Track 5: Microwave Photonics and Optical Signal Processing
Chicago Hall, 3F

13:30-15:30 • November 05, 2023 • Sunday
Free-Space Optics and Photonic Imaging
Presider: Cheng Wang, City University of HongKong, Hongkong, China

13:30-14:15 • ACPPOEM-0927-1 *Tutorial*
Microwave Photonic Radars
Shilong Pan
Nanjing University of Aeronautics and Astronautics, China
This tutorial introduces system architectures and key technologies of microwave photonic radars. Emerging technologies in this area and possible future research directions are discussed.

14:15-14:30 • ACPPOEM-0816-6
Photonic Time Compressing Assisted Real-time Fourier Transform System
Tao Lu, Dan Zhu, Jiewen Ding, Boyang Ni, Xin Liu, Shilong Pan
Nanjing University of Aeronautics and Astronautics, China
A novel photonic real-time Fourier transform (PRTFT) system assisted by the photonictimecompressing is proposed and demonstrated experimentally. By introducing the photonic time compressing, the frequency of the input RF signalis stretched, and thus the frequency-to-time mapping output is also stretched. In this way, the frequency resolution will be improved. A frequency magnification factor of 7 is achieved experimentally and the frequency resolution is improved from 140 to 30 MHz.

14:30-14:45 • ACPPOEM-0712-2
Microwave Photonic Imaging Radar Based on Polarization Multiplexing Coherent Receiving
Qingshui Guo[1,2], Qiang Zhang[1], Tongkai Xu[1], Shuo Liu[1], Wanshu Xiong[1], Kun Yin[1]
1.Zhejiang Laboratory, China; 2.Zhejiang University, China
A microwave photonic radar with ISAR imaging resolution better than 2.0 cm is proposed and experimentally demonstrated, in addition, the phase variation of 0.36 rad within 10 seconds in receiver is achieved.

14:45-15:00 • ACPPOEM-0714-3
Entanglement Assisted Quantum Radar Demonstration over Turbulent Free-Space Optical Channels
Ivan B Djordjevic, **Vijay Nafria**
University of Arizona, ECE Dept., United States
In entanglement assisted communications and sensing the optical phase-conjugation (OPC), required before homodyne detection takes place, is typically performed on signal photons on receive side. Unfortunately, in turbulent free-space optical channels, the signal photons can be scattered or absorbed by the channel, and if they reach the receiver they are very weak. Here we propose an entanglement assisted radar technique in which the OPC is performed on bright idler photons instead. By performing the OPC on idler photons on transmit side, while employing adaptive optics and classical homodyne detection on receive side, we experimentally demonstrate that the target detection probability of the proposed entanglement assisted radar over turbulent free-space optical channel is significantly better than that of corresponding classical detection scheme.

15:00-15:15 • ACPPOEM-0801-36
Reservoir Computing System based on VCSEL with the self-polarization-stabilization structure
Jinze Fan[1,2], Taihang Qiu[1,2], Yuqing Wu[1,2], Lei Deng[1,2], Qi Yang[1,2], Xiaoxiao Dai[1,2], Xiaojing Gao[3], Deming Liu[1,2], Mengfan Cheng[1,2]
1.Huazhong University of Science and Technology, China; 2.Shenzhen Huazhong University of Science and Technology Research Institute, China; 3.China University of Geosciences, China
We propose a reservoir computing system with a self-polarization-stabilization structure and demonstrate the performance improvement through the simulation task. Furthermore, we analyze the performance of the VCSEL-based reservoir in two other simulation tasks.

15:15-15:30 • ACPPOEM-0722-1
Stepped Frequency Radar with Broadband Signal Generation by Period One Laser Dynamics
Boyang Wu, Fangzheng Zhang, Xiaoyue Yu, Xing Wang, Shilong Pan, Xinyi Li
Nanjing University of Aeronautics and Astronautics, China
A stepped frequency radar is proposed using period one laser dynamics to generate signals with a bandwidth of 4 GHz and a frequency step of 100 MHz. High-resolution detection of multiple targets is demonstrated.

15:30-16:00 Coffee Break

16:00-18:00 • November 05, 2023 • Sunday
Photonic chips for Optical networks
Presider: Xiaodan Pang, KTH Royal Institute of Technology, Sweden

16:00-16:30 • ACPPOEM-0811-9 *Invited*
Integrated lithium niobate microwave photonics
Cheng Wang
City University of Hong Kong, Hong Kong, China
In this talk, I will discuss our recent efforts on thin-film lithium niobate microwave photonics, including devices like ultra-broad-band and high-linearity modulators, power-efficient electro-optic combs, and system-level demonstrations of high-speed microwave photonic signal processers and in-situ optical vector analyzers.

