Hui CHEN

Senior Researcher · AI & Digital Science Research Center (AIDRC)

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Research Interests

- **5G/6G Radio Localization & Sensing**: 6D localization; mmWave/THz; near-field; hardware impairment; mobility.
- **RIS-Aided Localization**: sidelink positioning; calibration; layout optimization; profile design; multi-static sensing.
- **ML for Signal Processing**: learning-based localization; stochastic optimization; human-machine interaction.

Professional Experience

Technology Innovation Institute (TII) *Abu Dhabi, United Arab Emirates*

Senior Researcher *2023.10 - Present*

- **RIS-aided ISAC** (Reconfigurable intelligent surfaces-aided integrated sensing and communication) (Collaborating with ZJU | 10/23-present)

Chalmers University of Technology (CTH) *Gothenburg, Sweden*

Postdoctoral Researcher | Supervisor: Prof. Henk Wymeersch *2021.08 - 2023.10*

- **Hexa-X-II** (An EU Flagship Project for a Sustainable, Inclusive, and Trustworthy 6G Platform) (**European Project** | 01/23-10/23)
- **Hexa-X** (A Flagship for B5G/6G Vision and Intelligent Fabric of Technology Enablers) (**European Project** | 08/21-06/23)
- **RISE-6G** (Reconfigurable Intelligent Sustainable Environments for 6G Wireless Networks) (**European Project** | 08/22-10/23)
- **5GPOS** (5G Cellular Positioning for Vehicular Safety) (**Swedish Project** | 11/21-06/22)

NEOM Smart City *Riyadh, Saudi Arabia*

Mixed Reality Developer (Internship) | Supervisor: Dr. Andrew Yip *2020.03 - 2020.04*

- **VR Kitchen** (Virtual Kitchen Simulator for virtual agent training (VR) and smart glass (AR))

National Space Science Center (NSSC) - Chinese Academy of Sciences (CAS) *Beijing, China*

Research Assistant | Supervisor: Prof. Guangjie Zhai *2014.08 - 2016.07*

- **National Major Scientific Instruments Development Project of China** (Assistant in circuit design and testing.)

Education

King Abdullah University of Science and Technology (KAUST) *Thuwal, Saudi Arabia*

Ph.D. Electrical & Computer Engineering | Supervisor: Prof. Tareq Al-Naffouri *2016.08 - 2021.08*

- Thesis: Stochastic Optimization in Target Positioning and Location-based Applications
- KAUST Fellowship (Full Tuition Waiver & Monthly Stipend)

University of Chinese Academy of Sciences (UCAS) *Beijing, China*

M.S. Computer Application Technology *2013.09 - 2016.07*

- Recommended for Direct Admission without Examinations (Full Tuition Waiver & Monthly Stipend)

Beijing Forestry University *Beijing, China*

B.S. Electrical Engineering *2009.09 - 2013.07*

- National Scholarship (Three Times), Outstanding Graduate of Beijing

Research Experience

RIS-aided ISAC (Algorithm Development and Experimental Validation) ***AIDRC, TII, Abu Dhabi, UAE***

Senior Researcher *2023.10 - Present*

- Develop RIS-aided ISAC system focusing on auto-calibration of RIS anchors and RL-based beam optimization.
- Evaluate localization, sensing, and beam optimization algorithms using GreenerWave RIS board.

5G/6G Radio Localization and Sensing ***Chalmers, Gothenburg, Sweden***

Postdoctoral Researcher *2021.08 - Present*

- mmWave/THz localization and sensing: hardware impairments (HWI), UE mobility, coverage analysis, layout optimization.
- RIS-aided localization and sensing: sidelink positioning; calibration; cooperative localization; multi-static sensing.
- Learning-based Localization: ML/DL methods for challenging resource allocation and localization scenarios.
- Onsite 5G Positioning Experiments: vehicular positioning using Ericsson 5G base station (Tx) and Silvers mmWave board (Rx).

Terahertz-band Signal Localization (THz Localization) for 6G Systems *ISL, KAUST, Thuwal, Saudi Arabia*

Main Researcher *2020.10 - 2021.08*

- Developed a THz MIMO channel simulator with features such as misalignment, spherical wave model, and beam squint effect.
- Provided a detailed tutorial on THz-band signal localization performance analysis and optimization problem formulation.
- Surveyed localization and tracking algorithms with array-of-subarray (AOSA) structure concepts.
- Evaluated the localization performance of mmWave/THz systems, discussed lessons learned, and provided future directions.

