ARMAN FARHANG

Curriculum Vitae March 23, 2024

PERSONAL INFORMATION

Gender	Male
Residence	Ireland - Stamp 4 holder
Address	26 Orwell Woods, Rathgar, Dublin 6, Dublin, Ireland, D06YV58.
Phone	+353 87 3655476
Email	arman.farhang@tcd.ie

EMPLOYMENT

Assistant Professor July 2021- present
Trinity College Dublin, The University of Dublin, Ireland

Assistant Professor (Tenured) September 2018 - July 2021
Maynooth University, Ireland

Lecturer/Assistant Professor March 2018 - September 2018
University College Dublin, Ireland

Part-Time Lecturer September 2017 - December 2017
National University of Ireland Maynooth, Ireland

Research Fellow December 2015 - March 2018
CONNECT
Trinity College Dublin, The University of Dublin, Ireland

EDUCATION

PhD Studies 2011 - 2015
Trinity College Dublin, The University of Dublin, Ireland
Doctor of Philosophy in Wireless Communications. Thesis title: *"Multiuser Communications for Next Generation Wireless Networks"*.

Master Studies 2007 - 2010
Sadjad University of Technology, Mashhad, Iran
Master of Science in Electrical Engineering, Communications. Thesis title: *"Comparison of FBMC and OFDM Systems for Broadband Power Line Communications"*.

Bachelor Studies 2002 - 2007
Azad University of Najafabad, Iran
Bachelor of Science in Electrical Engineering, Communications.

RESEARCH EXPERTISE / EXPERIENCE

The focus of my research is on the broad area of signal processing for communications. I take advantage of my knowledge in mathematical modeling, probability theory and signal processing to solve real world research challenges. While developing signal processing algorithms through theoretical work, I collaborate with different groups around the world from both academia and industry to verify these algorithms through practical experiments. I take novel approaches in my work like generalization of signal processing operations to include topology of the samples taken from the real world signals.

This is essential to push beyond the boundaries of current communication systems as it leads to new signal and communication channel representation and modeling while enabling signal processing over networks. Furthermore, moving towards new applications like autonomous driving, connected infotainment and smart cities necessitates development of advanced signal processing techniques for smart sensor networks and networked embedded systems. With this vision, I have established a successful and vibrant research program that is characterized with impact and excellence. This is evident from my research outcomes such as my publication record in top tier journals and conferences and attracting prestigious research grants for individual-led and collaborative research projects. In my research group at Trinity College Dublin, I am currently supervising 5 PhD students and 3 postdoctoral researchers. During the last couple of years, I have built an international reputation and research leadership in the areas of modulation, modem design, synchronization, channel estimation and equalization for both single- and multi-antenna systems. This is the result of successful collaborations that I have established with world known experts both in Ireland and abroad through working on multiple research projects that are listed below.

REFLECT-MMWAVE (Principal Investigator) January 2023 - December 2025
The project, Smart Radio Environments with Reconfigurable Intelligent Surfaces - Communications Through Blockage in Millimeter-wave Systems (REFLECT-MMWAVE), is funded as part of a combined investment of around €1 million under the US-Ireland Research and Development Partnership programme of Science Foundation Ireland (SFI) between the University of Utah in the US, Queen's University Belfast in Northern Ireland, and Trinity College Dublin in the Republic of Ireland. The total budget of €374,176 (direct costs) is allocated to Trinity College Dublin. This project explores an emerging communication paradigm where the propagation of the electromagnetic waves is manipulated in a controllable fashion. This is achieved by using Reconfigurable Intelligent Surfaces (RIS) to solve the signal blockage and hence, improve the overall user experience in commercial networks by improving the reliability of the wireless connections. This contributes towards increased connectivity and reliability of the future mmWave wireless networks. REFLECT-MMWAVE project brings together multidisciplinary experts from radio frequency and analogue circuits and antenna design, signal processing, machine learning and communication networks.

NEW WAVE (Principal Investigator) 2020 - present
The project, New Waveforms for Next Generation Wireless Networks (NEW WAVE), is funded by Science Foundation Ireland (SFI) under the prestigious research excellence award Frontiers for the Future with the total budget of €436,604 (direct costs) for the duration of 4 years. This project was ranked among top 40 applications in areas of science, technology, engineering and mathematics in Ireland. NEW WAVE develops a technology to enable a more compact and efficient usage of physical radio resources with unprecedented levels of area spectral efficiency for vehicular communication systems as compared with the current wireless systems. The proposed technology will unlock additional degrees of freedom provided by deployment of physical radio resources in multiple dimensions, i.e. time, frequency, and space, to combat the multipath and Doppler effects present in vehicular communication channels. This enables new applications and services such as autonomous vehicles. The goal of this research is to ensure such applications are safe, smart and efficient. To accomplish this goal, NEW WAVE focuses on improving latency, connectivity and reliability of wireless links. In this project, I collaborate with Dublin City University (DCU) in Ireland and University of Utah, in the USA.

CONNECT (Funded Investigator) 2015 - present

As a Funded Investigator in CONNECT, the Centre for Future Networks and Communications funded by SFI, I am leading research in the new transmission/detection technologies forming the physical layer of the future wireless systems. CONNECT is engaged with over 35 companies including large multinationals, SMEs and start-ups. CONNECT brings together world-class expertise from ten Irish academic institutes to create a one-stop-shop for telecommunications research, development and innovation.
My contributions to CONNECT are the following.

- I built the 5G waveforms group which I further expanded to include multiple academic institutions. I am leading the research around waveforms for 5G and beyond such as orthogonal time frequency space (OTFS) modulation, Filter Bank MultiCarrier (FBMC), Filtered Orthogonal Frequency Division Multiplexing (F-OFDM), Universal Filtered OFDM (UF-OFDM), and Generalized Frequency Division Multiplexing (GFDM). As one of the overarching features towards 5G-and-beyond, I am developing a framework for PHY layer *network slicing* through air-interface heterogeneous signal orchestration and efficient resource allocation. My research in this area includes both single and multiple antenna systems such as massive MIMO while considering sub-6 GHz, and millimeter waves frequency bands.