16:30-16:45 • ACPPOEM-0815-21
On-Chip Fully Reconfigurable Microwave Photonic Flat-Top Filter
Zhenjie Yu[1,2,3,4], Xu Hong[1,2,3,4], Bin Wang[1,2,3,4], Weifeng Zhang[1,2,3,4]
1.Beijing Institute of Technology, China; 2.Key Laboratory of Electronic and Information Technology in Satellite Navigation, China; 3.Beijing Institute of Technology Chongqing Innovation Center, China; 4.Chongqing Key Laboratory of Novel Civilian Radar, China
We propose and experimentally demonstrate an on-chip fully reconfigurable microwave photonic flat-top filter based on cascaded ultrahigh-Q silicon racetrack micro-ring resonators (MRRs). The microwave photonic filter (MPF) is realized based on phase modulation to intensity modulation conversion, which maps the spectral response of the cascaded MRRs in the optical domain to the one of the resulted microwave filter in the electrical domain. To enable filter frequency tunability, two independent micro-heaters are placed on top of the two MRRs. By controlling the direct current (DC) voltage applied to the micro-heaters, a flat-top MPF is produced, whose center frequency and bandwidth can be flexibly tuned. A silicon-based ultrahigh-Q cascaded MRRs chip is designed, fabricated and evaluated. With the use of the chip, a flat-top MPF is experimentally demonstrated. The experimental results show that the MPF has a tunable center frequency from 4 to 24 GHz and a tunable bandwidth from 225 to 405 MHz. Thanks to its strong reconfigurability, the proposed integrated microwave photonic flat-top filter is promising to be widely used in multi-function microwave photonic signal processing systems.

16:45-17:00 • ACPPOEM-0814-35
Frequency-Tunable Active Mode-Locked Optoelectronic Oscillator Incorporating an Electrically-Switchable Silicon Photonic Micro-Ring Resonator
Yaming Liu[1,2,3,4], Yushu Jiang[1,2,3,4], Bin Wang[1,2,3,4], Weifeng Zhang[1,2,3,4]
1.Beijing Institute of Technology, China; 2.Key Laboratory of Electronic and Information Technology in Satellite Navigation, China; 3.Beijing Institute of Technology Chongqing Innovation Center, China; 4.Chongqing Key Laboratory of Novel Civilian Radar, China
We propose and experimentally demonstrate a frequency-tunable active mode-locked optoelectronic oscillator (AML-OEO) for microwave pulse generation. The proposed AML-OEO has a dual-loop configuration based on phase modulation to intensity modulation conversion. In the loops, an electrically-switchable silicon photonic micro-ring resonator (MRR) with a top-placed metallic micro-heater and a lateral PN junction incorporated in the waveguide is used to play two-fold key functions. First, the MRR is employed as a narrow optical notch filter for frequency selection in the OEO implementation, and with the use of the top-placed micro-heater, the generated microwave frequency is highly tunable in a large range based on the thermal optics; secondly, the MRR is leveraged to realize the mode locking by performing the periodically high-speed gain modulation based on the lateral PN junction. An experiment is performed, and microwave pulses with a period of 1.08 μs and tunable center frequencies from 6 GHz to 18 GHz are experimentally generated. The proposed AML-OEO provides a flexible tunability and a compact structure, which is promising to be widely used in high-speed pulsed doppler radar and multi-carrier communication systems.

17:00-17:15 • ACPPOEM-0726-5
Optical forward error correction based on recirculating frequency shifter
Tianyan Guo, Jiangbing Du, Zuyuan He
Shanghai Jiao Tong University, China
In this paper, optical forward error correction using recirculating frequency shifter is proposed and investigated. The optical and in-the-fly process leads to great potential for low latency and high-speed optical communications.

17:15-17:30 • ACPPOEM-0814-39
On-chip Reconfigurable Silicon Photonic Fabry-Perot Resonator
Lang Zhou[1,2,3,4], Yihao Cheng[1,2,3,4], Bin Wang[1,2,3,4], Weifeng Zhang[1,2,3,4]
1.Beijing Institute of Technology, China; 2.Key Laboratory of Electronic and Information Technology in Satellite Navigation, China; 3.Beijing Institute of Technology Chongqing Innovation Center, China; 4.Chongqing Key Laboratory of Novel Civilian Radar, China;
We propose and design an on-chip reconfigurable silicon photonic Fabry-Poret (FP) resonator. The proposed FP resonator mainly consists of a pair of Sagnac loop mirrors (SLMs) with tunable reflectivity and a low-loss multimode ridge waveguide, which is of great help to reducing the optical propagation loss and to improving the Q-factor of the FP resonator. To achieve flexible tunability, metal micro-heaters are placed on top of the multimode ridge waveguide and the directional couplers (DCs) of the SLMs. By tuning the direct current voltage applied to the micro-heaters, the resonance wavelength and the bandwidth of the proposed FP resonator can be flexibly tuned. As a demonstration, the chip is fabricated and characterized. Experimental results show that the resonance wavelength of the proposed FP resonator can be tuned within a range of 0.25 nm, and the bandwidth of the FP resonator can be tuned from 2.0 pm to 25.1 pm, corresponding to a tunable Q-factor

from 7.8×10^5 to 0.6×10^5. The proposed FP resonator holds unique advantages including high Q-factor, flexible tunability, and compact footprint, which is potential to be widely used in microwave photonic signal processing and non-linear optical systems.

