

The *ITU Journal on Future and Evolving Technologies (ITU J-FET)* is an international journal providing complete coverage of all communications and networking paradigms, free of charge for both readers and authors. The ITU Journal considers yet-to-be-published papers addressing fundamental and applied research. It shares new techniques and concepts, analyses and tutorials, and learnings from experiments and physical and simulated testbeds. It also discusses the implications of the latest research results for policy and regulation, legal frameworks, and the economy and society. This publication builds bridges between disciplines, connects theory with application, and stimulates international dialogue. Its interdisciplinary approach reflects ITU's comprehensive field of interest and explores the convergence of ICT with other disciplines. The ITU Journal welcomes submissions at any time, on any topic within its scope.



Special issue on

## **Intelligent surfaces and their applications towards wide-scale deployment**

### **Call for papers**

Many innovative applications which rely on the control of the propagation of wireless signals in a 3D space have appeared in the literature, including in some cases pilot studies and experimental evaluations. The wide-ranging applications are enabled by engineered functionalities including electromagnetic invisibility, total radiation absorption, filtering and steering of impinging waves, as well as ultra-efficient, miniaturized antennas for sensors and implantable communication devices. These novel applications are normally realized by intelligent surfaces, which have become known under different nomenclature, including intelligent walls, large intelligent surfaces, intelligent reflecting surfaces, reconfigurable intelligent surfaces, and hypersurfaces, with some having the same meaning and others having subtle differences. Metasurfaces, as well as conceptually related technologies, such as phased antenna arrays and reflectarrays are commonly used; these material types comprise a set of controllably radiating elements arranged over a 2D layout, with each technology offering a range of supported functions and efficiency degrees.

Programmable wireless environments and smart radio environments have been widely socialized in the communications field, addressing diverse topics such as the control and optimization of the wireless propagation environment, mitigation of pathloss, multipath fading, Doppler effects, spectrum sensing, security and experimental implementation aspects. Moreover, the intelligent surface technology is currently studied from the aspect of integration into other real-world systems.

However, to realize diverse intelligent surfaces supported by applications in widely deployed systems, a comprehensive treatment of intelligent surfaces covering all system aspects, such as an end-to-end system model, a model of the environment, the constituent hardware and software, the control approaches and protocols, the deployment economics, as well as the theoretical foundations end-to-end still remain largely unanswered.

This special issue welcomes studies on **all aspects of intelligent metasurfaces**, from electromagnetic designs and electronics of metasurfaces and related manufacturing processes, to system integration and high-level control approaches, and 5G/6G wireless channel engineering applications. Works emphasizing on the end-to-end behavior of systems incorporating metasurfaces are of particular interest to the special issue.

## Suggested topics

### Physical-layer studies

- Electromagnetic designs and analysis of metasurfaces, from GHz to THz
- Electronic control of metasurfaces (circuits, energy efficiency, fault-tolerance)
- Metasurface manufacturing and assembly processes (from classic PCBs to emerging 3D printing techniques)

### Network-layer studies

- Control protocols and software for programmable metasurfaces
- Interface design for integrating metasurfaces to existing systems and networks (e.g., SDN)
- Resource modeling of metasurfaces and resource slicing algorithms

### Application-layer studies

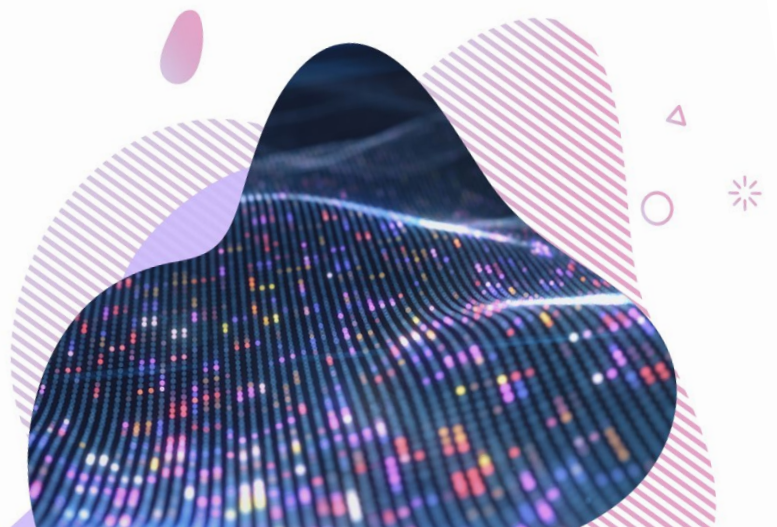
- Wireless channel engineering with metasurfaces
- Device localization with metasurfaces
- Metasurface-assisted ambient backscattering

### Verticals (any layer or cross-layer)

- Combining metasurfaces and artificial Intelligent/neural Networks
- Security at large (secure metasurface control hardware, secure control protocols and engineering secure wireless channels)
- Optimization at large (analytical or heuristic-driven)
- Use cases, test beds and experimentation
- System-wide architecture approaches
- Deployment techniques for metasurfaces
- System scalability and cost studies (including capital and operational expense analysis)
- Open challenges at large
- Extensions to mechanical and acoustic metasurfaces

## Keywords

Intelligent surfaces, metasurfaces, smart radio environments, intelligent metasurfaces, design, manufacturing, optimization, machine learning, theoretical foundations, resource modeling, resource orchestration, networking, protocols, SDN, 5G/6G, deployment, security, applications, scalability, cost analysis, system design, challenges



### **Deadlines extended**

Paper submission: **15 July 2022**

Paper acceptance notification: 4 October 2022

Camera-ready paper submission: 5 December 2022

Best paper award notification: 31 January 2023

### **Paper submission**

This special issue calls for original scientific papers. Submitted papers should not be under consideration for publication elsewhere.

Submissions must be made electronically using EDAS: Editor's Assistant at:

<https://edas.info/N29198>. Templates and

guidelines can be found at:

<https://www.itu.int/en/journal/j-fet/Pages/submission-guidelines.aspx>

### **Best paper award**

The authors of the three best papers, as judged by the Editorial Board of this special issue, will be awarded and permanently mentioned at the special issue's homepage, as well as publicly announced via the ITU social media.

### **Publication**

As soon as they get accepted, papers will be continuously published on the ITU digital library. They will then be bundled into the special issue digital publication.

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