- I am leading the research in the emerging area of graph signal processing (GSP), i.e. a generalized approach to signal processing with a wide range of applications from physical layer to signal processing over networks. I lead and manage this line of research in a work package in phase 2 of CONNECT.

- I bring the optical and wireless communications teams in CONNECT together around the topic of waveforms in the converged wireless-optical networks. In this work, while leading the baseband processing activities, I am collaborating with the optical communications group based in DCU. I have also collaborated with the antenna design group at Technological University Dublin. Such collaborations allow me to verify the efficacy of the algorithms I develop in my theoretical work by practical experimentation.

- I established a collaboration with our industrial partner Nokia Bell Labs Ireland where I led a project in the area of 5G under the CONNECT framework. In this collaboration, I started a new line of research on high mobility communications through novel signaling techniques to deal with the time-varying wireless channels.

ADEL (Collaborator) September 2015 - November 2016

Advanced Dynamic spectrum 5G mobile networks Employing Licensed shared access. Funded by the European Commission where Trinity College Dublin was a partner.
In this project, I was involved with a work package on cooperative communications where I conducted the research in the area of dynamic resource management.

ULYSSES (Collaborator) January 2015 - December 2015

Funded by Irish research council. This project was designed to support new research collaborations between Irish and French researchers through which I started my collaborations with CentraleSupélec in France. In this project, from the Irish side, I led the research in the area of 5G waveforms and their coexistence in Device-To-Device (D2D) communication systems. I should emphasize that my collaboration with CentraleSupélec is still active even though the project has ended.

CTVR (Collaborator) 2011 - 2015
CTVR was Ireland's national telecommunications research centre funded by Science Foundation Ireland. In CTVR, six academic institutions in Ireland as well as around 60 companies were collaborating. I did my PhD in CTVR in the area of multiuser communication systems and 5G technologies such as massive MIMO, and new waveforms.

AWARDS AND GRANTS

- Smart Radio Environments with Reconfigurable Intelligent Surfaces - Communications Through Blockage in Millimeter-wave Systems (REFLECT-MMWAVE), under *SFI US-Ireland R&D Partnership Programme*, Jan. 01, 2023 - Dec. 31, 2025, **€ 374,176.00**.
- New Waveforms for Next Generation Wireless Networks (NEW WAVE), under *SFI Frontiers for the Future Programme*, Oct. 01, 2020 - Sept. 30, 2024, **€ 436,604.00**.
- Radio Access Network Slicing (RAN-Slicing), under SFI/CONNECT PhD Scheme for supervision of a fully-funded PhD project, Sept. 2018 - Aug. 2022, **€ 112,600**.
- Ulysses Award, funded by Irish research council, 2014, **€ 2,500**.
- Student travel grant for attending IEEE WCNC 2014 conference.
- Commercialisation feasibility funding (CF20133717Y) from Enterprise Ireland, May 2013, **€ 13,838**.
- PhD scholarship at the Centre for Telecommunications and Research (CTVR), Trinity College Dublin, The University of Dublin, Ireland, 2011. The scholarship included four-year full tuition fee and living stipend.

DEPARTMENTAL / UNIVERSITY SERVICE

Exchange Coordinator September 2021 - present
Electronic Engineering Department, School of Engineering
Trinity College Dublin, Ireland

Program Director March 2019 - July 2021
MEng programme on Embedded and Wireless Systems
Electronic Engineering Department
Maynooth University, Ireland

Outreach Officer September 2018 - July 2021
Electronic Engineering Department
Maynooth University, Ireland

Appointment of Tutors/Demonstrators September 2018 - July 2021
Electronic Engineering Department
Maynooth University, Ireland

SERVICE TO THE DISCIPLINE AND MEMBERSHIP

- Associate Editor, EURASIP Journal on Wireless Communications and Networking, September 2018 - present.
- TPC Co-Chair, Organisation Committee for the IEEE Workshop on OTFS and Delay-Doppler Multicarrier Communications for 6G, 2023 and 2024.
- Student Volunteers Chair, Organisation Committee for the IEEE Communications Society flagship conference ICC 2020.

- TPC member of IEEE ICC 2020 to 2024, IEEE Globecom 2017 to 2024, IEEE WCNC 2021 to 2024, EUCNC 2024, PIMRC 2024, ICNC 2019, ISWCS 2016 to 2022, 6G Summit 2020, IEEE 5G World Forum (WF-5G) 2018 to 2020, WPMC 2017.
- Technical reviewer of IEEE Transactions on Signal Processing, IEEE Transactions on Wireless Communications, IEEE Transactions on Communications, IEEE Transactions on Vehicular Technology, IEEE Journal on Selected Areas in Communications, IEEE Transactions on Cognitive Communications and Networking, IEEE Communications letters, IEEE Wireless Communications letters, IEEE Signal Processing letters, IEEE Photonics Technology Letters, IEEE Access Journal, IET Electronics Letters, EURASIP Journal on Advances in Signal Processing, International Journal of Electronics and Communications.
- Technical reviewer of the conferences IEEE Globecom 2015 to 2023, IEEE ICC 2015, 2017 and 2020 to 2024, IEEE WCNC 2016 to 2024, ICNC 2019 to 2020, IEEE WF-5G 2018 to 2019, IEEE WCNC 2016 to 2019, IEEE PIMRC 2019, 2021 and 2024, IEEE VTC 2014-Spring, 2015-Fall, 2018-Spring, 2018-Fall, ISWCS 2014 to 2019, IEEE CCNC 2016 and 2018, ICT 2014 and 2018, IEEE SPAWC 2017, IEEE ISIT 2017 and 2024, WPMC 2017, ITS 2014, and Wireless Days 2013.
- Member of IEEE Communications Society, Signal Processing Society and Vehicular Technology Society.