17:30-17:45 • ACPPOEM-0727-22
Backward-Emitting Antenna Based on Ridge Subwavelength Grating Array Enabled High Wavelength Sensitivity
Weijie Xu, Junjia Wang
Southeast University, China
Optical antennas are the key components for optical phased array. In this work, we demonstrate a backward-emitting antenna based on ridge structure with a beam divergence of 0.13°and a wavelength sensitivity up to 0.237°/nm.

17:45-18:00 • ACPPOEM-0728-7 *Industry Innovation Nomination*
An On-chip Optical Quantizer with an ENOB of 5.83 bits using a Thermo-optic Phase Shifter Array
Donghe Tu[1,2], Xingrui Huang[1,2], Hang Yu[1,2], Yuxiang Yin[1,2], Zhiguo Yu[1], Huan Guan[1], Lei Jiang[1], Zhiyong Li[1]
1.State Key Laboratory on Integrated Optoelectronics, Institute of Semiconductors, Chinese Academy of Science, China; 2.College of Materials Science and Opto-Electronic Technology, University of Chinese Academy of Sciences, China
We demonstrate an optical quantizer on thin film lithium niobate (TFLN) with a 64-channel thermo-optic phase shifter (TOPS) array. An effective number of bits (ENOB) of 5.83 bits is accomplished by the proposed quantizer.

08:30-09:45 • November 06, 2023 • Monday
Photonics Applications and Implementations
Presider: Ke Wang,RMIT University, Australia

08:30-09:00 • ACPPOEM-0912-2 *Invited*
High coupling efficiency grating couplers for silicon photonics
Periklis Petropoulos, V. Vitali, R. Marchetti, T. Dominguez Bucio, F.Y. Gardes, C. Lacava
University of Southampton, United Kingdom
We present techniques for optimizing the coupling efficiency between silicon photonic and optical fiber systems based on the adoption of back-end-of-line CMOS-compatible waveguide grating couplers.

09:00-09:15 • ACPPOEM-0801-153
Phase sensitive amplification assisted by high-order harmonics based on six wave model
Zeyu Wu[1,2] Weilin Xie[1,2], Xuefeng Wang[3,4], Mingfei Li[3,4], Wenshuai Feng[3], Wei Wei[1], Yi Dong[1]
1. Beijing Institute of Technology, China; 2. Yangtze Delta Region Academy, Beijing Institute of Technology, China; 3. Research Center, Beijing Institute of Aerospace Control Devices, China; 4. Quantum Engineering Research Center, China Aerospace Science and Technology, China
Aiming at obtaining a flat and wide gain spectrum in the fiber-optic parametric process based phase-sensitive amplifier (PSA), In this work, we have established a theoretical study for the potential gain property of two pump PSA with the six-wave model. It allows for a more precise description and optimization for the signal gain spectrum from a practical point of view by exploiting the high-order harmonics.

09:15-09:30 • ACPPOEM-0801-25
Differential Doppler Velocity Measurement using a Distributed Bragg Reflector Mode-locked Laser
Hao Song, Dan Lu, Zhihao Zhang, Fei Guo, Daibing Zhou, Lingjuan Zhao
Institute of Semiconductors, CAS, China
A differential Doppler velocity measurement scheme using the synchronized multiple modes of a distributed Bragg reflector semiconductor mode-locked laser is proposed and experimentally demonstrated with a cross-referenced velocity measurement capability

09:30-09:45 • ACPPOEM-0801-33
Photonic generation of triangular-shaped waveform with tunable symmetry based on a single-drive Mach-Zehnder modulator and differentiator
Xiaohong Lan, Yang Jiang, Jing Xu, Qiong Zhang, Jinjian Feng, Qianyou Long, Yunkun Luo
College of Physics, Guizhou University, China
A novel and simple approach for photonic generation of triangular-shaped waveform with tunable symmetry is proposed and demonstrated experimentally. Firstly, triangular-shaped waveform with tunable symmetry is considered as a combination of sawtooth waveform, triangular waveform and reversed-sawtooth waveform. The generation of each of them is then accordingly implemented by a differentiator. Starting from a sinusoidal modulated signal, an integral waveform of triangular waveform and a dark parabola can be easily obtained, respectively, under different bias index and modulation index. From the perspective of envelope function operation, applying time-domain first-order differentiation to the former, triangular waveform (δ=50%) can be achieved. By differentiating to the latter, triangular-shaped waveform with tunable symmetry (δ=44%~45% and δ=56%~57%) can be obtained, respectively, under different time delay. Thus, triangular-shaped waveform with tunable symmetry (δ=44%~45%, 50%, δ=56%~57%) are generated. In experiment, all of the expected results are successfully demonstrated and agree with the theoretical predictions well.

