The 23rd Australian Communications Theory Workshop (AusCTW 2026)

Christchurch, New Zealand
February 2-4, 2026

Sponsored by

Supported by

Message from the Chairs: AusCTW 2026

Greetings and a warm welcome to the 23rd Australian Communications Theory Workshop (AusCTW 2026), held from February 2–4 in Christchurch, New Zealand

Established in 2000, AusCTW remains the premier forum for wireless communications theory in the region. This year, we are proud to host the community in the "Garden City," marking another year of vital academic exchange and innovation. This will the 23rd edition of AusCTW, the second time in Christchurch, and the third time in New Zealand.

To ensure a diverse and high-quality experience, our program features:

- 7 Distinguished Keynote Talks & and tutorial.
- 11 Technical Presentations
- 12 Posters
- 3 Panel Discussions

This program is made possible by the shared efforts of our committees and the continued engagement of the wireless communications community.

Acknowledgments

We express our heartfelt gratitude to the administrative staff and student volunteers from University of Canterbury.

A sincere thank you to our sponsors: New Zealand Tourism, University of Canterbury, the IEEE, and our supporters Aurora and TMYTEK. Your contribution is integral to the success of this workshop.

We hope you enjoy your time in Christchurch and find the workshop both productive and inspiring. We look forward to a conference filled with enriching discussions and memorable experiences.

Graeme Woodward, Mel Lloyd, Barry Wu
General and Local co-Chairs.

Adriel Kind, Akram Shafie, Pete Smith, Himal A. Suraweera
AusCTW 2026 TPC

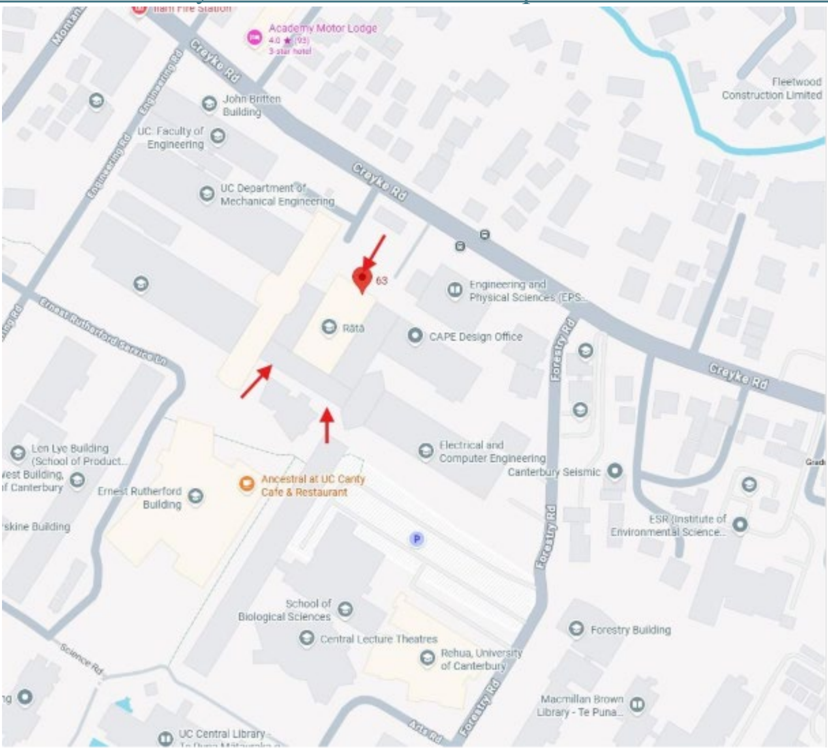
Conference Venue

The presentations, technical talks and tutorials are all being held in Room E5, Rātā Building, 63 Creyke Road, Ilam, Christchurch 8041 at the University of Canterbury.

Catered meals will be served in the Rātā Building Foyer, where there is also a café if you wish to purchase barista-made coffee.

Parking: Look for the QR codes in the carparks to pay for parking. You can park in Visitor, Staff or Student carparks. A map of UC including location of buildings, Halls accommodation and parking locations is here:

https://www.canterbury.ac.nz/about-uc/our-campus-and-environment/maps



Red arrows show location of entry doors.

Technical Program

Day 1 - Main Conference

Monday 2 February 2026

Room E5 – Ground Floor, Rāta Building,
63 Creyke Road, Uni. Canterbury, Ilam Campus

TIME	SESSION
8:15 AM	**Registrations**
9:00-9:10 AM	**Conference Welcome Speech** Prof. Rua Murray, UC
9:10-10:10 AM	**<u>Keynote 1 – Dr Seong-Lyun Kim, Yonsei University</u>** **Topic:** Hybrid Inference for Robot Manipulation over 5G-A Virtual/Open-RAN Network Platform
	Morning Tea and Poster Session
10:10-11:00 AM	1. **ISAC with Co-Prime Arrays: Virtual Aperture Sensing and Downlink Communication** Dr. Jing Zhang, Huazhong University of Science and Technology 2. **PAC Codes Meet CRC Polar Codes** Xinyi Gu, UNSW 3. **A Game-Theoretic Communication Framework for Justifiable Trust: Modelling Strategic Interactions between Regulators, Manufacturers, and Multimedia Agents** Dr. William Liu, Wuhan University of Communications 4. **Time Domain Zero-Padding (TZP) Affine Frequency Division Multiplexing and its Low-Complexity Equalization** Cheng Shen, UNSW 5. **Fluid antennas and near-field channels** Isaac Buhler, VUW 6. **Causal Conditional Directed Information in a Point Process Network** Dr Xinhui Rong, Uni. Melbourne. 7. **A Novel One-tap Equalizer for Zero-Padded AFDM System over Doubly Selective Channels** Chenyang Zhang, UNSW, 8. **Loss of subcarrier orthogonality caused by Doppler in OFDM** Hamish Shaw, UNSW 9. **New Tools for Tracking Small Invertebrates Using Harmonic Radar** Dr. Graeme Woodward, UC 10. **Performance Analysis and Detection of CP-FSCM over Frequency Selective Channels** Tianhong Gu, UNSW 11. **Analysis of Insect Localisation Accuracy Measured with a Novel Scanning Dual-Mode FMCW Harmonic Radar** Dr Rifat Afroz, UC
11:00-12:00 PM	**<u>Keynote 2– Dr Nahina Islam, CQ University</u>** **Topic:** AI-Driven Precision Agriculture: Intelligent Sensing, Autonomous Systems, and Scalable Field Intelligence
12:00-12:20 PM	**<u>Technical Talk 1: Toby Tomkinson, University of Auckland</u>** **Title:** What Goes Up Must Come Down… Slowly: Caching in LEO Constellations

12:20-1:30 PM	**Spit roast lunch. Rāta lawn (weather permitting)** *Sponsored by IEEE New Zealand, South Section*
1:30-2:30 PM	**Panel Discussion 1: 6G and WiFi Futures: Research translating into practice** **Panel Chair:** Prof. Iain Collings, Macquarie University
2:30-2:50 PM	**Industry tech talk - Sunny Wang & Alex Tseng, TMYTEK:** Towards 6G: Bridging Simulation and Emulation with a Ready-to-Use Experimental Testbed.
2:50-3:20 PM	**Afternoon Tea (Posters still available)**
3:20-4:20 PM	**Keynote 3 – Dr Andrew Zhang, UTS** **Title:** Passive sensing
4:20-4:40 PM	**Technical Talk 2 – Anastasia Verhovski** **Title:** UAV Swarm-based Distributed Antenna Array
4:40–5:00 PM	**Technical Talk 3 – Dr Adriel Kind, University of Canterbury** **Title:** Airborne dynamically positioned MIMO arrays
5:00 PM	**Walk to Ilam Homestead**
5:15 - 7:00 PM	**Welcome Drinks – Ilam Homestead**

Day 2 - Main Conference

Tuesday 3 February 2025

Room E5 – Ground Floor, Rāta Building, Uni. Canterbury, Ilam Campus.

