

Special Issue on Electromagnetic Information Theory

For future wireless communications, higher data rate, reliability, and traffic demands will lead to the development of novel communication frameworks that fully exploit the physics of electromagnetic waves. These emerging technologies include holographic MIMO, super-directive antenna array, extremely large antenna arrays, reconfigurable intelligent surfaces, orbital angular momentum (OAM) multiplexing, etc. To explore both potentials and limitations of these technologies, research into electromagnetic and information theory (EIT) is actively underway in both academia and industry. EIT is an interdisciplinary framework integrating electromagnetic wave (EM) theory and information theory (IT) for the analysis of physical systems for the communication, processing, and storage of information. It has been shown that physically large antenna arrays, large intelligent surfaces, RF lens antenna arrays, holographic MIMO, and/or continuous-aperture MIMO can be analyzed more effectively within an EIT framework. Furthermore, it is expected that the physical properties of the OAM, the non-diffraction properties of the Bessel beam, and/or the acceleration properties of the Airy beam will open new opportunities under the EIT framework.

For this special issue, we invite previously unpublished papers that contribute to the development of EIT. Topics of interest include, but are not limited to:

- **Theoretical analysis for EIT:** Channel capacity analysis, degree of freedom in the time, frequency, spatial, and wavenumber domain, characteristic mode analysis, functional analysis, stochastic and non-stochastic information measures of entropy and capacity, performance evaluation.
- **Channel modeling for EIT:** Physics consistent channel modeling, computational electromagnetics-based channel modeling, circuit theory-based channel modeling, reactive near-field, radiating near-field and far-field channel modeling.
- **Optics and quantum field theory for EIT:** Physics-consistent models for optical and photon-based communication, processing, and storage of information.
- **EIT based signal processing:** Beamforming and channel estimation for both near-field and far-field, interference cancelation, joint system optimization, holographic MIMO, continuous-aperture MIMO.
- **EIT based next generation antennas and beam manipulation:** Extremely large antenna arrays, large intelligent surfaces, reconfigurable antennas, reconfigurable intelligent surfaces, electromagnetic metasurfaces, wave manipulation, exploitation of physical properties of OAM, Bessel, and Airy beams.
- **EIT based wireless communications and network:** Vision, outlook, new challenges, and opportunities of EIT, EIT-based network, new use cases, hardware prototypes and testbeds.

Guest Editors:

Massimo Franceschetti (Lead), University of California,

Linglong Dai, Tsinghua University, China

Marco Donald Migliore, University of Cassino/Southern Lazio, Italy

Thomas Marzetta, New York University

Important Dates:

Manuscript submission deadline: 15 August, 2024

First Recommendation: 30 November, 2024

Revised Manuscript Due: 31 December, 2024

Final Decision: 31 January, 2025

Final Manuscripts to Publisher: 15 February, 2025

Expected Publication Date: April, 2025

Submission Guidelines: The papers will be peer-reviewed according to standard IT Society peer review procedures. The reviewers will be selected from the pool of established researchers working in the areas covered by the submitted papers. Prospective authors should prepare their papers following regular submission guidelines of the IEEE Journal on Selected Areas in Information Theory (see <https://www.itsoc.org/jsait/author-information>).

Manuscript Submission Website: <https://mc.manuscriptcentral.com/jsait-ieee>