09:45-10:30 Coffee Break

10:30-11:45 • November 06, 2023 • Monday
Terahertz and Radio over fiber
Presider: Xianbin Yu, Zhejiang University, China

10:30-10:45 • ACPPOEM-0815-96
End-to-end Learning Based Symbol-to-Symbol Autoencoder for G-band Fiber-Terahertz integrated Communication System
Changle Huang[1,2], Zhongya Li[1,2], Junlian Jia[1,2], Size Xing[1,3], Chenxi Wang[1,2], Boyu Dong[1,2], Jianyang Shi[1,2], Nan Chi[1,2], Junwen Zhang[1,3]
1.Key Laboratory of EMW Information (MoE), Fudan University, China; 2.Shanghai ERC of LEO Satellite Communication and Applications, China; 3.Shanghai CIC of LEO Satellite Communication Technology, China
An end-to-end learning-basedsymbol-to-symbol autoencoder frame work is proposed and demonstrated. Asensitivity gain of 1.3 dB is achieved at a data rate of 40 Gbps after 10-km fiber and 1-m wireless transmission.

10:45-11:00 • ACPPOEM-0729-21
Photonics-assisted Broadband Frequency-hopping System for W-band MMW Secure Communications
Hanfeng Wang, Fan Yang, Jian Zhang
University of Electronic Science and Technology of China, China
We propose a photonics-assisted broadband frequency hopping system for secure millimeter-wave (MMW) communications. Wireless transmission of 2 Gbps OOK signals is experimentally demonstrated, operating at 83-98 GHz with a hopping bandwidth of 16 GHz.

11:00-11:15 • ACPPOEM-0730-22
Inverse Designed Optical Phased Array Antenna Based on the Direct Binary Search Algorithm for Angle-Customized Beam Emission
Weijie Xu, Junjia Wang
Southeast University, China
The ability to steer light beams is the key technology of optical phased array (OPA). In this paper, we demonstrate a general framework for the inverse design of optical antennas, which enables angle-customized beam emission.

11:15-11:30 • ACPPOEM-0725-5
Coherent Joint Transmission with 1024-QAM for 6G Distributed-MIMO Networks with Analog Radio-over-LWIR FSO Fronthaul Links
Rafael Puerta[1,2], Mahdieh Joharifar[2], Richard Schatz[2], Anders Djupsjöbacka[3], Armands Ostrovskis[4], Yan-Ting Sun[2], Grégory Maisons[5], Johan Abautret[5], Roland Teissier[5], Lu Zhang[6,7], Sandis Spolitis[4], Vjaceslavs Bobrovs[4], Sergei Popov[2], Xianbin Yu[6,7], Oskars Ozolins[2,3,4], **Xiaodan Pang**[2,3,4]
1.Ericsson AB, Sweden; 2.KTH Royal Institute of Technology, Sweden; 3.RISE Research Institutes of Sweden, Sweden; 4.Riga Technical University, Latvia; 5.mirSense, France; 6.Zhejiang University, China; 7.Zhejiang Lab, China
Distributed-MIMO (D-MIMO) is a prospective solution for next-generation mobile networks to increase capacity and coverage. We experimentally validate 1024-QAM coherent joint transmissions in a two transmitter D-MIMO network including radio-over-LWIR FSO fronthaul links facilitating deployment and achieving diversity and power gains close to theoretical values.

11:30-11:45 • ACPPOEM-0801-145
Wideband-tunable (2-22 GHz) Low-phase-noise (− 120 dBc/Hz) Optoelectronic Oscillator Based on EML with RF-injection
Zhihao Zhang[1,2,3], Dan Lu[1,2,3], Daibing Zhou[1,2,3], Chen Ji[4], Lingjuan Zhao[1,2,3]
1.Key Laboratory of Semiconductor Materials Science, Institute of Semiconductors, Chinese Academy of Sciences, China; 2.Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, China; 3.Beijing Key Laboratory of Low Dimensional Semiconductor Materials and Devices, China; 4.College of Information Science and Electronic Engineering, Zhejiang University, China
An EML-based wideband-tunable OEO is demonstrated with phase noise of less than − 120 dBc/Hz in a tuning range of 2-22 GHz. RF injection is introduced to achieve frequency stabilization throughout the entire tuning range.

