#AVFOP2018

AVIONICS AND VEHICLE FIBER-OPTICS AND PHOTONICS CONFERENCE

AVFOP2018

13-14 NOVEMBER 2018

CROWN PLAZA PORTLAND DOWNTOWN

PORTLAND, OREGON, USA

Chris Ward, General Chair
Georgia Tech Research Institute, USA

Rob Nelson, Program Chair
Air Force Research Laboratory, USA

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IEEE Photonics Society

AVFOP 2018 Program-at-a-Glance

All sessions are in the Windsor Ballroom	TUESDAY, 13 NOVEMBER	WEDNESDAY, 14 NOVEMBER
8:00 am-8:30 am	BREAKFAST: BELMONT A, B & C	
8:30 am-10:00 am	**TuA:** Electro-optic Modulators **Session Chair:** M. Mashanovitch	**9:00 am-10:00 am** **WA:** Photonic Components **Session Chair:** B. Griffin
10:00 am-10:30 am	EXHIBITS/COFFEE BREAK: BELMONT A, B & C	
10:30 am-11:30 am	**TuB:** RF Photonic Processing **Session Chair:** C. Middleton	**WB:** Photonic Networks and Components I **Session Chair:** C. Ward
11:30 am-12:00 pm	**Exhibitor Introductions I**	**Exhibitor Introductions II**
12:00 pm-1:30 pm	LUNCH BREAK (ON OWN)	
1:30 pm-3:30 pm	**TuC:** Integrated Photonics **Session Chair:** J. McKinney	**1:30 pm-3:00 pm** **WC:** Photonic Networks and Components II **Session Chair:** M. Beranek
3:30 pm-4:00 pm	EXHIBITS/COFFEE BREAK: BELMONT A, B & C	
4:00 pm-5:00 pm	**TuD:** RF Photonic Applications **Session Chair:** J. Mazurowski	**4:00 pm-4:45 pm** **WD:** Photonic Devices and Applications **Session Chair:** G. Abbas
5:00 pm-6:30 pm	**Welcome Reception** Belmont A, B & C	**Registration – Windsor Foyer** Tuesday, 13 November 7:30 am-5:00 pm Wednesday, 14 November 7:30 am-5:00 pm

We would like to welcome you to the Avionics and Vehicle Fiber-Optics and Photonics Conference 2018 (AVFOP) in Portland, Oregon USA at the Crowne Plaza Portland Downtown Convention Center!

The first AVFOP was held in 2004, as a result of a U.S. government and industry consensus championing a standalone fiber optics and photonics conference dedicated to the field of avionics. In recent years, the aerospace, land, and sea vehicle industries have made great strides deploying fiber optics and photonics technology on commercial and military platforms. This trend will continue to grow as fiber optic system architectures, networking schemes, and components evolve and mature.

Fifteen years later, the AVFOP conference provides an indispensable international forum for the academic, industry, and government R&D community developing fiber-optic/ photonic components and system technologies for avionics. While from the beginning the topics discussed and solicited have been inclusive of all mobile platforms, this year, in addition to avionics, we would like to specifically encourage papers covering fiber optic/photonics technologies across mobile platforms, on surface ships, submarines, and ground vehicles.

The conference program will feature select expert invited speakers, but we again rely on a strong contributed paper program, and ask all of you to submit your work and meet us in Portland in 2018.

The AVFOP conference has attracted a strong group of exhibitors in past years and we expect this trend to continue, providing the participants with an opportunity for direct interaction with vendors during the conference.

We welcome your participation in the AVFOP 2018, and look forward to seeing you in Portland!

