

Chulsoon Hwang

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Research Interest

RF Desense, Signal and Power Integrity, Electromagnetic Interference, Intentional EMI/Hardware Security, Machine-learning, and Electromagnetics

Employment

- 09/2016 – Present **Assistant Professor**, Dept. Electrical and Computer Engineering, Missouri University Science and Technology, Rolla, MO (Formerly University of Missouri Rolla, UMR)
- 07/2015– 08/2016 **Visiting Research Assistant Professor**, Dept. Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla, MO
- 07/2012– 06/2015 **Senior Engineer**, HSI & Advanced Electromagnetic Compatibility Lab., Samsung Electronics Co., Ltd, Suwon, Korea
- 03/2007–06/2012 **Graduate Research Assistant**, Terahertz Laboratory, Dept. Electrical Engineering, KAIST, Daejeon, Korea

Education

- 03/2009–06/2012 Ph. D. Dept. Electrical Engineering, KAIST, Daejeon, Korea (Advisor: Prof. Joung-ho Kim)
- 03/2007– 02/2009 M.S. Dept. Electrical Engineering, KAIST, Daejeon, Korea (Advisor: Prof. Joung-ho Kim)
- 03/2001– 02/2007 B.S. Dept. Electrical Engineering, KAIST, Daejeon, Korea

Professional Activities

- **Technical Committee Officer**, Vice Chair, IEEE EMC Society SC5 - Power Electronics EMC 2020 ~ present
Secretary, IEEE EMC Society SC5 - Power Electronics EMC 2016 ~ 2020
- **Reviewer**, IEEE Trans. Electromagnetic Compatibility (>10 papers/year), IEEE Access, IEEE Trans. Circuits and Systems I, IEEE Trans. Components, Packaging and Manufacturing Technology, IEEE Microwave and Wireless Components Letters, Conferences: IEEE Int. Symp. on EMC 2016-2020, Asia-Pacific Int. Symp. on EMC 2016-2020, Asia-Pacific Microwave Conference (APMC) 2019-2020, IEEE Electrical Design and Advanced Packaging & systems (EDAPS), IEEE EMC Magazine, IEEE Int. Symp. on Circuits & Systems (ISCAS) 2021.
- **Session Organizer/Workshop Organizer/Workshop Presenter** at various technical conferences
- **Senior Member**, IEEE, 2018
- **IEEE-HKN**, 2019

Honors & Awards

- **Distinguished Reviewer of the IEEE Transactions on EMC for the year of 2019**, *IEEE T-EMC*, 2020
- **Google Faculty Research Award**, *Google*, Mar. 2020
- **Faculty Research Award**, *Missouri University of Science and Technology*, Dec. 2019
- **Symposium Best SIPI Paper Award**, *IEEE International Symposium on EMC&SIPI*, New Orleans, LA, July 2019
- **DesignCon Best Paper Award**, *DesignCon 2019*, Santa Clara, CA, Jan. 2019
- **APEMC Young Scientist Award**, *Joint IEEE International Symposium on EMC & Asia-Pacific Symposium on EMC*, Singapore, May 16, 2018
- **DesignCon Best Paper Award**, *DesignCon 2018*, Santa Clara, CA, Jan. 2018
- **Symposium Best Paper Award**, *Asia-Pacific International Symposium on EMC*, Seoul, Korea, June 2017

Awards received by advised students

- **IEEE James C. Klouda Memorial Scholarship Award**, received by **Yin Sun**, *IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity*, Aug, 2020
- **Student Hardware Design Contest 1st place**, received by **Omid Hoseini Izadi**, *IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity*, Aug, 2020
- **Symposium Best Student Paper Award**, received by **Yang Zhong**, *Asian Electromagnetics Conference (ASIAEM)*, Xi'an, China, Sep. 2019

Advising & Mentoring

▪ **Graduated Advisees:**

Ph.D.: Yin Sun (2020), Omid Hoseini Izadi (2020)

M.S.: Yang Zhong (2019), Harsh Shrivastav (2019)