12:00-13:30 Lunch Break

13:30-15:15 • November 06, 2023 • Monday
Optical Convolution Networks and Applications
Presider: Periklis Petropoulos, University of Southampton, United Kingdom

13:30-14:00 • ACPPOEM-0905-1 *Invited*
Optical Camera Communication: Principles and Applications
Yitong Wang[1], Mohamed Shehata[1], Kandeepan Sithamparanathan[1], Yiwei Xie[2], **Ke Wang**[1]
1.RMIT University, Australia; 2.Zhejiang University, China
With the development of modern lighting technology and wide availability of cameras, optical camera communication (OCC) has developed rapidly. In this paper, we review recent progress and challenges in both indoor and outdoor OCC systems.

14:00-14:15 • ACPPOEM-0801-131
Linear Frequency Swept Laser With High-Repetition-Rate Based on an Iterative Predistortion Method in the Fourier Domain
Guomeng Zuo[1], Xie Qijie[2], Na Quanxin[2], Zhu Xiaoqi[3], Liu Huabei[1], Fang Zhao[1], Zhuang Dongwei[2], Hao Zhang[1], Song Junfeng[4], Shao Liyang[5]
1.Southern university of sci & tech, China; 2.Peng Cheng Laboratory, China; 3.Shenzhen Photonx Technology Co.Ltd., China; 4.State Key Laboratory on Integrated opto-electronics, College of Electronic Science and Engineering, China; 5.School of Electronic and Electrical Engineering, Southern University of Science and Technology, China
We present a novel iterative pre-distortion method in the Fourier domain, specifically designed for frequency modulated continuous wave (FMCW) laser source boasting high modulation frequency and exceptional linearity.

14:15-14:30 • ACPPOEM-0801-133
Stable Dual-Polarized Mode Oscillation in a Birefringent Buried Heterostructure (BH) Laser
Soumi Pal, Arpit Khandelwal, Nitin Bhatia
1.Indian Institute of Technology Jodhpur, India
We investigate the numerical model for achieving stable gain conditions of a two-mode BH laser. The model is optimized for achieving two frequencies with a difference in the microwave region.

14:30-14:45 • ACPPOEM-0731-160
Complete photonic tensor convolution driven by single dataflow
Tang Kaifei[1,2], Wang Jiantao[1,2], Xiang Ji[1,2], Jiahui Liu[1,2], Yu Xin[1,2], Haijiang Cao[1,2], Zaobang Zeng[3], Rulei Xiao[1,2], Wei Jiang[1,2]
1.College of Engineering and Applied Sciences, Nanjing University, China; 2.National Laboratory of Solid-State Microstructures, Nanjing University, China;3.School of Physics and Optoelectronic Engineering, Nanjing University of Information Science & Technology, China
Current photonic convolutional processors transform tensor convolutions into multi-channel general matrix multiplication (GeMM), leading to data replication and hardware complexity. In this study, we propose and experimentally demonstrate a photonic tensor processing unit (PTPU) with single dataflow, which offers a more concise approach to multi-channel standard tensor convolution processing. In experiment, we extracted features from a 3-channel (RGB) image in horizontal and vertical directions using an integrated multi-wavelength source. We then built a 3D-convolutional neural network to predict the presence of COVID-19 based on computer tomography (CT) scan data consisting of 64-channel tensors.

14:45-15:00 • ACPPOEM-0801-14
All-optical complex-valued convolution based on time-delay interference structure
Wentao Gu, Xiaoyan Gao, Wenchan Dong, Xinliang Zhang
Huazhong University of Science and Technology, China
We propose an optical computing scheme based on time-delay interference structure that enables parallel complex-valued convolution in the wavelength dimension, and experimentally demonstrate versatile image processing at a pixel loading speed of 50 GHz.

15:00-15:15 • ACPPOEM-0801-149
An Optical Binary Neural Network Processor enabled by Homodyne Detection Technology
Weiwei Pan[1], Ruoyun Yao[1], Zhangwan Peng[1], Jinhua Chen[1], Wanshu Xiong[2], Chen Ji[1]
1.Zhejiang University, China; 2.Zhejiang Lab, China
We present a compact approach to implementing an optical binary neural network processor utilizing homodyne detection technology. Convolutional operations are performed using our proposal and simulation results have validated its efficacy in neural network calculations.

15:30-18:00 Coffee Break & Poster Session

18:30-21:00 Banquet and Awards Ceremony

08:30-09:45 November 07, 2023 • Tuesday
Microwave Photonics
Presider: Xinyi Zhu, Institut National de la Recherche Scientifique-EMT, Canada

08:30-09:00 • ACPPOEM-0815-46 *Invited*
Microwave/Millimeter-wave Integrated Sensing and Communication (ISAC) Techniques enabled by Photonics
Xihua Zou, Peixuan Li
Southwest Jiaotong University, China
Microwave/millimeter-wave integrated sensing and communication (ISAC) techniques now are extensively focused in 6G and defense scenarios, due to the high utilization efficiencies in hardware, space, power and spectrum. In this talk, advances in photonics-enabled microwave/millimeter-wave ISAC techniques are introduced, providing high data rate beyond tens Gbit/s and outstanding resolution as fine as mm-level.

