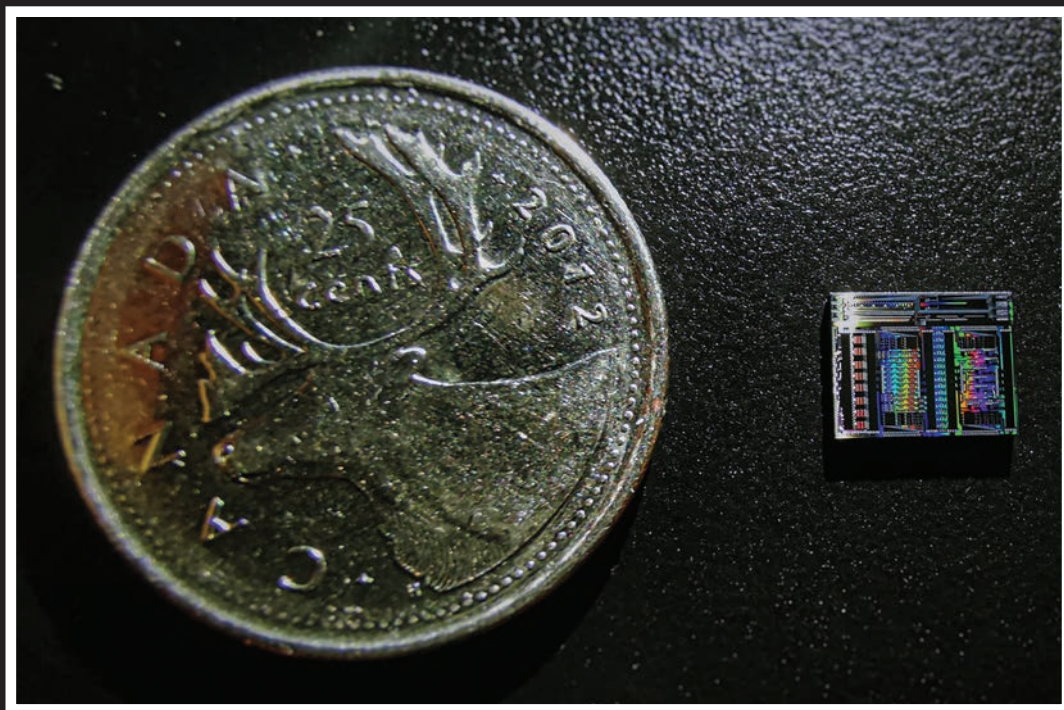


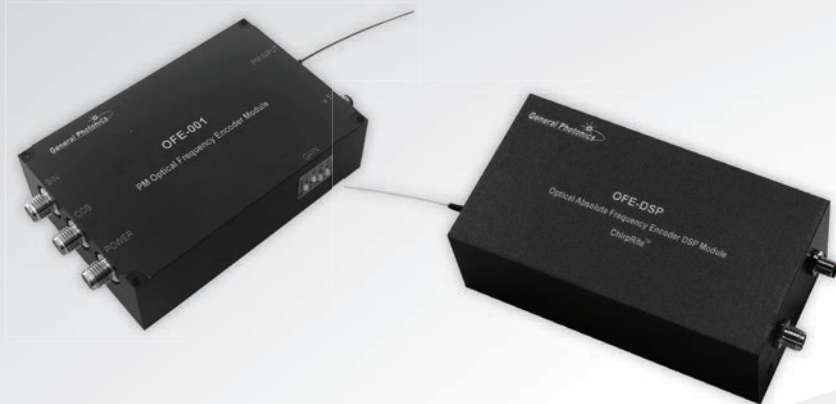
## On-chip Programmable Waveguide Bragg Gratings



### Also Inside:

- Photonics Workforce Development
- UCSB Women in Photonics Week
- British and Irish Conference on Optics and Photonics

