

# Singapore Workshop on Antennas

02 – 03 November 2026, Singapore

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## Keynote Speakers



Christophe Fumeaux  
The University of  
Queensland



Jiro Hirokawa  
Institute of Science Tokyo



Nader Behdad  
University of Wisconsin-  
Madison



Rui Zhang  
National University of  
Singapore

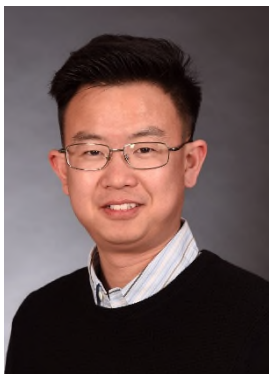


Erni Zhu  
Huawei Technologies



Zhinong Ying  
University of Electronic  
Science and Technology of  
China

## Distinguished Lecturers



Bing Zhang  
Sichuan University



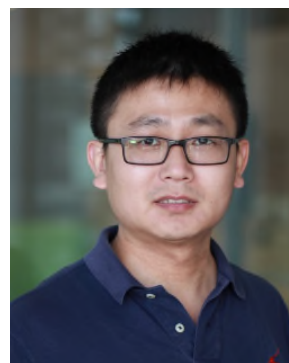
Gangil Byun  
Ulsan National Institute of  
Science and Technology



Guomin Yang  
Fudan University



Wei Fan  
Southeast University

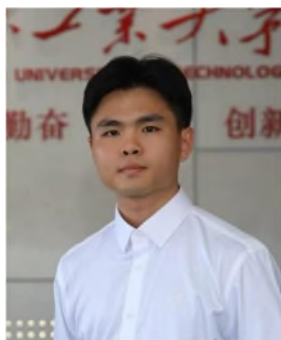


Yang Yang  
The University of Sydney

## Rising Stars



Chao Wang  
Anhui University



Hongxin Zhou  
Guangdong University of  
Technology



Weixu Yang  
Nanjing University of  
Aeronautics and  
Astronautics



Xihui Teng  
King Abdullah University of Science and  
Technology



Yaowei Hou  
City University of Hong Kong

**Program on 2 November 2026 (Monday), Venue: Siloso 1**

|          |                                                                                                                                                                                                                                                  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8:30 am  | Registration                                                                                                                                                                                                                                     |
| 8:50 am  | Welcome speech (by General Chair Yueping Zhang)                                                                                                                                                                                                  |
| 9:00 am  | Keynote Speech<br>From Modes to Beams: Harnessing Multi-Port Antennas for Hemispherical Beamforming<br>Christophe Fumeaux, The University of Queensland<br>(Chaired by Yueping Zhang, Nanyang Technological University)                          |
| 9:50 am  | Coffee Break                                                                                                                                                                                                                                     |
| 10:20 am | Keynote Speech<br>Waveguide-Bend Mode Conversion for Omnidirectional Antennas<br>Jiro Hirokawa, Institute of Science Tokyo<br>(Chaired by Christophe Fumeaux, The University of Queensland)                                                      |
| 11:10 am | Keynote Speech<br>Beyond the Bandwidth-Efficiency Limits of Electrically Small Antennas: Non-LTI Transmitters for HF Communications<br>Nader Behdad, University of Wisconsin-Madison<br>(Chaired by Rui Zhang, National University of Singapore) |
| 12:00 pm | Lunch at Silver Shell Cafe                                                                                                                                                                                                                       |
| 1:20 pm  | Keynote Speech<br>Exploiting 6D Movable Antenna for Enhanced Wireless Communication and Sensing<br>Rui Zhang, National University of Singapore<br>(Chaired by Nader Behdad, University of Wisconsin-Madison)                                     |
| 2:10 pm  | Keynote Speech<br>Evolution and Challenges of Wireless Communication Systems in the AI Era<br>Erni Zhu, Huawei Technologies<br>(Chaired by Zhinong Ying, University of Electronic Science and Technology of China)                               |
| 3:00 pm  | Coffee Break                                                                                                                                                                                                                                     |
| 3:30 pm  | Distinguished Lecture<br>Exploring the Potential of 3D Printing Technologies for Antenna Design and Fabrication - Challenges and Opportunities<br>Bing Zhang, Sichuan University<br>(Chaired by Yang Yang, The University of Sydney)             |
| 4:15 pm  | Distinguished Lecture<br>Toward Ultracompact Holographic Metasurface Antennas for LEO CubeSat Communications<br>Gangil Byun, Ulsan National Institute of Science and Technology<br>(Chaired by Yang Yang, The University of Sydney)              |
| 6:00 pm  | To board the bus for Welcome Reception at RedDot BrewHouse @ Dempsey Hill, 25A Dempsey Rd, #01-01, Singapore 247691.<br>(Attendees to wait at the hotel lobby by 6:00pm for the bus departing to the venue above)                                |

