

Editorial

Special Issue on ICWOC 2024—Part 1

WE ARE delighted to provide readers the state-of-the-art techniques showcased at the International Conference on Intelligent Computing and Wireless Optical Communications 2024 (ICWOC 2024) through this Special Issue, which is published in the esteemed IEEE PHOTONICS TECHNOLOGY LETTERS (PTL) journal. In recent years, the ICWOC conferences have garnered significant acclaim and global attention, vividly demonstrating the rapid evolution of Optical Wireless Communication (OWC) technology. They also reflect the burgeoning interest in applying OWC across a multitude of diverse scenarios, underscoring its growing importance and transformative potential in the field of modern communication.

This Special Issue features 31 meticulously selected letter-type articles, which will be published in three parts. These articles comprehensively cover a wide spectrum of aspects, including signal transmission, optical module design, function integration, and performance analysis. They explore the applications of OWC technology in general scenarios, indoor scenarios, outdoor scenarios, underwater scenarios, satellite scenarios, and other emerging scenarios, highlighting the technology's versatility and potential.

OWC for general scenarios: For general OWC systems, advanced modulation, transmission, and recognition techniques have been reported. The modulation techniques include probabilistically shaped 3D constellation design, modulus-based orthogonal frequency division multiplexing (OFDM) signaling, orthogonal multilevel chaos index modulation-aided asymmetrically clipped optical OFDM, real-valued precoding-enabled asymmetrical clipping-aided hybrid optical filter bank multi-carrier (FBMC), optical FBMC with index modulation, and dynamic chaotic encryption. The transmission techniques consist of adaptive transmission, massive multiple-input multiple-output (MIMO) decorrelation, massive random access control, beam steering, and beam shaping. Moreover, an enhanced transfer learning-based automatic modulation recognition method has also been proposed.

OWC for indoor scenarios: The indoor application of OWC focuses on indoor positioning. Specifically, two indoor positioning schemes have been developed including angle of arrival positioning using a multi-layer perceptron regression model and tilt-resilient positioning based on received signal strength fingerprint self-transferability.

OWC for outdoor scenarios: For outdoor OWC systems, a maximum likelihood approach for joint estimation of symbol timing offset and common phase error has been proposed for outdoor coherent optical OFDM systems, and a large field-of-view ultraviolet (UV) LED array transmitter has been designed

to enable over 1.1-km outdoor transmission with a data rate of 1.25 Mbps using on-off keying modulation and photomultiplier tube receiver.

OWC for underwater scenarios: For underwater OWC systems, several enabling techniques have been considered such as deep learning-based acquisition pointing and tracking, diffuser-based receiver for scintillation mitigation, dynamic threshold decision for real-time turbulence mitigation, and high-sensitivity reception using a single-photon level sensitivity silicon photomultiplier array with receiver diversity. Moreover, two experimental systems have been demonstrated including a scintillating fiber-based underwater wireless-fiber communication system and a UV LED-based non-line-of-sight underwater OWC system. In addition, a systematic overview of key radiative transfer equation solution strategies in case of underwater OWC scenario has been further conducted.

OWC for satellite scenarios: For satellite OWC systems, the performance of enhanced hybrid frequency-phase-keying laser communication in terrestrial-high altitude platform-satellite links with modulating retro-reflector array has been analyzed, the analytical expressions for the ergodic capacity of a non-orthogonal multiple access (NOMA)-based radio-frequency/free-space-optical integrated satellite-terrestrial relay network has been derived, and a direct current-biased optical orthogonal time-frequency-space modulation has been further proposed to enhance the link stability of laser satellite communication systems.

OWC for other emerging scenarios: Besides the above scenarios, OWC has also been introduced for many other emerging scenarios such as simultaneous lightwave information and power transfer (SLIPT) and integrated sensing and communication (ISAC). Particularly, a resource allocation scheme based on modified arithmetic optimization has been studied to improve the energy efficiency of SLIPT-enabled hybrid orthogonal frequency division multiple access and NOMA system, and two types of optical wireless ISAC systems have been investigated including a bidirectional retroreflective optical ISAC system using time division duplexing and clipped OFDM and an OFDM-based light detection and ranging-communication integration system using MIMO and particle swarm optimization based power distribution optimization.

We would like to express our sincere thanks to all contributing authors for their great effort and dedication in preparing and submitting high-quality articles to this Special Issue. We also wish to appreciate the esteemed reviewers for their voluntary, punctual, and thoughtful evaluations of all the submissions in this Special Issue. We further want to give our special gratitude to the Editor-in-Chief, Prof. Boon Ooi.

Without his kind invitation and strong support, we are unable to establish this Special Issue in PTL. Moreover, the editorial team, led by Sylvia Hinkson, deserves our deepest gratitude for their time and effort in making this Special Issue a great success. Finally, we earnestly anticipate that this Special Issue will furnish our readers and academic peers with the latest and most profound understandings of the dynamic and rapidly evolving field of OWC. By doing so, our objective is to ignite deeper curiosity, inspire novel viewpoints, and propel future breakthroughs within this captivating field.

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