# OPTICAL FREQUENCY ENCODER - ChirpRite™



## FEATURES:

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- Laser Phase Noise Insensitive
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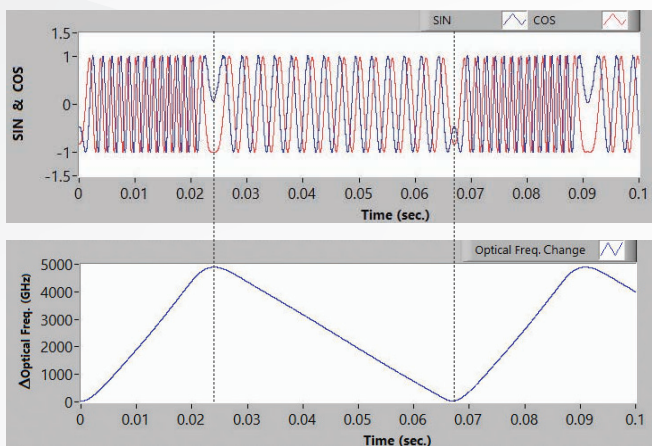
## APPLICATIONS:

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- Coherence LIDAR
- Coherence Detection Systems
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ChirpRite™ is a compact optical frequency encoder capable of obtaining detailed chirp information for tunable or swept-frequency lasers. The OFE-001 provides two analog signals proportional to the sine and cosine functions of the optical frequency, which can be used to obtain incremental optical frequency changes with high resolution. The OFE-DSP incorporates DSP circuitry to output the absolute optical frequency in both analog and digital formats, as well as generating a k-clock signal of user defined resolution. ChirpRite™ is designed specifically for applications involving swept-frequency lasers, including chirped LIDAR, OCT, OFDR, and TDLAS systems.

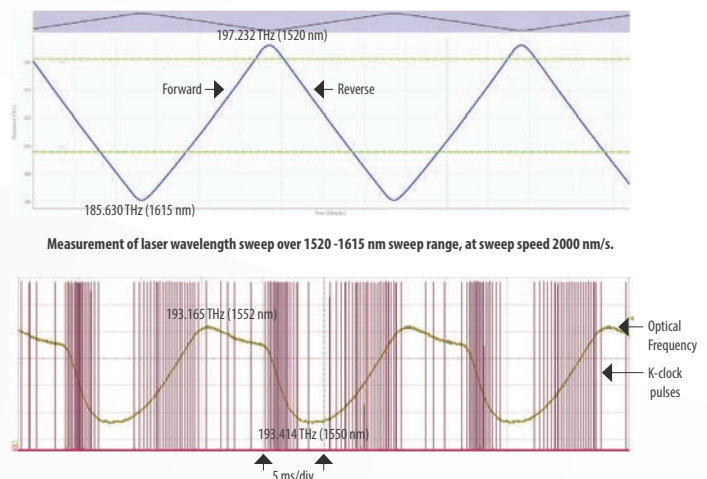
## LASER FREQUENCY MEASUREMENTS:

### OFE-001



OFE-001 output signals and derived frequency data for measurement of a swept wavelength signal.  
Top: Sine and cosine signals from OFE-001. Bottom: Optical frequency vs. time, derived from sine and cosine signals.  
The dotted lines indicate the inflection points in the wavelength sweep.

### OFE-DSP



Measurement of laser wavelength sweep over 1520 -1615 nm sweep range, at sweep speed 2000 nm/s.

OFE-DSP laser frequency variation measurement and output k-clock signal at 0.1 nm intervals.  
Laser wavelength sweep range: 2 nm (periodic modulation).



909.590.5473



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## Editor's Column

NICOLAS FONTAINE

Since the last Newsletter, I have attended Photonics West and the Optical Fiber Communications Conference (OFC). At both conferences, I saw many of the IEEE Photonics Society staff, assisted in social event programming, gave a few technical talks, and also watched MANY of my peers' talks. However, one of the most engaging events I attended was the Photonics Workforce Development Mixer designed to better reach community college and photonics technicians, which you can read more about in this issue!

This issue's "Get to Know Your Photonics Society Leadership", features Matthew Posner. Matthew is a young researcher starting his career at Excelitas Technologies in Canada and is the Young Professional Representative for the Society's Industry Engagement Committee. He has been heavily involved as a volunteer for several years now, even as a past Student Chapter Chair. If you would like some advice and tips on volunteering, please reach out to him! Especially students looking to start a new chapter and/or Young Professionals interested in industry, manufacturing, start-ups or commercialization topics. New volunteer opportunities are popping up in these areas every day!

