

Mert KALFA

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Summary

Senior researcher with 15+ years of experience in computational electromagnetics, periodic engineered surfaces/arrays, and defense R&D, now transitioning to academia with a strong record of publications, patents, teaching, and graduate student supervision.

Research Interests

Intelligent EM Environments
ML-enhanced computational electromagnetics
Large antenna arrays, RISs, metasurfaces
Semantic Signal Processing and Communications
Compressive sensing
Radar signal processing and ISAC

Education

- 2020 **Ph.D., Electrical and Electronics Engineering**, *Bilkent University*, Ankara, Turkiye.
CGPA: 3.96/4.00
Supervisors: Vakur B. Ertürk and Özgür Ergül
Dissertation: Multiple-precision MLFMA for efficient and accurate solutions of broadband electromagnetic problems
- 2013 **M.Sc., Electrical and Electronics Engineering**, *Bilkent University*, Ankara, Turkiye.
CGPA: 3.84/4.00
Supervisor: Vakur B. Ertürk
Thesis: Analysis of slotted sectoral waveguide antenna arrays embedded in cylindrically stratified media
- 2010 **B.Sc., Electrical and Electronics Engineering**, *Bilkent University*, Ankara, Turkiye.
CGPA: 3.91/4.00
- 2005 **High School**, *Ankara Science High School (Ankara Fen Lisesi)*, Ankara, Turkiye.
CGPA: 4.95/5.00

Teaching Experience

- 2024–2025 **EEE452 – Antenna Engineering**, Bilkent University, Ankara, Turkiye.
2024–2026 **MATH242 – Engineering Mathematics II**, Bilkent University, Ankara, Turkiye.

Professional Experience

- Dec. 2023 – **present** **Electronics Design Manager**, *Meteksan Defence*, Ankara, Turkiye.
My responsibilities include the executive and technical management of a team of engineers and technicians, as well as assuming sole system architect responsibilities on some projects, focused on the development and implementation of the current and next-generation radar, communications, electronic warfare, electro-optical, and acoustic systems.

- Dec. 2020 – **Post-Doctoral Researcher / Principal Research Engineer**, *Bilkent University / Huawei Canada Research Centre*, Ankara-Ottawa, Turkiye-Canada.
 Dec. 2023 As a Post-Doctoral Researcher funded by Huawei Canada Research Centre and located in Bilkent University, my responsibilities included developing novel architectures and sensing modalities for massive machine-type communication systems using advanced signal processing techniques, with a focus on semantic signal processing, compressive sensing, and machine learning. I also led the collaboration between Huawei Canada Research Centre and Bilkent University faculty, and supervised the team of graduate students working on the project.
- Sep. 2022 – **Acting R&D Director, Engineering Manager**, *Huawei Technologies Co. Ltd.*, Ankara, Turkiye.
 Dec. 2023 Concurrent with my role in the Huawei-Bilkent Collaboration, I have led the formation of the Ankara office for Huawei Turkiye R&D Center, formation of the Post-5G Research Department, and the efforts to obtain the R&D License from the Turkiye Ministry of Industry and Technology.
- Sep. 2016 – **Lead Research Engineer**, *Aselsan*, Ankara, Turkiye.
 Dec. 2020 My responsibilities included developing novel system architectures for radar and EW systems (including advanced signal processing techniques such as compressive sensing and machine learning, novel phased array designs & architectures, advanced phased array diagnostics, quantum radar systems), and systems design and validation of technology demonstrator prototypes for up to TRL-4 validation. I have also managed a team of six researchers and assumed research project management duties.
- Jul. 2010 – **Antenna Design Engineer**, *Aselsan*, Ankara, Turkiye.
 Sep. 2016 My responsibilities included designing ultra-wideband phased array antennas, supervising a team of engineers for the design of electronic warfare phased array front-ends (including antennas, T/R modules, packaging), and developing antenna measurement techniques for phased arrays in the compact range and near-field facilities.

