Do-Hoon Kwon

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Antennas and Propagation Laboratory
Department of Electrical and Computer Engineering
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Education

Ph.D. (2000) in Electrical Engineering, The Ohio State University, Columbus, OH
Area of specialization: High-frequency asymptotic methods (GTD/UTD), effcient numerical electromagnetic analysis, phased array antennas
Minor areas: Finite difference methods in mathematics, communications and signal processing in electrical engineering

M.S. (1995) in Electrical Engineering, The Ohio State University, Columbus, OH
Area of specialization: Numerical electromagnetics

B.S. (1994) in Electrical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Korea

Employment

Associate professor, Department of Electrical and Computer Engineering
University of Massachusetts Amherst, Amherst, MA (Aug. 2008–Present)
Lab association: Antennas and Propagation Laboratory

Visiting professor (during a full-year sabbatical), Department of Electronics and Nanoengineering
Aalto University, Finland (Aug. 2016–Jul. 2017)
Host: Prof. Sergei A. Tretyakov

Post-doctoral researcher, Department of Electrical Engineering and Material Research Science and Engineering Center (MRSEC)
The Pennsylvania State University, University Park, PA (Apr. 2006–Jul. 2008)
Mentor: Prof. Douglas H. Werner
Area of specialization: Electromagnetic and optical metamaterials, electromagnetic cloaking, frequency selective surfaces, small/miniaturized antennas

Senior engineer, Corporate Research & Development Center and Samsung Advanced Institute of Technology
Samsung Electronics Co., Suwon, Korea (Jul. 2000–Mar. 2006)

Projects

[Cooperative Agreement] Radio source location using dynamic, cooperative antenna arrays, PI: Do-Hoon Kwon, Co-PIs: Robert Jackson and Ramakrishna Janaswamy, Source: Army Research Lab via ARO, Period: 9/2021–9/2024 (36 months), Fund: $778,832 (my share: 1/3 of the total fund = $259,611)

[Contract] Small time-varying antennas for ultra-wideband radio signals, PI: Ramakrishna Janaswamy, Co-PI: Do-Hoon Kwon, Source: Air Force STTR Phase I via AntennaSys, Inc., Period: 12/2019–6/2020 (6 months), Fund: $55,801 (my share: 40% of the total fund = $22,320)

[Grant] Functional electromagnetic surfaces on irregular grids, PI: Do-Hoon Kwon, Source: National Science Foundation, Period: 9/2019–8/2022 (36 months), Fund: $362,389

[Grant] Single and dual polarized metasurface cloaks for microwave invisibility and low observability, PI: Do-Hoon Kwon, Source: Army Research Offce, Period: 8/2019–8/2022 (36 months), Fund: $367,004

[Cooperative Agreement] Wearable antijam GPS antennas for dismounted soldier navigation systems, PI: Ramakrishna Janaswamy, Co-PI: Do-Hoon Kwon, Source: Army CERDEC via ARO, Period: 1/2016–1/2019 (36 months), Fund: $242,602 (my share: 50% of the total fund = $121,301)

[Contract] Antennas at a Virtual Location using Metamaterials, PI: Do-Hoon Kwon, Source: Air Force Research Laboratory (via S4, Inc.), Period: 11/2013–10/2014 (12 months), Fund: $138,870

[Contract] Array Elements for Dual-Polarized C and Ku Band Aperture, PI: Do-Hoon Kwon, Source: NOAA SBIR Phase II (via Remote Sensing Solutions, Inc.), Period: 10/2012-9/2014 (24 months), Fund: $120,000

[Grant] Fundamental Limitations of Phased Array Antenna Elements, PI: Do-Hoon Kwon, Source: Army Research Offce, Period: 10/2012-9/2015 (36 months), Fund: $303,506

[Grant] Robust Emergency Data (RED) Link, PI: Do-Hoon Kwon, Source: NSF STTR Phase I (via Q-Track Corporation), Period: 7/2012-6/2013 (12 months), Fund: $51,733

[Contract] 70/90-GHz Cassegrain Refectarray for High Data Rate Communication, PI: Do-Hoon Kwon, Source: Electronics and Telecommunications Research Institute, Korea, Period: 7/2012-12/2012 (6 months), Fund: $50,000

[Contract] Bandwidth Limitations of Small Antennas Above a Ground Plane, PI: Do-Hoon Kwon, Source: The SI Organization, Period: 7/2012-11/2012 (5 months), Fund: $50,000