▪ **Current Graduate Students (9 Ph.D., 6 M.S.):**

Ph. D.: Jiayi He, Ruijie He, Ling Zhang, Anfeng Huang, Muqi Ouyang, Shengxuan Xia, Junho Joo, Xiangrui Su, Yifan Ding

M.S.: Runbing Hua, Shun Liu, Woncheol Song, Xin Fang, Jack Juang, Tanner Fokkens

- **Undergraduate Research:** Connor Halleman (2020-present), Nicolas Spears (2019), Jack Juang (2019), William Ong (2019)
- **Postdoctoral Fellows:** Dr. Taelim Song (Jan. 2020 – present), Dr. Zhifei Xu (May. 2019 – Dec. 2020)
- **Visiting Scholars:** Yutao Tang (Oct. 2019 ~ Oct. 2020), Dr. Jongjoo Lee (Apr. 2019 ~ Feb. 2020), Cheolhan Kim (Aug. 2018 ~ Aug. 2019), Youngmin Ku (Jan. 2018 ~ Jan. 2019)

Research Expenditures

- 2019 CY: \$425,485 FY: \$337,675
- 2018 CY: \$264,227 FY: \$175,419
- 2017 CY: \$108,570 FY: \$65,151
- 2016 CY: \$11,476 FY: did not start

Research Awards

Solo-PI

- **Hyundai Mobis**, “Chamber-less Radiated Emission Estimation”, \$70,000 (100%), 11/10/2020-11/09/2021
- **SK Hynix**, “Component-level Assessment Techniques for RF Desense”, \$100,000 (100%), gift
- **Google**, “Studying Cellphone Tx Desense due to Loose Metal Contact”, \$110,000 (100%), 3/18/2020-3/17/2021
- **Google, Faculty Research Award**, “Machine Learning Based Design of Power Distribution Networks”, \$42,928 (100%), gift
- **SK Hynix**, “System-level Power Supply Induced Jitter Optimization”, \$70,000 (100%), gift
- **Hyundai Motor Company**, “Defensive Technologies against Intentional EMI of Automotive”, \$100,000 (100%), 08/01/2018-07/31/2019
- **Samsung Electronics Co., Ltd.**, “Numerical Method of Electromagnetic Interference in High Speed Serial Link Systems”, \$120,000 (100%), 01/01/2018-12/31/2018

PI

- **Cisco**, “Center for EMC Membership: Cisco-PDN”, \$70,000/ year (50%), 11/01/2021 - present
- **Apple Computer**, “Center for EMC Membership”, \$70,000 / year (50%), 09/28/2020 - present

- **IBM**, “Center for EMC Membership”, \$70,000 / year (50%), 04/01/2020 - present
- **SONY EMCS Corp. (RFI)**, “Center for EMC Membership”, \$70,000 / year (50%), 04/01/2017 - present
- **Asustek Computer Inc.**, “Center for EMC Membership”, \$70,000 / year (50%), 02/01/2017 - present
- **Deere and Company**, “Center for EMC Membership”, \$70,000 / year (50%), 03/24/2017 – 03/23/2021
- **Samsung Electronics Co., Ltd. (Mobile)**, “Center for EMC Membership”, \$70,000 (50%), 04/15/2019-04/14/2020
- **Juniper Networks Inc.**, “Center for EMC Membership”, \$70,000 (50%), 04/12/2019-04/11/2020
- **Ford Motor Company**, “Assessment of IEMI Threats on Automobiles”, \$70,000 (77%), gift
- **Samsung Electronics Co., Ltd. (GTC)**, “Center for EMC Membership”, \$70,000 (50%), 03/11/2019-03/10/2020
- **Samsung Electronics Co., Ltd.**, “Center for EMC Membership”, \$60,000 (20%), 05/01/2017-04/30/2018
- **Shenzhen Yichong Wireless Power Technology**, “Center for EMC Membership”, \$30,000 (50%), 10/01/2016 - 09/30/2017