TIME	SESSION
8:30AM	**Doors Open**
9:00-9:10 AM	**Announcements**
9:10-10:10	**Keynote 4 – Dr Vish Ponnampalam, Google** **Topic:** Signals, Silicon, and Scale: From Communication Theory to Global AI Infrastructure
10:10-10:30 AM	**Technical Talk 4 – Dr Jinho Choi, Adelaide University** **Title:** Uplink ISAC in 6G Networks with Massive MIMO
10:30-11:00 AM	**Morning Tea**
11:00-12:00 PM	**Keynote 5 – Chris Hill, Aurora** **Topic:** Spectrum Allocation and Management in Geostationary Orbit above 3GHz: Established Industry Practices
12:00-12:20 PM	**Technical Talk 5 - Dr Zhouygou Gu, Singapore Univ. Technology and Design** **Title:** Learning Large-Scale Time-Varying Graphs for Laser Inter-Satellite Link Management in LEO Mega-Constellations
12:20-1:30 PM	**Lunch**
1:30-2:30 PM	**Panel Discussion 2: AI in wireless communications (beyond the hype)** **Panel Chair:** Prof. Philippa Martin, UC
2:30- 2:50 PM	**Technical Talk 6 – Dr Jingge Zhu, University of Melbourne** **Title:** Beyond identification: Boolean function computation via channels
2:50-3:10 PM	**Technical Talk 7 – Dr Matthias Frey, University of Melbourne** **Title:** Online Prediction of Stochastic Sequences with High Probability Regret Bounds
3:10-3:40 PM	**Afternoon Tea**
3:40-4:40 PM	**Keynote 6 – Dr Konstanty Bialkowski, UQ** **Topic:** Enabling Passive Radar via Low-Cost Hardware and Multi-static Deployments
4:40-5:00 PM	**Technical Talk 8 – Dr Akram Shafie, UNSW** **Title:** Enabling One-tap equalizer over doubly selective channels with AFDM
	Bus departs UC at 5.30pm for dinner
6:00 PM	**Conference Dinner –** The Monday Room
9:00PM	**Bus returns to UC via Riccarton Road & Tupuānuku**

Day 3 - Main Conference

Wednesday 4 February 2025

Room E5 – Ground Floor, Rāta Building, Uni. Canterbury, Ilam Campus.

TIME	SESSION
8:30AM	**Doors Open**
9:00-9:10 AM	**Announcements**
9:10-10:10 AM	**Keynote 7 – Prof. Pete Smith, Victoria Univ. Wellington** **Topic:** Lost in space – the frontiers of fluid antenna systems
10:10:10:30 AM	**Technical Talk 9 – Andrei Mogilnikov, Uni. Twente, The Netherlands** **Title:** Design Challenges and Functionality of Passive Harmonic RFID
10:30-11:00 AM	**Morning Tea**
11:00-12:00 PM	**Tutorial: Delay-Doppler Modulation** A/Prof. Jun Tong and Prof. Jinhong Yuan, UNSW
12:00-12:20 PM	**Technical Talk 10 – Dr Deepak Mishra, UNSW** **Title:** Covert Wireless Sensing for Future Communication Systems
12:20-12:50 PM	**Panel Discussion 3: Enticing students back to comms electives** **Panel Chair**: Prof. Brian Krongold, Uni. Melbourne
12:50-1:00 PM	Awards, acknowledgements, wrap up
1:00 PM	**Conference Closure**

PLEASE NOTE: All listed times are based on NZDT: UTC/GMT +13 hour

Conference Dinner

The social dinner will be held at **The Monday Room** in the Christchurch Central Business District.

What is included as part of your conference ticket? Your 3-course meal, beverages (a selection of beer, wine, cider, low alcohol and non-alcoholic drinks).

If you wish to purchase alcohol from the wider drinks menu, such as spirits or cocktails, you may purchase these yourself from the bar.

Address: 161 High Street, Christchurch Central City, Christchurch 8011

Date: Tuesday 3rd February 2026 **Time:** 6:00PM-9:00PM

How to get there: We have arranged a large bus to transport us to the venue. The bus will depart from outside the conference venue (Creyke Road) at **5.30pm.**

Returning to accommodation: On our return, we will drop guests off at a couple of locations where most people are staying including; Riccarton Road, Tupuānuku Hall, and Chateau on the Park, before returning to our departure location.

Note: You are welcome to drive: on-street meter parking, and a parking in the rear (off St Asaph Street). Bike racks at intersection with Tuam St, ~50m away.

Welcome Drink

The welcome drink will be at the Ilam Homestead on campus, which is about a 10min walk from the conference venue. Everyone will walk from the conference venue to the Homestead after the last presentation on Monday. We have vans to shuttle any guests if required.

Address: 87 Ilam Rd, Christchurch, New Zealand

Time: 5:15PM-7:00PM

If you wish to make your own way there, there is some limited parking on-site. Please follow the instructions to pay for University Parking – you will find this at the QR codes in the parking areas.

Tupuānuku Hall – Accommodation

Address: 3 Homestead Lane, Ilam, Canterbury 8041

Check in: opens at 2pm on Sunday 1st February. Reception is open 24/7 if you need anything related to your accommodation.
If you have a late arriving flight, we have made the Tupuānuku team aware that there will be some late arrivals.

Breakfast will be served daily at 7.30am.

Walking to the conference: On Monday 2nd Feb please meet at the reception of Tupuānuku Hall by 8.20am, and one of our team will walk you to the conference venue.

Check Out: Please check out before you come to the conference on Wednesday 4th February. Tupuānuku Hall will be able to hold your luggage until after the conference ends.

Keynote Speakers

Prof. Seong-Lyun Kim
Yonsei University, South Korea

Hybrid Inference for Robot Manipulation over 5G-A Virtual/Open-RAN Network Platform

Abstract

Speculative decoding to improve the on-device models' diminished capabilities inherent to their scales has been thoroughly studied by many researchers. In particular, by selectively invoking uplink transmission for verification and resampling, the low latency of the on-device approximation model and the high accuracy of the remote target model can be achieved at the same time, making it an ideal architecture for robotic applications. To this end, we implement hybrid inference with speculative decoding for task planning and motion control of wireless robotic systems by collaboratively using on-device and remote transformer-based models. At the same time, we test its ability to minimize latency without compromising the accuracy on vRAN testbeds at Yonsei campus, with "5G-A Virtual/Open-RAN based Intelligent RAN Core Network Platform," funded by IITP (2024-2028). Our testbed is to use open source CU/DU (e.g., Open Air Interface) + O-RU (Radio Unit) while combining a "high physical" layer by Nvidia Aerial.