[Contract] Array Elements for Dual-Polarized C and Ku Band Aperture, PI: Do-Hoon Kwon, Source: NOAA SBIR Phase I (via Remote Sensing Solutions, Inc.), Period: 12/2011-3/2012 (4 months), Fund: $30,960

[Contract] 90-GHz Dual-Polarized Single-Aperture Refectarray with High Isolation, PI: Do-Hoon Kwon, Source: Electronics and Telecommunications Research Institute, Korea, Period: 9/2011-1/2012 (5 months), Fund: $50,000

[Contract] Dual-Frequency, Dual-Polarized Antenna, PI: Dan Schaubert, Co-I: Do-Hoon Kwon, Source: Remote Sensing Solutions, Inc., Period: 2/2009-1/2011 (24 months), Fund: $152k

[Contract] Antenna Design for Future Apertures, PI: Dan Schaubert, Co-PI: Do-Hoon Kwon, Source: US Air Force Research Laboratory, Period: 10/2009-9/2010 (12 months), Fund: $175k

[Contract] EHF Phased Arrays, PI: Dan Schaubert, Co-PIs: Do-Hoon Kwon, Robert Jackson, Marinos Vouvakis, Anatoliy Borrysenko, Source: Lockheed Martin Corporation, Period: 5/2009-4/2010 (12 months), Fund: $100,000

Teaching

ECE 213 (Discussion): Continuous-Time Signals and Systems

ECE 333: Fields and Waves I

ECE 585: Microwave Engineering II

ECE 597AP: Introduction to Antennas and Propagation

ECE 687: Antenna Theory and Design

ECE 697L: Phased Arrays

ECE 697TE: Transformation Electromagnetics and Metamaterials

Service

Director, transfer student advising (Present): Advise incoming, ECE undergraduate transfer students

Chair, the ECE Equipment Committee (AY2019–Present): Solicit and prioritize equipment purchases for instructional purposes within the department; allocate available funds

Director, the ECE 5-year BS/MS program (AY2015–2016, 2017–2019): Administer and manage the ECE Department's 5-year BS/MS program

Chair, the ECE Ph.D. Poster Session Committee (FA2013): Planned and ran the 2nd annual ECE Ph.D. poster session

Faculty advisor, the ECE Student Advisory Committee (ESAC) (AY2012–2015): Oversee and advise ESAC activities

Chair, ECE Picnic (SP12, SP13, SP14): Organize and plan for ECE Picnics in the spring semester

Member, Graduate seminar committee (AY2010–2011): Arranged and hosted invited seminars for the graduate seminar course in the Microwave Engineering area

Member, Graduate admissions committee (AY2008–2010): Evaluated applications for admission to ECE graduate program in Microwave Engineering feld

Advising

Current students

Hakjune Lee (Ph.D. student, 2nd year)

Tina Maurer (M.S. student with thesis, 2nd year)

Past students

Jeffrey Maloney (Ph.D. 2020; co-advised with Prof. Ramakrishna Janaswamy; currently with MITRE Corporation)

Hsieh-Chi Chang (Ph.D. 2020; M.S. 2012; currently with Dassault Systèmes)

M. Amin Nikravan (Ph.D. 2016; currently with Agilent Technologies, Inc.)

Caglar D. Emiroglu (Ph.D. 2015; M.S. 2011; currently with Apple, Inc.)

Narayana Balu (M.S. 2014; co-advised with Prof. Ramakrishna Janaswamy; currently with Dassault Systèmes)

Hua Bai (M.S. 2014; co-advised with Prof. Ramakrishna Janaswamy; currently with MathWorks, Inc)

Yutong Yang (M.S. 2014; currently with Advanced Energy Industries, Inc.)

Adebayo Adeyemi (M.S. 2014; currently with ESG Automotive, Inc.)

Christopher Merola (M.S. 2011; currently with Amazon.com, Inc.)

Committees

James Lacroix (M.S. 2022), Mahsa Torfeh (M.S. 2021), Mahdad Mansouree (Ph.D. 2021), Carl Wolsieffer (M.S. 2020), Christopher Merola (Ph.D. 2020), John Logan (Ph.D. 2016, M.S. 2013), Michael Lee (M.S. 2016), Huajie Ke (Ph.D. in Physics, 2013), Salma Mirza (M.S. 2010)

Publications

Degree Theses

[2] Do-Hoon Kwon, "Effcient method of moments formulation for large conducting scattering problems using asymptotic phasefront extraction," Ph.D. Dissertation, Department of Electrical Engineering, The Ohio State University, Columbus, OH, June 2000.