Co-PI

- **NSF**, “EAGER: SARE: Security and Functionality of Energy Storage Devices from an External Electromagnetic Attack”, 300,000 (50%), 09/01/2020-08/31/2022 (PI: Jonghyun Park)
- **NSF, Phase III I/UCRC Missouri S&T**: Center for Electromagnetic Compatibility, \$500,000 (33%), 12/15/2019-12/14/2024 (PI: Daryl Beetner)
- **Boeing Co.**, “Task 4 - 5G Wireless Integration Study/Analysis”, \$20,000 (20%), 09/02/2019-12/30/2020 (PI: Victor Khilkevich)
- **Boeing Co.**, “Task 5 - Mission Optimized RF System Operation”, \$20,000 (20%), 09/02/2019-12/30/2020 (PI: Maciej Zawodniok)
- **Amazon.com INC**, “TV Noise Source Reconstruction”, \$35,000 (40%), 05/01/2019-08/31/2019 (PI: Jun Fan)
- **DoE, Graduate Assistance in Areas of National Need (GAANN)**, “A Doctoral Program on Data-Enabled Assurance of Electromagnetic Compatibility”, \$597,000 (10%), 10/01/2018-09/30/2021 (PI: Sahra Sedigh Sarvestani)
- **NSF, Phase II I/UCRC Missouri S&T**: Center for Electromagnetic Compatibility, \$166,680 (10%), 09/25/2017-07/31/2019 (PI: Jun Fan)
- **Center for EMC Membership**, about \$1M/year (roughly 15-20% share of credit)
 - Members: Google, Intel, Apple Computer, IBM, Boeing Company, Cisco, SONY, LG Electronics, Nexperia., Samsung Electronics, John Deere, Juniper Networks

University Services

- EE Undergraduate Studies/Curriculum Committee (department), 2020 ~ present
- Faculty Research Award Committee (university), 2020 ~ present
- Library & Learning Resources Committee (department), 2019 ~ present
- NTT EMC Assistant Research Professor Search Committee, 2019
- Faculty Search Committee for Assistant Professor in Electromagnetics Position, 2019
- S&T Undergraduate Research Conference Judge, 4/16/2019
- NTT EMC Associate Research Professor Search Committee, 2018
- Graduate Research Showcase (GRS) Judge, 04/10/ 2017

Patent

- [1] E. Song, Y. Kwon, W. Kim, H. Park, H. Yun, E. S. Hong, and **C. Hwang**, “Passive Equalizer Design for High-speed Digital Signal Transmission”, U.S. patent. US9094240, April 21, 2014
- [2] **C. Hwang**, J. Ha, K. Kim, and K. Go, “Wireless charging apparatus,” Korea patent, P2013-0064890, June 5, 2013.