Chris Ward
General Chair
Georgia Tech Research Institute

Robert Nelson
Program Chair
Air Force Research Laboratory

General Chair
Chris Ward
Georgia Tech Research Institute

AVFOP 2018 Committee List

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Drew Glista, Liteboard Technology, USA
Benjamin Griffin, Air Force Research Laboratory, USA
Sarry Habiby, Vencore Labs-dba ACS, USA
Michael Hackert, NAVAIR, USA
Michael J. Hayduk, Air Force Research Laboratory/RIT, USA
William Krug, Boeing, USA
Milan Mashanovitch, Freedom Photonics, USA
Paul Matthews, Northrop Grumman, USA
John Mazurowski, Penn State Electro Optics Center, USA
Jason McKinney, U.S. Naval Research Laboratory, USA
Christopher Middlebrook, Michigan Technological University, USA
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Geoff Proudley, AVoptics Ltd., UK
Bill Reid, Amphenol Fiber Systems International, USA
Rick Stevens, Lockheed Martin ATL, USA
Gerard Walles, NAVAIR, USA
Weimin Zhou, Army Research Laboratory, USA
Sanja Zlatanovic, SSC Pacific, USA

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AVFOP 2018 Exhibitors

Amphenol Fiber Systems International
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Amphenol Fiber Systems International (AFSI, Allen TX) is a global innovator in the design, development and manufacturing of fiber optic solutions. AFSI's expertise has been established through its fiber optic cable assembly capabilities, alongside its interconnects offerings including the patented TFOCA-II® and TACBEAM® connectors and backshells, MIL-PRF-64266 and ARINC-801 Connectors.

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Diamond USA manufactures a wide range of reliable and customizable interconnect solutions. Our ruggedized solutions are well suited for harsh and demanding applications found within commercial and military platforms. We also offer multipurpose, COTS connectors with high performance that are suitable for dynamic environments, including avionics and space flight.

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Experior Laboratories is a third party test laboratory providing independent design verification and qualification testing services to fiber optic component and system manufacturers, military contractors, integrators and system providers within the Telecom, Mil/Aero, Space and many other industries. Experior Laboratories is MIL-STD-790 approved by DLA for various fiber, cable, termini and connector MIL standards.

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FiberQA develops and manufactures automated test equipment for endface inspection & cleaning that significantly decreases labor costs for supply chains worldwide. Alongside live demonstrations of a FastMT (inspect an MT-12 in 12 seconds!), FiberQA will be presenting the AVIT-dt: an automated, multi-ferrule, integrated inspection & cleaning desktop system.

Freedom Photonics LLC
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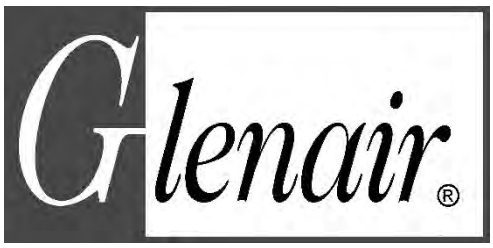
FREEDOM PHOTONICS is a manufacturer of unique and innovative photonic components, modules and subsystems. Our advanced semiconductor and dielectric photonic integration technology platforms are enabling new, high-performance fiber and free-space optical communication and sensing systems aimed at applications in diverse markets. If one of our standard solutions do not work for you, and you have a need that can be met through customizing our core photonic technology in the 750nm to 1900nm wavelength range, we will be happy to provide private label design, development and production services to support your needs.

Contact us for further information about Freedom Photonics' advanced PIC based products, or to learn how to tap into Freedom Photonics' vast PIC technology experience.

Glenair, Inc.
CONTACT: GREG NOLL



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Information Gatekeepers, Inc. is a publisher, trade show organizer, consultancy and information service provider in the fields of fiber optics, high-speed Internet, wireless, and emerging telecom markets. For more information, visit www.igigroup.com.

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Radiall is a global leader of interconnect solutions, including RF coaxial connectors and cable assemblies, coaxial switches, fiber optic, microwave components, and multipin connectors. Our global presence includes worldwide sales offices, subsidiaries and R&D within the U.S., Europe

and China. Radiall has strategically located manufacturing facilities in the U.S., Mexico, India, and China.

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Established in 1979, Santec is a global photonics engineering company and a leading manufacturer of Tunable Lasers, Optical Test and Measurement Products, and Advanced Optical Components. Santec's tunable lasers and test systems are known for high resolution, high accuracy, and high wavelength stability for high performance in photonic device characterization.