[1] Do-Hoon Kwon, "Asymptotic acceleration of the fast multipole method and its application to two-dimensional electromagnetic scattering by perfect conductors," M.S. Thesis, Department of Electrical Engineering, The Ohio State University, Columbus, OH, Oct. 1995.

Books

[1] D. H. Werner and D.-H. Kwon, Eds., *Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications*. London: Springer, 2014.

Book Chapters

[4] F. Liu, X. Wang, M. S. Mirmoosa, S. Tretyakov, O. Tsilipakos, A. C. Tasolamprou, M. Kafesaki, A. Pitilakis, N, V. Kantartzis, and D.-H. Kwon, "Electromagnetic specifcations and prototype designs of software-defned surfaces," in *The Internet of Materials*, C. Liaskos, Ed. Boca Raton, FL: CRC Press, 2020, ch. 3, pp. 7–75.

[3] V. Asadchy, A. Díaz-Rubio, D.-H. Kwon, and S. Tretyakov, "Analytical modeling of electromagnetic surfaces," in *Surface Electromagnetics: With Applications in Antenna, Microwave, and Optical Engineering*, F. Yang and Y. Rahmat-Samii, Eds. Cambridge: Cambridge University Press, 2019, ch. 2, pp. 30–65.

[2] D.-H. Kwon, Q. Wu, and D. H. Werner, "Transformation electromagnetics for cloaking, lensing, and radiation applications," in *Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications*, D. H. Werner and D.-H. Kwon, Eds. London: Springer, 2014, ch. 2, pp. 33–81.

[1] D.-H. Kwon, E. V. Balzovsky, Y. I. Buyanov, Y. Kim, and V. I. Koshelev, "Small printed ultrawideband antennas combining electric and magnetic type radiators," in *Ultra-Wideband Short-Pulse Electromagnetics 9*, F. Sabath *et al.*, Eds. New York: Springer, 2010, ch. 49, pp. 425–432.

Journal Papers (advisee name in capitals)

[71] F. Liu, D.-H. Kwon, and S. Tretyakov, "Refectarrays and metasurface refectors as diffraction gratings," *IEEE Antennas Propag. Mag.*, submitted for review.

[70] D.-H. Kwon, "Design of single-layer dense metasurfaces on irregular grids using discrete dipole approximation," *IEEE Trans. Antennas Propag.*, accepted for publication.

[69] H. LEE and D.-H. Kwon, "Microwave metasurface cloaking for freestanding objects," *Phys. Rev. Appl.*, vol. 17, 054012, 2022.

[68] D.-H. Kwon, "Modulated scalar reactance surfaces for endfre radiation pattern synthesis," *IEEE Trans. Antennas Propag.*, vol. 70, no. 1, pp. 440–450, Jan. 2022.

[67] H. LEE and D.-H. Kwon, "Large and effcient unidirectional plane-wave–surface-wave metasurface couplers based on modulated reactance surfaces," *Phys. Rev. B*, vol. 103, 165142, 2021.

[66] D.-H. Kwon, "Planar metasurface design for wide-angle refraction using interface feld optimization," *IEEE Antennas Wireless Propag. Lett.*, vol. 20, no. 4, pp. 428–432, Apr. 2021.

[65] A. Pitilakis, O. Tsilipakos, F. Liu, K. M. Kossifos, A. C. Tasolamprou, D.-H. Kwon, M. S. Mirmoosa, D. Manessis, N. V. Kantartzis, C. Liaskos, M. A. Antoniades, J. Georgiou, C. M. Soukoulis, M. Kafesaki, and S. A. Tretyakov, "A multi-functional intelligent metasurface: electromagnetic design accounting for fabrication aspects," *IEEE Trans. Antennas Propag.*, vol. 69, no. 3, pp. 1440–1454, Mar. 2021.

[64] D.-H. Kwon, "Modulated reactance surfaces for leaky-wave radiation based on complete aperture feld synthesis," *IEEE Trans. Antennas Propag.*, vol. 68, no. 7, pp. 5463–5477, Jul. 2020.

