INTRODUCTION TO THE SPECIAL SECTION “Lasers, Communications, and Intense Data Processing”

Alexey Yu. Bykovsky, Lebedev Physical Institute, Moscow

Sooner or later, any editorial board member of the Journal of Russian Laser Research tries to understand the relationship between the criteria, being used for the selection of papers, and trends emerging in various research areas of photonics, laser physics, and quantum optics. There are different methods to appreciate the resulting influence of research publications on the progress in applications, industry, and everyday life. For representative comparison of different research fields, one should use at least the following set of information sources:

- Public documents associated with state and international programs declared in different countries;
- Expert group questioning;
- Analysis of increase in technical characteristics of high-technology devices;
- Financial metrics for different research fields, markets, and industrial production volumes;
- Bibliographic analysis for different research topics;
- Science metrics h-indices and citation indices, representing the statistical parameters and toolkit for comparison of individual activity in different fields;
- Comparison of earlier done long-term predictions with the results obtained.

However, the practical matching of significance for different scientific topics within one research field of photonics is a slightly more difficult task, as many methods are closely connected and intertwined, that is why the brief preface cannot replace all methods mentioned above. Nevertheless, one can reveal examples of the drastic splash of revolutionary works during first years of research and the long “tail” of evolutionary activity for further development of supporting methods and applications. On the whole, the set of papers combined in the present special section refers to the evolutionary type of publications, which are based on intense computing and new data processing methods. At the same time, they deal with global scale research fields in the applied optics and laser physics.

In this special section, the papers are given according to their registration dates, but the given commentary follows to the specifics of data processing, where every reader can attribute different priorities due to individual experience.

According to, e.g., the roadmap of optical communications [1], the paper “Scintillation Index of a Spherical Wave Propagating Through Kolmogorov and Non-Kolmogorov Turbulence Along Laser-Satellite Communication Uplink at Large Zenith Angles” by Wenhe Du, Qi Yuan, Xiujuan Cheng, Yanchun Wang, Zhan Jin, Daosen Liu, Shuang Feng, and Zhanyu Yang [2] is devoted to the role of Kolmogorov and non-Kolmogorov turbulences in laser-satellite optical wireless communication uplink. It represents both global networks and cosmic communication systems, but is also close to quantum communications. Now all these types of network systems are being actively investigated and optimized according to the growing role of telecommunications underscored by COVID-19-induced contact limitations.

The other kind of wireless optics communications is represented by the paper “Analysis of Imaging Quality of New Laser Communication System on Missile in the Aerodynamic Environment” by Lun Jiang, Xin Yu, Chao Wang, Tianjun Dai, Zhengshuang Dai, and Shoufeng Tong [3]. Its item is the analysis of impact of aerodynamic environment on the imaging quality of the laser communication system on a missile. This topic goes beyond purely defense problems of global network-centric systems and undertakes quite traditional problems of image processing.

One more paper “Improved Point Cloud Registration with Scale Invariant Feature Extracted” by Qinglong Hu, Jiayu Niu, Zhiwei Wang, and Shifeng Wang [4] deals with the very actual problem of computer vision for modern robotics and namely discusses some aspects of 3D reconstruction and informative feature extraction; here the search of invariant features is old but unsolved yet problem, in spite of the active research within international project OpenCV (Open Source Computer Vision Library) [5] and free exchange of algorithms. The topic of computer reconstruction of human vision abilities is being investigated for more than a half a century and now is typically evolutionary research. For such a complicated field as pattern recognition and imitation of human abilities, the trend to the design of libraries of specialized software packages also seems to be adequate solution, which somehow correlates with the LabVIEW software, applied in two other papers “Research on Femtosecond Laser Pulse Width Measurement Based on LabVIEW” by Xiaoting Sun, Yongliang Li and Yashuai Yang [6], as well as in “Study on Polarization of Laser Beam Based on LabVIEW” by Xiaoting Sun, Yongliang Li, Yingming Zhang, Chenwen Hu and Zhiwen Chen [7].

The papers in this section are devoted to the advanced measurement of laser-beam characteristics in hardware setups. Measurements of polarization of laser beams and femtosecond-laser pulse width are applicable for different tasks of optical coding and data processing, and possibly these papers will encourage somebody for new experiments in optics and laser systems supported by specialized data processing toolkit. Also one more intense data processing paper “A New ADE-TLM for Lorentz Dispersive Medium” by Abdellah Attalhaoui, Hamid Bezzout, Mohamed Habibi, and Hanan El Faylali [8] in the special section refers to the further evolution in numerical solution of Maxwell’s equations in dispersive medium, namely, for auxiliary differential equation method in transmission line modeling. One can hope that this will help to obtain more productive calculations of waveguide components for multiplexing and switching devices for fiber networks.

References

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