Stochastic Optimization in Target Positioning and Location-based Applications *KAUST, Thuwal, Saudi Arabia*

Main Researcher (Ph.D. Thesis) *2016.08 - 2021.08*

- Analyzed performance and designed algorithm for joint TDOA/PDOA localization.
- Designed DOA estimation and text classification algorithms for a real-time ultrasonic air-writing system.
- Designed greedy and deep learning (DL)-based antenna selection algorithms for switch-based MIMO systems.
- Designed and tested signals/algorithms for a real-time ultrasonic indoor localization system.

FPGA-based Time-to-Digital Converter *UCAS, Beijing, China*

Research Assistant (M.S. Thesis) *2014.09 - 2016.06*

- Designed a digital circuit to measure the time (60ps resolution) between two rising edges of a signal based on Virtex-5 FPGA.
- Developed a user interface using C# language running on Windows OS.

Scholarships, Honors & Awards

Scholarships

2016-2021 **KAUST Fellowship**, by King Abdullah University of Science and Technology
2013-2016 **Recommended for Direct Admission to UCAS (top 3%)**, Tuition-waiver & Monthly Stipend
2013 **UCAS Excellent Student Scholarship**, by University of Chinese Academy of Sciences
2010-2012 **National Scholarship (top 2‰)**, 3 times, by Ministry of Education of China *¥8K×3 awards*

Honors & Awards

2023 **Ericsson Research Grant**, Localization Security in 5G/6G Networks, Ericsson, Sweden *SEK 30K*
2023 **Seal of Excellence** (90.4/100), Marie Curie Fellowship (MSCA-PF), European Commission
2021 **1 of the 10 selected teams in 'SMECEYI' Initiative**, Swiss Pavilion, Expo Dubai, UAE
2021 **1st Place in Digital Innovation Awards-Digital Research Track**, by MCIT, KSA *$21.3K price*
2017 **4th place in Microsoft Indoor Localization Competition**, Pittsburgh, PA, USA
2013 **'Outstanding Graduate of Beijing' Award**, by Beijing Municipal Commission of Education
2012 **1st Prize in Beijing, 3rd Prize in China, iCAN Contest**, Wuxi, China
2011 **'Merit Student of Beijing' Award**, by Beijing Municipal Commission of Education

Professional Development & Service

Skills

Programming MATLAB, Python (TensorFlow), C# (Unity 3D), C/C++ (Arduino), Verilog, VHDL
IT Skills VR/AR Development, Interactive Simulation & Visualization, 3D Modeling

Teaching

Spring 2023 **Guest Lecturer**, SSY135 Wireless Communications, Chalmers, Sweden
Spring 2023 **Guest Lecturer**, SSY145 Wireless Networks, Chalmers, Sweden
Fall 2018 **Teaching Assistant**, EE242 Digital Communication and Coding, KAUST, KSA
Fall 2017 **Teaching Assistant**, EE242 Digital Communication and Coding, KAUST, KSA

Outreach

2019-2020 **Startup 'Wisensing' Co-founder**, TAQADAM Accelerator (2019-Cohort 3) *$20K funding*
2019-2020 **Residential Assistant**, Office of Residential Life, Graduate Affairs, KAUST

Service & Membership

- **Peer Review**: IEEE Wireless Commun., IEEE Commun. Mag., IEEE COMST, IEEE JSAC, IEEE JSTSP, IEEE TWC, IEEE TCOM, IEEE TSP, IEEE TVT, IEEE OJ-COMS, IEEE WCL, IEEE CL, IEEE SPL, Springer Nature
- **TCP Member**: ICC 2023, VTC 2023, EuCNC & 6G Summit 2023
- **Memberships**: IEEE Member, Communications Society Member, Vehicular Technology Society Member

Publications

Ongoing Works

[*J20] H. Wymeersch, **H. Chen**, H. Guo, M. F. Keskin, B. M. Khorsandi, M. H. Moghaddam, A. Ramirez, K. Schindhelm, A. Stavridis, T. Svensson, and V. Yajnanarayana. "6G Positioning and Sensing Through the Lens of Sustainability, Inclusiveness, and Trustworthiness." [Submitted to IEEE Veh. Technol. Mag., Sep. 2023]