[63] D.-H. Kwon, "Illusion electromagnetics for free-standing objects using passive lossless metasurfaces," *Phys. Rev. B*, vol. 101, 235135, 2020.

[62] K. M. Kossifos, L. Petrou, G. Varnava, A. Pitilakis, O. Tsilipakos, F. Liu, P. Karousios, A. Tasolamprou, M. Seckel, D. Manessis, N. V. Kantartzis, D.-H. Kwon, M. A. Antoniades, and J. Georgiou, "Toward the realization of a programmable metasurface absorber enabled by custom integrated circuit technology," *IEEE Access*, vol. 8, pp. 92986–92998, 2020.

[61]F. Liu, O. Tsilipakos, A. Pitilakis, A. C. Tasolamprou, M. S. Mirmoosa, N. V. Kantartzis, D.-H. Kwon, J. Georgiou, K. Kossifos, M. A. Antoniades, M. Kafesaki, C. M. Soukoulis, and S. A. Tretyakov, "Intelligent metasurfaces with continuously tunable local surface impedance for multiple reconfgurable functions," *Phys. Rev. Appl.*, vol. 11, 044024, 2019.

[60] D.-H. Kwon, "Lossless tensor surface electromagnetic cloaking for large objects in free space," *Phys. Rev. B*, vol. 98, 125137, 2018.

[59] D.-H. Kwon, "Lossless scalar metasurfaces for anomalous refection based on effcient surface feld optimization," *IEEE Antennas Wireless Propag. Lett.*, vol. 17, no. 7, pp. 1149–1152, Jul. 2018.

[58] Y. H. Cho and D.-H. Kwon, "Effcient analytical evaluation of complex dispersion relations of a multiple-row periodic array of magnetodielectric circular cylinders," *IEEE Trans. Antennas Propag.*, vol. 66, no. 5, pp. 2449–2457, May 2018.

[57] S. N. Tcvetkova, D.-H. Kwon, A. Díaz-Rubio, and S. A. Tretyakov, "Near-perfect conversion of a propagating plane wave into a surface wave using metasurfaces," *Phys. Rev. B*, vol. 97, 115447, 2018.

[56] D.-H. Kwon, G. Ptitcyn, A. Díaz-Rubio, and S. A. Tretyakov, "Transmission magnitude and phase control for polarization-preserving refectionless metasurf aces," *Phys. Rev. Appl.*, vol. 9, 034005, 2018.

[55] D.-H. Kwon and S. A. Tretyakov, "Arbitrary beam control using passive lossless metasurfaces enabled by orthogonally-polarized custom surface waves," *Phys. Rev. B*, vol. 97, 035439, 2018.

[54] V. S. Asadchy, A. Díaz-Rubio, S. N. Tcvetkova, D.-H. Kwon, A. Elsakka, M. Albooyeh, and S. A. Tretyakov, "Flat engineered multichannel refectors, " *Phys. Rev. X*, vol. 7, 031046, 2017.

[53] D.-H. Kwon and S. A. Tretyakov, "Perfect refection control for impenetrable surfaces using surface waves of orthogonal polarization," *Phys. Rev. B*, vol. 96, 085438, 2017.

[52] J. A. MALONEY, D.-H. Kwon, S. D. Keller, and R. Janaswamy, "Realistic GPS coverage prediction for dual polarized controlled reception pattern antennas," *IEEE Antennas Wireless Propag. Lett.*, vol. 16, pp. 1907–1910, 2017.

[51] M. Albooyeh, D.-H. Kwon, F. Capolino, and S. A. Tretyakov, "Equivalent realizations of reciprocal metasurfaces: the role of tangential and normal polarizations," *Phys. Rev. B*, vol. 95, 115453, 2017.

[50] C. D. EMIROGLU and D.-H. Kwon, "Design and realization of virtual line source using metamaterials," *IEEE Trans. Antennas Propag.*, vol. 64, no. 12, pp. 5220–5229, Dec. 2016.

[49] M. A. NIKRAVAN and D.-H. Kwon, "A broadband perpendicular E-plane waveguide-to-suspended stripline transition," *Microw. Opt. Technol. Lett.*, vol. 58, no. 8, pp. 1831–1834, Aug. 2016.

[48] D.-H. Kwon and H.-C. CHANG, "Bandwidth limitations of linearly-polarized infnite planar phased arrays in free space," *IEEE Trans. Antennas Propag.*, vol. 63, no. 8, pp. 3423–3431, Aug. 2015.