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Optical Solutions Group is a leading developer of optical and photonics design and analysis software: CODE V®, Light Tolls®, LucidShape®, and RSoft™ products. RSoft products provide a full range of design, optimization and planning tools for optical communications, as well as award winning solutions for optoelectronics components and subsystems.

Thorlabs (2 booths)
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Founded in 1989, Thorlabs is a vertically integrated manufacturer of products to serve the photonics industry. With sites located worldwide, Thorlabs core manufacturing competencies include optics, fiber-optics, fiber-optic processing systems, optomechanics, optoelectronics, microscopy systems, and semiconductor-based devices including Lithium Niobate modulators, QCL/ICL mid-IR lasers, and tunable MEMS-VCSELs.

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Timbercon fiber optic cables are designed to allow a high degree of flexibility and customization. By providing virtually unlimited options, we can ensure you receive a product designed for your specific need and application.

Ultra Communications Inc.
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Ultra Communications develops RF and photonic components for harsh environment and high reliability applications. These applications require components to operate through wide temperature ranges, shock, vibration, condensation, chemicals, and/or radiation. We are representing quad channel fiber optic transceivers that operate at multi-gigabit data rates.

VPIphotonics, Inc.
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VPIphotonics provides flexible simulation software and design services supporting requirements of active/passive integrated photonics, doped-fiber applications, optical system and network applications, and cost-optimized equipment configuration. Join us for live demos on modeling transmission systems with 4D modulation formats, complex integrated devices in Silicon Photonics and InP, and pulsed or high-power doped-fiber applications.

Final Program

TUESDAY, 13 NOVEMBER 2018

7:30 am–5:00 pm **Windsor Foyer**

Registration

8:00 am–8:30 am **Belmont A, B & C**

Breakfast

8:30 am–10:00 am **Windsor Ballroom**
Session TuA **Electro-Optic Modulators**
Session Chair Milan Mashanovitch, *Freedom Photonics, Santa Barbara, CA, USA*

8:30 am–9:00 am ***(Invited)***

TuA1 **Gain, SFDR and NF for Analog Links with with Arbitary Transfer Functions,** Stephen E. Ralph, Varghese A. Thomas, Christian G. Bottenfield, Stephen M. Hurst, and Gareeyasee Saha, *Georgia Institute of Technology, Atlanta, GA, USA*

We present general expressions for RF gain, spurious free dynamic range and noise figure for analog links with arbitrary transmittances. We apply these to links comprised of simulated and fabricated integrated modulators.

9:00 am–9:30 am ***(Invited)***

TuA2 **Sources of RF Intermodulation Distortion in Silicon Photonic Modulators,** Navid Hosseinzadeh, Aditya Jain, Roger Helkey, and James Buckwalter, *University of California, Santa Barbara, Santa Barbara, CA, USA*

We present a model of intermodulation distortion in RF silicon photonic modulators to highlight mechanisms that limit the device linearity. We compare the SFDR of two MZMs to show a common IMD limitation and indicate methods to improve linearity in silicon photonic RF modulators.

9:30 am–9:45 am

TuA3 **Linear Ring Modulators with DC Kerr Phase Shifters,** Aditya Jain, *University of California, Santa Barbara, Santa Barbara, CA, USA*, Xinru Wu, *Chinese University of Hong Kong, Hong Kong*, John E. Bowers, Roger Helkey, and James F. Buckwalter, *University of California, Santa Barbara, Santa Barbara, CA, USA*

We demonstrate a silicon ring modulator with linear phase shift versus voltage, derived from the interplay between plasma dispersion effect and DC Kerr effect. The dynamic range is 103.6 dB. $Hz^{2/3}$ at a 1.2 GHz carrier.

9:45 am–10:00 am

TuA4 **Single-Sideband Thin Film Lithium Niobate (TFLNTM) Electro-Optic Modulators for RF over Fiber,** D. Brown, S. McKeown, *UES, Inc., Dayton, OH, USA*, B. Griffin, *Air Force Research Laboratory, Wright Patterson, OH, USA*, V. Stenger, J. Toney, S. Sriram, *SRICO, Inc., Columbus, OH, USA*, and R. Nelson, *Air Force Research Laboratory, Wright Patterson, OH, USA*

A high speed thin film lithium niobate modulator device is integrated with a Bragg grating for in situ sideband filtering. The configuration has potential for high efficiency linear intensity modulation at bandwidths exceeding 70 GHz. This proof of concept study explores the benefits ofin...