**Program on 3 November 2026 (Tuesday), Venue: Siloso 1**

|          |                                                                                                                                                                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9:10 am  | Keynote Speech<br>Advancing Distributed Antenna System: From EM near field features to Intelligent Electromagnetic Space<br>Zhinong Ying, University of Electronic Science and Technology of China<br>(Chaired by Wei Fan, Southeast University)                              |
| 10:00 am | Coffee Break                                                                                                                                                                                                                                                                  |
| 10:30 am | Distinguished Lecture<br>Research Progress of Magnetoelectric Antennas and Optimized Design of Novel SAW Magnetoelectric Antennas<br>Guomin Yang, Fudan University<br>(Chaired by Gangil Byun, Ulsan National Institute of Science and Technology)                            |
| 11:15 am | Distinguished Lecture<br>Testing for Advanced Phased Array Systems, Challenges and Recent Advances<br>Wei Fan, Southeast University<br>(Chaired by Gangil Byun, Ulsan National Institute of Science and Technology)                                                           |
| 12:00 pm | Lunch at Silver Shell Cafe                                                                                                                                                                                                                                                    |
| 1:15 pm  | Distinguished Lecture<br>Emerging Advanced Manufacturing Techniques for 3D/4D Antennas<br>Yang Yang, The University of Sydney<br>(Chaired by Bing Zhang, Sichuan University)                                                                                                  |
| 2:00 pm  | Rising Star Talk<br>A Design Strategy for Broadband, Wide-Angle Circularly Polarized Beam-Scanning Antenna Arrays with Low Scan Loss<br>Chao Wang, Anhui University<br>(Chaired by Bing Zhang, Sichuan University)                                                            |
| 2:30 pm  | Rising Star Talk<br>Coupled-Resonator Array Antennas for Frequency-Diverse Sensing<br>Hongxin Zhou, Guangdong University of Technology<br>(Chaired by Bing Zhang, Sichuan University)                                                                                         |
| 3:00 pm  | Coffee Break                                                                                                                                                                                                                                                                  |
| 3:30 pm  | Rising Star Talk<br>Passive Metasurfaces for Antenna Applications: From Static Multifunctionality to Dynamic Reconfigurability<br>Weixu Yang, Nanjing University of Aeronautics and Astronautics<br>(Chaired by Guomin Yang, Fudan University)                                |
| 4:00 pm  | Rising Star Talk<br>One Framework, Different Dielectrics: A Generalized Design Method for Periodic Leaky-Wave Endfire Antennas with High Gain-to-Length Ratio<br>Xihui Teng, King Abdullah University of Science and Technology<br>(Chaired by Guomin Yang, Fudan University) |
| 4:30 pm  | Rising Star Talk<br>History, Research Progress and Outlook of Laminated Resonator Antennas<br>Yaowei Hou, City University of Hong Kong<br>(Chaired by Guomin Yang, Fudan University)                                                                                          |
| 6:30 pm  | Banquet at Siloso 3<br>(Certificate presentation, Eng Leong Tan, Nanyang Technological University)                                                                                                                                                                            |

## Keynote Speech

### From Modes to Beams: Harnessing Multi-Port Antennas for Hemispherical Beamforming

Christophe Fumeaux, The University of Queensland

#### Abstract:

The growing demands of modern wireless communications systems are creating new challenges for antenna design. Antenna platforms of increasing complexity, capable of providing multiple dynamically accessible functionalities, are becoming essential to enhance capacity and support the diverse requirements of communications and sensing applications. This presentation focuses on the concept of multi-port, multi-mode antennas, in which multiple independent radiating modes are excited within the same frequency band and shared physical volume. By tightly integrating these uncorrelated modes into a compact structure, such antennas can significantly enhance link capacity and agility through pattern diversity and Multiple-Input Multiple-Output (MIMO) operation.