[47] D.-H. Kwon, "Effective height, receiving area, and receiving effcienc y of infnite planar phased array elements," *IEEE Trans. Antennas Propag.*, vol. 63, no. 5, pp. 2022–2031, May 2015.

[46] H.-C. CHANG, Y. H. Cho, and D.-H. Kwon, "Radiation Q bounds for small electric dipoles over a conducting ground plane," *IEEE Trans. Antennas Propag.*, vol. 62, no. 4, pp. 2031–2040, Apr. 2014.

[45] M. A. NIKRAVAN, H. G. Schantz, A. H. Unden, and D.-H. Kwon, "Channel multiplexing technique utilizing electric and magnetic components of a radio wave," *IEEE Commun. Lett.*, vol. 18, no. 2, pp. 317–320, Feb. 2014.

[44] D.-H. Kwon, "Transformation electromagnetics and optics," *Forum for Electromagnetic Research Methods and Application Technologies*, pp. 1–11, Feb. 2014. [Online]. Available: http://www.e-fermat.org

[43] D.-H. Kwon and D. M. Pozar, "Energy storage and radiation Q of infnite planar dipole phased arrays," *IEEE Trans. Antennas Propag.*, vol. 62, no. 1, pp. 153–162, Jan. 2014.

[42] Y. H. Cho and D.-H. Kwon, "Effcient mode-matching analysis of two-dimensional scattering by periodic array of circular cylinders," *IEEE Trans. Antennas Propag.*, vol. 61, no. 3, pp. 1327–1333, Mar. 2013.

[41] D.-H. Kwon, "Quasi-Conformal Transformation Optics Lenses for Conformal Arrays," *IEEE Antennas Wireless Propag. Lett.*, vol. 11, pp. 1125–1128, 2012.

[40] D.-H. Kwon and C. D. EMIROGLU, "Non-orthogonal grids in two-dimensional transmission-line metamaterials," *IEEE Trans. Antennas Propag.*, vol. 60, no. 9, pp. 4210–4218, Sep. 2012.

[39] D.-H. Kwon, "Transformation electromagnetic design of an embedded monopole in a ground recess for conformal applications," *IEEE Antennas Wireless Propag. Lett.*, vol. 9, pp. 432–435, 2010.

[38] C. D. EMIROGLU and D.-H. Kwon, "Impedance-matched three-dimensional beam expander and compressor designs via transformation optics," *J. Appl. Phys.*, vol. 107, no. 8, 084502, Apr. 2010.

[37] D.-H. Kwon and D. H. Werner, "Transformation electromagnetics: an overview of the theory and applications," *IEEE Antennas Propag. Mag.*, vol. 52, no. 1, pp. 24–46, Feb. 2010.

[36] D.-H. Kwon and C. D. EMIROGLU, "Low-profle embedded design of endfre scanning arrays with coordinate transformations," *J. Appl. Phys.*, vol. 107, no. 3, 034508, Feb. 2010.

[35] D.-H. Kwon and D. M. Pozar, "Optimal characteristics of an arbitrary receive antenna," *IEEE Trans. Antennas Propag.*, vol. 57, no. 12, pp. 3720–3727, Dec. 2009.

[34] D.-H. Kwon and D. H. Werner, "Beam scanning using fat transformation electromagnetic focusing lenses," *IEEE Antennas Wireless Propag. Lett.*, vol. 8, pp. 1115–1118, 2009.

[33] D.-H. Kwon, "Virtual circular array using material-embedded linear source distributions," *Appl. Phys. Lett.*, vol. 95, no. 17, 173503, Oct. 2009.

[32] D.-H. Kwon and D. H. Werner, "Flat focusing lens designs having minimized refection based on coordinate transformation techniques," *Opt. Express*, vol. 17, no. 10, pp. 7807–7817, May 2009.

[31] D.-H. Kwon and D. H. Werner, "Transformation optical designs for wave collimators, fat lenses, and right-angle bends," *New J. Phys.*, vol. 10, 115023, Nov. 2008.

[30] D.-H. Kwon and D. H. Werner, "Polarization splitter and polarization rotator designs based on transformation optics," *Opt. Express*, vol. 16, no. 23, pp. 18731–18738, Nov. 2008.

[29] D.-H. Kwon, "Radiation Q and gain of TM and TE sources in phase-delayed rotated confgurations, " *IEEE Trans. Antennas Propag.*, vol. 56, no. 8, pp. 2783–2786, Aug. 2008.