[*J19] **H. Chen**, M.F. Keskin, A. Sakhnini, N. Decarli, S. Pollin, D. Dardary, and H. Wymeersch. "Near Field Localization and Sensing for 6G Systems: Opportunities and Challenges." [Submitted to IEEE Wireless Commun., Jul. 2023]

[*J18] M. Ammous, **H. Chen**, H. Wymeersch and S. Valaee. "Zero Access Points 3D Cooperative Sidelink Positioning via Reconfigurable Intelligent Surface." [Submitted to IEEE Trans. Mobile Comput., *arXiv available*, May. 2023]

[*J17] P. Zheng, **H. Chen**, T. Ballal, M. Valkama, H. Wymeersch and T.Y. Al-Naffouri. "JrCUP: Joint RIS Calibration and User Positioning for 6G Wireless Systems." [Submitted to IEEE Trans. Wireless Commun., *arXiv available*, Apr. 2023]

[*J16] **H. Chen**, M.F. Keskin, S. Aghdam, H. Kim, S. Lindberg, A. Wolfgang, T.E. Abrudan, T. Eriksson, and H. Wymeersch. "Modeling and Analysis of 5G/6G Localization under Hardware Impairments." [Submitted to IEEE Trans. Wireless Commun., *arXiv available*, Mar. 2023]

[*J15] **H. Chen**, P. Zheng, M.F. Keskin, T.Y. Al-Naffouri and H. Wymeersch. "Multi-RIS-Enabled 3D Sidelink Positioning." [Submitted to IEEE Trans. Wireless Commun., *arXiv available*, Feb. 2023]

[*J14] Y. Ge, H. Khosravi, F. Jiang, **H. Chen**, S. Lindberg, P. Hammarberg, H. Kim, O. Brunnegard, O. Eriksson, B.E. Olsson, F. Tufvesson, L. Svensson, and H. Wymeersch. "Experimental Validation of Single BS 5G mmWave Positioning and Mapping for Intelligent Transport." [Submitted to IEEE Trans. Veh. Technol., *arXiv available*, Feb. 2023]

[*B3] "Reconfigurable Metasurfaces for Wireless Communications: Architectures, Modeling, and Optimization (Chapter-Localization and Calibration in RIS-aided Communication Systems)." [Ongoing Springer Book, 2024]

Book Chapters

[B2] "Positioning and Location-based Analytics in 5G and Beyond (Ch01-Introduction and Fundamentals; Ch02-Positioning Methods; Ch04-Enablers Toward 6G Positioning and Sensing)." [Ongoing Book Chapters, Wiley-IEEE Press, Sep. 2023]

[B1] "Towards Sustainable and Trustworthy 6G System: Challenges, Enablers, and Architectural Design." (Ch04-Towards Joint Communication and Sensing), Jun. 2023 [https://www.nowpublishers.com/article/BookDetails/9781638282389]

Articles

[A1] **H. Chen**, H. Wymeersch. "Phone signals can help you find your way in cities even without GPS." *Nature News & Views Article*, Nov. 2022. [https://www.nature.com/articles/d41586-022-03696-3]

Journal & Magazine Papers

[J13] P. Zheng, T. Ballal, **H. Chen**, H. Wymeersch, and T.Y. Al-Naffouri. "Coverage Analysis of Joint Localization and Communication in THz Systems with 3D Arrays." *IEEE Trans. Wireless Commun.*, Sep. 2023.

[J12] H. Kim, **H. Chen**, M.F. Keskin, Y. Ge, K. Keykhosravi, G.C. Alexandropoulos, S. Kim, and H. Wymeersch. "RIS-Enabled and Access-Point-Free Simultaneous Radio Localization and Mapping." *IEEE Trans. Wireless Commun.*, Aug. 2023.

[J11] R. Ghazalian, **H. Chen**, G.C. Alexandropoulos, G. Seco-Granados, H. Wymeersch, and R. Jantti. "Joint User Localization and Location Calibration of A Hybrid Reconfigurable Intelligent Surface." *IEEE Trans. Veh. Technol.*, Aug. 2023.