TEACHING EXPERTISE / EXPERIENCE

I think of teaching at college level as a fundamental service lecturers are providing to the community, shaping the minds of future leaders and decision makers. I have always been excited about teaching. My approach to teaching includes four fundamental ingredients, (i) high degree of clarity, (ii) high degree of interaction, (iii) motivation and enthusiasm, and (iv) continuous assessment including a subtle alternation of challenge and support. I believe in knowledge-based, research-led teaching while keeping the balance between the underlying principles and advanced research outputs. I have experience of teaching first year to fourth year students in multiple institutions for over five years as listed below.

Digital Wireless Communications 2023 - present
Trinity College Dublin, Ireland
BAI/MAI and MSc Course (4^{th}/ 5^{th} Year), Lecturer

Probability and Statistics 2023 - present
Trinity College Dublin, Ireland
BAI/MAI Course (3^{rd} Year), Lecturer

Electrical Engineering 2021 - present
Trinity College Dublin, Ireland
BAI/MAI Course (1^{st} Year), Lecturer

Microelectronic Circuits Spring 2022
Trinity College Dublin, Ireland
BAI/MAI Course (4^{th} Year), Lecturer

Modulation and Coding 2019 - 2021
Maynooth University, Ireland
BSc Course (3^{rd} Year), Lecturer

Introduction to Signal Processing 2018 - 2021
Maynooth University, Ireland
BSc Course (2^{nd} Year), Lecturer

Wireless Digital Communications 2017 - 2021
Maynooth University, Ireland
BSc Course (4^{th} Year), Lecturer

Digital Systems 2 Spring 2020
Maynooth University, Ireland
BSc Course (2^{nd} Year), Lecturer

Telecommunications I Spring 2018
Trinity College Dublin, The University of Dublin, Ireland
BAI Course (1^{st} Year), Lecturer

Digital Communications 2015 - 2016
Trinity College Dublin, Ireland
BAI Course (4^{th} Year), Guest Lecturer

Digital Electronic Design Project Module 2013 - 2015
Trinity College Dublin, Ireland
BAI Course (3^{rd} Year), Teaching Assistant

Signals and Systems Lab Fall 2012
Trinity College Dublin, The University of Dublin, Ireland
BAI Course (3^{rd} Year), Teaching Assistant

Engineering Probability and Statistics 2010-2011
Iranzamin Private University, Isfahan, Iran
BSc. Course (2^{nd} Year), Lecturer

Advanced Theory of Communications Spring 2009
Sadjad University of Technology, Mashhad, Iran
MSc. Course, Teaching Assistant

Stochastic Processes Fall 2008
Sadjad University of Technology, Mashhad, Iran
MSc. Course, Teaching Assistant

RESEARCH SUPERVISION / MENTORSHIP

Postdoctoral Researchers

Mohamad Hejazi Dinan November 2023 - present
Trinity College Dublin, Ireland
Area of research: *RIS Phase Shift Design and Beamforming in mmWave Systems.*

Stephen McWade October 2022 - present
Trinity College Dublin, Ireland
Area of research: *Signal Impairment Analysis and Estimation in mmWave Systems.*

Sanoopkumar Pungayil Sasindran December 2021 - present
Trinity College Dublin, Ireland
Area of research: *Synchronization and Channel Estimation for OTFS.*

Sinead Barton April 2019 - October 2019
Maynooth University, Ireland
Area of research: *Project with industry in CONNECT centre on "Wireless Network Coverage Analysis".*

Hamid Saeedi-Sourck July 2017 - July 2018
Trinity College Dublin, Ireland
Area of research: *Emerging Area of Graph Signal Processing*

PhD Students

Jialiang Zhu September 2023 - present
Trinity College Dublin, Ireland
Area of research: *Delay-Doppler Domain Signaling in Single/Multiple-Antenna Systems*

Hanning Wangi September 2023 - present
Trinity College Dublin, Ireland
Area of research: *Channel Estimation and Signal Detection in RIS-Assisted Communication Systems*

Arman Azizi September 2021 - present
Trinity College Dublin, Ireland
Area of research: *Resource Allocation and Optimization Techniques for RIS-Assisted Communications*

Mohsen Bayat January 2021 - present
Trinity College Dublin, Ireland
Area of research: *Practical Aspects of Delay-Doppler Signaling in High Mobility Wireless Communications*

Danilo Lelin Li October 2020 - present
Trinity College Dublin, Ireland
Area of research: *Waveform Design for High Mobility Wireless Communications*

Hamed Hosseini March 2019 - November 2023
University of Utah, Salt Lake City, USA
Area of research: *Channel Estimation and Signal Detection in Massive MIMO Systems*

Stephen McWade September 2018 - September 2022
University College Dublin, Ireland
Area of research: *Radio Access Network Slicing*

Sumin Jeong September 2018 - September 2022
University College Dublin, Ireland
Area of research: *Synchronization Aspects of Massive MIMO Systems*

Parna Sabeti October 2015 - January 2020
Trinity College Dublin, Ireland
Area of research: *Multiple Antenna Signal Processing*

Conor Sexton January 2016 - September 2019
Trinity College Dublin, Ireland
Area of research: *Physical Layer Adaptations to Support Resource Sharing in Next Generation Wireless Networks*

Amir Aminjavaheri January 2015 - September 2018
University of Utah, Salt Lake City, USA
Area of research: *New Waveforms and Multiple Antenna Signal Processing*

Ahmad RezazadehReyhani January 2015 - September 2018
University of Utah, Salt Lake City, USA
Area of research: *Physical Layer Aspects of 5G and Beyond*

RESEARCH INTERESTS AND ACTIVITIES

- Signal Processing for Communications
- Wireless Communications
- Millimeter Wave Communications
- Integrated Optical-Wireless Networks

- Advanced Waveform Design for Future Communication Systems
- Multiuser Signal Detection and Synchronization
- Deep Learning-based Transceiver Design
- Array Signal Processing and MIMO Systems
- Device to Device Communications and Internet of Things
- Radio Access Network Slicing
- Resource Allocation Aspects of New Waveforms and Massive MIMO

RESEARCH VISITS

University of Leuven - KU Leuven 23 to 25 August 2016
Leuven, Belgium
The focus of this visit was on the massive MIMO testbed in KU Leuven.