[28] I. C. Khoo, D. H. Werner, D. H. Kwon, and A. Diaz, "Designing liquid crystalline nonlinear optical meta-materials with large birefringence and sub-unity refractive index," *Mol. Cryst. Liq. Cryst.*, vol. 488, pp. 88–99, 2008.

[27] D.-H. Kwon, D. H. Werner, A. V. Kildishev, and V. M. Shalaev, "Material parameter retrieval procedure for general bi-isotropic metamaterials and its application to optical chiral negative-index metamaterial design," *Opt. Express*, vol. 16, no. 16, pp. 11822–11829, July 2008.

[26] D.-H. Kwon, P. L. Werner, and D. H. Werner, "Optical planar chiral metamaterial designs for strong circular dichroism and polarization rotation," *Opt. Express*, vol. 16, no. 16, pp. 11802–11807, July 2008.

[25] D.-H. Kwon and D. H. Werner, "Restoration of antenna parameters in scattering environments using electromagnetic cloaking," *Appl. Phys. Lett.*, vol. 92, no. 11, 113507, Mar. 2008.

[24] D.-H. Kwon and D. H. Werner, "Two-dimensional electromagnetic cloak having a uniform thickness for elliptic cylindrical regions," *Appl. Phys. Lett.*, vol. 92, no. 11, 113502, Mar. 2008.

[23] D.-H. Kwon, X. Wang, Z. Bayraktar, B. Weiner, and D. H. Werner, "Near-infrared metamaterial flms with reconfgurable transmissi ve/refecti ve properties," *Opt. Lett.*, vol. 33, no. 6, pp. 545–547, Mar. 2008.

[22] D.-H. Kwon, E. V. Balzovsky, Y. I. Buyanov, Y. Kim, and V. I. Koshelev, "Small printed combined electric-magnetic type ultrawideband antenna with directive radiation characteristics," *IEEE Trans. Antennas Propag.*, vol. 56, no. 1, pp. 237–241, Jan. 2008.

[21] D.-H. Kwon and D. H. Werner, "Two-dimensional eccentric elliptic electromagnetic cloaks," *Appl. Phys. Lett.*, vol. 92, no. 1, 013505, Jan. 2008.

[20] X. Wang, D.-H. Kwon, D. H. Werner, I.-C. Khoo, A. V. Kildishev, and V. M. Shalaev, "Tunable optical negative-index metamaterials employing anisotropic liquid crystals," *Appl. Phys. Lett.*, vol. 91, no. 14, 143122, Oct. 2007.

[19] A. V. Kildishev, U. K. Chettiar, Z. Liu, V. M. Shalaev, D.-H. Kwon, Z. Bayraktar, and D. H. Werner, "Stochastic optimization of low-loss optical negative index metamaterial," *J. Opt. Soc. Am. B*, vol. 24, no. 10, pp. A34–A39, Oct. 2007.

[18] I. C. Khoo, A. Diaz, D. Kwon, D. H. Werner, J. Liou, M. Stinger, J. H. Park, S. Kubo, and T. Mallouk, "Nonlinear and electro-optics of nano-dispersed nematic liquid crystals with tunable negative-, zero-, and positive indices," *J. Nonlinear Opt. Phys. Mater.*, vol. 16, no. 3, pp. 381–399, Sep. 2007.

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[16] D.-H. Kwon, "Wideband balun and vertical transition between microstrip and parallel-strip transmission line," *Microw. Opt. Tech. Lett.*, vol. 49, no. 7, pp. 1530–1532, July 2007.

[15] A. V. Kildishev, V. P. Drachev, U. K. Chettiar, V. M. Shalaev, D. H. Werner, and D.-H. Kwon, "Comment on "Negative refractive index in artifcial metamaterials"," *Opt. Lett.*, vol. 32, no. 11, pp. 1510–1511, June 2007.

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[13] D.-H. Kwon, L. Li, J. A. Bossard, M. G. Bray, and D. H. Werner, "Zero index metamaterials with checkerboard structure," *Electron. Lett.*, vol. 43, no. 6, pp. 319–320, Mar. 2007.

[12] D.-H. Kwon, D. H. Werner, A. V. Kildishev, and V. M. Shalaev, "Near-infrared metamaterials with dual-band negative-index characteristics," *Opt. Express*, vol. 15, no. 4, pp. 1647–1652, Feb. 2007.