10:00 am–10:30 am **Belmont A, B & C**

Exhibits / Coffee Break

10:30 am–11:30 am **Windsor Ballroom**
Session TuB **RF Photonic Processing**
Session Chair Charles Middleton, *Harris Corporation, USA*

10:30 am–11:00 am ***(Invited)***

TuB1 **Develop RF-Photonic Technology for Wideband Spectrum Analyses,** Weimin Zhou, Michael R. Stead, *Army Research Laboratory, Adelphi, MD, USA*, Eric Magi, Moritz Merklain, and Benjamin Eggleton, *University of Sydney, Sydney, Australia*

We are developing new RF-Photonic technologies to provide fast wideband RF spectrum analyses up to 100 GHz. These include an analog time-domain auto-correlation processer technique which provides an “instant picture” of the RF spectrum and a stimulated Brillouin scattering-based fast scanning RF spectrum analyzer.

11:00 am–11:15 am

TuB2 **GHz-Band RF Receiver and Spectrometer Based on Laser Speckle in Multimode Waveguides,** Adam C. Scofield, George A. Sefler, T. Justin Shaw, Andrew D. Stapleton, and George C. Valley, *The Aerospace Corporation, El Segundo, CA, USA*

We report the experimental demonstrations of compressive sensing RF receiver and spectrometer with photonic systems in which the measurement matrices are implemented using speckle in multimode waveguides. We calibrate by measuring a dictionary of single frequency RF sinusoids and recover multiple tones with both systems.

11:15 am–11:30 am

TuB3 **Large Bandwidth Channelized RF Receiver Based on Chirped Pulses Mixing,** Yuduo Guo, FeiFei Yin, Kun Xu, and Yitang Dai, *Beijing University of Posts and Telecommunications, Beijing, China*

Here we report a technology of channelized wide band RF signal receiver. It utilizes the mixing characteristics of a chirped pulse and its own delay to produce adjustable chirp local oscillators. The setup covers the band from DC to 40 GHz.

11:30 am–12:00 pm **Windsor Ballroom**

Exhibitor Introductions I

12:00 pm–1:30 pm

Lunch Break (On Own)

1:30 pm–3:30 pm **Windsor Ballroom**

Session TuC **Integrated Photonics**

Session Chair Jason D. Mckinney, *U.S. Naval Research Laboratory, Washington, DC, USA*

1:30 pm–2:00 pm ***(Invited)***

TuC1 **RF Active Optical Cable (AOC) Leveraging the AIM Photonics RF Analog KTMA,** Rick Stevens, *Lockheed Martin ATL, Atlanta, GA, USA*, Arthur Paolella, *Harris*, Stephen Ralph, *Georgia Institute of Technology, Atlanta, GA, USA*, Andreas Beling, *University of Virginia, Charlottesville, VA, USA*, and James F. Buckwalter, *University of California, Santa Barbara, Santa Barbara, CA, USA*

An RF Active Optical Cable (AOC) can be used to directly replace coaxial cables on both commercial and military systems and addresses current challenges in cable loss, cable weight, EMI, reliability, and scalability. The RF AOC will leverage Photonics Integrated Circuit (PIC) manufacturing advances.

2:00 pm–2:30 pm ***(Invited)***

TuC2 **Low Loss Silicon Photonic Switches,** Ming Wu, *University of California, Berkeley, Berkeley, CA, USA*

Silicon photonics offers a path to large-scale photonic switches. In this talk, we review the state of the art of silicon photonic switches, with emphasis on silicon photonic MEMS switches with high port count (64 × 64 and 128 × 128), microsecond response time and low insertion loss.

2:30 pm–2:45 pm

TuC3 **Analog Photonic Timing Equalization Method for Multi-Channel RF Photonic Links,** Jianfu Wang, Suen Xin Chew, Xiaoke Yi, and Linh Nguyen, *University of Sydney, Sydney, Australia*

A new photonic timing equalization approach is presented to compensate the group delay among multiple signals in an analog photonic link. The results show the group delay variation across multiple RF photonic channels can be significantly compensated with 96.2% reduction after the equalization.

