPERIENCE	**Incheon National University**	Incheon, South Korea
	Assistant Professor	Sep. 2018 - Present

- Signal processing algorithm for human-type and machine-type communications
- Design of intelligent wireless communiation systems

Intel Corporation — Oregon, USA
Wireless Standards Research Engineer — Dec. 2015 - Jul. 2018

- Investigation of the dynamic blockage effects on performance in mmWave
- Development of PHY and MAC algorithm for self-contained and flexible duplex transmission
- Performance analysis of wireless backhaul solution in sub-6GHz and mmWave bands
- Technical contribution to Integrated Access and Backhaul for NR study item

Purdue University — Indiana, USA
Research Assistant — Jan. 2012 - Dec. 2015

- Multi-resolution codebook and beamforming sequence design in millimeter wave systems
- Pilot beam pattern and hybrid beamforming design in massive MIMO systems
- Precoder design for blind separation and estimation in MIMO-OFDM systems
- Development of a link level simulator based on Digital Video Broadcasting (DVB-T2)

EDUCATION

Purdue University — Indiana, USA
Ph.D. in Electrical and Computer Engineering — Aug. 2011 – Dec. 2015
Advisors: Professors Michael Zoltowski and David Love

Korea Advanced Institute of Science and Technology (KAIST) — Daejeon, South Korea
Master of Science in Electrical Engineering — Feb. 2010
Advisor: Professor Youngchul Sung

Soongsil University — Seoul, South Korea
Bachelor of Engineering in Electrical Engineering — Feb. 2008

PUBLICATIONS

<u>Journal Articles (Submitted/In preparation)</u>

[M1] **Song Noh** *et al.*, "Capacity analysis for LEO satellite communications," in preparation for submission, 2022.

[M2] Kyungsik Seo, **Song Noh** *et al.*, "Deep learning-based phase tracking for sub-THz communications," in preparation for submission, 2022.

[M3] **Song Noh** *et al.*, "Joint direct and indirect channel estimation for RISassisted millimeter-wave systems based on array signal processing," in preparation for submission, 2022.

[M4] Daehee Kim, Sungmin Lee, **Song Noh**, and Jaekoo Lee, "Enhancing object detection via super-resolution: A survey," submitted to *ACM Computing Surveys*, Mar. 2022.

[M5] Kyungsik Seo, Jaekoo Lee, and **Song Noh**, "Deep learning-based direction finding in the presence of direction-dependent mutual coupling," submitted to *ICT Express*, Feb. 2022.

<u>Journal Articles (Published/Accepted)</u>

[J1] **Song Noh**, Junse Lee, Gilwon Lee, Kyungsik Seo, Youngchul Sung, and Heejung Yu, "Channel estimation techniques for IRS-assisted millimeter-wave communication," *IEEE Veh. Technol. Mag.*, vol. 17, no. 2, pp 64 – 73, Jun. 2022.

[J2] Seoyeon Oh, Minseok Yu, Seonghyeon Cho, **Song Noh**, and Hyunchae Chun, "Bi-LSTM augmented deep neural network for multi-Gbps VCSEL based visible light communication link," *Sensors*, vol. 22, no. 11, May 2022.

[J3] **Song Noh**, Jiho Song, Junse Lee, and Heejung Yu, "High-resolution and low-complexity direction of arrival estimation for hybrid array of subarrays," *IEEE Access*, vol. 10, pp 54922 – 54935, May 2022.

[J4] Ji Min Park, Juphil Cho, **Song Noh**, and Heejung Yu, "Optimal frame structure for joint communication-radar systems," *IEEE Access*, vol. 10, pp 52336 – 52342, May 2022.

[J5] Jiho Song, Jong-Ho Lee, **Song Noh**, and Jeongsik Choi, "Millimeter wave reflection pattern codebook design for IRS-assisted V2V communications," *IEEE Trans. Veh. Technol.*, to be published, Apr. 2022.

[J6] **Song Noh**, Heejung Yu, and Youngchul Sung, "Training signal design for sparse channel estimation in intelligent reflecting surface-assisted millimeter-wave communication," to appear in *IEEE Trans. Wireless Commun.*, Jul. 2021.