[11] D.-H. Kwon and Y. Kim, "Small low-profle loop wideband antennas with unidirectional radiation characteristics," *IEEE Trans. Antennas Propag.*, vol. 55, no. 1, pp. 72–77, Jan. 2007.

[10] D.-H. Kwon, "Effect of antenna gain and group delay variations on pulse-preserving capabilities of ultra-wideband antennas," *IEEE Trans. Antennas Propag.*, vol. 54, no. 8, pp. 2208–2215, Aug. 2006.

[9] D.-H. Kwon and Y. Kim, "Suppression of cable leakage current for edge-fed printed dipole UWB antennas using leakage-blocking slots," *IEEE Antennas Wireless Propag. Lett.*, vol. 5, pp. 183–186, 2006.

[8] D.-H. Kwon, "A wideband balun and vertical transition between conductor-backed CPW and parallel-strip transmission line," *IEEE Microwave Wireless Compon. Lett.*, vol. 16, no. 4, pp. 152–154, Apr. 2006.

[7] D.-H. Kwon and Y. Kim, "A wideband vertical transition between co-planar waveguide and parallel-strip transmission line," *IEEE Microwave Wireless Compon. Lett.*, vol. 15, no. 9, pp. 591–593, Sep. 2005.

[6] Y. Kim and D.-H. Kwon, "CPW-fed right-angled dual tapered notch antenna for ultra-wideband communication," *Electron. Lett.*, vol. 41, no. 12, pp. 5–6, June 2005.

[5] D.-H. Kwon, "On the radiation Q and the gain of crossed electric and magnetic dipole moments," *IEEE Trans. Antennas Propag.*, vol. 53, no. 5, pp. 1681–1687, May 2005.

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[2] D.-H. Kwon, R. J. Burkholder, and P. H. Pathak, "Ray analysis of electromagnetic feld build-up and quality factor of electrically large shielded enclosures," *IEEE Trans. Electromagn. Compat.*, vol. 40, no. 1, pp. 19–26, Feb. 1998.

[1] R. J. Burkholder and D.-H. Kwon, "High-frequency asymptotic acceleration of the fast multipole method," *Rad. Sci.*, vol. 31, pp. 1199–1206, Sep.–Oct. 1996.

Conference papers (advisee name in capitals)

[97] F. Liu, D.-H. Kwon, and S. A. Tretyakov, "Refectarrays and metasurface refectors as diffraction gratings," accepted for presentation at *2021 Int. Appl. Comput. Electromagn. Soc. (ACES-China) Symp.*, Xuzhou, China, Jul. 2022.

[96] H. LEE and D.-H. Kwon, "A scalar cylindrical printed metasurface cloak for free-standing objects in 2-D TE polarization [invited]," submitted for presentation at *the 16th International Congress on Artificial Materials for Novel Wave Phenomena (Metamaterials 2022)*, Siena, Italy, Sep. 2022.

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[4] Y.-J. Kim, D.-H. Kwon, and S.-S. Lee, "Ultra-wideband planar antenna having frequency notch function," U.S. Patent 7 050 013, May 23, 2006.

[3] K.-H. Kim, Y.-E. Kim, and D.-H. Kwon, "Built-in antenna system for indoor wireless communications," U.S. Patent 6 947 009, Sep. 20, 2005.

[2] D.-H. Kwon, "Small and omni-directional biconical antenna for wireless communications," U.S. Patent 6 943 747, Sep. 13, 2005.

[1] W.-J. Kim, D.-H. Kwon, W.-K. Lee, and Y.-S. Kim, "Noncoherent pulse position and phase shift keying transmission/reception system and a transmission/reception signal processing method therefor," U.S. Patent 6 909 337, Jun. 21, 2005.