2:45 pm–3:00 pm

TuC4 **High-Power, Efficient DFB Laser Technology for RF Photonics Links,** Milan Mashanovitch, Stewart Fryslie, Bob Buckley, Keith Guinn, Gordon Morrison, and Leif A. Johansson, *Freedom Photonics, Santa Barbara, CA, USA*

We present a high power DFB laser technology, developed for operation at 1280 nm and 1550 nm, showing >250 mW laser output power and laser efficiencies up to 36%.

3:00 pm–3:15 pm

TuC5 **A Novel Comb-Optimized (COMBO) DBR Laser,** G. B. Morrison, J. Sherman, I. Gonzalez, K. Ottoson, J. Campbell, S. Estrella, P. Leisher, D. Renner, L. Johansson, and M. Mashanovitch, *Freedom Photonics, Santa Barbara, CA, USA*

We describe a novel approach to design of DBR lasers that utilizes sampled gratings to optimize mirror loss and mirror bandwidth independently. This versatile new approach has enabled a wide variety of lasers, from compact low power consumption to high power single mode designs.

3:15 pm–3:30 pm

TuC6 **Quasicoherent Receivers,** Varghese A. Thomas, Saeed Zeinolabedinzadeh, and Stephen E. Ralph, *Georgia Institute of Technology, Atlanta, GA, USA*

We present simulations of various envelope detection based quasicoherent receivers. These receivers provide sensitivity improvements of up to 18dB over direct detect receivers, while having a much simpler architecture compared to the classical coherent receiver.

3:30 pm–4:00 pm **Belmont A, B & C**

Exhibits / Coffee Break

4:00 pm–5:00 pm **Windsor Ballroom**
Session TuD **RF Photonic Applications**
Session Chair John Mazurowski, *Pennsylvania State University, PA, USA*

4:00 pm–4:30 pm ***(Invited)***

TuD1 **Photonics for Munitions Applications,** Adam J. Rutkowski and Christian Keyser, *Air Force Research Laboratory, Wright Patterson, OH, USA*

The following topics will be presented: A compact passive millimeter wave imager for navigation in fog or smoke. Low-CSWAP multispectral and/or polarimetric LiDAR systems using temporally multiplexed architectures for target identification. LiDAR laser sources based on nonlinear optics in gas-filled hollow-core photonic crystal fibers.

4:30 pm–5:00 pm

TuD2 **Frequency Agile Photonic Front-End for Wideband Transmission and Reception,** Jean Kalkavage, Natalie Bos, Robert Schmid, Jay Song, and Thomas Clark, *Johns Hopkins Applied Physics Laboratory, Laurel, MD, USA*

We have developed and tested a 0–45 GHz frequency agile photonic front-end for up- and down-conversion of signals with >800 MHz instantaneous bandwidth, <1 us switching speed, and low end-to-end latency. The 3U OpenVPX system has been tested in a TRL6 demonstration.

5:00 pm–6:30 pm **Belmont A, B & C**

Welcome Reception

WEDNESDAY, 14 NOVEMBER 2018

7:30 am–5:00 pm **Windsor Foyer**

Registration

8:00 am–8:30 am **Belmont A, B & C**

Breakfast

9:00 am–10:00 am **Windsor Ballroom**

Session WA **Photonic Components**

Session Chair Benjamin Griffin, *Air Force Research Laboratory, Wright Patterson, OH, USA*

9:00 am–9:30 am ***(Invited)***

WA1 **Do Recent Advances in Repair Technology Make it a Viable Alternative to Replacement Strategies?,** Andy Voizey, *AVOptics*

Moving away from a replacement strategy to one which allows repair of fibre optic harnesses on aircraft has not been without its challenges. This paper presents work performed by AVoptics on splicing and curing that now makes repair a viable alternative to a replacement strategy.