[J10] **H. Chen**, H. Kim, M. Ammous, G. Seco-Granados, G.C. Alexandropoulos, S. Valaee, and H. Wymeersch. "RISs and Sidelink Communications in Smart Cities: The Key to Seamless Localization and Sensing." *IEEE Commun. Mag.*, Aug. 2023.

[J9] A. Behravan, V. Yajnanarayana, M.F. Keskin, **H. Chen**, D. Shrestha, T.E. Abrudan, T. Svensson, K. Schindhelm, A. Wolfgang, S. Lindberg, and H. Wymeersch. "Positioning and sensing in 6G: Gaps, Challenges and Opportunities." *IEEE Veh. Technol. Mag.*, Mar. 2023.

[J8] **H. Chen**, T. Ballal, M.E. Eltayeb, and T.Y. Al-Naffouri. "Antenna Selection in Switch-Based MIMO Array via DOA Threshold Region Approximation." *IEEE Trans. Veh. Technol.*, Jul. 2022.

[J7] X. Liu, T. Ballal, **H. Chen**, and T.Y. Al-Naffouri. "Constrained Wrapped Least Squares: A Tool for High Accuracy GNSS Attitude Determination." *IEEE Trans. Instrum. Meas.*, Jul. 2022.

[J6] **H. Chen**, H. Sarieddeen, T. Ballal, H. Wymeersch, M.S. Alouini, and T.Y. Al-Naffouri. "A Tutorial on Terahertz-Band Localization for 6G Communication Systems." *IEEE Commun. Surveys Tuts.*, May. 2022.

[J5] S. Tarboush, H. Sarieddeen, **H. Chen**, M.H. Loukil, H. Jemma, M.S. Alouini, and T.Y. Al-Naffouri. "TeraMIMO: A Channel Simulator for Wideband Ultra-Massive MIMO THz Communications." *IEEE Trans. Veh. Technol.*, Oct. 2021.

[J4] **H. Chen**, T. Ballal, and T.Y. Al-Naffouri. "DOA Estimation with Non-Uniform Linear Arrays: A Phase-Difference Projection Approach." *IEEE Wireless Commun. Lett.*, Aug. 2021.

[J3] X. Ma, T. Ballal, **H. Chen**, O. Aldayel, and T.Y. Al-Naffouri. "A Maximum-Likelihood TDOA Localization Algorithm Using Difference-of-Convex Programming." *IEEE Signal Process. Lett.*, Jan. 2021.

[J2] **H. Chen**, T. Ballal, A.H. Muqaibel, X. Zhang, and T.Y. Al-Naffouri. "Air-Writing via Receiver Array Based Ultrasonic Source Localization." *IEEE Trans. Instrum. Meas.*, Apr. 2020.

[J1] **H. Chen**, T. Ballal, N. Saeed, M.S. Alouini, and T.Y. Al-Naffouri. "A Joint TDOA-PDOA Localization Approach Using Particle Swarm Optimization." *IEEE Wireless Commun. Lett.*, Apr. 2020.

Patents

[P2] **Hui Chen**, Tarig Ballal Khidir Ahmed, and Tareq Yousef Al-Naffouri. "Ultrasound Based Air-Writing System and Method." U.S. Patent 11,11630,518, issued on 18-Apr-2023.

[P1] **Hui Chen**, Tarig Ballal Khidir Ahmed, Mohamed Saadeldin, and Tareq Yousef Al-Naffouri. "Angle-of-Arrival-Based Gesture Recognition System and Method." U.S. Patent 10,386,481, issued on 20-Aug-2019.

Technical Reports/ White Papers/ Deliverables

[R5] Hexa-X D2.4: "Enabling Radio Technologies and Roadmap towards 6G." Jun. 2023. [Report] [Slides]

[R4] Hexa-X D3.3: "Final models and measurements for localization and sensing." May. 2023. [Report] [Slides]

[R3] White Paper: "The 6G Architecture Landscape: European Perspective." European Commission, Feb. 2023. [Report]

[R2] Hexa-X D3.2: "Initial models and measurements for localization and sensing." Oct. 2022. [Report] [Slides]

[R1] Hexa-X D3.1: "Localization and sensing use cases and gap analysis." Dec. 2021. (European 6G Flagship Project **Hexa-X** Deliverables) [Report] [Slides]

Conference & Workshop Papers

[C18] P. Zheng, **H. Chen**, H. Wymeersch, and T. Y. Al-Naffouri. "Near Field Sidelink Positioning through A Single Active RIS." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2023.