Biography

Seong-Lyun Kim is a Professor at the School of Electrical & Electronic Engineering, Yonsei University, Seoul, Korea, heading the Radio Resource Managemen & Optimization Laboratory (RAMO) and the Center for Flexible Radio (CFR+). He was an Assistant Professor of Radio Communication Systems at the Department of Signals, Sensors & Systems, Royal Institute of Technology (KTH), Stockholm, Sweden. He was a Visiting Professor at the Control Group, Helsinki University of Technology (now Aalto), Finland, and the KTH Center for Wireless Systems. He was an editorial board member of IEEE Transactions on Vehicular Technology, IEEE Communications Letters, Elsevier Control Engineering Practice, Elsevier ICT Express, and Journal of Communications and Network. He served as the leading guest editor of IEEE Wireless Communications, and IEEE Network for wireless communications in networked robotics. His research interest includes radio resource management and information theory in wireless networks, and robotic networks.

Dr Nahina Islam
Central Queensland University

AI-Driven Precision Agriculture: Intelligent Sensing, Autonomous Systems, and Scalable Field Intelligence

Abstract

Artificial intelligence (AI) is increasingly reshaping modern agriculture by enabling scalable, data-driven, and non-destructive solutions to complex field challenges. The integration of AI with advanced imaging, sensing, and autonomous platforms is unlocking new opportunities in precision weed management, targeted intervention, and crop quality assessment. In this keynote, I will present a series of applied case studies demonstrating how AI technologies are being translated from research to real-world agricultural impact. These include: the development of an AI-driven Internet of Drones framework for targeted weed spraying; and the integration of computer-aided deep learning with UAV imagery for precision weed detection and mapping in Australian rangelands. I will also discuss a novel AI-enabled framework that leverages hyperspectral imaging to estimate biochemical and quality-related plant traits in herbs using non-destructive field-based sensing. Together, these examples illustrate how AI, UAVs, and advanced imaging can deliver environmentally sustainable, commercially viable, and scalable solutions for next-generation agriculture, while highlighting key lessons in system design, robustness, and industry translation.

Biography

Dr Nahina Islam is a Senior Lecturer in Information and Communication Technology at Central Queensland University and the Research Cluster Leader for AI and Data Science within the CML-NET Research Centre. Her research expertise spans artificial intelligence, deep learning, computer vision, hyperspectral and UAV imaging, IoT, and smart farming systems, with a strong emphasis on industry-engaged and impact-driven research.

Dr Islam has led and contributed to multiple nationally competitive and industry-funded projects, including Australia's Economic Accelerator (AEA) Innovate and CSIRO NGGP initiatives, working closely with government agencies, universities, and industry partners. She actively supervises HDR students, contributes to research governance and commercialisation activities, and serves the broader research community through leadership and service roles with professional organisations including IEEE, IEEE VIC Women in Engineering, the IEEE VIC IoT Community (Vice Chair), and the Australian Computer Society (ACS). Her work focuses on translating AI-enabled technologies into practical solutions for sustainable agriculture and environmental monitoring.

Prof. Andrew Zhang
University of Technology Sydney

Integrated Bi-static Sensing in Wireless Communication Networks: Technologies and Applications

Abstract

Empowered by Integrated Sensing and Communications (ISAC), next-generation communication networks are envisioned to deliver ubiquitous sensing capabilities by leveraging existing communication infrastructure. Bi-static sensing stands out as a practical near-term solution: it circumvents the stringent full-duplex requirement of mono-static sensing while offering rich spatial diversity. A major challenge lies in clock asynchronism between spatially separated communication nodes, which can introduce sensing ambiguities and hinder coherent processing of discontinuous measurements, such as Doppler frequency estimation. Overcoming this barrier would enable sensing to be seamlessly embedded into communication networks with minimal infrastructure or hardware modifications. This talk explores advanced techniques to tackle clock asynchronism, with a particular emphasis on efficient single-receiver solutions. It will introduce the challenge in the context of 6G perceptive mobile networks, followed by a review of recent progress on single-receiver methods applicable to both single-antenna and multi-antenna systems. Recent applications built on these techniques, including moving object tracking, localisation, and environmental monitoring (rainfall and water-level sensing) will be presented. The talk concludes with open challenges and promising directions for future research in this rapidly evolving field.

Biography

Dr J. Andrew Zhang is a Professor in the School of Electrical and Data Engineering, University of Technology Sydney. His research interests are signal processing methods for wireless communications & sensing, with more than 330 papers in leading Journals and conference proceedings, and 7 best paper awards. He is a recipient of CSIRO Chairman's Medal and the Australian Engineering Innovation Award for exceptional research achievements in multi-gigabit wireless communications. Prof. Zhang is a pioneer in ISAC research, initiating the concept of perceptive mobile networks, by defining the system framework of integrating sensing into mobile networks and demonstrating its feasibility in 2017. Prof. Zhang co-organised ISAC workshops at leading conferences and special issues in leading IEEE journals. He has delivered ISAC tutorials in ICC 2021 & 2022, ISCIT 2024 and IEEE Radar 2024, and numerous keynotes, invited talks, and webinars. Prof. Zhang has received more than eight million dollars in research funds in this area.

`https://sites.google.com/view/andrewzhang/`

Dr Vish Ponnampalam
Google

Signals, Silicon, and Scale: From Communication Theory to Global AI Infrastructure

Abstract
Current discourse often frames the intersection of AI and communications as either "AI for networks" or "Networks for AI." However, there is a far more powerful third perspective: the foundational skillset of a communication theory researcher—rooted in mathematical rigor, stochastic modeling, and system-level optimization—is a universal toolkit for the entire AI stack. This talk attempts to demonstrate how "Signals" (research rigor) evolves into "Silicon" (hardware-software optimization) and finally "Scale" (global infrastructure), drawing on my career as a case study. My goal is to inspire the next generation of Australian communications researchers to see their deep technical training not just as a narrow specialty, but as a universal toolkit for architecting the foundations of the AI revolution.

Biography
Vish Ponnampalam is a Senior Infrastructure Leader with over two decades of experience driving innovation at the intersection of AI, networking, and automation. Currently, Vish serves as an Uber Tech Lead at Google. In this role, he is responsible for the technical strategy and execution governing Google’s multi-generational GPU fleet, which supports global cloud customers and first-party AI services. Before joining Google, Vish was an Engineering Lead for Infrastructure at Meta. His work there focused on leading programs to support global user growth and engagement, including initiatives to improve low-latency video delivery and reduce the cost of internet connectivity. Earlier in his career, Vish held deep engineering technology roles in the wireless networking space at companies such as IPWireless, Toshiba Research, and Ubiquiti. He holds a PhD in Communication Theory and a BE (First Class Honors) from the University of Sydney, as well as an MBA from The Wharton School, University of Pennsylvania.

Chris Hill
Aurora Australis Network

Spectrum Allocation and Management in Geostationary Orbit above 3GHz: Established Industry Practices

Abstract

Researchers have pondered the ability to dynamically share spectrum for terrestrial purposes on frequencies that have been traditionally allocated for Earth-Space communications. Material on geostationary payloads has historically been difficult to obtain, as most details are held commercial-in-confidence. This presentation covers some of the hardware considerations related to transponder configurations, and the manner in which capacity is typically assigned to commercial satellite service providers and other wholesale users of transponder capacity, including the existing mechanisms for frequency re-use and interference identification and mitigation.

Biography

Chris is a Telecommunications Engineer and Company Director with a particular interest in satellite communications. He co-founded ITC Global and served as global CTO, growing the business to be the largest provider of satellite communications to the mining sector, and the third largest to the energy sector, as well as having one of the largest global maritime networks. ITC was acquired by Panasonic in 2015. He has consulted to major satellite operators, and served as CTO for Speedcast until March 2023. His remit included responsibility for all technological strategy for the business, including satellite communications hub technologies, teleports and associated ground segment, satellite transponder selection, MPLS backbone, and cybersecurity.