9:30 am–9:45 am

WA2 **High-Density 12 Transmitters Plus 12 Receivers Rugged Optical Fiber Transceivers,** Gabriel Monette, Saïd El Kharraz, and Jocelyn Lauzon, *Reflex Photonics Inc., Kirkland, Quebec, Canada*

A novel optical fiber transceiver offering 24 channels at up to 14 Gbps is presented; its external dimensions are 32.3 ×13.4 × 4.5 mm; it is compatible with the VITA66.4 standard or can be embedded on a host PCB; its operating temperature range is –40 to 100°C.

9:45 am–10:00 am

WA3 **Surface Mounted Fiber Optic Sensors for Accurate Monitoring of Pressure Profiles Across an Airfoil,** John Arkwright, Anthony Papageorgiou, Luke Parkinson, Andrew Karas, Kristy Hansen, *Flinders University, Tonsley, Australia,* and Richard Kelso, *University of Adelaide, Adelaide, Australia*

We present a low profile surface mounted fiber optic pressure sensor for monitoring pressure profiles across an airfoil surface. The device has been tested on a symmetric airfoil section in a wind tunnel and shows excellent agreement with standard pressure taps.

10:00 am–10:30 **Belmont A, B & C**

Exhibits / Coffee Break

10:30 am–11:30 am **Windsor Ballroom**

Session WB **Photonic Networks and Components I**

Session Chair Chris Ward, *Georgia Tech Research Institute, Atlanta, GA, USA*

10:30 am–11:00 am ***(Invited)***

WB1 **SAE Fiber Optics and Applied Photonics,** John Mazurowski, *Pennsylvania State University, Freeport, PA, USA*

This is a status of activities for the SAE Aerospace Division Fiber Optics and Applied Photonics Committee.

11:00 am–11:15 am

WB2 **Optical Fibre Sensing for Civil Aircraft Applications: Main Perspectives and Challenges,** Alessio Cipullo, *Airbus Operations Ltd., Filton (Bristol), UK*, Sy-Dat Le, *Airbus Operations SAS, Toulouse, France*, Kevin Jones, *Smart Fibres Ltd., Bracknell, UK*, Marco Awater, *AcQ Inducom, Oss, The Netherlands*, Ethan Moss, *Airbus Operations Ltd., Filton (Bristol), UK*, Alberto Sposito, *Oxsensis Ltd., Didcot, UK*

Optical Fibre Sensing is a growing area for civil aviation. The development of "Universal" interrogators for different sensor technologies (such as FBG and Fabry-Pérot) is of particular interest. Nevertheless, significant challenges still exist for the use of single-mode fibres and mastering of the reliability aspects.

11:15 am–11:30 am

WB3 **Flexible Polymer Waveguide Technology for Low-Cost In-Car and In-Plane Optical Interconnects,** Fengyuan Shi, Nikolaos Bamiedakis, Richard V. Penty, Ian H. White, and Daping Chu, *University of Cambridge, Cambridge, UK*

Flexible polymer multimode waveguides are a promising low-cost technology for achieving high-speed optical interconnection in next-generation automobiles and aircrafts. Here, an overview of the light transmission performance of such waveguides is presented, achieving low loss, low crosstalk, high bandwidth and robust operation under strong flexure.

11:30 am–12:00 pm **Windsor Ballroom**

Exhibitor Introductions II

12:00 pm–1:30 pm

Lunch Break (On Own)

1:30 pm–3:00 pm **Windsor Ballroom**

Session WC **Photonic Networks and Components II**

Session Chair Mark Beranek, *NAVAIR, USA*

1:30 pm–2:00 pm ***(Invited)***

WC1 **Fiber Optic Transceivers with Integrated Optical Time Domain Reflectometry,** Charlie Kuznia, *Ultra Communications*

We present the integration of optical time domain reflectometry (OTDR) technology within harsh environment fiber optic applications, including data transmission and sensing applications. We present an approach utilizing an application specific integrated circuit (ASIC) and optical coupling methods to achieve OTDR functionality.