[C17] P. Zheng, **H. Chen**, T. Ballal, H. Wymeersch, T. Y. Al-Naffouri. "Misspecified Cramér-Rao Bound of RIS-Aided Localization Under Geometry Mismatch." In *Proc. IEEE Int. Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2023.

[C16] H. Kim, A. Fascista, **H. Chen**, Y. Ge, G.C. Alexandropoulos, G. Seco-Granados, and H. Wymeersch. "RIS-Aided Monostatic Sensing and Object Detection with Single and Double Bounce Multipath." In *Proc. IEEE International Conference on Communications (ICC) Workshop*, 2023.

[C15] R. Ghazalian, **H. Chen**, G.C. Alexandropoulos, G. Seco-Granados, H. Wymeersch, and R. Jantti. "RIS Position and Orientation Estimation via Multi-Carrier Transmissions and Multiple Receivers." In *Proc. IEEE International Conference on Communications (ICC)*, 2023.

[C14] Y. Lu, **H. Chen**, J. Talvitie, H. Wymeersch, and M. Valkama. "Joint RIS Calibration and Multi-User Positioning." In *Proc. IEEE Vehicular Technology Conference (VTC) workshop*, 2022.

[C13] **H. Chen**, F. Jiang, Y. Ge, H. Kim, and H. Wymeersch. "Doppler-Enabled Single-Antenna Localization and Mapping without Synchronization." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2022.

[C12] **H. Chen**, A. Elzanaty, R. Ghazalian, M.F. Keskin, R. Jantti, and H. Wymeersch. "Channel Model Mismatch Analysis for XL-MIMO Systems from a Localization Perspective." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2022.

[C11] Y. Ge, O. Kaltiokallio, **H. Chen**, F. Jiang, J. Talvitie. M. Valkama, L. Svensson, and H. Wymeersch. "Exploiting Doppler in Bistatic mmWave Radio SLAM." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2022.

[C10] P. Zheng, T. Ballal, **H. Chen**, H. Wymeersch, and T.Y. Al-Naffouri. "Localization Coverage Analysis of THz Communication Systems with a 3D Array." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2022.

[C9] R. Ghazalian, K. Keikhorsravi, **H. Chen**, H. Wymeersch, and R. Jantti. "Bi-Static Sensing for Near-Field RIS Localization." In *Proc. IEEE Global Communications Conference (GLOBECOM)*, 2022.

[C8] Y. Ge, **H. Chen**, F. Jiang, M. Zhu, H. Khosravi, S. Lindberg, H. Herbertsson, O. Eriksson, O. Brunnegard, B.E. Olsson, P. Hammarberg, F. Tufvesson, L. Svensson, and H. Wymeersch. "Experimental Validation of Single Base Station 5G mmWave Positioning: Initial Findings." In *Proc. IEEE International Conference on Information Fusion (FUSION)*, 2022.

[C7] H. Wymeersch, A. Parssinen, T.E. Abrudan, A. Wolfgang, K. Haneda, M. Sarajlic, M.E. Leinonen, M.F. Keskin, **H. Chen**, S. Lindberg, P. Kyosti, T. Svensson, and X. Yang. "6G Radio Requirements to Support Integrated Communication, Localization, and Sensing." In *Proc. European Conference on Networks and Communications (EUCNC) & 6G Summit*, 2022.

[C6] **H. Chen**, S. Aghdam, M.F. Keskin, Y. Wu, S. Lindberg, A. Wolfgang, U. Gustavsson, T. Eriksson, and H. Wymeersch. "MCRB-based Performance Analysis of 6G Localization under Hardware Impairments." In *Proc. IEEE International Conference on Communication (ICC) Workshop*, 2022.

[C5] **H. Chen**, T. Ballal, and T.Y. Al-Naffouri. "Phase-Difference-Based 3-D Source Localization Using a Compact Receiver Configuration." In *Proc. 28th European Signal Processing Conference (EUSIPCO)*, 2020.