Professional Awards

- 2021 **Ph.D. Dissertation Award**, granted by IEEE Turkiye Section for outstanding dissertations in the pertinent fields of IEEE.
- 2017 **Excellence in Electrodynamics Award**, granted by Leopold B. Felsen Foundation, Boston, for my contributions as a Turkish researcher in the field of electrodynamics.
- 2018 **IEEE AP-S/URSI Symposium Honorable Mention and Travel Grant**, granted by IEEE for my paper titled *Error control of MLFMA within a multiple-precision arithmetic framework*, to help defray travel expenses for attending the symposium.
- 2014 **Best Student Paper Award** for *Analysis of slotted sectoral waveguide array antennas embedded in cylindrically stratified media*, URSI 2014 National Assembly.
- 2018 **SET Panel Excellence Award (SPEA)**, as part of NATO Research Task Group SET-236, *Design and Analysis of Compressive Sensing Techniques for Radar and ESM Applications*, (2016 – 2018).
- 2023 **Individual Gold Medal**, highest individual honor granted by Huawei Technologies Co. Ltd. for my work on Semantic Signal Processing.
- 2019 **Best Poster Award** for *Multiple-Precision MLFMA for Efficient Solution of Multi-Scale Electromagnetic Problems*, IEEE Bilkent Graduate Research Conference.
- 2017 **Best Presentation Award** for *Mixed-precision arithmetic for multilevel fast multipole algorithm*, IEEE Bilkent Graduate Research Conference.
- 2013 **Best Presentation Award**, for *Analysis of slotted sectoral waveguides embedded in cylindrically stratified media using closed-form Green's function representations*, IEEE Bilkent Graduate Research Conference.
- 2021 **Future Star Award**, granted by Huawei Technologies Co. Ltd.
- 2016 **Certificate of Appreciation**, granted by Aselsan Inc. for my "exceptional work in the development and delivery process in the KORAL project."

Patents

- 2023 B. Kılıç, A. Güngör, **M. Kalfa**, O. Arikan, *Compressed sensing based adaptive direction of arrival estimation technique for dynamic target environments*, WO2022235246A3, TR2021007563.
- 2020 **M. Kalfa**, E. Halavut, H. H. Canbey, *Antenna array having ultra-wide band and high polarization purity*, US10879625B2, TR201720526A2, PL235589B1, WO2019117839A1.

Publications

Journal Articles

- 2025 (*Under preparation*), E. Koç, **M. Kalfa**, and V. B. Ertürk. A novel hierarchical method for the efficient solution of scattering problems involving elongated structures. *To be submitted to IEEE Transactions on Antennas and Propagation*, 2025.
- 2025 E. Koç, **M. Kalfa**, S.E. Doğan, and V. B. Ertürk. A novel highly parallelizable machine-learning-based method for the fast solution of integral equations for electromagnetic scattering problems. *IEEE Transactions on Antennas and Propagation, Early Access*, 2025.
- 2025 S. Akkoç, A. Çınar, B. Ercan, **M. Kalfa**, and O. Arikan. Practical hardware demonstration of a multi-sensor goal-oriented semantic signal processing and communications network. *Journal of the Franklin Institute*, volume 362, page 107363, 2025.
- 2024 **M. Kalfa**, Ö. Ergül, and V. B. Ertürk. Multiple-precision arithmetic implementation of the multilevel fast multipole algorithm. *IEEE Transactions on Antennas and Propagation*, volume 72, pages 11–21, 2024.
- 2023 **M. Kalfa**, S. Y. Yetim, A. Atalik, M. Gök, Y. Ge, R. Li, W. Tong, T. M. Duman, and O. Arikan. Reliable extraction of semantic information and rate of innovation estimation for graph signals. *IEEE Journal on Selected Areas in Communications*, volume 41, pages 119–140, 2023.
- 2022 B. Kilic, A. Güngör, **M. Kalfa**, and O. Arikan. Adaptive measurement matrix design in direction of arrival estimation. *IEEE Transactions on Signal Processing*, volume 70, pages 4742–4756, 2022.
- 2021 **M. Kalfa**, M. Gok, A. Atalik, B. Tegin, T. M. Duman, and O. Arikan. Towards goal-oriented semantic signal processing: Applications and future challenges. *Digital Signal Processing*, volume 119, pages 103–134, 2021.
- 2021 **M. Kalfa**, V. B. Ertürk, and Ö. Ergül. Error analysis of MLFMA with closed-form expressions. *IEEE Transactions on Antennas and Propagation*, volume 69, pages 6618–6623, 2021.
- 2018 **M. Kalfa**, Ö. Ergül, and V. B. Ertürk. Error control of multiple-precision MLFMA. *IEEE Transactions on Antennas and Propagation*, volume 66, pages 5651–5656, 2018.
- 2016 **M. Kalfa** and V. B. Ertürk. Analysis of slotted sectoral waveguide arrays with multilayered radomes. *IEEE Transactions on Antennas and Propagation*, volume 64, pages 800–805, 2016.
- 2011 M. S. Akyuz, V. B. Erturk, and **M. Kalfa**. Closed-form Green's function representations for mutual coupling calculations between apertures on a perfect electric conductor circular cylinder covered with dielectric layers. *IEEE Transactions on Antennas and Propagation*, volume 59, pages 3094–3098, 2011.

