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Editorial: Modeling and Applications of Optoelectronic Devices for Access Networks

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Editorial on the Research Topic

Modeling and Applications of Optoelectronic Devices for Access Networks

With the development of optical devices and advanced materials, optoelectronic devices can be newly reconsidered and improved since these are indispensable for access networks. Specifically, the modeling and applications of optoelectronic devices play an important role in promoting the development of access networks. Therefore, this Research Topic reports on the latest developments in the modeling and applications of optoelectronic devices.

MODELING OF OPTOELECTRONIC DEVICES FOR ACCESS NETWORKS

It is beneficial to improve the accuracy and performance of optoelectronic detections in access networks by establishing models of optoelectronic devices [1, 2]. A differential entropy feature signal recognition model based on a gated recurrent unit network was proposed to improve the recognition accuracy of optoelectronic detections (Zhu and Zhong). In this model, differential entropy and power spectral density feature signals were used to reduce electrode channels, which provided a basic theory for the optoelectronic detections. Similarly, an improved WC-KNN model based on frequency modulation (FM) signals was proposed to improve the accuracy of photoelectric devices (Duan et al.). Specifically, the complexity of these devices in indoor scenarios was reduced effectively and the positioning accuracy was improved, which could expand their plethora of practical indoor applications for access networks.

The efficiency of access networks is related to the performance of optoelectronic devices. Moreover, their performance can be analyzed and optimized by establishing specific models, which can improve the efficiency of access networks [3, 4]. A model based on the density functional theory was proposed to describe the electrochemical performance of cathode materials (Gao et al.). The conductivity and the potential energy of cathode material were also calculated, and theoretical proposal for the electrochemical performance of doping could be provided by this model. In addition, this model was applied to the study of optoelectronic devices, which could improve the performance analysis of optoelectronic devices. Similarly, a model was applied to analyze the device performance (Zhuang et al.), in which a severe degradation was found at short wave lengths. Then, by using the

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model, suggestions to improve the optoelectronic efficiency were provided.

Non-invasive detection of Majorana bound states (MBSs) is one of the core issues in the modeling of optoelectronic devices [5]. Conductance properties in double quantum dots (QDs) were studied by the Green's function method (Chi et al.). The information of MBSs can be inferred by comparing properties of linear conductance. Then, resonances at zero and positive energy regimes would display the typical Fano line-shape when MBSs are overlapped, which was useful for quantum information processing and design of new quantum devices. Similarly, spin-dependent current and tunneling magnetoresistance (TMR) in a QD were investigated by the non-equilibrium Green's technique (Tang and Mao). The TMR was sandwiched between two ferromagnetic leads, and the MBSs were formed at the opposite ends of a superconductor nanowire. Furthermore, it was found that the intensity of the TMR depended on the spin polarization of electrodes in a non-monotonic way, and it was positive for a large spin-polarization regardless of the existence of MBSs. In addition, MBSs are promising in the context of high-efficiency and energy-saving quantum devices [6]. The photon-assisted transport through a QD side-coupled to a topological nanowire hosting MBSs at its two ends was studied (Chi et al.). It was found that the photon-induced peaks in the transmission function were split by the existence of MBSs, and the value of central peaks was suppressed to zero. Meanwhile, positions of additional peaks induced by the MBS-MBS overlapping in the presence of the photon field were quite different from the case of the zero-photon field, which could propose a new application for quantum devices.

APPLICATIONS OF OPTOELECTRONIC DEVICES FOR ACCESS NETWORKS

The fabrication of optoelectronic devices is needed for the development of access networks [7]. Large-scale growth of zinc oxide (ZnO) nanorod arrays on graphene sheets was realized by hydrothermal techniques, and the Fowler-Nordheim theory was used to build a model to describe the properties of the arrays' field emissions (Yang et al.). The morphological characteristics of ZnO nanorods can also be tuned by varying reaction time and concentrations of the solution. These specific nanorod arrays with enhancement of emission properties would be useful for modulator units of access networks. Ultrasmall precious metal clusters have attracted extensive attention for promoting electron transfer in optoelectronic devices [8]. Ultrasmall Au clusters based on defective TiO_2 nanosheets (Au/D-TiO_2) were fabricated (Zhang et al.). Different defects of TiO_2 nanosheets (D-TiO_2) were induced by using a heating process. This method could be effective for enhancing the stability of electron transfer in optoelectronic devices.

Applications of optoelectronic devices can provide good prospects for the development of access networks [9, 10]. A photonic-assisted channelized receiver, which is based on the spectrum analysis, was developed for multi-band microwave signals (Huang et al.). Instantaneous spectral analysis was introduced to determine the frequency and bandwidth of the dynamic wideband signal. Then, the dynamic wideband signal was received by a multi-band coherent channelizer. This new receiver provided a low-complexity and low-cost implementation, which showed a tremendous advantage and potential in access networks. An application based on data access of a thermal camera was proposed to distinguish vehicle headlight (Li S. et al.). In this application, details of thermal images were enhanced by adjusting the temperature display dynamically. Then, features of a vehicle headlight were extracted by YOLOv3, high beams and low beams were further distinguished by the filter. This application provided an effective method for distinguishing headlight, which can be applied to transportation-based access networks. The performance of optoelectronic devices can be improved by new applications [11]. A new driving waveform with a direct current (DC) and an alternating current (AC) was proposed to improve the performance of Electrowetting displays (EWDs) (Liu et al.). In this driving waveform, the DC was used to reduce the response time of EWDs, and the AC was used to suppress the oil backflow. Similarly, a multi adaptive driving waveform was proposed to reduce the influence of hysteresis effect in EWDs (Li W. et al.). Then, different driving waveforms were designed and implemented according to different driving stages of EWDs. This could effectively reduce the hysteresis effect of EWDs.

Optical information detection is of great significance to promote application development of optoelectronic devices [12]. A microcomputer was used for the real-time intelligent reading of a pointer instrument, it could accurately locate the panel area and read corresponding values (Lin et al.). At the same time, it was convenient to collect and analyze historical data for system optimizations, which had a high feasibility and a practical value for access networks. In addition, an adaptive specular highlight detection was proposed for endoscopic images (Yu et al.). Specifically, a criterion for specular highlight detection based on the ratio of red channel was designed for each pixel. This detection application provided accuracy for an endoscopic imaging system. Open electrowetting on dielectric (EWOD) devices have been widely used in optical information detection [13]. An EWOD digital microfluidic operating device, which was convenient in manufacture based on a printed circuit board, was realized. A Paraflim M and silicone oil were used as the dielectric hydrophobic layer (Yi et al.). This EWOD optoelectronic device not only had simple preparation steps, but also reduced production cost, with clear practical impact for access networks.

CONCLUSION

The development of society puts forward higher requirements for access networks, and modeling and applications of optoelectronic devices have an important impact on the performance of access networks. The contributions of this Research Topic describe

the new progress of optoelectronic devices, which improve the efficiency and accuracy of an access network system. The rapid development of optoelectronic devices is expected to bring other theoretical and practical breakthroughs for access networks in the next few years.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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