The talk will first discuss techniques for efficiently realizing multiple independent modes within a limited volume. It will then show how multi-port antennas, combined with global optimization algorithms, can be used to achieve advanced beamforming by exploiting a large number of co-located radiating modes. This approach enables consistent full-hemisphere beam steering and null placement for arbitrary polarization states. The resulting paradigm opens new opportunities for future communication and distributed sensing systems.

## Keynote Speech

### Waveguide-Bend Mode Conversion for Omnidirectional Antennas

Jiro Hirokawa, Institute of Science Tokyo

#### Abstract:

This keynote reviews mode conversion in waveguide bends from a common perspective, with particular emphasis on the principles used to control modal behavior in circular and rectangular waveguides. The discussion focuses on how a dominant mode can be coupled to a selected higher-order mode and how the cross-sectional geometry, bend angle, and radius of curvature determine the resulting coupling. Practical design issues are also considered, including the achievement of efficient conversion around the design frequency, suppression of unwanted higher-order modes, and realization of a useful operating bandwidth.

The first case concerns vertical polarization. A circular-waveguide bend is used to convert the TE<sub>11</sub> mode into the axially symmetric TM<sub>01</sub> mode. Two identical bends with opposite bending directions are combined to form a symmetric converter that permits bottom feeding while retaining broadband conversion characteristics. Tapered waveguide sections are incorporated to provide the required dimensional transitions and to control modal reflection and transmission during the conversion process.

The second case addresses horizontal polarization. Here, a rectangular-waveguide bend is designed to convert the dominant TE<sub>10</sub> mode into the higher-order TE<sub>20</sub> mode. The converted field is then transformed into the circular-waveguide TE<sub>01</sub> mode by appropriately varying the waveguide cross section. The influence of waveguide dimensional ratios and the length of inserted straight sections on mode separation and operating bandwidth is examined.

The final case considers the simultaneous treatment of two orthogonal polarizations. To accommodate the two different conversion processes within a common structure, a super-elliptical waveguide cross section is introduced as an intermediate geometry between circular and rectangular waveguides. By adjusting its shape, the cutoff-frequency separation and bend-induced coupling of the polarization-dependent modes can be controlled. Conditions for realizing both mode conversions in a single bent-waveguide structure are discussed. A multistage tapered waveguide is further employed to make the cross-sectional transformation gradual, thereby maintaining high conversion efficiency while suppressing unwanted modal excitation for both polarizations.

Taken together, these three cases provide a unified view of mode conversion based on waveguide bends and cross-sectional shaping, and clarify a systematic approach to multimode control in high-frequency waveguide structures.

## Keynote Speech

### Beyond the Bandwidth-Efficiency Limits of Electrically Small Antennas: Non-LTI Transmitters for HF Communications

Nader Behdad, University of Wisconsin-Madison

#### Abstract:

High-frequency (HF) communications are critical for beyond-line-of-sight (BLOS) and highly resilient tactical links. However, because of the long wavelengths in the HF band, practical platform integration requires electrically small antennas (ESAs). Traditional passive, linear-time-invariant (LTI) ESAs are inherently bound by fundamental physical limits (such as the Chu limit), resulting in high quality factors and steep bandwidth-efficiency trade-offs. This talk presents the design, system integration, and over-the-air (OTA) measurement of a non-linear-time-invariant (non-LTI) ESA that effectively circumvents these traditional passive limits. By intentionally violating the passive LTI assumptions used to derive these fundamental bounds, our system achieves bandwidth-efficiency products that significantly exceed those of conventional antennas. Specifically, we introduce an integrated non-LTI ESA architecture that combines an electrically small radiator (a 1-meter monopole) integrated with a class-E switch-mode power amplifier utilizing a GaN transistor switch. Instead of relying on a traditional transmitter chain and impedance-matching networks, our system consolidates RF carrier generation, power amplification, and digital modulation directly at the antenna stage. Modulation of the radiated waveform is achieved by applying pre-defined, pulse-width-modulated gate-driving signals (GDS) to the switch-mode circuit, allowing precise control of amplitude, phase, and frequency.