[C4] **H. Chen**, T. Ballal, X. Liu, and T.Y. Al-Naffouri. "Realtime 2-D DOA Estimation Using Phase-Difference Projection (PDP)." In *Proc. 27th European Signal Processing Conference (EUSIPCO)*, 2019.

[C3] **H. Chen**, T. Ballal, and T.Y. Al-Naffouri. "A Decomposition Approach for Complex Gesture Recognition Using DTW and Prefix Tree." In *Proc. IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, 2019.

[C2] **H. Chen**, T. Ballal, and T.Y. Al-Naffouri. "Fast Phase-Difference-Based DOA Estimation Using Random Ferns." In *Proc. IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, 2018.

[C1] **H. Chen**, T. Ballal, M. Saad, and T.Y. Al-Naffouri. "Angle-of-Arrival-Based Gesture Recognition Using Ultrasonic Multi-frequency Signals." In *Proc. 25th European Signal Processing Conference (EUSIPCO)*, 2017.

Demos

[D4] Abdulwahab Felemban, Lucas Bezerra, **Hui Chen** Yerzhan Orazayev, Mohammed Al-Sharif. "**Smart Tap**." (NEOM AI Challenge Project, 2020) [Online Page] [Demo Video]

An AI-controlled tap using a depth camera (graph neural network-based action recognition) is developed to reduce water wastage. Both onside and VR demos are provided.

[D3] **Hui Chen**. "**Virtual Kitchen Simulator**." (Personal Project, 2020) [Online Page] [Demo Video]

A virtual kitchen environment with multiple purposes: user training, behavior analysis, layout optimization, etc.

[D2] **Hui Chen**, Tarig Ballal, Mohamed Saad, and Tareq Y. Al-Naffouri. "**UBAS: An Ultrasound Based Air-writing System**." (ICASSP Demo session, Calgary, Alberta, Canada, 2018) [Online Page] [Demo Video] [Reference]

An ultrasound-based air mouse with "Mouse", "Keyboard", and "Air-writing" mode.

[D1] **Hui Chen**, Mohammed Al-Sharif, Mohamed Saad, Tarig Ballal, Chris Bleakley, and Tareq Y. Al-Naffouri. "**KAUST Acoustic Positioning System**." (Microsoft Indoor Localization Competition, IPSN, Pittsburgh, PA, USA, 2017) [Online Page]

A 3D ultrasonic indoor positioning system for Microsoft Indoor localization competition.

Talks/Presentations

[T9] 2023.05: "5G/6G Radio Localization Basics.", **SSY145 Wireless Networks, Guest Lecturer**, Chalmers University of Technology, Gothenburg, Sweden. (Host: Prof. Tommy Svensson)

[T8] 2023.02: "5G/6G Radio Localization Basics.", **SSY135 Wireless Communications, Guest Lecturer**, Chalmers University of Technology, Gothenburg, Sweden. (Host: Prof. Henk Wymeersch)

[T7] 2022.12: "Doppler-Enabled Single-Antenna Localization and Mapping without Synchronization.", **GLOBECOM 2022**, Rio de Janeiro, Brazil.

[T6] 2022.12: "Channel Model Mismatch Analysis for XL-MIMO Systems from a Localization Perspective.", **GLOBECOM 2022**, Rio de Janeiro, Brazil.

[T5] 2022.09: "Joint RIS Calibration and Multi-User Positioning.", **VTC-Fall 2022** (Online), London/Beijing, UK/China.

[T4] 2022.06: "6G Radio Requirements to Support Integrated Communication, Localization, and Sensing.", **EUCNC & 6G Summit 2022**, Grenoble, France.

[T3] 2022.05: "MCRB-based Performance Analysis of 6G Localization under Hardware Impairments.", **ICC 2022 Workshop** (Online), Seoul, South Korea.

[T2] 2021.01: "Phase-difference-based 3-D Source Localization Using a Compact Receiver Configuration.", **EUSIPCO 2020** (Online), Amsterdam, Netherlands.

[T1] 2017.09: "Angle-of-Arrival-Based Gesture Recognition Using Ultrasonic Multi-frequency Signals.", **EUSIPCO 2017**, Kos, Greece.