09:00-09:30 • ACPPOEM-0821-3 *Invited*
Terahertz photonics in radar and ISAC applications
Xianbin Yu[1], Zhidong Lyu[1], Zuomin Yang[1], Hongqi Zhang[1], Hang Yang[1], Nan Li[1], Changming Zhang[2], Xiaodan Pang[3,4,5], Oskars Ozolins[3,4,5], Lu Zhang[1], Xianmin Zhang[1]
1.Zhejiang University, China; 2.Zhejiang Lab, China; 3.KTH Royal Institute of Technology, Sweden; 4.RISE Research Institutes of Sweden, Sweden; 5.Institute of Telecommunications, Riga Technical University, Latvia
This paper reviews our recent progress on photonic terahertz radar and integrated sensing and communication (ISAC) systems in the 300GHz band with distinguished sensing performance.

09:30-09:45 • ACPPOEM-0731-110
Photonic-assisted compressive sensing with dispersion fiber
Chunyu Che, Jiasi Yang, Jiazhen Cai, Yufei Fu, Xinlu Gao, Shanguo Huang
State Key Laboratory of Information Photonics and Optical Communications Beijing University of Posts and Telecommunications, China
The technique of microwave photonic filtering and the structure of dual-drive Mach-Zehnder modulator (DDMZM) are applied to photonic-assisted compressed sensing (CS) for better system performance.

10:00-10:30 Coffee Break

10:30-12:00 • November 07, 2023 • Tuesday
Advanced Laser and Spectral Analysis
Presider: Radan Slavik, University of Southampton, United Kingdom

10:30-11:00 • ACPPOEM-0922-1 *Invited*
Photonic-enabled real-time dynamic spectral analysis and processing of high-speed waveforms
Xinyi Zhu, José Azaña
Institut National de la Recherche Scientifique-EMT, Canada
We review a novel scheme based on electro-optic phase modulation following the Talbot effect that enables real-time spectrogram analysis of high-speed signals. The method is further showcased for application to programmable time-varying frequency filtering.

11:00-11:30 • ACPPOEM-0730-1 *Invited*
Linewidth narrowing and intense optical pulse generation in microscopic Fano lasers
Yu Yi
Technical University of Denmark, Denmark
We present the results of significantly reduced quantum-limited linewidth and the generation of intense optical pulses using microscopic semiconductor Fano lasers. These results pave the laser for numerous low-power, ultrafast on-chip applications.

11:30-11:45 • ACPPOEM-0721-8
Frequency-tunable Narrow Linewidth THz Signal Generation by Semiconductor Lasers Subject to Mutual Optical Injection
Xiaoyue Yu[1], Fangzheng Zhang[1], Guanqun Sun[1], Zhidong Lv[2], Shilong Pan[1], Changming Zhang[3], Xianbin Yu[2]
1.Nanjing University of Aeronautics and Astronautics, China; 2.Zhejiang University, China; 3.Zhejiang Lab, China
A frequency-tunable narrow linewidth THz signal generation method is demonstrated using optically mutual-injected semiconductor lasers based on period-one dynamics. THz signals from 100 GHz to 300 GHz are generated with the linewidth bellow 10 kHz.

11:45-12:00 • ACPPOEM-0801-136
Microwave pulse generation based on active mode-locking coupled optoelectronic oscillator
Juncheng Li, Zhengtao Wang, Yali Zhang, Tingchuan Gao, Shouhai Li, Zhiyao Zhang, Shangjian Zhang, Yong Liu
University of Electronic Science and Technology of China, China
In this paper, we propose an active mode-locking coupled optoelectronic oscillator (AML-COEO) to generate microwave pulses. Fundamental frequency and harmonic AML-COEOs have been demonstrated by controlling the external low-frequency sinusoidal signal, which replaces the direct-current bias voltage and is directly applied to the bias port of the sharing modulator in the proposed AML-COEO. It is believed that this generation method will enrich the application of the COEO in the pulse Doppler radar.

12:00-13:30 Lunch Break

13:30-15:30 • November 07, 2023 • Tuesday
Optoelectronic Oscillators and Microwave Photonics
Presider: Heng Zhou, University of Electronic Science and Technology of China, China

13:30-14:00 • ACPPOEM-0927-2 *Invited*
Hollow core fibers for RF photonics
Radan Slavik
University of Southampton, United Kingdom
Thanks to the strong suppression of the light-glass interaction in the hollow core optical fibers, they can have simultaneously low chromatic dispersion and nonlinearity, opening new opportunities in multitude of applications, including RF photonics links.