Invited talks

Invited talk "Interface feld optimization for wide-angle metasurface refractors in TM polarization" at *the 2021 IEEE Int. Symp. Antennas Propag.,* Singapore, Dec. 2021. (online)

Invited talk "Functional electromagnetic surface design via complete interface feld synthesis," at *the 15th International Congress on Artificial Materials and Novel Wave Phenomena (Metamaterials 2021),* New York, NY, Sep. 2021. (online)

Invited talk "Planar modulated reactance surfaces for endfre antenna applications" at *the 6th International Conference on Metamaterials and Nanophotonics (Metanano 2021)*, Tbilisi, Georgia, Sep. 2021. (online)

Invited seminar "Holistic lossless functional surface design via complete boundary feld synthesis" at the Department of Electronics and Nanoengineering, Aalto University, Finland (11/4/2020, online)

Invited talk "Modulated reactance surfaces for effcient plane wave to surface wave conversion" at *the 5th International Conference on Metamaterials and Nanophotonics (Metanano 2020)*, Tbilisi, Georgia, Sep. 2020. (online, without proceeding)

Invited seminar "Holistic lossless boundary conditions and their application to metasurfaces" at Department of Electrical and Computer Engineering, Seoul National University, Korea (8/26/2019)

Invited seminar "Transformation EM and metamaterials for antennas at a virtual location" at Air Force Research Lab/Sensors Directorate, Wright-Patterson Air Force Base, OH (8/30/2011)

Invited seminar "Transformation optics/electromagnetics device designs" at the Material Research Science and Engineering Center (MRSEC) of the Pennsylvania State University (1/10/2011)

Invited seminar "Transformation optics/electromagnetics device designs" at the Electrical and Computer Engineering Department of Worcester Polytechnic Institute (11/4/2010)

Invited seminar "Small electric-magnetic type antennas for enhanced gain and bandwidth" at IEEE Antennas and Propagation Society Boston Section Meeting (1/27/2009)

Honors and Awards

2011 IEEE Antennas and Propagation Edward E. Altshuler Prize Paper Award (inaugural)

Reconfgurable transmissive/refecti ve metamaterial paper (D.-H. Kwon *et al.*, *Opt. Lett.* **33**, 545 (2008)) highlighted in the April 2008 issue of Nature Photonics.

Achievement award, RF Technology Group, Communication Laboratory, Samsung Advanced Institute of Technology (2006)

Breakthrough award, Samsung Advanced Institute of Technology (2005)

Outstanding graduate research award, ElectroScience Laboratory, Department of Electrical Engineering, The Ohio State University (1995)

Memberships

IEEE Antennas and Propagation Society (Membership grade: Senior Member)

Professional activities

Associate editor for *IEEE Antennas Wireless Propag. Lett.* (Jul. 2013–Jul. 2019)

Guest editor for IEEE AWPL Special Cluster on Transformation Electromagnetics (2014)

Editor for Journal of Electromagnetic Engineering and Science (JEES) (Jan. 2014–Dec. 2014)

Reviewer for Army Research Offce basic research grant proposals

Co-chair of Student Program and member of Technical Program Committee, 2013 IEEE International Symposium on Phased Array Systems & Technology, Waltham, MA, Oct. 2013.

Reviewer for IEEE journals: *IEEE Trans. Aerosp. Electron. Syst.*, *IEEE Trans. Robot. Autom.*, *IEEE Trans. Microw. Theory Tech.*, *IEEE J. Sel. Topics Quantum Electron.*, *IEEE Trans. Antennas Propag.*, *IEEE Antennas Propag. Mag.*, *IEEE Antennas Wireless Propag. Lett.*, *Proc. IEEE*, *IEEE Microw. Wireless Compon. Lett.*

Reviewer for IET journals: *IET Microw. Antennas Propag.*, *Electron. Lett.*

Reviewer for physics journals: *Appl. Phys. Lett.*, *J. Appl. Phys.*, *Phys. Rev. Appl.*

Reviewer for optics journals: *Nature Photon.*, *Opt. Express*, *Opt. Lett.*

Reviewer for Springer Nature journals: *Sci. Rep.*

Reviewer for other journals: *ETRI J.*, *Prog. Electromagn. Res.*, *J. Electromagn. Waves Appl.*, *Appl. Comput. Electromagn. Soc. J.*, *Int. J. Antennas Propag.*, *Wirel. Commun. Mob. Comput.*, *Engineering* (by Elsevier).

Co-chair of Student Program and member of Technical Program Committee, 2010 IEEE International Symposium on Phased Array Systems & Technology, Waltham, MA, Oct. 2010.

Panelist for the NSF-ENG-ECCS-IHCS program (Jun. 2010)

Session co-organizer and co-chair, “Special Session: Transformation Electromagnetics” (Session 517), 2009 IEEE Antennas Propag. Soc. Int. Symp., Charleston, SC, Jun. 2009.

Secretary-Treasurer, IEEE Central Pennsylvania Section (2008)