Conference Proceedings

- 2024 E. Koç, **M. Kalfa**, and V. B. Ertürk. A novel machine-learning-based method for the fast solution of integral equations for electromagnetic scattering problems. In *2024 IEEE International Symposium on Antennas and Propagation and INC/USNC-URSI Radio Science Meeting (AP-S/INC-USNC-URSI)*, pages 231–232, 2024.

- 2023 **M. Kalfa**. Semantic signal processing: Enabling the future of intelligent communication networks. In *2023 IEEE International Conference on Communications (ICC), 2nd workshop on Semantic Communications*, 2023.
- 2020 F. Yavuz and **M. Kalfa**. Radar target detection via deep learning. In *2020 28th Signal Processing and Communications Applications Conference (SIU)*, pages 1–4, 2020.
- 2020 B. Kılıç, **M. Kalfa**, and O. Arıkan. Adaptive sensing matrix design in compressive sensing based direction of arrival estimation with hardware constraints. In *2020 IEEE USNC-CNC-URSI North American Radio Science Meeting (Joint with AP-S Symposium)*, pages 149–150, 2020.
- 2020 B. Kılıç, A. Güngör, **M. Kalfa**, and O. Arıkan. Sensing matrix design for compressive sensing based direction of arrival estimation. In *2020 28th Signal Processing and Communications Applications Conference (SIU)*, pages 1–4, 2020.
- 2020 B. Kılıç, A. Güngör, **M. Kalfa**, and O. Arıkan. Adaptive measurement matrix design in compressed sensing based direction of arrival estimation. In *2020 28th European Signal Processing Conference (EUSIPCO)*, pages 1881–1885, 2020.
- 2020 R. Ergün, B. Kılıç, **M. Kalfa**, and O. Arıkan. Adaptive compressive sensing based direction of arrival estimation using particle filters. In *2020 28th Signal Processing and Communications Applications Conference (SIU)*, pages 1–4, 2020.
- 2020 M. U. Bahçeci and **M. Kalfa**. Implementation and control of fundamental signal processing blocks for radar in FPGA. In *2020 28th Signal Processing and Communications Applications Conference (SIU)*, pages 1–4, 2020.
- 2019 B. Kılıç, **M. Kalfa**, and O. Arıkan. Prior-based grid selection algorithm for compressed sensing based direction of arrival estimation methods. In *2019 IEEE International Symposium on Phased Array System & Technology (ARRAY)*, pages 1–5, 2019.
- 2018 **M. Kalfa** and H. E. Güven. Fast 2-D direction of arrival estimation using two-stage gridless compressive sensing. In *2018 International Conference on Radar (RADAR)*, pages 1–5, 2018.
- 2018 **M. Kalfa**, V. B. Ertürk, and Ö. Ergül. Error control of MLFMA within a multiple-precision arithmetic framework. In *2018 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting*, pages 2299–2300, 2018. **(Recipient of the Honorable Mention and Travel Grant)**.
- 2016 B. A. Yılmaz and **M. Kalfa**. Wide-scanning 9:1 bandwidth dual-polarized phased array Vivaldi antenna design. In *2016 URSI National Assembly*, pages 1–3, 2016.
- 2015 **M. Kalfa**, Ş. Karan, and V. B. Ertürk. Analysis of cylindrically conformal antennas using closed-form green's function representations. In *2015 9th European Conference on Antennas and Propagation (EuCAP)*, pages 1–4, 2015.
- 2015 **M. Kalfa** and V. B. Ertürk. Analysis of slotted sectoral waveguide array antennas with multilayer radomes and nonzero metal thickness. In *2015 USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)*, pages 121–121, 2015.
- 2014 **M. Kalfa** and V. B. Ertürk. Design and analysis of slotted sectoral waveguide array antennas embedded in cylindrically stratified media. In *2014 USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)*, pages 146–146, 2014.
- 2014 **M. Kalfa** and V. B. Ertürk. Analysis of slotted sectoral waveguide antenna arrays embedded in cylindrically stratified media. In *2014 URSI National Assembly*, pages 1–3, 2014. **(Recipient of the Best Paper Award)**.
- 2013 **M. Kalfa** and E. Halavut. A fast method for obtaining active S-parameters in large uniform phased array antennas. In *2013 IEEE International Symposium on Phased Array Systems and Technology*, pages 684–688, 2013.