The Research Highlights article is from Weifeng Zhang and Jianping Yao at the University of Ottawa and is entitled, "On-Chip Programmable Waveguide Bragg Gratings". Typically, Fiber Bragg gratings are fixed devices; however, the authors have figured out a way to actively tune the gratings to reconfigure the spectral shape. Please read the article and contact the authors for further information!

Much like my other columns, I want to emphasize that the Society wants to hear news from you, its members and advocates representing photonics around the world. The Newsletter has five enthusiastic and motivated Associate Editors that I encourage you to inquire about submitting articles. Students, Young Professionals, experienced members, chapters and local institutions should be motivated to submit. From innovative research advancements to local educational programs, social events, and more! Submit articles about any projects you are proud to share with your peers and could potentially spark new ideas and photonics collaboration.

Don't be shy, and please contact me, the staff, or the Associate Editors if you are interested in contributing, no matter how new you are to the Society!

As always, I hope you enjoy reading the articles!

# IEEE Photonics Society

## President

Chennupati Jagadish  
Australian National University  
Canberra, Australia  
Ph: +61-2-61250363  
Email: Chennupati.Jagadish@anu.edu.au

## Past President

Kent Choquette  
University of Illinois  
Dept. of Electrical and Computer Engineering  
208 North Wright Street  
Urbana, IL 61801  
Tel: +1 217 265 0563  
Email: choquette@illinois.edu

## Secretary-Treasurer

Paul Juodawlkis  
MIT Lincoln Laboratory  
244 Wood Street  
Lexington, MA 02421-6426  
Tel: +1 781 981 7895  
Email: juodawlkis@ll.mit.edu

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**Editor-in-Chief**  
Nicolas Fontaine  
Nokia Bell Laboratories  
791 Holmdel Rd, Holmdel, NJ 07733  
732-888-7262  
Email: nicolas.fontaine@nokia.com

## Associate Editor of Australia

Joel Carpenter  
The University of Queensland Australia  
Brisbane St Lucia, QLD 4072  
Email: j.carpenter@uq.edu.au

## Associate Editor of Central, Latin and South American

Juan A. Hernandez Cordero  
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Department of Rheology and Mechanics of Materials  
National Autonomous University of Mexico  
Circuito Exterior s/n, Ciudad Universitaria,  
AP 70-360; Coyoacán,  
Mexico City 04510, Mexico  
Email: jhcordero@iim.unam.mx

## Associate Editor of Asia & Pacific

Nicholas H. L. Wong  
DenseLight Semiconductors Pte Ltd  
6 Changi North Street 2  
Singapore 498831  
Email: n.h.l.wong@ieee.org

## Associate Editor of Northern Europe

Martin Lavery  
School of Engineering  
Rankine Building  
University of Glasgow  
Oakfield Avenue  
G12 8LT  
Martin.Lavery@glasgow.ac.uk

## Associate Editor of Southern Europe

Ivana Gasulla  
ITEAM Research Institute  
Universitat Politècnica de València  
Camino de Vera, 46022 Valencia Spain  
Email: ivgames@iteam.upv.es

## Staff Editor

Lisa Sandt  
IEEE Photonics Society  
445 Hoes Lane  
Piscataway, NJ 08854  
Tel: 1 732 465 6662  
Fax: 1 732 981 1138  
Email: ipsnewsletter@ieee.org

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## President's Column

CHENNUPATI JAGADISH

Hope you are enjoying your spring in Northern Hemisphere and fall in Southern Hemisphere. I am writing this column from OFC 2019 in San Diego.

As usual, the Optical Fiber Communication Conference (OFC) has been a great success and I congratulate all the chairs, committees and staff of the three professional societies for their excellent efforts with OFC. Congratulations to Kim Roberts, from Ciena, for receiving this year's John Tyndall Award. The award is endowed by Corning and sponsored by the IEEE Photonics Society and The Optical Society. While at OFC 2019, our Society also recognized seven IEEE Fellows elevated this year. Congratulations to all, the awardees and those who took the time to recognize their peers.