Lectures and Invited Presentations

- [1] “Inaudible Command Injection to Voice-Controlled Devices using EMI”, MUELAN tech talk, virtual, 08/31/2020
- [2] “Power Integrity”, *Glaxton Paul Global University in IEEE Symposium on EMC&SIPI*, Virtual Conference, 7/29/2020
- [3] “IC/package Radiation Mechanism for RF Desense Analysis”, *EMC Korea 2020*, Seoul, Korea, 07/21/2020 (webinar)
- [4] “Transmission Lines and Signal Integrity”, *Glaxton Paul Global University in IEEE Symposium on EMC&SIPI*, New Orleans, LA, 7/24/2019
- [5] “PCB Decoupling”, *Tutorial in IEEE Symposium on EMC&SIPI*, New Orleans, LA, 7/22/2019
- [6] “RF Desense in Wireless Devices”, *Samsung*, Hwasung, Korea, 06/10/2019
- [7] “Threats of Intentional EMI and Hardware Security”, *Mando R&D Center*, Pangyo, Korea, 5/31/2019
- [8] “Threats of Intentional EMI and Hardware Security”, *Samsung*, Suwon, Korea, 5/30/2019
- [9] “D-dot sensor and Intentional EMI”, *National Security Research Institute*, Daejeon, Korea, 5/28/2019
- [10] “RF/Digital Integration in IoT Devices”, *Sungkyunkwan University*, Suwon, Korea, 5/23/2019
- [11] “D-dot sensor and Intentional EMI”, *Replex*, Seoul, Korea, 5/22/2019
- [12] “RF Desense in Wireless Devices”, *KAIST*, Daejeon, Korea, 12/21/2018
- [13] “Exploration of Machine Learning in EMC Applications”, *Aju University*, Suwon, Korea, 12/20/2018
- [14] “Coupling Path Visualization Technique”, *EMC Workshop in Samsung Electronics*, Suwon, Korea, 12/19/2018
- [15] “Statistical Analysis of HBM Channel Performance”, *Tutorial in IEEE EDAPS Symposium*, Chandigarh, India, 12/16/2018
- [16] “Research in Electromagnetic Compatibility”, IEEE Emphasis Area Workshop, *Missouri S&T*, 11/14/2018
- [17] “Analysis and Modeling of RF Desense in Mobile Devices”, *Google*, Mountain View, CA, 08/27/2018
- [18] “PAM-4 Signaling Fundamentals and Challenges”, *Samsung EMC Conference 2018*, Yongin, Korea, 08/14/2018
- [19] “High-speed Channel Design for RF desense”, *Samsung EMC Conference 2018*, Yongin, Korea, 08/14/2018
- [20] “Fast and Accurate RFI Analysis for Wireless Devices”, *Samsung Electronics*, Hwasung, Korea, 08/13/2018
- [21] “Power Integrity Concepts for High-Speed Design on Multi-Layer PCBs”, *Workshop in IEEE Symposium on EMC*, Long Beach, CA, 08/03/2018
- [22] “Fast and Accurate RFI Analysis for Wireless Devices”, *Sungkyunkwan University*, Suwon, Korea, 12/22/2017
- [23] “Fast and Accurate RFI Analysis for Wireless Devices”, *Yonsei University*, Seoul, Korea, 12/21/2017
- [24] “Fast and Accurate RFI Analysis for Wireless Devices”, *Workshop in Samsung Electronics*, Suwon, Korea, 12/19/2017
- [25] “Source Reconstruction and RFI Estimation”, *Amazon*, CA, 10/16/2017
- [26] “Analysis and Modeling of RF Desensitization in Mobile Devices”, *UNIST*, Ulsan, Korea, 07/04/2017
- [27] “System Level Approach for RF Desensitization”, *ETRI*, Daejeon, Korea, 06/30/2017
- [28] “Mechanism and Modeling of Noise Source and Coupling for RF Desensitization”, *Samsung Electronics*, Hwasung, Korea, 06/28/2017
- [29] “Analysis and Modeling of RF Desensitization in Mobile Devices”, *Kwangwoon Univ.*, Seoul, Korea, 06/23/2017
- [30] “Mechanism and Modeling of Noise Source and Coupling for RF Desensitization”, *EMC Workshop in Samsung Electronics*, Suwon, Korea, 06/19/2017
- [31] “Analysis and Modeling of RF Desensitization in Mobile Devices” *UESTC*, Chengdu, China, 06/15/2017

Publications

▪ Book/Chapters

- [1] C. Hwang, “RF Desensitization in Wireless Devices”, in *RF Systems, Circuits and Components*, editor Xi Sung Loo, Intech, ISBN 978-953-51-6250-6, Nov. 2018.
- [2] C. Hwang, J. Kim, J. Fan, J. Kim and J. L. Drewniak, “Modeling of On-Chip Power Distribution Network”, in *Noise Coupling in System-on-Chip*, editor Thomas Noulis, CRC Press, ISBN 9781498796774, Dec. 2017, Chapter 5, pp. 93 -138.

▪ Refereed Journal Articles

2020

- [1] L. Zhang, J. Juang, Z. Kiguradze, B. Pu, S. Jin, S. Wu, Z. Yang, and C. Hwang, “Fast PDN Impedance Prediction using Deep Learning”, submitted to *International Journal of Numerical Modeling: Electronic Networks, Devices and Fields*.