- 2013 **M. Kalfa** and V.B. Erturk. Derivation of green's function representations for the analysis of sectoral waveguides embedded in cylindrically stratified media. In *2013 USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)*, page 172, 2013.
- 2013 **M. Kalfa** and V.B. Erturk. Analysis of slotted sectoral waveguides embedded in cylindrically stratified media using closed-form green's function representations. In *2013 USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)*, page 157, 2013.

Keynote Speeches

- 2023 **M. Kalfa**, *Semantic Signal Processing: Enabling the Future of Intelligent Communication Networks*, IEEE International Conference on Communications (ICC), 2nd workshop on Semantic Communications, June, 2023.

Supervised Graduate Theses

- 2025 **Enes Koç, M.Sc.**, *Novel methods for fast and accurate solutions of electromagnetic integral equations*, Electrical and Electronics Engineering Dept., Bilkent University, Ankara, Turkiye. (Co-supervised with Prof. Vakur B. Erturk)
- 2025 **Doğaç Dilek, M.Sc.**, *A surface dipole-based framework for fast and efficient solution of electromagnetic scattering problems*, Electrical and Electronics Engineering Dept., Bilkent University, Ankara, Turkiye. (Co-supervised with Prof. Vakur B. Erturk)
- 2021 **Seçil Eda Doğan, M.Sc.**, *A novel hierarchical machine-learning-based method for efficient solutions of electromagnetic scattering problems*, Electrical and Electronics Engineering Dept., Bilkent University, Ankara, Turkiye. (Co-supervised with Prof. Vakur B. Erturk)

Academic Services / Activities

- Active **Member**, IEEE, Antennas and Propagation Society, Signal Processing Society, Communications Society
- Active **Reviewer**, IEEE Transactions on Antennas and Propagation, IEEE Antennas and Wireless Propagation Letters, IEEE Journal on the Selected Areas of Communications, IEEE Transactions on Communications, IEEE Transactions on Signal Processing, IEEE Transactions on Vehicular Technology, IEEE Communications Magazine, IEEE IoT Magazine, IEEE Wireless Comms Magazine, Journal of Engineering Applications of Artificial Intelligence, Journal of the Franklin Institute, Journal of Network and Computer Applications, Springer Nature Scientific Reports.
- Active **Reviewer**, TEYDEB 1501 Industrial R&D Projects Grant Programme, TUBITAK, Turkiye.
- 2024–Present **Technical Program Committee**, IEEE Global Communications Conference (GLOBECOM).
- 2022–2023 **Technical Program Committee**, IEEE International Conference on Communications (ICC), Special Workshop on Semantic Communications.
- 2020 **Special Session Chair**, *Compressed Sensing and Deep Learning in Radar Signal Processing Applications*, IEEE Signal Processing and Communication Applications Conference (SIU), Turkiye.
- 2019 – 2021 **Member**, NATO Research Task Group SCI-ET-041, *Integrating Compressive Sensing and Machine Learning Techniques for Radar Applications*
- 2016 – 2018 **Member**, NATO Research Task Group SET-236, *Design and Analysis of Compressive Sensing Techniques for Radar and ESM Applications*, **Recipient of SET Panel Excellence Award (SPEA)**

Selection of Delivered Projects

Meteksan Defence, Design, development, and validation of an S-Band AESA Radar (TRL-6) with online self-calibration capabilities. I specifically contributed to the overall system design, antenna design, control hardware for beamforming, and self-calibration algorithm, including digital design.