During the presentation, we will detail recent outdoor OTA measurement campaigns conducted at 10.665 MHz. We will demonstrate the successful transmission and demodulation of wideband digitally modulated waveforms—including OOK, BPSK, QPSK, and 8PSK—at symbol rates of up to 3 MS/s and radiated power levels of up to 9.1 W using this non-LTI ESA, achieving  $16\times$ – $36\times$  (12.0–15.6 dB) bandwidth-efficiency product improvements over competing LTI ESAs. To quantify the capability leap, we will also present direct comparative data against a conventional LTI ESA transmitter utilizing the same radiating element and a commercial power amplifier. Ultimately, this talk will highlight how this non-LTI ESA architecture can drastically improve the size, weight, power, and cost (SWaP-C) as well as the performance of next-generation, bandwidth-hungry HF systems. While defense applications such as resilient, beyond-line-of-sight tactical links are a natural fit, the same approach benefits any platform where antenna size is constrained and bandwidth is at a premium, including maritime and aeronautical communications, skywave links serving remote and polar regions, and disaster-response and emergency backup communications. More broadly, we will make the case that relaxing the LTI assumption opens a rich and largely unexplored design space for electrically small antennas across the RF spectrum.

## Keynote Speech

### Exploiting 6D Movable Antenna for Enhanced Wireless Communication and Sensing

Rui Zhang, National University of Singapore

#### Abstract:

Six-dimensional movable antenna (6DMA) has been recently recognized as a promising technology for enhancing wireless network performance through adjusting antenna's position and/or orientation at the transceiver. In this talk, we provide a comprehensive overview of MA with flexible antenna positioning, including its historical development, practical architectures and implementation methods, contemporary applications in wireless networks, as well as mathematical models, design issues and promising approaches to solve them. Various performance advantages of MA over conventional fixed-position antenna is demonstrated, in terms of spatial diversity/multiplexing, interference mitigation, flexible beamforming, as well as wireless sensing. In particular, a general 6DMA framework is introduced, which includes existing antenna/array positioning (with fixed orientation) or rotation (with fixed position) models as special cases. Finally, we shed light on research directions worthy of investigation in future work to unleash the full potential of MA/6DMA for wireless networks.

## Keynote Speech

### Evolution and Challenges of Wireless Communication Systems in the AI Era

Erni Zhu, Huawei Technologies

#### Abstract:

The dawn of the artificial intelligence (AI) era is radically reshaping wireless communication paradigms, driving unprecedented shifts in business requirements and system architectures. Modern AI-driven applications demand extreme metrics, including massive uplink throughput, ubiquitous high-speed coverage, new spectrum utilization, and ultra-massive MIMO scaling up to 256TR. These requirements impose stringent constraints on conventional radio frequency (RF) front-ends and antenna array designs. To bridge this gap, this presentation explores the emerging frontier of “AI for RF and Antenna”, identifying key innovation spaces, opportunities, and technical requirements at the physical and electromagnetic hardware layers. Using concrete industrial examples, we evaluate the tangible value AI delivers in maximizing RF efficiency and dynamic beamforming, balanced against the rigid constraints of model complexity, real-time latency, and hardware boundaries. Finally, we synthesize the open questions facing the wireless sector, offering a structured breakdown of major AI for RF and Antenna challenges that the industry must collaboratively address to unlock next-generation native-AI networks.

## Keynote Speech

### Advancing Distributed Antenna System: From EM near field features to Intelligent Electromagnetic Space

Zhinong Ying, University of Electronic Science and Technology of China

#### Abstract:

6G distributed multiple-input multiple-output (D-MIMO) antenna systems represent a revolutionary technology that exploits spatially distributed nodes to enhance spectral efficiency, coverage, and energy efficiency. A defining enabler of this paradigm shift is the near-field operation regime, which unlocks unprecedented spatial degrees of freedom. These near-field capabilities can be realized through a diverse ecosystem of distributed antenna technologies, including D-MIMO nodes, radio strips and weaves, reconfigurable intelligent surfaces (RIS), intelligent wireless transparent relays (IWTR), Moveable antennas (MA), reconfigurable antennas, meta-material and other programmable electromagnetic hardware.

Despite this transformative potential, many critical obstacles remain to be overcome, spanning signal amplification and forwarding, synchronization, fronthaul/backhaul requirements, and scalability, alongside fundamental research topics such as near-field beamforming, spatial multiplexing, ISAC, channel modeling, antenna innovation, intelligent algorithms, and system architecture. Furthermore, future networks are poised to shift toward Hierarchical Autonomy and Intent-driven paradigms, giving rise to the concept of an intelligent EM space—built upon programmable hardware such as IWTRs, distributed MIMO nodes, and RIS—that continuously maintains the electromagnetic state (EM State) and enables autonomous local optimization.