2:00 pm–2:15 pm

WC2 **Probabilistic Shaping for VCSEL-MMF Links,** Siddharth Varughese, Justin Lavrencik, and Stephen E. Ralph, *Georgia Institute of Technology, Atlanta, GA, USA*

We analyse the benefits of probabilistic shaping in reducing received power requirements in error-free VCSEL-MMF links. Experimental results demonstrate nearly 1 dB reduction for the same net data rate. All results are through 100 m of OM5 fiber at 10^{-12} SER.

2:15 pm–2:30 pm

WC3 **Counter Directional Optical Network Using Ribbon Fiber,** John Mazurowski, *Pennsylvania State University, Freeport, PA, USA*

This network concept is directed at smaller platforms. It incorporates a source module and nodes, connected by fibers in the ribbon. To transmit, a source fiber is connected to a receiving fiber through a modulator; this signal travels in the direction opposite the source signal.

2:30 pm–2:45 pm

WC4 **Full-Duplex Communication with Photonic Based RF Self-Interference Cancellation,** Xiuyou Han, Shuo Wang, Yuchen Shao, Xinxin Su, Hanqiao Wang, and Mingshan Zhao, *Dalian University of Technology, Dalian, China*

RF self-interference is the crucial issue to be resolved necessarily for full-duplex communication. A photonic method based on an integrated dual-parallel Mach-Zehnder modulator for cancelling the RF-self interference is proposed with experimental demonstration, showing the advantages of broad bandwidth and large cancellation depth.

2:45 pm–3:00 pm

WC5 **Compact 7-Channel SiN Wavelength De-Multiplexer with Multi-Core Fiber Fan-Out,** Sarvagya Dwivedi, Weiqang Xie, Victoria Rosborough, and Jonathan Klamkin, *University of California, Santa Barbara, Santa Barbara, CA, USA*

We have demonstrated a compact and low-loss, cascaded Mach-Zehnder interferometer based 7-channels wavelength de-multiplexer realized on a SiN platform over C-band with a multi-core fiber fan-out. The measured insertion loss and channel cross-talk are found below 0.5 dB and –8 dB for all the channels.

3:30 pm–4:00 pm **Belmont A, B & C**

Exhibits / Coffee Break

4:00 pm–4:45 pm **Windsor Ballroom**
Session WD **Photonic Devices and Applications**
Session Chair: Gregory Abbas, *EOSpace, USA*

4:00 pm–4:15 pm

WD1 **High Speed, Low Power Photonic C-MOSFETs for Sub-14 nm ULSI Technology,** James N. Pan, *Advanced Enterprise and License Co., Linthicum, MD, USA*

This paper reports a novel optoelectronic sub-14nm CMOS transistor, fabricated with a tunnel light emitting diode (TLED) or quantum well laser (QWL) in the drain region, and an underlying avalanche breakdown photo diode (APD). The CMOS, QWL, and APD are integrated as one device.

4:15 pm–4:30 pm

WD2 **Design of 3D Printed Integrated Multiplexer of Spatial Domain Multiplexing Communication System,** Syed H. Murshid, Han Wang, Engin Eyceyurt, and Rayan Enaya, *Florida Institute of Technology, Melbourne, FL, USA*

This presents spatial multiplexing in optical fiber communication systems, using a novel high resolution 3D printed multiplexer, which is designed with the help of Solid Works and Zemax. Simulated and experimental results for a two channel SDM system and their output intensity profile is presented.

4:30 pm–4:45 pm

WD3 **Micro-Structured Fiber as Temperature Sensor in a Loop Architecture,** René Dominguez-Cruz, *Universidad Autónoma de Tamaulipas, Reynosa, México*, Daniel May-Arrioja, Daniel López-Cortés, Rodolfo Martinez-Manuel, *Centro de Investigaciones en Óptica Unidad Aguascalientes, Aguascalientes, México*, Oscar Baldovino-Pantaleón, and Gerardo Romero-Galván, *Universidad Autónoma de Tamaulipas, Reynosa, México*

We report a temperature sensor built by a micro-structured fiber using a Sagnac array. The waveguide is provided by a two-hole fiber (THF) which are located asymmetrically from the core. A temperature sensitivity is around 2.22 nm/°C was reached using a 2 m-long of THF.

END OF PROGRAM

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