14:00-14:30 • ACPPOEM-0927-4 *Invited*
Microresonator Frequency Comb for Optical Signal Processing and Microwave Photonics
Heng Zhou
University of Electronic Science and Technology of China, China
This talk presents our recent works on, first, all-optical multichannel QPSK phase regeneration using microresonator Kerr combs; second, ultra-low noise microcomb generation with 1mHz fundamental linewidth; third, tunable mmWave and THz frequency synthesis using microcombs.

14:30-14:45 • ACPPOEM-0801-87
Microwave Photonic Channelizer Based on Cascaded Microring Resonators
Ziyang Lu, Hongwei Chen, Sigang Yang, Minghua Chen
Tsinghua University, China
We demonstrate an 8-channel microwave photonic channelizer with an instantaneous bandwidth of over 10 GHz based on cascaded microring resonators. A two-tone RF input is experimentally received and successfully reconstructed.

14:45-15:00 • ACPPOEM-0815-9
Broadband Signal Synthesis Based on Microwave Photonics Channelization
Guchang Chen, Xue Lan, Xiangzhi Xie, Feifei Yin, Yitang Dai, Kun Xu
Beijing University of Posts and Telecommunications, China
In experiment, the generation of LFM signals were achieved with transient bandwidth of 4 GHz and working frequency range from 400 MHz to 20 GHz.The pulse width ranged from 1usto 1ms.

15:00-15:15 • ACPPOEM-0729-1
High-precision Micro-displacement Measurement Based on Self-calibration and Optoelectronic Oscillators
Hao Luo
TianJin university, China
A novel high-precision micro-displacement measurement method is proposed and experimentally demonstrated. The measurement resolution of the system can reach 356 pm. The standard deviations are less than 130 nm over a measurement range of 19 mm.

15:15-15:30 • ACPPOEM-0814-74
Dynamic noise analysis and linewidth measurement for frequency-swept laser
Qichao CHEN, Yubo ZHANG, Feifei YIN, Haoyan XU, Yitang DAI, Kun XU
Beijing University of Posts and Telecommunications, China
A dynamic noise analysis and linewidth measurement technology based on 3×3 coupler Michelson interferometer with frequency trend extraction algorithm is proposed.

15:30-16:00 Coffee Break

16:00-18:00 • November 07, 2023 • Tuesday
Microwave Photonics and Fronthaul Transmission
Presider: Xihua Zou, Southwest Jiaotong University, China

16:00-16:30 • ACPPOEM-0731-164 *Invited*
NR Conformance Testing and Coherent Joint Transmission Validation in Distributed-MIMO with Analog Fronthaul for 6G
Xiaodan Pang[1,2,3], Rafael Puerta[1,4], Mahdieh Joharifar[1], Richard Schatz[1], Lu Zhang[5,6], Sandis Spolitis[3], Vjaceslavs Bobrovs[3], Xianbin Yu[5,6], Oskars Ozolins[1,2,3]
1.KTH Royal Institute of Technology, Sweden; 2.RISE Research Institutes of Sweden, Sweden; 3.Riga Technical University, Latvia; 4.Ericsson AB, Sweden; 5.Zhejiang University, China; 6.Zhejiang Lab, China
We present NR conformance testing of analog radio-over-fiber (ARoF) and analog radio-over-free-space-optics (ARoFSO) fronthaul links for Distributed MIMO (D-MIMO) systems in 6G mobile networks. Experimental validations of coherent joint transmissions are also performed to meet the stringent synchronization demands.

16:30-16:45 • ACPPOEM-0815-107
Stable Wideband Signal Dissemination Based on High-accuracy Optical Transfer Delay Measurement
Zelin Lyu[1,2,3,4], Qianlong Zhang[1,2,3,4], Bin Wang[1,2,3,4], Weifeng Zhang[1,2,3,4]
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We propose and experimentally demonstrate a stable wideband signal dissemination system based on high-accuracy optical transfer delay measurement. In the proposed system, the absolute time delay of the fiber link is accurately measured based on phase-derived ranging, and then the fiber link is actively stabilized for stable wideband signal dissemination. As a demonstration, a wideband signal with a bandwidth of 4 GHz and a center frequency of 16 GHz is transmitted over a 1-km-long single-mode fiber, and the peak-to-peak time jitter is as small as 31.2 fs. The proposed system provides a high stability and a unique capability of absolute time delay measurement, which is promising to be widely used in distributed coherent detection systems.