University of Utah December 2015 - January 2016
Salt Lake City, Utah, United States
The focus of this visit was in the area of massive MIMO equalization using time-reversal combining/transmission. The outcome of this visit was publication of a conference paper and a journal article.

CentraleSupélec 13 to 20 June 2015
Rennes, France
The focus of this visit was on the coexistence of 5G waveforms in Device-To-Device (D2D) communication systems. The outcome of this visit was publication of two conference papers and a journal article.

University of Utah September 2013 - December 2013
Salt Lake City, Utah, United States
The focus of this visit was on multiuser signal detection and massive MIMO. The outcome of this visit was publication of two conference papers and a journal article.

KEYNOTES, INVITED TALKS AND PRESENTATIONS

- Nanyang Technological University and Institute for Infocomm Research (I^2R), *"On Practical Aspects of Orthogonal Time Frequency Space Modulation"*, Singapore, September 2022 **(Invited talk)**.
- Waveform Design Team at Huawei, *"New Waveforms for Massive MIMO"*, Huawei 2012 wireless technology Laboratory, Chengdu subdivision, China, 07 December, 2020 **(Invited talk)**.
- WPOS/WCOMP2020, *"Trends in Waveform Design for Future Multi-Service Communication Networks "*, 15th Graduate / Computer Workshop, University of Brasilia, Brazil, 23 October, 2020 **(Keynote talk)**.
- Hamilton Institute, Maynooth University, *"New Waveforms: Enablers for Future Multi-Service Communication Networks"*, Dublin, Ireland, 29 January, 2020 **(Invited talk)**.
- CONNECT-NOKIA Workshop, Trinity College Dublin, *"Modulation Techniques for 5G and beyond"*, Dublin, Ireland, 24 April, 2018 **(Invited talk)**.
- University of Leuven - KU Leuven, *"New Waveforms in Massive MIMO"*, Leuven, Belgium, 23 August, 2016 **(Invited talk)**.
- University College Dublin, *"Candidate Technologies for 5G: the Physical Layer Prospect"*, Dublin, Ireland, 12 April, 2016 **(Invited talk)**.
- CentraleSupélec, *"New-Waveform Candidates for 5G: Options and Opportunities"*, Rennes, France, 16 June, 2015 **(Invited talk)**.

- King's College London, *"Filter Bank Multicarrier for Massive MIMO"*, London, United Kingdom, 24 June, 2014 **(Invited talk)**.
- International Ph.D. course *"Cognitive Radios and Networks: Theory and Practice"*, CTVR, Trinity College Dublin, May, 2013.
- TCD Technology Transfer Office (TTO) showcase, Trinity College Dublin, October, 2012 **(Presentation)**.

SHORT COURSES AND TUTORIALS

- **Arman Farhang**, Lei Zhang, and Colm Browning,"When Optical and Wireless Networks Converge to Enable Multi-Service Communications: From Theory to Practice," *Presented in European Signal Processing Conference (EUSIPCO),* August 2021, (Half-day tutorial).
- Behrouz Farhang-Boroujeny, **Arman Farhang**, and Lei Zhang, "Mixed Numerologies and Flexible Waveforms: Enablers for Multi-Service Communications," *Presented in IEEE International Conference on Communications (ICC),* June 2020, (Half-day tutorial).

SKILLS

Communications Science	Wireless/Cellular Communications, Physical Layer (PHY), Theoretical/Numerical Analysis, Digital Signal Processing (DSP), Signal Processing for Communications, Digital Communications, Adaptive Filtering, Waveform Design, Multicarrier Systems, Modem Algorithm/Structure Design, Synchronization, Multiuser Detection, Massive MIMO, Channel tracking, Channel Estimation and Equalization, Interference Mitigation/Cancellation
Programming Skills	Matlab and Simulink, C/C++, Python
Computing Platforms	Linux, iOS, Microsoft Windows
Languages	English: Fluent in speaking, writing, reading and listening Farsi: Native language

PATENTS

1. Danilo Lelin Li, and **Arman Farhang**, "Joint Channel estimation and equalization with reduced pilot overhead for OFDM-based massive MIMO," *UK patent application No. 2218593.8, Filed in December 2022.*
2. **Arman Farhang**, "A Method and System for Compensating for Interference Due to Carrier Frequency Offset in an OFDM Communication System," *United States patent application No. 61/876,972, Filed in September 2014.*
3. **Arman Farhang**, "A Generalized Frequency Division Multiplexing Transceiver," *UK patent application No. 1417277.9, Filed in September 2014.*

BOOKS

1. Lei Zhang, **Arman Farhang**, Gang Feng, Oluwakayode Onireti, "Radio Access Network Slicing and Virtualization for 5G Vertical Industries," ***John Wiley and Sons***, 2020.