He has an MBA in Technology Management, a Master of Engineering in Telecommunications Engineering, and is a Senior Member of the IEEE.

A/Prof. Konstanty Bialkowski
University of Queensland

Enabling Passive Radar via Low-Cost Hardware and Multi-static Deployments

Abstract

Passive radar is a type of radar system with several advantages over traditional active radar systems. Unlike active radar, passive radar doesn’t require a dedicated transmitter and instead uses existing signals from the environment, like radio or television signals as a source of illumination, making it low cost, low power and portable. With advancements in receiver technology and computational power, passive radar has become an increasingly attractive option in many applications where active radar would have been used. However, detection range and accuracy are limited by the geometry of a single receiver scenario and the signal-to-noise ratio of the received signal. One way to overcome these limitations is to use multiple receivers to triangulate the position of a target, providing increased coverage and the ability to detect smaller targets. This talk will explain the basics of passive radar and demonstrate a low-cost implementation using software defined radio. The talk will then move on to some active research areas in multi-static passive radar including the challenges (synchronisation, data storage and computational complexity), high bandwidth and high resolution, different ways to achieve multiple receiver passive radar to provide Cartesian coordinate detection of targets.

Biography

A/Prof. Konstanty Bialkowski’s research interests lie in the area of wireless sensing, passive radar, communication systems, and signal processing, and specifically in the use of multiple antennas or sensors within these fields. Software-defined-radio (SDR) is a useful tool, allowing practical experimentation in specific areas like wireless sensing, biological applications, high reliability or high data rate communications and radio-frequency identification. In addition to his academic role at the University of Queensland, Konstanty is also Head of Technology Development at EMvision Medical Devices. EMvision is a medical device startup focused on microwave-frequency diagnostics, utilising his expertise in Wireless sensing and Signal processing.

Some of his key contributions have been in the development of architectures to collect information from various sensors including RF, vibration and acoustic signals; as well as sensor algorithms for passive radar, where using multiple receivers is capable of resolving target location in 3D space, rather than just the range and Doppler; and showing that SDRs can be used to develop low-cost biomedical imaging devices.

Prof. Pete Smith
Victoria University Wellington

Lost in space – the frontiers of fluid antenna systems

Abstract

What are the benefits to communication if you operate in continuous space? Several trends are leading to the full use of space, e,g., connected arrays, ultra-dense arrays and fluid antennas. While the most common approach remains discrete, continuous transmitting surfaces and antennas capable of movement in continuous space have both been considered for some time and are now receiving more attention. This forms the area of a joint collaboration between the University of Melbourne (Rajitha Senanayake) and Victoria University of Wellington (Peter Smith) funded by the Royal Society of New Zealand. In this talk I will give an overview of the project and some initial results in one, two and three dimensional space.

Biography

Peter Smith received the B.Sc degree in Mathematics and the Ph.D degree in Statistics from the University of London, London, U.K., in 1983 and 1988, respectively. From 1983 to 1986 he was with the Telecommunications Laboratories at GEC Hirst Research Centre. From 1988 to 2001 he was a lecturer in statistics at Victoria University of Wellington, New Zealand. From 2001-2015 he worked in Electrical and Computer Engineering at the University of Canterbury. In 2015 he joined
Victoria University of Wellington as Professor of Statistics. He is also an Adjunct Professor in Electrical and Computer Engineering at the University of Canterbury, New Zealand and an Honorary Professor in the School of Electronics, Electrical Engineering and Computer Science, Queens University Belfast. He was elected a Fellow of the IEEE in 2015 and in 2017 was awarded a Distinguished Visiting Fellowship by the UK based Royal Academy of Engineering at Queens University Belfast. His research interests include the statistical aspects of design, modeling and analysis for communication systems, especially antenna arrays, MIMO, cognitive radio, massive MIMO, mmWave systems, reconfigurable intelligent surfaces, ISAC and fluid antennas.

Panel Discussions

Panel 1:
6G and WiFi Futures: Research translating into practice

Chair: Prof. Iain Collings

Panel Members: TBC

Panel 2:
AI in wireless communications (beyond the hype)

Chair: Prof. Philippa Martin

Panel Members: Kevin Sowerby, Nahina Islam, Yonatan Weissler, Peng Cheng

---

Panel 3:
Enticing students back to comms electives

Chair: Prof. Brian Krongold

Panel Members: TBC

Technical Talks

Toby Tomkinson (University of Auckland)

What Goes Up Must Come Down… Slowly: Caching in LEO Constellations

Abstract

Low Earth Orbit (LEO) satellite constellations are emerging as the new kid on the block for Internet provisioning. In the traditional fixed-line Internet, there is usually an abundance of aggregate bandwidth between Internet Service Providers (ISP) and their end users, making it attractive to cache frequently-requested data in Content Delivery Network servers close to the end users in order to prevent repetitive transmission of the same content across international trunk bottlenecks. This concept does not easily transfer to LEO constellations: Physical and regulatory constraints limit aggregate downlink data rates from satellites to local users (Shannon-Hartley) to well below those available to most terrestrial ISPs, and as LEO satellites remain visible to a local area for minutes only, any content of local interest stored on satellites has limited opportunity to produce cache hits, and likewise, the probability that a required piece of content can be found in a cache on the satellite is quite limited. This presentation attempts to quantify the impact of cache misses on effective throughput.

Biography

I'm a hardworking and reliable individual with a strong foundation in technology and excellent interpersonal skills. I have a solid academic background, a recently completed dissertation, and am a current doctoral student at the University of Auckland.

Industry Tech Talk: Sunny Wang & Alex Tseng (TMYTEK)

Towards 6G: Bridging Simulation and Emulation with a Ready-to-Use Experimental Testbed

Abstract

TMYTEK will be showcasing its latest 6G-ready research platforms and solutions designed to accelerate innovation from theory to real-world experimentation. TMYTEK supply several advanced research platforms, including the BBox 8×8 Duo, a dual-polarized, IF-ready 28 GHz phased array that supports rapid prototyping for 5G/6G, MIMO, and joint communication and sensing (JCAS) research and the XRifle Dynamic RIS, a next-generation reconfigurable intelligent surface designed to enable adaptive beam control, coverage optimization, and intelligent wireless connectivity.

Biography

TMY Technology, Inc. (TMYTEK) delivers breakthrough mmWave solutions for 5G/B5G and satellite communication applications. As a leading technology developer, TMYTEK transforms mmWave RF frontends with innovative devices implementing phased arrays with modern Antenna-in-Package (AiP) technologies and redefining OTA testing methodologies. Together with our global partners, TMYTEK enables industrial innovation to reduce the time from prototyping to production of communication application for improved connectivity and the benefit of users.

Anastasia Verhovski (University of Canterbury)

UAV Swarm-based Distributed Antenna Array

Abstract

The benefits of the antenna array technology combined with the mobility of a UAV swarm have the potential to significantly advance UAV swarm capabilities. A UAV swarm-based distributed antenna array consists of multiple UAVs, each carrying an antenna element, and working together as one to form an antenna array. A UAV swarm antenna array is likely to achieve higher performance in terms of increased gain and spatial diversity than a traditional antenna array on a single UAV platform due to a large number of swarm elements and high flexibility. In addition, integrating mmWave sensing capabilities into a UAV swarm enables precise, millimeter-scale UAV spacing in the swarm which is crucial for distributed beamforming.