This talk introduces the antenna theory underlying the near-field characteristics of radiators and scatterers, examines the properties of distributed antenna systems, and explores methods for extending the effective near-field region. It analyzes and compares the advantages and limitations of various electromagnetic modeling approaches, reviews recent advances in near-field point focusing, degrees of freedom, spatial multiplexing, and electromagnetic information theory, and discusses the influence of different array topologies on near-field characteristics—supported by selected measurement results and the design of various distributed antennas. Building on these foundations, the talk further dissects the building blocks of the intelligent EM space, including D-MIMO nodes, RIS, IWTR, MA, and reconfigurable antennas, and discusses the remain technical challenges. Finally, it predicts the future trend of AI-driven evolution from node-connectivity management toward intelligent EM space management.

## Distinguished Lecture

### Exploring the Potential of 3D Printing Technologies for Antenna Design and Fabrication - Challenges and Opportunities

Bing Zhang, Sichuan University

#### Abstract:

The 3D printing technology, as a representative of additive manufacturing technology, has shown considerable application prospects and enormous development potential in various fields. Compared with traditional subtractive manufacturing, 3D printing as an additive manufacturing technology has unique advantages, such as a short turn-around cycle, less material waste, and ease of fabricating complex structures. The advantage of 3D printing gives antenna scientists and designers extra freedom to design and fabricate something that has never been seen before. The wide selection of materials in 3D printing makes it easy to manipulate electromagnetic (EM) waves in a 3D-printed antenna by the combination of different material characteristics. However, current research on 3D-printed antennas focuses on using “new” fabrication technology to implement “old” designs. The capability of 3D printing technology to fabricate complex structures has not been well explored. Moreover, the undesirable surface roughness and dimensional tolerance of 3D-printed devices hinder their widespread applications. This talk focuses on the application of 3D printing technology in antennas and microwave devices fabrication, tracing the birth and evolution of 3D printing technology, classifying 3D printing technologies according to different materials and processes, reviewing representative 3D printed antennas and microwave devices, and envisaging the application of 3D printing technology in the field of EM engineering.

## Distinguished Lecture

### Toward Ultracompact Holographic Metasurface Antennas for LEO CubeSat Communications

Gangil Byun, Ulsan National Institute of Science and Technology

#### Abstract:

The rapid growth of low-Earth-orbit CubeSat missions is creating strong demand for antennas that combine high gain, high efficiency, and circular polarization within a severely constrained payload volume. Holographic metasurface antennas offer a promising route toward this goal through their low-profile form factor, surface-integrated feeding, and flexible control of aperture fields. However, maintaining efficient radiation becomes increasingly difficult as the electrical aperture is reduced, since guided power may reach the antenna boundary before being fully converted into radiation.

This talk explores an approach to ultracompact holographic metasurface antennas based on the joint control of surface-wave propagation and radiation leakage. An electromagnetic bandgap structure is incorporated to tailor the dispersion characteristics of the guided mode, while multilayer impedance modulation strengthens coupling to the desired radiating mode and supports circular polarization. The underlying tradeoff between efficiency and size, antenna synthesis procedure, and practical multilayer implementation will be discussed. A fabricated antenna prototype is presented as a case study, with simulated and measured results used to examine impedance matching, polarization, gain, and radiation efficiency. The results demonstrate the potential of dispersion-engineered holographic antennas as compact, high-performance solutions for CubeSat communication payloads and other size-constrained space platforms.

Distinguished Lecture

## Research Progress of Magnetoelectric Antennas and Optimized Design of Novel SAW Magnetoelectric Antennas

Guomin Yang, Fudan University

### Abstract:

Magnetoelectric (ME) antennas are a new class of ultracompact antennas developed based on the magnetoelectric coupling effect. Different from conventional antennas that radiate via electromagnetic resonance, they rely on multi-field electro-mechano-magnetic coupling to realize energy conversion and electromagnetic radiation. Such antennas exhibit prominent technical advantages in low-frequency miniaturization, on-chip integration, and low-profile radio-frequency devices. This report first reviews the fundamental operating principle of general ME antennas. Subsequently, the research progress of ME antennas is systematically summarized, including achievements of mainstream configurations such as bulk and thin-film ME antennas. Common technical bottlenecks are also discussed, including insufficient coupling efficiency, high loss, limited bandwidth, and challenging fabrication integration. To address the drawbacks of state-of-the-art technologies, our group has carried out innovative research on surface acoustic wave (SAW) ME antennas and developed distinctive structural designs, which offering new feasible strategies for the design and optimization of high-performance miniature SAW ME antennas.