- [2] Y. Sun, S. Liu, H. Shrivastav, X. Sun, Y. Ku, and **C. Hwang**, "Equivalent Source Reconstruction for Electromagnetic Interference Estimation in Solid-State Drive" submitted to *IEEE Trans. on Electromagnetic Compatibility*.
- [3] Z. Xu, Z. Wang, Y. Sun, **C. Hwang**, H. Delingette, and J. Fan, "Jitter Aware Economic PDN Optimization with Genetic Algorithm", submitted to *IEEE Trans. on MTT*
- [4] Y. Sun, J. Lee, and **C. Hwang**, "A Generalized Power Supply Induced Jitter Sensitivity Analysis Method Based on Power Supply Rejection Ratio Response" submitted to *IEEE Trans. on VLSI*
- [5] Z. Xu, R. Hua, J. Juang, S. Xia, J. Fan, and **C. Hwang**, "Inaudible Attack on Smart Speakers with Intentional Electromagnetic Interference" submitted to *IEEE Trans. on MTT* (under review: accepted with major revision)
- [6] Y. Zhong, T. Enomoto, S. Seto, K. Araki, and **C. Hwang**, "A New Reconstruction Method for the Source above A Non-ideal Ground Plane," *IEEE Trans. on Electromagnetic Compatibility* (early access).
- [7] Y. Sun, S. Wu, J. Zhang, **C. Hwang**, and Z. Yang, "Simulation Methodologies for Acoustic Noise Induced by Multilayer Ceramic Capacitors of Power Distribution Network in Mobile Systems", *IEEE Trans. on Electromagnetic Compatibility* (early access).
- [8] Q. Huang, L. Zhang, J. Rajagopalan, D. Pai, C. Chen, A. Gaikwad, **C. Hwang**, and J. Fan, "A Novel RFI Mitigation Method Using Source Rotation" *IEEE Trans. on Electromagnetic Compatibility* (early access).
- [9] Y. Sun, J. Kim, M. Ouyang, and **C. Hwang**, "Improved Target Impedance Concept with Jitter Specification" *IEEE Trans. on Electromagnetic Compatibility*, vol. 62. no.4, pp.1534-1545.
- [10] Y. Liu, J. Li, **C. Hwang**, and V. Khilkevich, "Near-Field Scan of multiple non-correlated sources using blind source separation", *IEEE Trans. on Electromagnetic Compatibility*, vol. 62. no.4, pp.1376-1385.
- [11] Y. Zhong, W. Song, C. Kim, and **C. Hwang**, "Coupling Path Visualization and Its Application in Preventing Electromagnetic Interference" *IEEE Trans. on Electromagnetic Compatibility*, vol. 62. no.4, pp.1485-1492.
- [12] Y. Sun, S. Wu, J. Zhang, **C. Hwang**, and Z. Yang, "Measurement Methodologies for Acoustic Noise Induced by Multilayer Ceramic Capacitors of Power Distribution Network in Mobile Systems" *IEEE Trans. on Electromagnetic Compatibility*, vol. 62. no.4, pp.1515-1523.
- [13] Y. Sun, H. Lin, B. Tseng, D. Pommerenke, and **C. Hwang**, "Mechanism and validation of USB 3.0 connector caused RFI," *IEEE Trans. on Electromagnetic Compatibility*, vol. 62. no.4, pp.1169-1178.
- [14] K. Kim, H.W. shim, and **C. Hwang**, "Analysis and Solution for RF Interference caused by PMIC Noise in Mobile Platforms," *IEEE Trans. on Electromagnetic Compatibility*, vol. 62, no. 3, pp. 682-690, June 2020

2019

- [15] Y. Ku, H. H. Park, and **C. Hwang**, "Zero-Height and Broadband Magnetic Dipole Source Generation for Board-level Shield Can Evaluation," *IEEE Trans. on Electromagnetic Compatibility*, vol. 61, no. 6, pp. 1860-1866, Dec. 2019
- [16] Q. Huang, T. Enomoto, S. Seto, K. Araki, J. Fan, and **C. Hwang**, "A Transfer Function Based Calculation Method for Radio Frequency Interference" *IEEE Trans. on Electromagnetic Compatibility*, vol. 61, no. 4, pp. 1280-1288, Aug. 2019.