The three plenary talks at the conference were excellent and covered 5G communications, Photonic Integration and Autonomous Vehicles. In the case of 5G, wireless and optical communications will be working together to provide seamless service to users. Open innovation and open architectures have been identified as way forward for the future of 5G while creating secure environment. The Photonic Integrated Circuits talk also emphasized the issues related to integrating both electronics and photonics and various approaches to reduce size, increase speed and reduce cost. As for the Autonomous Vehicles talk, it focused on the complexity of issues the developers of these cars need to deal with to ensure safe driving of cars in sun, rain, snow, fog, dust. Perception, prediction and planning have been identified as critical elements. Again these require integration of sensors, vision systems, radar, hardware and software. Hopefully the development of autonomous vehicles will reduce the death rate of humans (1.3 Million per year currently die on our roads and 94% of these are due to human error). It is good to see our photonics technologies will play an important and critical role in developing these vehicles.

I spent lot of my time at OFC 2019 at 'One IEEE' Booth meeting with IEEE Photonics Society members and community partners. It is good to receive nice feedback from members that we are moving in the right direction in terms of globalization, diversity and inclusion, industry engagement, young professionals outreach, mentorship and education. In particular, our younger member expressed to me that they want to see our Society creating a more diverse and inclusive environment where all feel comfortable participating in our Society activities. They are looking for a sense of 'family' within the ever-growing photonics community.

The IEEE Photonics Society leadership had a meeting of the Board of Governors at OFC as well. The board approved

the establishment of a Globalization Committee, which will be chaired by Ben Eggleton from Sydney University. We very much look forward to committee's guidance to various parts of our Society on globalization. Furthermore, the Society has also streamlined its awards program to ensure that it is consistent with IEEE policies. Dalma Novak has been appointed as the new chair of the Awards Committee and we sincerely thank Jim Coleman for serving in this role during the past 5 years.

Over the course of the conference week, various councils and committees of the Society also met and discussed their plans for the year. If you are interested in serving as a volunteer leader, please feel free to reach out to me directly expressing your areas of interest. With many new committees forming, we are looking for 'champions' in the field to serve.

IEEE Technical Activities Board (TAB) meetings were held in Tampa in February 2019. Plan S was discussed again and to meet the guidelines of EU, many IEEE societies have begun the process of adopting and/or converting to open access journals and guidelines. In our case, IEEE Photonics Journal is already open access and we will not have to start a new journal.

However, the IEEE Photonics Society plans to establish a Photonics Section in the IEEE-wide open access journal, IEEE Access. This would allow authors to choose the IEEE Photonics Society and ultimately allow their papers to be assessed by reviewers from the photonics community through Associate Editors who are experts in photonics subject matters. If you are submitting to IEEE Access, I encourage you to choose IEEE Photonics Society as the managing entity to get your manuscript reviewed, once this option becomes available. There will be more to come on this as we continue working with the IEEE Publications Department on implementation.

Lastly, Dalma Novak, former Past President, has been approved to be on the slate of candidates for a Division Director position of the IEEE. This is a great opportunity for us to support and vote for Dalma, thereby our Society will have a voice at the Board of Directors meetings. You will hear from me and staff in the near future on this matter. It's an opportunity to get involved, volunteer to serve your Society and benefit from being part of the IEEE Photonics family.

*With warm greetings,  
Chennupati Jagadish  
Australian National University, Canberra  
c.jagadish@ieee.org*

# On-Chip Programmable Waveguide Bragg Gratings

*Weifeng Zhang and Jianping Yao\*, Microwave Photonic Research Laboratory, School of Electrical Engineering and Computer Science, University of Ottawa, 25 Templeton Street, Ottawa, Ontario, Canada K1N 6N5.*

In 1913, Bragg's law was formulated. Since then, Bragg gratings, as ubiquitous optical devices, have enjoyed widespread use in various systems. In particular, the successful inscription of a Bragg grating in a fiber core has significantly boosted its engineering applications. To date, most grating devices are specifically designed for a particular use, which limits general-purpose applications since its index modulation profile is fixed after fabrication. To overcome this long-standing limitation, the implementation of a programmable grating, capable of reconfiguring its spectral response by field programming, is a long pursuit.