Distinguished Lecture

Testing for Advanced Phased Array Systems, Challenges and Recent Advances

Wei Fan, Southeast University

Abstract:

Advanced phased array technologies are evolving toward low cost, high integration, high operating frequencies, multi-beam capability, wide beam steering range, and large-aperture antenna arrays, alongside distributed array configurations for emerging 6G communication, non-terrestrial network (NTN), and radar applications. These rapid technological advances have brought increasingly stringent requirements for phased array testing. Practical testing faces multiple critical challenges, including insufficient phase measurement information, compact testing distances constrained by cost budgets, non-ideal factory testing environments, high demands on testing efficiency, and strong industrial requirements for cost reduction. This talk will systematically elaborate on the key testing challenges faced by advanced phased array systems. Furthermore, it will present the latest research progress and promising technical solutions to tackle the aforementioned challenges.

## Distinguished Lecture

### Emerging Advanced Manufacturing Techniques for 3D/4D Antennas

Yang Yang, The University of Sydney

#### Abstract:

Cutting-edge additive manufacturing technologies will enable three-dimensional (3D) radio frequency and millimetre-wave electronics with exceptional performance for emerging intelligent and immersive technologies, including 5G/6G communications, terahertz sensing, microwave biomedical imaging, wearable and implantable sensors, and non-invasive health monitoring. These advances will establish a versatile manufacturing direction that delivers immediate impact across biomedical engineering, healthcare, defence, space, and telecommunications industries. This talk will present recent advances in additive manufacturing technologies and their transformative applications in antenna design. Particular emphasis will be placed on conductive and dielectric multimaterial 3D-printed antennas, as well as four-dimensional (4D) shape-reconfigurable antennas, where the fourth dimension “time” enables antennas to dynamically alter their geometry and electromagnetic performance in response to external stimuli. Additionally, applying spatiotemporal modulation to CRLH LWAs can generate harmonic waves and enhance physical layer security, promoting safer wireless communication.

Rising Star Talk

## A Design Strategy for Broadband, Wide-Angle Circularly Polarized Beam-Scanning Antenna Arrays with Low Scan Loss

Chao Wang, Anhui University

### Abstract:

Circularly polarized (CP) antennas are widely used in satellite communications due to their ability to suppress multipath interference and prevent polarization mismatch. With advancements in wireless communication technology, the demand for CP antennas with high gain, wide-angle scanning, broad bandwidth, low cost, and simple structure is increasing. However, achieving CP waves requires the horizontal polarization (HP) and vertical polarization (VP) components to maintain orthogonality and a  $90^\circ$  phase difference, ensuring an axial ratio (AR) less than 3 dB. As the scanning angle increases and the frequency deviates from the center frequency, the discrepancy between HP and VP grows, resulting in significant AR degradation. Consequently, achieving wide-angle CP beam scanning over a broad bandwidth becomes inherently challenging. Although phase-compensation techniques, such as sequential rotation or the quadrature excitation of two linearly polarized antennas, can enable broadband CP beam scanning, they increase system complexity and cost. We propose a strategy that overcomes the conventional trade-off between broad bandwidth and wide-angle scanning in CP antenna design without requiring additional phase compensation. It therefore provides a low-cost and flexible solution for broadband, wide-angle CP scanning arrays, with considerable potential for practical applications.

Rising Star Talk

## Coupled-Resonator Array Antennas for Frequency-Diverse Sensing

Hongxin Zhou, Guangdong University of Technology

### Abstract:

Coupled-resonator array antennas exploit the strong phase dispersion of coupled resonator networks to achieve beam steering with extremely high scanning rates within a narrow operational bandwidth. Unlike conventional leaky-wave antennas relying on traveling-wave phase accumulation, these arrays employ controlled coupling topologies to produce sharp phase variations across a compact aperture, enabling continuous broadside scanning with high radiation efficiency and planar compatibility. This inherent frequency-dependent beam diversity makes them naturally suited for frequency-diverse imaging and sensing, where spatial information is encoded in the spectral domain without mechanical scanning or phased-array hardware. The high scanning rate allows sufficient spatial diversity to be generated within a minimal frequency band, reducing spectrum occupation and front-end bandwidth requirements. This talk provides an overview of the operating principles, design methodologies, and emerging applications of coupled-resonator array antennas in the context of frequency-diverse sensing.