2018

- [17] H. Kim, J. Kim, J. Fan, and **C. Hwang**, "Precise Analytical Model of Power Supply Induced Jitter (PSIJ) Transfer Function at Inverter Chains" *IEEE Trans. on Electromagnetic Compatibility*, vol. 60, no. 5, pp. 1491-1499, Oct. 2018.
- [18] **C. Hwang**, D. Pommerenke, J. Fan, T. Enomoto, J. Maeshima, and K. Araki, "Wideband Noise Measurement Technique in Duplex Systems for RF Interference," *IEEE Trans. on Electromagnetic Compatibility*, vol. 60, no. 4, pp. 1038-1044, Aug. 2018.
- [19] Q. Huang, L. Li, X. Yan, B. Bae, H. Park, **C. Hwang**, and J. Fan, "MoM Based Ground Current Reconstruction in RFI Application", *IEEE Trans. on Electromagnetic Compatibility*, vol. 60, no. 4, pp. 1121-1128, Aug. 2018.
- [20] G. Maghlakelidze, X. Yan, L. Guan, S. Marathe, Q. Huang, B. Bae, **C. Hwang**, J. Fan, and D. Pommerenke, "SNR Analysis and Optimization in Near-Field Scanning and EMI Applications", *IEEE Trans. on Electromagnetic Compatibility*, vol. 60, no. 4, pp. 1087-1094, Aug. 2018.
- [21] K. Kim, H.W. Shim, A. C. Scogna, and **C. Hwang**, "SMPS Ringing Noise Modeling and Managing Methodology for RFI Solutions in Mobile Platforms" *IEEE Trans. on Components, Packaging and Manufacturing Technology*, vol. 8, no. 4, pp. 554-561, April 2018.
- [22] **C. Hwang**, M. Ouyang, and J. Fan, "Return Path Discontinuity Analysis of an Edge Mount SMA Launch Structure in Multilayer Boards," *IEEE Trans. on Electromagnetic Compatibility*, vol. 60, no. 2, pp. 453-458, April 2018.
- [23] X. Chu, **C. Hwang**, J. Fan and Y. Li, "Analytic Calculation of Jitter Induced by Power and Ground Noise Based on IBIS I/V Curve,"

IEEE Trans. on Electromagnetic Compatibility, vol. 60, no. 2, pp. 468-477, April 2018.

2017

- [24] **C. Hwang**, D. Pommerenke, J. Fan, T. Enomoto, J. Maeshima, and K. Araki, "Modeling and Estimation of LCD Noise Modulation for Radio Frequency Interference" *IEEE Trans. on Electromagnetic Compatibility*, vol. 59, no. 6, pp. 1685-1692, Dec. 2017.
- [25] Q. Huang, F. Zhang, T. Enomoto, J. Maeshima, K. Araki, and **C. Hwang**, "Physics Based Dipole Moment Source Reconstruction for RFI on a Practical Cellphone," *IEEE Trans. on Electromagnetic Compatibility*, vol. 59, no. 6, pp. 1693-1700, Dec. 2017.
- [26] Q. Wang, J. Cho, N. Erickson, **C. Hwang**, F. De Paulis, S. Piersanti, A. Orlandi, B. Achkir, and J. Fan, "Novel De-Embedding Methodology and Broadband Microprobe Measurement for Through-Silicon Via Pair in Silicon Interposer," *IEEE Trans. on Electromagnetic Compatibility*, vol. 59, no. 5, pp. 1565-1575, Oct. 2017.
- [27] G.Y. Cho, J. Jin, H.B. Park, H.H. Park, and **C. Hwang**, "Assessment of Integrated Circuits Emissions with an Equivalent Dipole Moment Method" *IEEE Tran. on Electromagnetic Compatibility*, vol. 59, no. 2, pp. 633-638, April 2017