Dr Adriel Kind (University of Canterbury)

Airborne Dynamically Positioned MIMO Arrays

Abstract
Consider multiple drones jointly transmitting multiple uplink spatial streams, each to one or more separate base stations. Simply adjusting the drones' positions in 3D space (within a single wavelength) with respect to one another can achieve optimal beamforming performance, but cannot exceed it.

Biography
Adriel joined the University of Canterbury in 2013 as a Senior Research Engineer at the Wireless Research Centre. Adriel has 10 years of industrial experience in wireless telecommunications engineering. Most recently he was with NEC Australia as a 3GPP standards delegate and IP producer for LTE-advanced. He spent four years at Agere Systems/LSI, developing smart algorithms for low power WCDMA receiver ASICs. Adriel has also worked with several startups where he was able to successfully apply his expertise in signal processing, algorithm development, machine learning and information theory.

Prof. Jinho Choi (University of Adelaide)

Uplink ISAC in 6G Networks with Massive MIMO

Abstract
Integrated Sensing and Communication (ISAC) represents the next evolution in 6G cellular networks, leveraging the power of massive MIMO antenna systems. Operating in both downlink and uplink modes, ISAC enables simultaneous communication and sensing, with uplink ISAC offering particular advantages by preserving downlink performance and centralizing complex processing at the base station. This talk will explore the challenges of uplink ISAC and present a high-performance framework that addresses key resource conflicts through the joint optimization of antenna array splitting and radar beamforming. Practical, scalable solutions are introduced, along with advanced signal processing techniques such as Successive Interference Cancellation, providing a clear architecture for deploying efficient and reliable uplink ISAC in future networks.

Biography
Jinho Choi was born in Seoul, Korea. He received B.E. (magna cum laude) degree in electronics engineering in 1989 from Sogang University, Seoul, and M.S.E. and Ph.D. degrees in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST) in 1991 and 1994, respectively. He is with the School of Electrical and Mechanical Engineering, the University of Adelaide, Australia, as a Professor. His research interests include the Internet of Things (IoT), wireless communications, and statistical signal processing. He authored two books published by Cambridge University Press in 2006 and 2010 and one book by Wiley-IEEE in 2022. Prof. Choi received a number of best paper awards including the 1999 Best Paper Award for Signal Processing from EURASIP. He is a Fellow of the IEEE and has been on the list of World’s Top 2% Scientists by Stanford University since 2020. Currently, he is a Senior Editor of IEEE Wireless Communications Letters and an Associate Editor of IEEE Trans. Mobile Computing. He has also served as a Division Editor of Journal of Communications and Networks (JCN), an Associate Editor or Editor of other journals including IEEE Trans. Communications, IEEE Communications Letters, JCN, IEEE Trans. Vehicular Technology, and ETRI journal.

Dr. Zhouygou Gu (Singapore University of Technology and Design)

Learning Large-Scale Time-Varying Graphs for Laser Inter-Satellite Link Management in LEO Mega-Constellations

Abstract

Our work studies laser inter-satellite link (LISL) management in large LEO mega-constellations from a network optimization and communications-theoretic perspective. We model the constellation as a large-scale, time-varying graph with realistic physical-layer and hardware constraints, including limited laser terminals, pointing uncertainty, and stochastic link capacities. The resulting joint problem of link activation, multi-commodity routing, and rate allocation is NP-hard. To address this, we develop a Lagrangian duality–based formulation that relaxes per-link capacity constraints into edge-wise congestion prices, decomposing the problem into tractable subproblems (maximum-weight matching, shortest-path routing, and linear rate allocation). A graph neural network is trained to predict near-optimal Lagrange multipliers in one step, enabling real-time decisions without iterative solvers. Simulations on Starlink-like constellations show consistent throughput gains and low decision latency.

Biography

My research explores the intersection of graph theory and artificial intelligence to advance wireless networks. (M,IEEE) I am currently a research fellow of Prof. Jihong Park at the Singapore University of Technology and Design (SUTD). I was a research fellow of Prof. Jinho Choi at Deakin University in 2024 and was a research assistant of Prof. Branka Vucetic at the University of Sydney (USYD) in 2023. I obtained my Ph.D. degree from Centre for IoT and Telecommunications at the School of Electrical and Information Engineering, USYD, Australia, in 2023, where I also obtained the B.E. (Hons.) and the M.Phil. degrees from USYD in 2016 and 2019, respectively. Throughout my studies, I was fortunate to work under the supervision of Dr. Wibowo Hardjawana and Prof. Branka Vucetic, which provided me with invaluable guidance in my research endeavors. My Ph.D. thesis focuses on “Scheduler Designs in Wireless Networks” and my works are published in prestigious journals and conferences, e.g., TON, JSAC and TWC etc.

Dr. Jingge Zhu (University of Melbourne)

Beyond Identification: Boolean Function Computation via Channels

Abstract

Consider a point-to-point communication system in which the transmitter holds a binary message, and the receiver's goal is to recover a Boolean function of that message, where the function is unknown to the transmitter. We ask what is the minimum number of channel uses for reliable transmission. This problem generalizes the identification-via-channels framework introduced by Ahlswede and Dueck. We provide a complete characterization of the capacity results in terms of scaling laws, and highlight interesting connections to semantic communication and to communication complexity.

Biography

Jingge Zhu's research interests include Information Theory, Communication Systems and Machine Learning. Dr Zhu is currently a Senior Lecturer (Assistant Professor) in the Department of Electrical and Electronic Engineering at the University of Melbourne. More information about his research can be found in his personal website: zhujingge.com

Prior to joining Melbourne, Dr Zhu was a Postdoctoral Researcher at the University of California, Berkeley. He obtained his PhD from cole Polytechnique Fdrale de Lausanne. He received his M.S. and B.E. degrees from Shanghai Jiao Tong University. He also received a Dipl. -Ing. degree from Technische Universitt Berlin.

Dr. Matthias Frey (University of Melbourne)

Online Prediction of Stochastic Sequences with High-Probability Regret Bounds

Abstract

Universal prediction of stochastic sequences with a finite time horizon known to the learner is a classical problem in information theory due to its close ties to the universal coding problem. The question we investigate is whether it is possible to derive vanishing regret bounds that hold with high probability, complementing existing bounds from the literature that hold in expectation. We propose such high-probability bounds which have a very similar form as the prior expectation bounds. For the case of universal prediction of a stochastic process over a countable alphabet, our bound states a convergence rate of with probability as least compared to prior known in-expectation bounds of the order . We also propose an impossibility result which proves that it is not possible to improve the exponent of in a bound of the same form without making additional assumptions.

Biography

Matthias Frey received the B.Sc. degree in mathematics from Freie Universität Berlin in 2010, the M.Sc. degree in mathematics from the University of Münster in 2012, and the Dr.rer.nat. degree from Technische Universität Berlin, in 2024. He is currently a Research Fellow with The University of Melbourne. Previously, he was with the Research and Development, Samson KT-Elektronik, Berlin, and with Technische Universität Berlin as a Research Associate. His research revolves around topics in wireless communications, including over-the-air computation, statistical signal processing, and physical layer security.