BOOK CHAPTERS

1. **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Orthogonal Time-Frequency Space Modulation: Principles and Implementation," in *Radio Access Network Slicing and Virtualization for 5G Vertical Industries*, ***John Wiley and Sons***, 2020.
2. Bowen Yang, Xiaoying Zhang, Lei Zhang, **Arman Farhang**, Pei Xiao, and Muhammad Ali Imran "Low Out-of-band Radiation Waveform for 5G and Beyond," in *Radio Access Network Slicing and Virtualization for 5G Vertical Industries*, ***John Wiley and Sons***, 2020.
3. Majid Butt, Jasmina McMenamy, **Arman Farhang**, Irene Macaluso, Carlo Galiotto, Nicola Marchetti, "Resource Management Techniques in Licensed Shared Access Networks," in *Networks of the Future - Architectures, Technologies, and Implementations*, **Chapman and Hall/CRC**, 2017.
4. **Arman Farhang**, Nicola Marchetti, and Behrouz Farhang-Boroujeny, "Filter Bank Multicarrier for Massive MIMO," in *Signal Processing for 5G: Algorithms and Implementations*, ***John Wiley and Sons***, 2016.

PEER-REVIEWED JOURNAL PUBLICATIONS

1. Hamed Hosseiny, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Downlink Transmission in FBMC-Based Massive MIMO With Co-Located and Distributed Antennas," in *IEEE Transactions on Vehicular Communications*, January 2024.
2. Stephen McWade, **Arman Farhang**, and Mark Flanagan, "Low-Complexity Reliability-Based Equalization and Detection for OTFS-NOMA," in *IEEE Transactions on Communications*, November 2023.
3. Danilo Lelin Li, and **Arman Farhang**, "Joint Channel Estimation and Equalization in Massive MIMO Using a Single Pilot Subcarrier," in *IEEE Wireless Communication Letters*, November 2023.
4. Arman Azizi, and **Arman Farhang**, "RIS Meets Aerodynamic HAPS: A Multi-Objective Optimization Approach," in *IEEE Wireless Communication Letters*, November 2023.
5. Xiang Huang, **Arman Farhang** and Rong-Rong Chen, "Channel Estimation and Turbo Equalization for Coded OTFS and OFDM: A Comparison," in *IEEE Wireless Communication Letters*, September 2023.
6. Sumin Jeong, **Arman Farhang**, Nemanja Stefan Perović, and Mark Flanagan, "Joint CFO and Channel Estimation for RIS-Aided Multi-User Massive MIMO Systems," in *IEEE Transactions on Vehicular Technology*, September 2023.
7. Mohsen Bayat, and **Arman Farhang**, "Time and Frequency Synchronization for OTFS," in *IEEE Wireless Communication Letters*, December 2022.
8. Hamed Hosseiny, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "FBMC Receiver Design and Analysis for Medium and Large Scale Antenna Systems," in *IEEE Transactions on Vehicular Communications*, March 2022.
9. Sumin Jeong, **Arman Farhang**, Nemanja Stefan Perović, and Mark Flanagan, "Low-Complexity Joint CFO and Channel Estimation for RIS-Aided OFDM Systems," in *IEEE Wireless Communication Letters*, January 2022.
10. Stephen McWade, Mark F Flanagan, Juquan Mao, Lei Zhang, and **Arman Farhang**, "Resource Allocation for Mixed Numerology NOMA," in *IEEE Wireless Communication Letters*, October 2021.
11. Harun Šiljak, Nouman Ashraf, Michael Taynnan Barros, Daniel Perez Martins, Bernard Butler, **Arman Farhang**, Nicola Marchetti, Sasitharan Balasubramaniam, "Evolving Intelligent Reflector Surface towards 6G for Public Health: Ap-

plication in Airborne Virus Detection," in *IEEE Network Magazine*, May 2021.

12. André Gomes, Jacek Kibiłda, **Arman Farhang**, Ronan farrell, and Luiz DaSilva, "Multi-Operator Connectivity Sharing for Reliable Networks: A Data-Driven Risk Analysis," in *IEEE Transactions on Network and Service Management*, April 2021.
13. Amir Miraki, Hamid Saeedi-Sourck, Nicola Marchetti, and **Arman Farhang**, "Spectral Domain Spline Graph Filter Bank," in *IEEE Signal Processing Letters*, February 2021.
14. Amol Delmade, Colm Browning, Theo Verolet, Julien Poette, **Arman Farhang**, Hamza Hallak Elwan, R David Koilpillai, Guy Aubin, Francois Lelarge, Abderrahim Ramdane, Deepa Venkitesh, and Liam P Barry, "Optical Heterodyne Analog Radio-over-Fiber Link for Millimeter-Wave Wireless Systems," in *IEEE/OSA Journal of Lightwave Technology, October 2020.*
15. Sumin Jeong, **Arman Farhang**, Feifei Gao, and Mark Flanagan, "Frequency Synchronisation for Massive MIMO: A Survey," in *IET Communications, June 2020.*
16. Parna Sabeti, **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Frequency Synchronization for OFDM-based Massive MIMO Systems," in *IEEE Transactions on Signal Processing*, June 2019.
17. Hamidreza Shayanfar, Hamid Saeedi-Sourck, and **Arman Farhang**, "A Low Complexity Search Method for CFO Estimation in GFDM," in *IET Electronics Letters*, March 2019.
18. Amir Aminjavaheri, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Filter Bank Multicarrier in Massive MIMO: Analysis and Channel Equalization," in *IEEE Transactions on Signal Processing*, June 2018.
19. Colm Browning, Hamza Hallak Elwan, Eamonn P. Martin, Sean O'Duill, Julien Poette, Paul Sheridan, **Arman Farhang**, Beatrice Cabon, and Liam P. Barry, "Gain-Switched Optical Frequency Combs for Future Mobile Radio-over-Fiber Millimeter-Wave Systems," in *IEEE Journal of Lightwave Technology*, May 2018.
20. Hamidreza Shayanfar, Hamid Saeedi-Sourck, **Arman Farhang**, and Linda E. Doyle, "Maximum-Likelihood Synchronization and Channel Estimation with Multiuser Detection in GFDMA," in *Transactions on Emerging Telecommunications Technologies*, April 2018.
21. Amol Delmade, Colm Browning, **Arman Farhang**, Nicola Marchetti, Linda Doyle, David Koilpillai, Liam Barry, and Deepa Venkitesh, "Performance Analysis of Analog IF over Fiber Fronthaul link with 4G & 5G Co-existence," in *IEEE/OSA Journal of Optical Communications and Networking*, March 2018.
22. Conor Sexton, Quentin Bodinier, **Arman Farhang**, Nicola Marchetti, Faouzi Bader, and Luiz A. DaSilva, "Coexistence between D2D and Cellular Communications Using Multiple Waveforms in 5G," in *IEEE Internet of Things Journal*, February 2018.
23. **Arman Farhang**, Ahmad RezazadehReyhani, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Low Complexity Modem Structure for OFDM-based Orthogonal Time Frequency Space Modulation," in *IEEE Wireless Communications Letters*, November 2017.
24. Arsalan Saljoghei, **Arman Farhang**, Colm Browning, Philip Perry, Nicola Marchetti, Liam Barry, and Linda E. Doyle, "A Comparison of OFDMA and GFDMA for Next-Generation PONs," in *IEEE/OSA Journal of Optical Communications and Networking,* October 2017.
25. Colm Browning, Eamonn Martin, **Arman Farhang**, and Liam Barry, "60 GHz 5G Radio-over-Fiber using UF-OFDM with Optical Heterodyning," in *IEEE Photonics Technology Letters,* October 2017.