2011-2016

- [28] B. Ko, J. Kim, J. Ryoo, **C. Hwang**, J. Song, and S.-W. Kim, "Simplified Chip Power Modeling Methodology Without Netlist Information in Early Stage of SoC Design Process", *IEEE Trans. on Components, Packaging and Manufacturing Technology*, vol. 6, no. 10, pp. 1513-1521, Oct. 2016.
- [29] B. Ko, J. Kim, J. Ryoo, **C. Hwang**, C.-K. Kwon, S.-W. Kim, "Practical approach to power integrity-driven design process for power-delivery networks," *IET Circuits, Devices & Systems*, vol. 10, no. 5, p. 448 – 455, Sep. 2016.
- [30] L. Li, J. Pan, **C. Hwang** and J. Fan, "Radiation Noise Source Modeling and Application in Near-Field Coupling Estimation," *IEEE Trans. on Electromagnetic Compatibility*, vol. 58, no. 4, pp. 1314-1321, Aug. 2016.
- [31] **C. Hwang**, H.B. Park, and H. H. Park, "A Simple Estimation of TRP and Radiation Pattern for Mobile Antennas Using Planar Near-Field Scanning Method" *Microwave and Optical Technology Letters*, Vol. 58, No. 6, pp.1437-1443, June 2016.
- [32] **C. Hwang**, J.-D. Lim, G.Y. Cho, H.B. Park, and H.H. Park, "A Novel Shielding Effectiveness Matrix of Small Shield Cans Based on Equivalent Dipole Moments for RF Interference Applications." *IEEE Trans. on Electromagnetic Compatibility*, vol. 58, No. 3, pp. 766-775, June 2016.
- [33] **C. Hwang**, B. Achkir, and J. Fan, "Capacitance Enhanced Through-Silicon Via for Power Distribution Networks in 3D-ICs," *IEEE Electron Device Letters*, vol. 37, No. 4, pp. 478-481, April 2016.
- [34] J. Pan, H. Wang, X. Gao, J. Fan, **C. Hwang**, E. Song, and H.B. Park, and J. Fan, "Radio-Frequency Interference Estimation Using Equivalent Dipole-Moment Models and Decomposition Method Based on Reciprocity, *IEEE Trans. on Electromagnetic Compatibility*, vol. 58, no. 1, pp. 75-84, Feb. 2016.
- [35] E. Song, H.B. Park, **C. Hwang**, and H.H. Park, "Placement Optimization of Integrated Circuits for Reduced Radio-Frequency Interferences in Mobile Devices," *Microwave and Optical Technology Letters*, vol. 58, no. 1, pp.31-37, Jan. 2016.
- [36] H.H. Park, **C. Hwang**, K.Y. Jung, and Y.B. Park, "Mode Matching Analysis of Via-Plate Capacitance in Multilayer Structures with Finite Plate Thickness," *IEEE Trans. on Electromagnetic Compatibility*, vol.57, no.5, pp.1188-1196, Oct. 2015
- [37] **C. Hwang**, W. Park, and D.G. Kam, "Complex Permittivity Extraction from PCB Stripline Measurement Using Recessed Probe Launch," *IEICE Electronics Express*, vol. 12, No. 5, Mar 2015.
- [38] J. Kim, J. Lee, S. Cho, **C. Hwang**, C. Yoon, and J. Fan, "Analytical Probability Density Calculation for Step Pulse Response of a Single-Ended Buffer with Arbitrary Power-Supply Voltage Fluctuations," *IEEE Trans. on Circuits and Systems I: Regular Papers*, vol. 61, no. 7, pp. 2022-2033, July 2014.
- [39] S. Ahn, **C. Hwang**, and H.H. Park, "Optimized shield design for reduction of EMF from wireless power transfer systems" *IEICE Electronics Express*, vol. 11, no. 2, Jan. 2014.
- [40] M. Kim, K. Koo, **C. Hwang**, Y. Shim, J.S. Pak, S. Ahn, and J. Kim, "Vertical Stepped Impedance EBG (VSI-EBG) Structure for Wideband Suppression of Simultaneous Switching Noise in Multi-layer PCBs," *IEEE Trans. on Electromagnetic Compatibility*, vol. 55, no. 2, pp. 307-314, Apr. 2013.
- [41] **C. Hwang**, J. Kim, B. Achkir, and J. Fan, "Analytical Transfer Functions relating Power and Ground Voltage Fluctuations to Jitter at a Single-Ended Full-Swing Buffer," *IEEE Trans. on Components, Packaging and Manufacturing Technology*, vol. 3, no. 1, pp.113-125, Jan. 2013.
- [42] K. Kim, **C. Hwang**, K. Koo, J. Cho, H. Kim, J. Kim, J. Lee, H. Park, and J.S. Pak, "Modeling and Analysis of a Power Distribution