Dr. Akram Shafie (UNSW)

Enabling One-Tap Equalization over Doubly Selective Channels with AFDM

Abstract

Chirp-based modulation, such as affine frequency division multiplexing (AFDM), and delay-Doppler domain modulations (OTFS/ODDM) have recently emerged as promising contenders for achieving reliable communications in high-mobility scenarios characterized by doubly selective channels. Despite their promise, a key drawback they face is inter-symbol interference (ISI) in the domain of modulation, necessitating high complexity multi-tap equalization. To address this challenge, this talk proposes a novel AFDM-based transmission scheme that can enable a one-tap equalizer over doubly selective channels. The proposal first involves the suitable selection of AFDM parameters, introducing zero-padding in the affine domain at the transmitter, and cyclically superimposed signal reconstruction at the receiver. These operations simplify the effective affine domain channel matrix to be quasi-stationary with a slowly varying phase term. Finally, receiver symbols are processed in a new domain called the frequency of affine (FoA) domain, where one-tap equalization is performed over doubly selective channels. We highlight that while one-tap equalization was previously achievable only for OFDM over frequency-selective channels, the proposed design enables the one-tap equalization capability to AFDM over doubly selective channels for high mobility applications.

Biography

Dr. A. Shafie received the B.Sc. degree with first-class honors in Electrical and Electronic Engineering from the University of Peradeniya (UOP), Sri Lanka, in 2017, and the Ph.D. degree in Engineering and Computer Science from the Australian National University, Australia, in 2023. He is currently a Lecturer and Early Career Academic Fellow (ECAF) in the School of Electrical Engineering and Telecommunications at the University of New South Wales (UNSW), Australia.

Andrei Mogilnikov (University of Twente)

Design Challenges and Functionality of Passive Harmonic RFID

Abstract

Passive harmonic radio-frequency identification (RFID) systems use nonlinear backscattering to separate transmit and receive frequencies, offering an alternative to conventional single-band RFID. By interrogating tags at a fundamental frequency and receiving at harmonic frequencies, these systems suppress clutter and interference that dominate the excitation band, making them suitable for high-interference environments. Chipless passive harmonic transponders are particularly attractive because of their simplicity, low cost, and robustness. They typically consist only of an antenna and a nonlinear element, most commonly a zero-bias Schottky diode, and operate without integrated circuits or onboard power sources. Despite these advantages, chipless harmonic RFID systems face significant limitations. Low power conversion efficiency, sensitivity to diode characteristics and impedance matching, and environmental factors restrict read range and reliability. Reader architectures must provide high transmit–receive isolation and effective filtering to mitigate self-interference and spurious harmonics, while also coping with increased free-space path loss at harmonic frequencies. Furthermore, multiband operation introduces regulatory and standardization challenges, as existing RFID frameworks are primarily designed for single-frequency systems.
A major bottleneck remains the limited data capacity of chipless tags, which typically function as one-bit transponders. Proposed identification strategies include spectral fingerprinting, multi-resonant antennas, and narrowband frequency-selective designs that create unique harmonic responses for tag discrimination. In parallel, harmonic transponders have been adapted for sensing by exploiting changes in antenna loading, nonlinear element biasing, or temperature-dependent diode behaviour to infer parameters such as humidity, pressure, or liquid level. Ongoing research focuses on hybrid architectures that combine passive harmonic backscattering with solutions derived from conventional RFID systems, alongside improved antenna designs, fabrication methods, and signal processing techniques to enhance scalability, robustness, and interoperability.

Biography

I am a PhD student in the Radio Systems group at EEMCS. My current research focuses on the design of harmonic tags and radar systems, particularly for tracking invertebrates in nature. I received my joint Master's degree in Innovative Microwave Electronics and Optics from the University of Limoges (France), the University of Brescia (Italy), and the University of the Basque Country (Spain) in 2022.

Dr Deepak Mishra (UNSW)

Covert Wireless Sensing for Future Communication Systems

Abstract

Wireless sensing has rapidly evolved from a speculative concept to a practical capability influencing the design of next-generation communication systems. By analysing subtle variations in wireless propagation, particularly Channel State Information (CSI), AI-enabled systems can infer human presence, motion, object interactions, and other environmental changes without requiring cameras or wearables. These capabilities open exciting opportunities for smart infrastructure, human–machine interaction, and intelligent networked systems, but they also introduce emerging privacy and cybersecurity risks. This talk explores the growing field of covert wireless sensing, where ordinary ambient wireless signals can be repurposed to detect activities, track individuals, or sense objects without active user participation. It will present recent experimental results demonstrating how these systems can detect unauthorised persons, restricted objects, and suspicious behaviours. As wireless intelligence becomes increasingly embedded in future communication systems, understanding both its capabilities and risks is essential. This session provides a technical foundation on covert wireless sensing and outlines its implications for next-generation networks, security frameworks, and the broader wireless research community.

Biography

Deepak Mishra is a Senior Lecturer and Deputy Director of Postgraduate Academic Studies in the School of Electrical Engineering and Telecommunications at the University of New South Wales (UNSW), Sydney. He is also the Co-Founder and CTO of GinigAI Pty Ltd, a UNSW-based startup focused on Embedded Radio Intelligence for precision human and asset safety. He received his PhD in Electrical Engineering from the Indian Institute of Technology (IIT) Delhi in 2017.

Before joining UNSW, he was a Postdoctoral Researcher at Linköping University, Sweden, and has held visiting research positions at Northeastern University, the University of Rochester (USA), Huawei Technologies (France), Southwest Jiaotong University (China), and Queen's University Belfast (UK). He is a recipient of several competitive awards, including the ARC Discovery Early Career Researcher Award and IMB PhD Fellowship. His research interests include AI-enabled wireless sensing, covert and privacy-aware backscatter communication, massive MIMO, energy-harvesting communication networks, and physical-layer security for future wireless systems. He serves as an Associate Editor for multiple leading international journals and has received numerous Exemplary Reviewer and Editorial Awards for his contributions to the research community.

Tutorial

Delay-Doppler Domain Multicarrier Modulation for Future Communication and Sensing

Jinhong Yuan and Jun Tong

Abstract

Delay–Doppler (DD) domain multicarrier (MC) modulation (DDMC) has emerged as a promising technique for enabling both highly reliable communications and high-resolution sensing in high-mobility environments. This talk introduces a new orthogonal DD division multiplexing (ODDM) approach to DDMC, distinguished by its DD-domain orthogonal pulse (DDOP). We will examine how the pulse-train structure of the DDOP relates to pulse-Doppler radar and show how DDMC can substantially enhance the sensing capabilities of conventional radar systems. The talk will also highlight recent insights into other fundamental properties of DDMC, including its distinctive interaction with linear time-variant (LTV) channels. Finally, we will discuss how DDMC/ODDM can be incorporated into the integrated sensing and communications (ISAC) framework, and conclude with key research challenges and emerging opportunities in this area.

Jinhong Yuan received the B.E. and Ph.D. degrees in electronics engineering in 1991 and 1997, respectively. From 1997 to 1999, he was a Research Fellow with University of Sydney. In 2000, he joined the University of New South Wales, where he is currently Head of School. He has published two books, five book chapters, over 300 papers in telecommunications journals and conference proceedings, and 50 industrial reports. He is an IEEE Fellow. He served as the IEEE NSW Chapter Chair of Joint Communications/Signal Processions/Ocean Engineering Chapter during 2011-2014 and served as an Associate Editor for the IEEE Transactions on Communications during 2012-2017 and 2020-2025 and IEEE Transactions on Wireless Communications during 2018-2023. His current research interests include error control coding and information theory, communication theory, and wireless communications.