26. Amir Aminjavaheri, **Arman Farhang**, Ahmad Rezazadeh, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "OFDM without CP in Massive MIMO," in *IEEE Transactions on Wireless Communications,* September 2017.
27. Zahra Sharifian, Mohammad Javad Omidi, Hamid Saeedi-Sourck, and **Arman Farhang**, "Linear Precoding for PAPR reduction of GFDMA Signals," in *IEEE Wireless Communications Letters,* August 2016.
28. François Bentosela, Horia Cornean, **Arman Farhang**, and Nicola Marchetti, "On the Sublinear Behavior of Massive Multi User MIMO Sum Rate for Deterministic Channel Models," in *IEEE Transactions on Communications,* August 2016.
29. **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Low Complexity Modem Design for GFDM," in *IEEE Transactions on Signal Processing,* November 2015.
30. Hamed Ahmadi, **Arman Farhang**, Nicola Marchetti, and Allen MacKenzie, "A Game Theoretical Approach for Pilot Contamination Avoidance in Massive MIMO," in *IEEE Wireless Communications Letters*, October 2015.
31. Joao Paulo Miranda, **Arman Farhang**, Nicola Marchetti, Felipe A.P. De Figueiredo, Fabbryccio A. C. M. Cardoso, and Fabricio Figueiredo, "On Massive MIMO and its Applications to Machine Type Communications and FBMC-based Networks," in *EAI Endorsed Transactions on Ubiquitous Environments*, July 2015.
32. **Arman Farhang**, Nicola Marchetti, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Low Complexity CFO Compensation in Uplink OFDMA Systems With Receiver Windowing," in *IEEE Transactions on Signal Processing,* March 2015.

PEER-REVIEWED CONFERENCE PUBLICATIONS

1. **Arman Farhang** and Mohsen Bayat, "SC-FDMA as a Delay-Doppler Domain Modulation Technique," Accepted for Presentation in *the IEEE International Conference on Communications (ICC), Workshop on OTFS and Delay-Doppler Multicarrier Communications for 6G,* June 2024.
2. Mohsen Bayat, and **Arman Farhang**, "A Generalized Framework for Pulse-Shaping on Delay-Doppler Plane," Accepted for Presentation in *the IEEE International Conference on Communications (ICC),* June 2024.
3. Sanoopkumar P. S., Stephen McWade, and **Arman Farhang**, "Truncated Turbo Equalizer with SIC for OTFS," in *Proc. of the IEEE Global Communications Conference (Globecom), Workshop on Emerging Topics in 6G Communications,* December 2023.
4. Mohsen Bayat, Sanoopkumar P. S., and **Arman Farhang**, "Practical Synchronization for OTFS," in *Proc. of the IEEE International Conference on Communications (ICC),* May 2023.
5. Sanoopkumar P. S., and **Arman Farhang**, "A Practical Pilot for Channel Estimation of OTFS," in *Proc. of the IEEE International Conference on Communications (ICC),* May 2023.
6. Stephen McWade, Mark F. Flanagan, and **Arman Farhang**, "Low-Complexity Equalization and Detection for OTFS-NOMA," in *Proc. of the IEEE International Conference on Communications (ICC), Workshop on OTFS and Delay-Doppler Multicarrier Communications for 6G,* May 2023.
7. Hamed Hosseiny, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Downlink Precoding for FBMC-based Massive MIMO with Imperfect Channel Reciprocity," in *Proc. of the IEEE International Conference on Communications (ICC),* May 2022.