Network in TSV-based 3D IC including P/G TSVs, On-chip Decoupling Capacitors, and Silicon Substrate Effects,” *IEEE Trans. on Components, Packaging and Manufacturing Technology*, vol. 2, no. 12, pp.2057-2070, Dec. 2012.

- [43] M. Kim, K. Koo, **C. Hwang**, Y. Shim, J. Kim, and J. Kim, “A Compact and Wideband Electromagnetic Bandgap Structure Using a Defected Ground Structure for Power/Ground Noise Suppression in Multilayer Packages and PCBs,” *IEEE Trans. on Electromagnetic Compatibility*, vol. 54, no. 3, pp. 689-695, Jun. 2012.
- [44] **C. Hwang**, Y. Shim, K. Koo, M. Kim, J.S. Pak, and J. Kim, “An On-Chip Electromagnetic Bandgap Structure using an On-Chip Inductor and a MOS Capacitor,” *IEEE Microwave and Wireless Components Letters*, vol.21, no.8, pp.439-441, Aug. 2011.
- [45] **C. Hwang**, J. Kim, E. Song, Y. Shim, and J. Kim, “A Wideband and Compact Partial Electromagnetic Bandgap Structure With a Narrow Via Pitch for a Signal Via Shield,” *IEEE Trans. on Electromagnetic Compatibility*, vol.53, no.1, pp.241-244, Feb. 2011.
- [46] **C. Hwang**, K. Kim, J.S. Pak, and J. Kim, “Modeling of an On-Chip Power/Ground Meshed Plane Using Frequency Dependent Parameters,” *Journal of Electromagnetic Engineering and Science*, vol. 11, no. 3, pp. 192-200, Sep 2011.

▪ Conference Papers

2020

- [1] W. Song, Y. Zhong, C. Kim, C. Park, and **C. Hwang**, “Transfer Function Measurement for Automotive Intentional Electromagnetic Interference” *IEEE Symp. Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC+ SIPI) 2020*.
- [2] J. Joo, W. Song, B. Bae, H. Kim, S. Lee, Y. Kwon, and **C. Hwang**, “Complex Permittivity Extraction using Substrate Integrated Waveguide Cavity Resonator without Cross-Sectioning” *IEEE Symp. Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC+ SIPI) 2020*.
- [3] M. Ouyang, Y. Sun, J. Lee, J. Kim, and **C. Hwang**, “Mechanism Analysis on Radio Frequency Radiation in IC/Package with Bonding Wires” *IEEE Symp. Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC+ SIPI) 2020*. **(best student paper finalist)**
- [4] O. H. Izadi, K. Frazier, N. Altunyurt, S. Sedighsarvestani, D. Pommerenke, and **C. Hwang**, “A New Tunable Damped Sine-like Waveform Generator For IEMI Applications” *IEEE Symp. Electromagnetic Compatibility, Signal Integrity and Power Integrity (EMC+ SIPI) 2020*.
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