[J7] Waqas Khalid, Heejung Yu, Dinh Thuan Do, Zeeshan Kaleem, and **Song Noh**, "RIS-aided physical layer security with full-duplex jamming in underlay D2D networks," *IEEE Access*, vol. 9, pp 99667 – 99679, Jul. 2021.

[J8] **Song Noh**, Jaekoo Lee, Heejung Yu, and Jiho Song, "Design of channel estimation for hybrid beamforming millimeter wave systems in the presence of beam squint," *IEEE Syst. J.*, to be published, Jun. 2021.

[J9] Jaekoo Lee, Myungkeun Yoon and **Song Noh**, "Advanced Network Sampling with Heterogeneous Multiple Chains," *Sensors*, vol. 21, no. 5, pp 6737 – 6751, Mar. 2021.

[J10] **Song Noh**, Hyunchae Chun, "Beamforming algorithms," *J. Korean Inst. Electromagn. Eng. Sci.*, vol. 31, no. 8, pp 701 – 712, Aug. 2020.

[J11] **Song Noh**, Jiho Song, Youngchul Sung, and Heejung Yu, "Fast beam search and refinement for millimeter-wave massive MIMO based on two-level phased arrays,"," *IEEE Trans. Wireless Commun.*, vol. 19, no. 10, pp 6737 – 6751, Jul. 2020.

[J12] Waqas Khalid, Heejung Yu, and **Song Noh**, "Residual energy analysis in cognitive radios with energy harvesting UAV under reliability and secrecy constraints," *Sensors*, vol. 20, no. 10, May 2020.

[J13] Jiho Song, Byungju Lee, **Song Noh**, and Jong-Ho Lee, "Adaptive multiuser transmission using millimeter wave beam alignment with user selection," *IEEE Trans. Veh. Technol.*, vol. 69, no. 8, pp 9140 – 9145, May 2020.

[J14] Byounghak Kim, Heejung Yu, **Song Noh**, "Cognitive interference cancellation with digital channelizer for satellite communication," *Sensors*, vol. 20, no. 2, Jan. 2020.

[J15] Jiho Song, Byungju Lee, **Song Noh**, and Jong-Ho Lee, "Limited feedback designs for machine-type communications exploiting user cooperation," *IEEE Access*, vol. 7, pp 95154 - 95169, Sep. 2019.

[J16] **Song Noh**, Michael Zoltowski, and David Love, "Multi-resolution codebook and adaptive beamforming sequence design for millimeter wave beam alignment," *IEEE Trans. Wireless Commun.*, vol. 16, no. 9, pp 5689 – 5701, Sep. 2017.

[J17] Il Y. Chun, **Song Noh**, David Love, Thomas M. Talavage, Stephen Beckley, and Sherman J. Kisner, "Mean square error (MSE)-based excitation pattern design for parallel transmit and receive SENSE MRI image reconstruction," *IEEE Trans. Comput. Imag.*, vol. 2, no. 4, pp. 424 – 439, Dec. 2016.

[J18] **Song Noh**, Michael Zoltowski, and David Love, "Training sequence design for feedback assisted hybrid beamforming in massive MIMO systems," *IEEE Trans. Commun.*, vol. 61, no. 1, pp 187 – 200, Jan. 2016.

[J19] **Song Noh**, Michael Zoltowski, Youngchul Sung, and David Love, "Pilot beam pattern design for channel estimation in massive MIMO systems," *IEEE J. Sel. Topics Signal Process.*, vol. 8, no. 5, pp. 787 – 801, Oct. 2014.

[J20] **Song Noh**, Youngchul Sung, and Michael Zoltowski, "A new precoder design for blind channel estimation in MIMO-OFDM systems," *IEEE Trans. Wireless Commun.*, vol. 13, no. 12, pp. 7011 – 7024, Dec. 2014.

Conference Papers

[C1] **Song Noh**, Heejung Yu, and Youngchul Sung "Training signal design for sparse channel estimation in millimeter-wave communication with intelligent reflecting surfaces," in *Proc. IEEE ICC,* Montreal, Canada, Jun. 2021.

[C2] Kyungsik Seo and **Song Noh**, "A study on the use of deep learning technique for nonlinear system identification," in *Proc. KICS,* Yongpyong, Korea, Feb. 2021.

[C3] Kyungsik Seo and **Song Noh**, "Analysis of DNN-based data detection with phase noise for Teraherz OFDM systems," in *Proc. KICS,* Seoul, Korea, Nov. 2020.

