

SPECIAL ISSUE

SPECIAL ISSUE ON RECONFIGURABLE INTELLIGENT SURFACES

Edited by M. Di Renzo and S. Tretyakov

1164 Communication Models for Reconfigurable Intelligent Surfaces: From Surface Electromagnetics to Wireless Networks Optimization

By M. Di Renzo, F. H. Danufane, and S. Tretyakov

| INVITED PAPER | This article provides an overview of communication models that are most often employed in wireless communications for analyzing and optimizing reconfigurable intelligent surfaces.

1210 Wavefront Shaping for Wireless Communications in Complex Media: From Time Reversal to Reconfigurable Intelligent Surfaces

By G. Lerosey and M. Fink

| INVITED PAPER | This article provides an overview of the research works and enabling technologies that have underpinned the development of reconfigurable intelligent surfaces.

1227 Theory, Analysis, and Design of Metasurfaces for Smart Radio Environments

By E. Martini and S. Maci

| INVITED PAPER | This article provides an overview of the fundamental theory behind reconfigurable intelligent surfaces, with focus on surface-wave and nonspecular reconfigurable reflective surfaces.

1244 MIMO Evolution Beyond 5G Through Reconfigurable Intelligent Surfaces and Fluid Antenna Systems

By A. Shojaefard, K.-K. Wong, K.-F. Tong, Z. Chu, A. Mourad, A. Haghighat, I. Hemadeh, N. Thanh Nguyen, V. Tapio, and M. Juntti

| INVITED PAPER | This article provides an overview of the application of reconfigurable intelligent surfaces for free-space communications and surface-wave communications, and it introduces the operating principles of fluid antennas.

1266 Reconfigurable Intelligent Surfaces: Simplified-Architecture Transmitters—From Theory to Implementations

By Q. Cheng, L. Zhang, J. Y. Dai, W. Tang, J. C. Ke, S. Liu, J. C. Liang, S. Jin, and T. J. Cui

| INVITED PAPER | This article provides an overview of the theoretical models for space-time digital metasurfaces and information metasurfaces, the mechanisms for wavefront shaping, and the signal modulation models in space and time for wave-matter interactions.

1290 Reconfigurable Intelligent Surfaces: Channel Characterization and Modeling

By J. Huang, C.-X. Wang, Y. Sun, R. Feng, J. Huang, B. Guo, Z. Zhong, and T. J. Cui

| INVITED PAPER | This article provides an overview of wireless channel models for reconfigurable intelligent surfaces, and channel measurements and experiments are presented.

1312 Channel Estimation With Reconfigurable Intelligent Surfaces—A General Framework

By A. L. Swindlehurst, G. Zhou, R. Liu, C. Pan, and M. Li

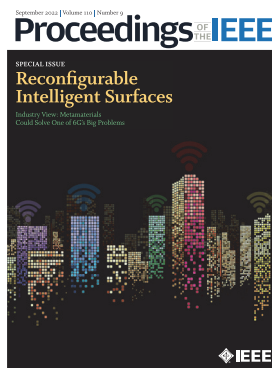
| INVITED PAPER | This article provides an overview of the identifiability of wireless channels for reconfigurable intelligent surfaces by considering the available pilot data and the setup of the surfaces during training.

DEPARTMENTS

1151 INDUSTRY VIEW
Metamaterials Could Solve One of 6G's Big Problems
By M. Poulakis

1159 SCANNING THE ISSUE
Reconfigurable Intelligent Surfaces
By M. Di Renzo and S. Tretyakov

1526 FUTURE SPECIAL ISSUE/SPECIAL SECTIONS



On the Cover:
This month's cover image highlights a cityscape where building walls integrated with reconfigurable intelligent surfaces help create a smart radio environment.

[Continued on page 1150 >]

CONTENTS

CONTINUED FROM PAGE 1149

SPECIAL ISSUE: Reconfigurable Intelligent Surfaces

1339 Backscatter Communication Assisted by Reconfigurable Intelligent Surfaces

By Y.-C. Liang, Q. Zhang, J. Wang, R. Long, H. Zhou, and G. Yang

| INVITED PAPER | This article provides an overview of backscatter communications assisted by reconfigurable intelligent surfaces that are configured as information transmitters.

1358 A State-of-the-Art Survey on Reconfigurable Intelligent Surface-Assisted Non-Orthogonal Multiple Access Networks

By Z. Ding, L. Lv, F. Fang, O. A. Dobre, G. K. Karagiannidis, N. Al-Dhahir, R. Schober, and H. V. Poor

| INVITED PAPER | This article provides an overview of the recent progress on the synergistic integration of reconfigurable intelligent surfaces and non-orthogonal multiple access schemes.

1380 Intelligent Reflecting Surface-Aided Wireless Networks: From Single-Reflection to Multireflection Design and Optimization

By W. Mei, B. Zheng, C. You, and R. Zhang

| INVITED PAPER | This article provides an overview of wireless networks aided by reconfigurable intelligent surfaces, with an emphasis on the presence of multiple surfaces and multiple signal reflections.

1401 Toward Ubiquitous Sensing and Localization With Reconfigurable Intelligent Surfaces

By H. Zhang, B. Di, K. Bian, Z. Han, H. V. Poor, and L. Song

| INVITED PAPER | This article provides an overview on the applications and open challenges of reconfigurable intelligent surfaces for integrated communication, sensing, and localization.

1423 Nonterrestrial Communications Assisted by Reconfigurable Intelligent Surfaces

By J. Ye, J. Qiao, A. Kammoun, and M.-S. Alouini

| INVITED PAPER | This article provides an overview of the concept of nonterrestrial networks assisted by reconfigurable intelligent surfaces.

1466 Software-Defined Reconfigurable Intelligent Surfaces: From Theory to End-to-End Implementation

By C. Liaskos, L. Mamatras, A. Pourdamghani, A. Tsiolaridou, S. Ioannidis, A. Pitsillides, S. Schmid, and I. F. Akyildiz

| INVITED PAPER | This article provides an overview of metasurface-based hardware and software components for application to programmable wireless environments. The complete workflow from the user device to the final services is discussed.

1494 Pervasive Machine Learning for Smart Radio Environments Enabled by Reconfigurable Intelligent Surfaces

By G. C. Alexandropoulos, K. Stylianopoulos, C. Huang, C. Yuen, M. Bennis, and M. Debbah

| INVITED PAPER | This article provides an overview of online machine learning methods for optimizing wireless networks in the presence of multiple users and multiple reconfigurable intelligent surfaces.

Proceedings OF THE IEEE

On the Web

proceedingsoftheieee.ieee.org

Find the following information on our website.

[About the Proceedings](#)
[Recent and Upcoming Issues](#)
[Featured and Popular Articles](#)
[Instructions for Guest Editors and Authors](#)
[Editorial Leadership](#)
[Webinar Series](#)
[Subscription Information](#)



On the Web

www.ieee.org

MEMBERSHIP

Check out the many features available through the IEEE Membership Portal.

PUBLICATIONS

Find IEEE articles by using the search features of IEEE Xplore

SERVICES

The IEEE offers many services to Members, as well as other groups.

STANDARDS

The IEEE is the leader in the development of many industry standards.

CONFERENCES

Search for the ideal IEEE Conference, on the subject of your choice

CAREERS/JOBS

Find your next job through this IEEE service.