Jun Tong received the Ph.D. degree in electronic engineering from City University of Hong Kong in 2009. He was a research academic at the University of Newcastle from 2009 to 2011 and an Akademischer Rat at Paderborn University from 2011 to 2013. He is currently an Associate Professor with the School of Engineering, University of Wollongong, Australia. His research interests are in wireless communications, signal processing and their applications.

Poster Presentations

Note: Student authors are denoted by the symbol "🧑‍🎓" and are eligible for student awards.

POSTER 1. ISAC with Co-Prime Arrays: Virtual Aperture Sensing and Downlink Communication

Dr Jing Zhang, Huazhong University of Science and Technology

Abstract: Integrated sensing and communication (ISAC) provides a promising solution for communicating with intended users based on real-time sensing results according to the sensing result under predefined beam pattern constraints. However, practical antenna deployments for simultaneous sensing and communication remain challenging due to limited physical aperture size and a limited number of available radio-frequency (RF) chains. Meanwhile, resource allocation in a co-located antenna array is inherently difficult due to mutual interference among overlapping beampatterns. In this paper, we consider an ISAC system equipped with a sparse co-prime array (CPA) for sensing, while the remaining positions are occupied with antenna elements for communication. Through transmit vector optimization, the CPA beampattern is shaped to concentrate sensing power within the target angular sector and suppress sidelobes in other directions. The sensing precoder is designed based on a Cramér–Rao bound (CRB)-oriented metric that exploits the virtual array structure induced by the CPA. The communication precoder is jointly optimized to satisfy signal-to-interference-plus-noise ratio (SINR) and total power constraints. An alternating optimization (AO) algorithm is adopted to solve the formulated problem under the constraint of the minimum data rate for all Unmanned Aerial Vehicles (UAVs). Simulation results demonstrate that the proposed CPA-based ISAC design significantly reduces the sensing CRB while meeting the SINR demands of all UAVs, thereby achieving an effective tradeoff between sensing and communication performance.

POSTER 2. PAC Codes Meet CRC Polar Codes

Xinyi Gu, UNSW

Abstract: Cyclic redundancy check–aided polar (CRC-polar) codes are well known for their strong error-correction performance under successive cancellation list decoding and have been observed to significantly reduce the number of minimum-weight codewords (MWCs) compared to conventional polar codes. However, the underlying mechanisms responsible for this reduction, and how CRC constraints structurally suppress MWCs, have not been systematically analyzed. In this work, we study the formation of MWCs in CRC-polar codes and show that their performance advantage primarily arises from the interaction between CRC parity constraints and the generator matrix of polar codes, which effectively eliminates the number of MWCs.

Motivated by this observation, we propose a modified rate profile for polarization-adjusted convolutional (PAC) codes, termed profile-shifted PAC (PS-PAC) codes. By applying a fixed shift to the rate profile, PS-PAC codes enable high-index constraint-dependent bits through convolutional precoding, leading to a substantial reduction in the number of MWCs without requiring optimization for different code lengths or code rates. Numerical results demonstrate that PS-PAC codes consistently outperform CRC-polar codes across a wide range of parameters, achieving up to a 0.5 dB power gain for short block lengths.
Furthermore, inspired by the convolutional precoding of PAC codes, we enhance CRC-polar codes by continuously deploying parity-check constraints over frozen-bit positions, resulting in a new construction referred to as continuous CRC-Polar codes. This distributed masking of parity constraints further improves the performance of CRC-polar codes for medium-length blocks, yielding gains of up to 0.12 dB.

Overall, this work provides new insight into the structural origins of performance gains in CRC-polar and PAC-based codes and presents simple, low-complexity design approaches applicable across diverse code lengths and rates.

POSTER 3. A Game-Theoretic Communication Framework for Justifiable Trust: Modelling Strategic Interactions between Regulators, Manufacturers, and Multimedia Agents

Dr William Liu, Wuhan University of Communications

Abstract: As Artificial Intelligence (AI) shifts from passive instrumentation to active social agency , traditional regulatory frameworks struggle to ensure "justifiable trust"—trust that is evidentiary rather than merely perceived. This research proposes a novel paradigm shift by treating the socio-technical AI ecosystem as a multi-layered communication network. We model the interactions between three primary strategic actors: the AI Regulatory Agency (Auditor), the AI Manufactory (Creator), and Individual Multimedia Agents (Platforms like TikTok or WeChat).

We formulate a Bayesian Game of Incomplete Information to address the "law lag" and informational asymmetries inherent in rapid AI development. In this model, the Platform acts as a transmitter of "trust signals" to the user , while the Manufactory holds private information regarding the AI's true alignment and competence. We propose to introduce a communication-theoretic metric, Trust Capacity, defined as the maximum rate at which justifiable trust can be reliably transmitted over a noisy, potentially deceptive social field.

Our mathematical modelling is to explore the Nash Equilibria where the Regulator's auditing strategy, comprising sampling frequency and penalty weights, incentivizes the Manufactory and Platform to adopt a "truth-telling" state. By analyzing the Signal-to-Noise Ratio (SNR) of transparency reports and algorithmic disclosures , we identify the threshold at which a user's trust becomes "justifiable" rather than "misguided". This new work provides a rigorous foundation for AI governance that prioritizes user benefit through the lens of strategic communication and information integrity.

POSTER 4. Time Domain Zero-Padding (TZP) Affine Frequency Division Multiplexing and its Low-Complexity Equalization

Cheng Shen, UNSW 🧑‍🎓

Abstract: This work addresses the development of computationally efficient transmission and detection techniques for affine frequency division multiplexing (AFDM) operating over doubly selective channels. We introduce a time-domain zero-padding (TZP) AFDM frame structure that leads to a simplified time-domain input–output (IO) model without sacrificing spectral efficiency. Building on this model, a two-stage detection strategy is proposed. The first stage applies a low-complexity linear MMSE detector in the time domain to generate an initial estimate. In the second stage, a cross-domain iterative MMSE detector is designed, where statistical information from the initial detection is exploited, the time domain IO structure is leveraged to reduce complexity, and the DAFT domain symbol constraints are incorporated to improve reliability. Numerical results verify that the proposed TZP-AFDM framework and detection scheme consistently outperform existing solutions, offering improved error performance, higher spectral efficiency, and reduced computational cost.

POSTER 5. Fluid Antennas and Near-Field Channels

Isaac Bühler, Victoria University of Wellington 🧑‍🎓

Abstract: Fluid Antenna (FA) systems exploit spatial channel variations by allowing a single antenna to move within a finite region. While most existing analyses assume far-field (FF) propagation, this work investigates FA performance in near-field (NF) ray-based channels. Using a ray-based channel model and a Rayleigh fading approximation, we derive expressions for the channel correlation function and the variance of the channel derivative along the antenna trajectory. This variance governs key FA performance metrics, including the level crossing rate and the high-SNR probability.

We show that the derivative variance admits a clear geometric interpretation: it is the power-weighted variance of the projections of the directions of arrival onto the scan direction. In FF channels this quantity is spatially invariant, whereas in NF channels it depends on the antenna position. We extend our analysis to the non-uniform power (across the FA) NF model. Numerical results validate the analysis and demonstrate that although certain NF geometries can yield improved FA performance, these gains are highly scenario-dependent.