16:45-17:00 • ACPPOEM-0815-20
Photonics-Assisted Complex-Valued Discrete Fourier Transform Processor Based on Temporal Computing
Weizhen Yu[1,2,3,4], Bin Wang[1,2,3,4], Weifeng Zhang[1,2,3,4]
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In this paper, we propose and experimentally demonstrate a photonics-assisted complex-valued discrete Fourier transform (DFT) processor based on temporal computing. In the proposed DFT processor, the complex-valued input data and the orthogonal basis are encoded in sequence on an optical carrier via two high-speed dual-drive Mach-Zehnder modulators (DD-MZMs). By precisely controlling the synchronization time of the input data and orthogonal basis loading, the complex-valued multiplication operation is performed in the time domain. An optical hybrid is used to implement coherent detection, and two low-speed photodetectors are used to perform the complex-valued accumulation operation. As a demonstration, 32-points complex-valued DFT is performed, and the normalized root mean square error (NRMSE) is as small as 0.0133. In addition, a 16×32 pixels image is employed to implement 2D DFT, which achieves an NRMSE as small as 0.0065. The proposed DFT processor holds unique advantages including high throughput and low latency, which is potential to be widely used in artificial intelligence computing and radar signal processing systems.

17:00-17:15 • ACPPOEM-0730-26
Optical True Time Delay Compensation Network-Based Beam Tracking for THz Massive MIMO Systems
Shilong Jia[1], Chongfu Zhang[1], Zixin Zhao[1], Lipeng Dai[1], Huan Huang[1], Songnian Fu[2], Kun Qiu[1]
1.University of Electronic Science and Technology of China, China; 2.Guangdong University of Technology, China
Terahertz (THz) communication is one of the most important technologies of future 6G due to its ultra-bandwidth. In THz massive multiple-input multiple-output (MIMO) systems, the performance of beam tracking is significantly degraded due to the beam split effect. In this paper, we propose an optical true time delay compensation network (OTTDCN)-based beam tracking scheme. In the proposed OTTDCN-based beam tracking scheme, the OTTDCN is introduced between the radio-frequency (RF) chains and the phase shifter network. The OTTDCN pregenerates the beam compensation modes and controls the degree of the beam split effect through frequency-dependent phase compensation to create multiple beams to track the physical directions of multiple users. Meanwhile, we develop a beam compensation mode-based beam tracking (BCM-BT) algorithm, which considers the selection of the optimal beam compensation modes. The results show that the OTTDCN-based beam tracking scheme can effectively reduce beam tracking overhead and achieve near-optimal sum rate performance.

17:15-17:30 • ACPPOEM-0815-32
Stable Wideband WDM Receiving System Based on Relative Phase-locking
Baixuanyao Ye, Wei Wei, Xi Wang, Weilin Xie, Yi Dong
Beijing Institute of Technology, China
We present a wideband wavelength division multiplexed receiving system. The relative transmission delay variation between 2 channels is controlled within 40fs using a probe-based homodyne phase-locked loop.

17:30-17:45 • ACPPOEM-0731-139
High-Fidelity Positive Real Matrix Transformation with Coherent Integrated Photonics Chip
Guangsong Yuan, Hongxiang Guo, Yuepeng Wu, Yi Guo, Shunxin Song, Jian Wu
Beijing University of Posts and Telecommunications, China
We implement random 3x3 positive real matrix transformation with a 4x4 coherent integrated photonics chip. Experiments show the similarity results for random single or two parallel matrices are 95.2% and 93.5%, respectively.

17:45-18:00 • ACPPOEM-0801-65 *Industry Innovation Nomination*
A Photonic Transceiver for the Aggregation and Disaggregation of Microwave Signals Based on an Optical Frequency Comb Source
Haikun Huang[1], Shengkang Zeng[1], Lingzhi Li[1], Jiejun Zhang[1], Jianping Yao[2]
1.Jinan University, China; 2.University of Ottawa, Canada
A photonic transceiver for the aggregation and disaggregation of microwave signals based on an optical frequency comb source is proposed and experimentally demonstrated. The key device is a dual-polarization dual-drive Mach-Zehnder modulator (DP-DDMZM) which is employed to perform signal aggregation and disaggregation. In the aggregation mode, four binary phase shift keying (BPSK) microwave signals with each having a bit rate of 2 Gbps at different frequencies received by four antennas are aggregated into two quadrature phase shift keying (QPSK) single-sideband (SSB) modulation optical signals with orthogonal polarizations. The spectral efficiency is quadrupled with a combined bit rate of 8 Gbps. After coherent detection, the aggregated signals are decoded. The error vector amplitude (EVM) is 19.93% and the bit error rate (BER) is 2.61×10^{-7}. In the disaggregation mode, a QPSK microwave signal with a bit rate of 4 Gbps received by an antenna is disaggregated into two BPSK optical signals, with each disaggregated signal having a bit rate of 2 Gbps and an EVM of 13.75%.