8. Danilo Lelin Li, and **Arman Farhang**, "OTFS Without CP in Massive MIMO: Breaking Doppler Limitations with TR-MRC and Windowing," in *Proc. of the IEEE Wireless Communications and Networking Conference (WCNC),* April 2022.
9. Juquan Mao, **Arman Farhang**, Lei Zhang, Zheng Chu, Pei Xiao and Sai Gu, "Interference Analysis in Multi-Numerology OFDM Systems: A Continuous-Time Approach," in *Proc. of the IEEE International Conference on Communications (ICC), Workshop on Ultra-high speed, Low latency and Massive Communication for futuristic 6G Networks*, June 2021.
10. Sumin Jeong, **Arman Farhang**, and Mark Flanagan, "Collaborative Vs. Non-Collaborative CFO Estimation for Distributed Large-Scale MIMO Systems," in *Proc. of the IEEE Vehicular Technology Conference (VTC),* October 2020.
11. Stephen McWade, Mark F Flanagan, Lei Zhang, and **Arman Farhang**, "Interference and Rate Analysis of Multinumerology NOMA," in *Proc. of the IEEE International Conference on Communications (ICC),* June 2020.
12. Parna Sabeti, **Arman Farhang**, Irene Macaluso, Nicola Marchetti, and Linda E. Doyle, "Blind Channel Estimation for Massive MIMO: A Deep Learning Assisted Approach," in *Proc. of the IEEE International Conference on Communications (ICC),* June 2020.
13. Hamed Hosseiny, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Spectrally Efficient Pilot Structure and Channel Estimation for Multiuser FBMC Systems," in *Proc. of the IEEE International Conference on Communications (ICC),* June 2020.
14. André Gomes, Jacek Kibiłda, **Arman Farhang**, Ronan farrell, and Luiz DaSilva, "Network Sharing for Reliable Networks: A Data-Driven Study," in *Proc. of the IEEE International Conference on Communications (ICC),* June 2020.
15. **Arman Farhang**, Amir Aminjavaheri, and Behrouz Farhang-Boroujeny, "Single Carrier Transmission in Massive MIMO Revisited," in *Proc. of the International Conference on Computing, Networking and Communications (ICNC),* February 2020.
16. Amol Delmade, Colm Browning, **Arman Farhang**, David Koilpillai, Deepa Venkitesh, Liam Barry, "OFDM Baud Rate Limitations in an Optical Heterodyne Analog Fronthaul Link using Unlocked Fibre Lasers," in *Proc. of the International Topical Meeting on Microwave Photonics (MWP),* October 2019.
17. Amol Delmade, Colm Browning, Yi Lin, **Arman Farhang**, David Koilpillai, Deepa Venkitesh, Liam Barry, "Digital Frequency/Phase Offset Correction for 60 GHz OFDM Radio-over-Fibre with Unlocked Fibre Lasers," in *Proc. of the European Conference on Optical Communication (ECOC),* September 2019.
18. Hamidreza Shayanfar, Hamid Saeedi-Sourck, and **Arman Farhang**, "CFO and Channel Estimation Techniques for GFDM," in *Proc. of the IEEE MTT-S International Microwave Workshop Series on 5G Hardware and System Technologies (IMWS-5G),* August 2018.
19. Parna Sabeti, **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "CFO Estimation for OFDM-based Massive MIMO Systems in Asymptotic Regime," in *Proc. of the IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM),* July 2018.
20. Ahmad RezazadehReyhani, **Arman Farhang**, Mingyue Ji, Rong Rong Chen, and Behrouz Farhang-Boroujeny, "Analysis of Discrete-Time MIMO OFDM-Based Orthogonal Time Frequency Space Modulation," in *Proc. of the IEEE International Conference on Communications (ICC),* May 2018.

21. Parna Sabeti, **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Low-complexity CFO Compensation for OFDM-based Massive MIMO Systems," in *Proc. of the IEEE Global Communications Conference (Globecom), Workshop on Large-Scale Antenna Systems in Licensed and Unlicensed Bands,* December 2017.
22. Eamonn Martin, Colm Browning, **Arman Farhang**, Manh Ha Hoang, Matthias John, Max James Ammann, Linda Doyle, and Liam Barry, "28 GHz 5G Radio over Fibre using UF-OFDM with Optical Heterodyning," in *Proc. of the International Topical Meeting on Microwave Photonics (MWP),* October 2017.
23. Amir Aminjavaheri, **Arman Farhang**, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Prototype Filter Design for FBMC in Massive MIMO Channels," in *Proc. of the IEEE Conference on Communications (ICC),* May 2017.
24. Colm Browning, **Arman Farhang**, Arsalan Saljoghei, Nicola Marchetti, Vidak Vujicic, Linda Doyle, and Liam Barry, "5G Wireless and Wired Convergence in a Passive Optical Network using UF-OFDM and GFDM," in *Proc. of the IEEE Conference on Communications (ICC), International workshop on the main trends in 5G networks (MT5Gnet)*, May 2017.
25. Amol Delmade, Colm Browning, **Arman Farhang**, Nicola Marchetti, Linda Doyle, David Koilpillai, Liam Barry, and Deepa Venkitesh, "Performance Analysis of Optical Front-Hauling for 5G Waveforms," in *Proc. of the conference on lasers and electro-optics (CLEO),* June 2017.
26. Arsalan Saljoghei, **Arman Farhang**, Colm Browning, Nicola Marchetti, Linda E. Doyle, and Liam Barry, "Investigation of the Performance of GFDMA and OFDMA for Spectrally Efficient Broadband PONs," in *Proc. of the Optical Fiber Communication Conference (OFC),* March 2017.
27. **Arman Farhang**, Amir Aminjavaheri, Ahmad Rezazadeh, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Time Reversal with Post-Equalization for OFDM without CP in Massive MIMO," in *Proc. of International Symposium on Wireless Communication Systems (ISWCS),* September 2016.
28. Jasmina McMenamy, **Arman Farhang**, Nicola Marchetti, and Irene Macaluso, "Enhanced Auction-Assisted LSA," in *Proc. of International Symposium on Wireless Communication Systems (ISWCS),* September 2016.
29. Conor Sexton, Quentin Bodinier, **Arman Farhang**, Nicola Marchetti, Faouzi Bader, and Luiz A. DaSilva, "Coexistence of OFDM and FBMC for Underlay D2D Communication in 5G Networks," in *Proc. of IEEE Global Communications Conference (Globecom), Workshop on Emerging Technologies for 5G Wireless Cellular Networks,* December 2016.
30. Parna Sabeti, **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Performance Analysis of FBMC-PAM in Massive MIMO," in *Proc. of IEEE Global Communications Conference (Globecom), Workshop on Emerging Technologies for 5G Wireless Cellular Networks,* December 2016.
31. Hamed Hojatian, Hamid Saeedi-Sourck, Mohammad Javad Omidi, and **Arman Farhang**, "Joint CFO and Channel Estimation in OFDM-based Massive MIMO Systems," in *Proc. of 8th International Symposium on Telecommunications (IST),* September 2016.
32. Quentin Bodinier, **Arman Farhang**, Faouzi Bader, Hamed Ahmadi, Jacques Palicot, and Luiz A. DaSilva, "5G Waveforms for Overlay D2D Communications: Effects of Time-Frequency Misalignment," in *Proc. of IEEE International Conference on Communications (ICC)*, May 2016.
33. Behrouz Farhang-Boroujeny, **Arman Farhang**, Ahmad Rezazadeh, Amir Aminjavaheri, and Daiming Qu, "A Comparison of Linear FBMC and Circularly Shaped Waveforms," in *Proc. of IEEE International Conference on Wireless Information*