## Rising Star Talk

### Passive Metasurfaces for Antenna Applications: From Static Multifunctionality to Dynamic Reconfigurability

Weixu Yang, Nanjing University of Aeronautics and Astronautics

#### Abstract:

Electromagnetic metasurfaces enable subwavelength control over the amplitude, phase, and polarization of electromagnetic waves, making them one of the promising ways to advance next-generation antenna technology. Compared with active-component-loaded designs such as those employing PIN diodes, passive metasurfaces offer a compelling route to multifunctional and reconfigurable performance, with the advantages of low power consumption, low cost, and favorable scalability to high frequencies. This talk presents recent advances in the evolution of passive metasurfaces, progressing from static multifunctional architectures, including full-space chiral metasurfaces for bidirectional transmit-reflect-array antennas, spin-decoupled anisotropic metasurfaces for low-sidelobe dual-circularly-polarized transmitarrays, and direction-duplex Janus metasurfaces for asymmetric beam shaping and holography, toward dynamically reconfigurable architectures based on twisted chiral metasurfaces, a promising passive strategy for achieving dynamic electromagnetic functionality. These developments underscore the important role of multifunctional and reconfigurable metasurfaces in satellite communications and next-generation wireless systems.

## Rising Star Talk

### One Framework, Different Dielectrics: A Generalized Design Method for Periodic Leaky-Wave Endfire Antennas with High Gain-to-Length Ratio

Xihui Teng, King Abdullah University of Science and Technology

#### Abstract:

Periodic leaky-wave endfire antennas are attractive for wireless communication, radar, and sensing applications because they can provide high gain with a compact longitudinal aperture. However, conventional designs often exhibit a limited gain-to-length ratio and strong dependence on specific dielectric environments. This talk presents a generalized design framework and method for compact periodic leaky-wave endfire antennas with high gain and high gain-to-length ratio across arbitrary dielectric constants. The proposed framework establishes three operating regimes according to the substrate permittivity. For high-permittivity substrates, a single-unit alternated configuration is employed to realize endfire radiation using the  $-1$ st spatial harmonic. For low-permittivity substrates, a multi-unit alternated configuration combined with subarray-level beamforming is introduced to suppress undesired higher-order spatial-harmonic radiation while maintaining high-gain endfire performance. For the air-based case, a zero-unit alternated configuration is adopted to support stable fundamental-mode endfire radiation. Representative designs under different dielectric conditions are presented to illustrate and validate the proposed methodology. The results demonstrate that periodic leaky-wave endfire antennas with high gain-to-length ratio can be systematically realized across a wide range of dielectric environments without fundamentally changing the overall array topology, providing a unified approach to compact, high-performance endfire antenna design.

## Rising Star Talk

### History, Research Progress and Outlook of Laminated Resonator Antennas

Yaowei Hou, City University of Hong Kong

#### Abstract:

Laminated resonator antenna (LRA), also known as substrate integrated cavity antenna (SICA), was originally introduced in 1999 in LTCC process for 77 GHz short-range automotive radar applications. LRA belongs to three-dimensional (3D) resonant integrated antenna, which is constructed by a metallic-via fence, an embedded metallic floor, and a top open aperture. Featuring simple structure, easy fabrication, high radiation efficiency, and inherent ability of surface-wave suppression, LRA has been proved as a promising candidate for millimeter-wave antenna-in-package (AiP) applications. This talk will retrospect the history and development of LRA first. Regarding the issues of this antenna type, the established theoretical model of LRA will be introduced. Besides, differential dual and circularly polarized (CP) LRA designs in PCB process will be presented. Then, the self-decoupling technique of dual CP co-aperture LRA for 24 GHz in-band full-duplex radar and miniaturization technique of 60 GHz LRA for phased array in LTCC process will be discussed. Finally, the outlook on the research of LRAs will be given.