POSTER 6. Causal Conditional Directed Information in a Point Process Network

Dr Xinhui Rong, Prof. Girish Nair, University of Melbourne

Abstract: The causal conditional (CC) directed information (DI) can test the Granger causality for stochastic processes. However, for point process networks, the

CCDI has only been developed for a trivariate network. In this work, we develop the general multivariate CCDI under Kramer's framework by developing the CC likelihood, which is characterized by marginal intensity functions. We establish several Granger causality equivalences, unifying and generalizing existing results. Further, for Hawkes networks, we develop an estimation method of CCDI requiring only one point process trajectory, by developing an analytical formula for the marginal intensity functions, and an ergodic theorem for the CCDI.

POSTER 7. A Novel One-Tap Equalizer for Zero-Padded AFDM System over Doubly Selective Channels

Chenyang Zhang, UNSW 🎓

Abstract: Chirp-based modulation schemes, including affine frequency division multiplexing (AFDM) and delay–Doppler domain modulations such as OTFS and ODDM, have attracted growing interest for reliable communication over doubly selective channels in high-mobility environments. A key limitation of these schemes is inter-symbol interference (ISI) in the modulation domain, which typically necessitates complex equalization.

This poster presents a novel AFDM-based transmission scheme that enables one-tap equalization over doubly selective channels. The proposed approach selects appropriate AFDM parameters and introduces zero-padding in the affine domain at the transmitter, transforming the effective channel into a quasi-stationary affine-domain representation with slowly varying phase components. At the receiver, cyclically superimposed signal reconstruction further reshapes the effective channel matrix into a quasi-circulant matrix. Applying a discrete Fourier transform to the received affine domain symbols generates new frequency-of-affine (FoA) domain symbols, and these symbols can then be equalised using a simple one-tap equaliser. The proposed scheme extends the concept of one-tap equalization beyond conventional OFDM over frequency-selective channels to AFDM operating in doubly selective channels, significantly reducing receiver complexity and making the design well-suited for high-mobility communication scenarios.

POSTER 8. Loss of Subcarrier Orthogonality Caused by Doppler in OFDM

Hamish Shaw, UNSW

Abstract: This work addresses the loss of subcarrier orthogonality caused by Doppler frequency shifts in high-mobility orthogonal frequency-division multiplexing (OFDM) systems. In doubly selective channels, the Doppler-induced subcarrier shifts are non-uniform, and we derive a closed-form expression for the optimal frequency offset that maximises received subcarrier power while partially suppressing intercarrier interference (ICI). The offsets are obtained via Newton–Raphson iteration and used for demodulation through the non-uniform fast Fourier transform (NUFFT), which retains FFT-like $\mathcal{O}(M \log M)$ complexity. Simulation results show that, at 500 km/h, the NUFFT-based receiver provides a significant improvement for uncoded OFDM and low-density parity-check (LDPC) coded OFDM. For lower velocities of 250 km/h, we can still see measurable gains. Since only the sampling stage is modified, the method introduces no structural change to the OFDM transceiver and enables low-complexity single-tap equalisation to remain effective in high-mobility channels.

POSTER 9. New Tools for Tracking Small Invertebrates Using Harmonic Radar

Dr Graeme Woodward, University of Canterbury

Abstract:

We introduce two novel radar systems for tracking small invertebrates, such as insects, using a harmonic radar operating around 9GHz/18GHz. The first is a scanning radar that continuously measures the range and angle of tagged targets to study their movement patterns. The second is a handheld radar designed for fieldworkers to periodically re-locate tagged targets with visual and audio prompts. Preliminary field results show promising capabilities, with the scanning radar detecting tags up to 130 m, and sub- 1 m localisation accuracy (at 20–30 m range). The handheld radar could function effectively within 60 m under ideal conditions. However, challenges remain, such as the dependence on the tag orientation, occlusion by vegetation/leaf litter, affixing tags, and the influence of nearby objects (including the target body). Future work will address these issues, in addition to expanding system capabilities using mobile platforms and remote monitoring using cloud processing.

POSTER 10. Performance Analysis and Detection of CP-FSCM over Frequency Selective Channels

Tianhong Gu, UNSW

Abstract:

Scanning dual-mode X-band FMCW harmonic radar is a novel system design to radio localise insects attached to a passive harmonic tag. Experimental verifications showed that the system, when augmented with a single auxiliary transmitter, can range tags up to 130m when oriented broadside to the illuminators. However, due to the omnidirectional insect movements (particularly those flying), tags will often be oriented unfavourably. In this work, we analyse how unfavourable tag orientations affect the radar's localisation accuracy. Results show that an unfavourable tag orientation can degrade its localisation accuracy by more than an order. Also, by gradually increasing the number of auxiliary transmitters in our measurements, we experimentally verify the benefit of using multiple transmitters in boosting the system SNR, which was previously established using simulations. The results significantly improve our understanding of the system's performance in insect localising in real environments.

POSTER 11. Analysis of Insect Localisation Accuracy Measured with a Novel Scanning Dual-Mode FMCW Harmonic Radar

Dr Rifat Afroz, University of Canterbury

Abstract:

Scanning dual-mode X-band FMCW harmonic radar is a novel system design to radio localise insects attached to a passive harmonic tag. Experimental verifications showed that the system, when augmented with a single auxiliary transmitter, can range tags up to 130m when oriented broadside to the illuminators. However, due to the omnidirectional insect movements (particularly those flying), tags will often be oriented unfavourably. In this work, we analyse how unfavourable tag orientations affect the radar's localisation accuracy. Results show that an unfavourable tag orientation can degrade its localisation accuracy by more than an order. Also, by gradually increasing the number of auxiliary transmitters in our measurements, we experimentally verify the benefit of using multiple transmitters in boosting the system SNR, which was previously established using simulations. The results significantly improve our understanding of the system's performance in insect localising in real environments.

POSTER 12. When Random Access Meets the MIMO Downlink

*(*Subject to availability of presenter*)

Dr Saman Atapattu, RMIT University

Abstract: Future wireless systems increasingly operate under sporadic traffic and grant-free access, where the transmitter does not know a priori which users require service. In such regimes, user activity must be inferred from noisy uplink observations before downlink transmission, creating a fundamental cross-layer coupling between random access detection and multiuser MIMO information delivery under finite coherence. This talk presents an operational framework that links uplink activity inference to downlink mutual information by accounting for information that is delivered, misdirected to inactive users, or lost due to missed detections. The resulting utility formulation captures the net information delivered per coherence block and enables joint design of sensing and transmission parameters. The analysis reveals intrinsic tradeoffs between access reliability, coherence allocation, and downlink multiplexing efficiency in modern grant-free multiuser MIMO systems.

Thanks to Our Committees

General Chair
Dr. Graeme Woodward

Co-Chairs
A/Prof Barry Wu
Mrs Mel Lloyd

Publicity Chairs
Dr William Liu
Mrs Mel Lloyd

Finance Chairs
Ms Annie McEwin

Sponsorship Chairs
Mr. Fred Samandari

Website Team
Isaac Buhler
Jaden Chen

Steering Committee
Iain Collings
Jamie Evans
Sarah Johnson
Lawrence Ong
M. Shirvanimoghaddam
Parastoo Sadeghi
Graeme Woodward
Jinhong Yuan
Rajitha Senanayake

Technical Program Committee
Adriel Kind
Akram Shafie
Pete Smith
Himal A. Suraweera

Volunteer Team
Sujan Warnakulasooriya
Adam Smith
Arati Kale
Rifat Afroz