Technology and Systems (ICWITS) and Applied Computational Electromagnetics (ACES), March 2016.

34. Ahmad Rezazadeh, **Arman Farhang**, and Behrouz Farhang-Boroujeny, "Circularly pulse-shaped waveforms for 5G: Options and comparisons," in *Proc. of IEEE Global Communications Conference (Globecom)*, December 2015.
35. Amir Aminjavaheri, **Arman Farhang**, Ahmad Rezazadeh, and Behrouz Farhang-Boroujeny, "Impact of Timing and Frequency Offsets on Multicarrier Waveform Candidates for 5G," in *Proc. of IEEE Signal Processing and SP Education Workshop (SPW)*, August 2015.
36. Amir Aminjavaheri, **Arman Farhang**, Nicola Marchetti, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Frequency spreading equalization in multicarrier massive MIMO," in *Proc. of IEEE International Conference on Communication Workshop (ICCW)*, June 2015.
37. **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Low Complexity GFDM Receiver Design: A New Approach," in *Proc. of IEEE International Conference on Communications (ICC)*, June 2015.
38. Zahra Sharifian, Mohammad Javad Omidi, **Arman Farhang**, and Hamid Saeedi-Sourck, "Polynomial Based Compressing and Iterative Expanding for PAPR Reduction in GFDM," in *Proc. of 23rd Iranian Conference on Electrical Engineering (ICEE),* May 2015.
39. **Arman Farhang**, Nicola Marchetti, Fabricio Figueiredo, and Joao Paulo Miranda, "Massive MIMO and Waveform Design for 5th Generation Wireless Communication Systems," in *Proc. of 1st International Conference on 5G for Ubiquitous Connectivity,* November 2014.
40. **Arman Farhang**, Amir Aminjavaheri, Nicola Marchetti, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Pilot Decontamination in CMT-based Massive MIMO Networks," in *Proc. of 11th International Symposium on Wireless Communications Systems (ISWCS),* August 2014.
41. **Arman Farhang**, Nicola Marchetti, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Filter Bank Multicarrier for Massive MIMO," in *Proc. of the IEEE 80th Vehicular Technology Conference (VTC-Fall),* September 2014.
42. **Arman Farhang**, Arslan Javaid Majid, Nicola Marchetti, Linda E. Doyle, and Behrouz Farhang-Boroujeny, "Interference localization for uplink OFDMA systems in presence of CFOs," in *Proc. of the IEEE Wireless Communications and Networking Conference (WCNC),* April 2014.
43. Ahmed Selim, **Arman Farhang**, and Linda E. Doyle, "Towards easier compliance with out-of-band emissions regulations," in *Proc. of International Conference on Computing, Networking and Communications (ICNC),* February 2014.
44. **Arman Farhang**, Nicola Marchetti, and Linda E. Doyle, "Low complexity LS and MMSE based CFO compensation techniques for the uplink of OFDMA systems," in *Proc. of the IEEE International Conference on Communications (ICC),* June 2013.
45. **Arman Farhang**, Mohammad Molavi Kakhki, and Behrouz Farhang-Boroujeny, "Wavelet-OFDM versus filtered-OFDM in power line communication systems," in *Proc. of 5th International Symposium on Telecommunications (IST),* December 2010.

JOURNAL PUBLICATIONS UNDER REVIEW

1. Mohsen Bayat, and **Arman Farhang**, "A Unified Framework for Pulse-Shaping on Delay-Doppler Plane," *Submitted to IEEE Transactions on Wireless Communications.* ***(In 2nd Round of Review)***.

CONFERENCE PUBLICATIONS UNDER REVIEW

1. Mohamad H. Dinan, and **Arman Farhang**, "RIS-Assisted OTFS Communications: Phase Configuration via Received Energy Maximization," *Submitted to the IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), workshop on integrated, intelligent and ubiquitous connectivity for 6G, September 2024.*

REFEREES

Dr. Linda E. Doyle
Provost of Trinity College Dublin, Ireland.
Address: House 1, Trinity College Dublin, Dublin 2, Ireland.
Homepage: https://www.tcd.ie/research/profiles/?profile=LEDOYLE
Email: Linda.Doyle@tcd.ie
Phone: (+353) 87 8171131

Prof. Liam Barry
Professor in School of Electronic Engineering, Dublin City University, Ireland.
Address: Dublin 9, Dublin City University, Ireland.
Homepage: https://opticlab.eeng.dcu.ie/people/prof-liam-barry/
Email: liam.barry@dcu.ie
Phone: (+353) 1 70045431