[C4] Hyeong Sook Park, Eun-Young Choi, Young Seog Song, **Song Noh**, and Kyungsik Seo, "DNN-based phase noise compensation for sub-THz communications," in *Proc. ICTC,* Jeju Island, Korea, Oct. 2020.

[C5] Kyungsik Seo and **Song Noh**, "Evaluation of DNN-based channel estimation techniques in millimeter wave systems," in *Proc. KICS,* Yongpyong, Korea, Aug. 2020. (Student Paper Award)

[C6] Kyungsik Seo and **Song Noh**, "Performance analysis of beam search techniques in millimeter wave systems," in *Proc. KICS,* Yongpyong, Korea, Feb. 2020.

[C7] **Song Noh**, Kyungsik Seo, Mirae Kim, and Junghwan Im, "Beam misalignment-aware beamforming system design," in *Proc. KICS,* Seoul, Korea, Nov. 2019.

[C8] **Song Noh**, Junghwan Im, Mirae Kim, and Kyungsik Seo, "Beamformed signal classification based on multiple hypothetical testing," in *Proc. KICS,* Jeju, Korea, Jun. 2019.

[C9] **Song Noh**, Dawei Ying, Qian (Clara) Li, Hassan Ghozlan, Apostolos (Tolis) Papathanassiou, and Geng Wu, "System evaluation for millimeter-wave radio access network," in *Proc. IEEE ICC,* Kansas City, MO, May 2018.

[C10] **Song Noh**, Michael Zoltowski, and David Love, "Multi-resolution codebook based beamforming sequence design in millimeter-wave systems," in *Proc. IEEE Globecom,* San Diego, CA, Dec. 2015.

[C11] **Song Noh**, Michael Zoltowski, and David Love, "Downlink training codebook design and hybrid precoding in FDD massive MIMO systems," in *Proc. IEEE Globecom,* Austin, TX, Dec. 2014. (**Best Paper Award**)

[C12] **Song Noh**, Michael Zoltowski, Youngchul Sung, and David Love, "Training signal design for channel estimation in massive MIMO systems," in *Proc. IEEE ICASSP,* Florence, Italy, May 2014.

[C13] **Song Noh** and Michael Zoltowski, "A new precoder design for precoding-based blind channel estimation for MIMO-OFDM systems," in *Proc. IEEE Globecom,* Atlanta, GA, Dec. 2013.

[C14] **Song Noh** and Michael Zoltowski, "Blind separation for precoding-based blind channel estimation for MIMO-OFDM systems," in *Proc. Asilomar,* Pacific Grove, CA, Nov. 2013.

[C15] **Song Noh**, Michael Zoltowski, Youngchul Sung, and David Love, "Optimal pilot beam pattern design for massive MIMO systems," in *Proc. Asilomar,* Pacific Grove, CA, Nov. 2013.

EXTERNAL ACTIVITIES

Technical Committee Activities

- Member, Wireless World Research Form (WWRF), Steering Board   Oct. 2017 - Jul. 2018

Reviewer of Journal and Conference Papers

- IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Transactions on Vehicular Technology
- IEEE Communications Letters, IEEE Wireless Communications Letters, IEEE Signal Processing Letters
- IEEE Globecom, IEEE ICC, IEEE WCNC

Invited Talks

- Beamforming tutorial: Algorithms, at The Korean Institute of Electromagnetic Engineering and Science (KIEES)   Jul. 2020
- Array signal processing for enhanced beam management, at The Korean Institute of Communications and Information Sciences (KICS)   Jun. 2019
- Channel estimation initiatives through training signal design in large-scale MIMO, at Soongsil University, Sep. 2014, and at KAIST   Aug. 2014

AWARDS AND HONORS

- Academic Research Award, Incheon National University   2020 − 2021
- Next Generation and Standards (NGS) Division Recognition Award, Intel   Q3 2017
- Wireless Communication Research (WCR) Division Recognition Award, Intel   Q1 2017
- IEEE Transactions on Communications Exemplary Reviewer   Apr. 2015
- Silver Prize in the 21st HumanTech Paper Contest sponsored by Samsung   Feb. 2015
- IEEE Global Communications Conference (Globecom) Best Paper Award   Dec. 2014