Meteksan Defence, Design, development, and validation of an Ku-Band Radar (TRL-9). I specifically contributed to the entire control and signal processing hardware and digital design for radar signal processing.

Meteksan Defence, Modernization of a long-range C-Band Tactical Data Link system (TRL-9). I specifically contributed to the waveform design (GMSK) and the corresponding digital design.

Huawei Technologies Co. Ltd., Design, development, and validation of a homogeneous multi-camera **goal-oriented semantic communications prototype** (TRL-3) that employs semantic extraction, tracking, and sensor fusion.

Huawei Technologies Co. Ltd., Design and demonstration of a cooperative driving algorithm that employs **Effective Semantic Signal Processing and Communications** (TRL-2).

Huawei Technologies Co. Ltd., Development of a simulation and training testbed for cooperative driving applications using Effective Semantic Signal Processing in CARLA simulator.

Aselsan Inc., Design, development and validation of a Radar/EW Direction Finding System (TRL-3) prototype that uses Compressive Sensing for direction-of-arrival estimation and ML algorithms for detection.

Aselsan Inc., Design, development, fabrication and validation of multiple phased array systems (TRL-6) for electronic warfare applications, including antenna, RF, control, and power electronics.

Aselsan Inc., Design, development, fabrication and validation of an octave-bandwidth wide-scan phased array antenna (TRL-9) for electronic warfare applications.

Aselsan Inc., Design and development of two different single-polarized 3:1 bandwidth wide-scan phased array antennas (TRL-9) for electronic warfare applications.

Aselsan Inc., Design and development of a dual-polarized 9:1 bandwidth wide-scan phased array antenna (TRL-3) for electronic warfare applications.

Aselsan Inc., Design and development of a 1-18GHz dual-waveguide probe (DWP) material characterization system for permittivity/permeability measurements.

Aselsan Inc., Development of a *Phased Array Diagnostics Suite* through application of various phased array diagnostics techniques in the literature for use in planar/cylindrical/spherical near-field measurement systems.

Aselsan Inc., Renovation of RF and mechanical components of the Compact Range Antenna Measurement System to increase its capabilities and robustness.

Aselsan Inc., Development of an in-house UTD code for analyzing installed antenna patterns over various platforms, and for the design of serrated edge reflectors.

Aselsan Inc., Design of an aperture stacked patch antenna with >40% bandwidth.

Ph.D., Bilkent University, Schematic and layout design of various 64-bit adder topologies using Cadence, as part of a VLSI course.

Ph.D., Bilkent University, Design, fabrication, and validation of a buck converter and an AC inverter, as part of a power electronics course

Tools and Programming Skills

EM Analysis Ansys HFSS, CST, FEKO, **In-house MoM/MLFMA/FEM/UTD/FDTD codes**
RF/Microwave Keysight ADS, AWR Microwave Office, Cadence

Digital & FPGA Xilinx Vivado (VHDL), MATLAB System Generator / Model Composer / HDL Coder, HDL Designer

EDA & Circuits Cadence Virtuoso, OrCAD, LTSpice, PADS Professional/Xpedition, **In-house Power Integrity Analysis and Eigenmode Solver for Impedance Analysis codes**

Scientific Programming MATLAB, Python, NumPy, SciPy, TensorFlow

Simulation Environments Simulink, CARLA, Agilent VEE, IBM Analog Hardware Acceleration Kit

Misc Git(Hub), SVN, LaTeX

▬ Hobbies

Music production (I play drums, and dabble in electric guitar and synthesizers)

Powerlifting

Worldbuilding

▬ References

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Additional references can be provided if required.