## Introduction

Thanks to the periodic variation of the refractive index in the fiber core or the waveguide, a fiber or waveguide Bragg grating is able to reflect a particular wavelength of light and transmit all others [1]. By specifying its index modulation profile, the spectral response of a Bragg grating could be customized. The simple configuration and unique filtering capability enable a Bragg grating as a versatile optical filter for widespread applications in various scientific and industrial fields [2], [3]. For example, a Bragg grating is inserted into the laser resonator of a solid-state laser to stabilize or tune its emission wavelength. In particular, in 1978, Hill and co-workers discovered fiber Bragg gratings (FBGs), which opened up an unprecedented opportunity to perform optical signal processing and optical fiber sensing [4].

From the beginning of this century, rapid development of semiconductor technologies, especially significant advancement in silicon photonics, has brought Bragg gratings into an on-chip

integration era [5]–[7]. Different on-chip waveguide Bragg gratings have been realized on the silicon photonic platform; however, the grating spectral response is predetermined and still cannot be reconfigured after fabrication. Although different mechanisms have been demonstrated to realize spectral tuning, these tuning approaches are mainly limited to shifts of the center wavelength [8], [9]. For many applications, other spectral characteristics, such as spectral shape and phase response, are required to be tunable. For example, with the explosive growth of data traffic, the elastic optical network (EON) architecture is considered a promising solution for next-generation optical networking [10]. Distinct from that in current optical networks, the spectrum grid in an EON is flexible. To address the need for flexible division of the optical spectrum, a reconfigurable optical add-drop multiplexer is an essential component, which can generate elastic optical paths by reconfiguring its filter response [11]. A programmable grating filter is a strong candidate to fulfill this role. To reach the goal, recently, we have reported a programmable waveguide grating in which, by controlling voltages, the grating spectral response can be reconfigured to fit into different applications [12].

## Programmable Grating Design

The schematic view of the programmable grating is shown in figure 1. The grating consists of multiple series-connected uniform Bragg grating sections, in which the gratings are produced by creating periodic corrugations on the rib sidewall, and a Fabry-Pérot (FP) cavity section in the middle of the grating. Each uniform Bragg grating section incorporates an

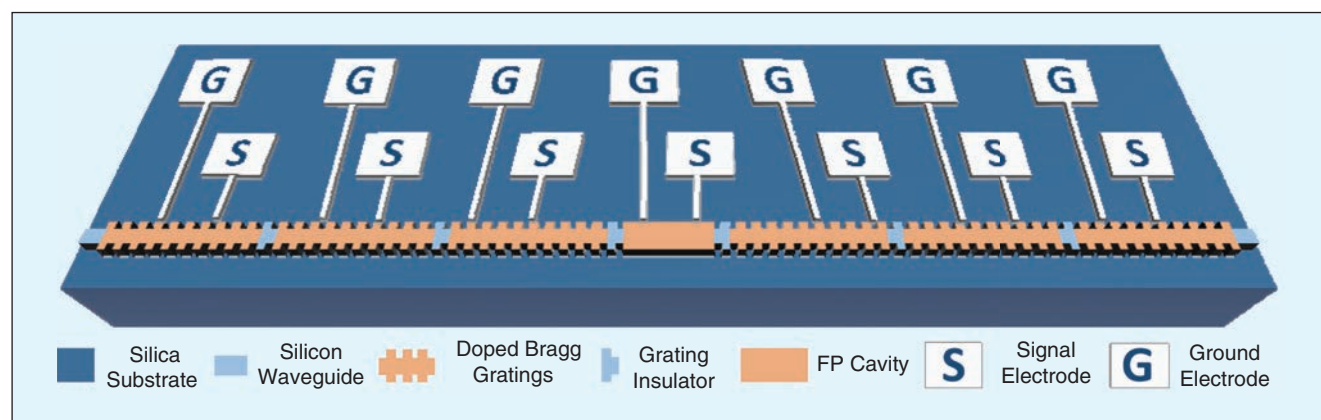


Figure 1. Schematic view of the programmable grating, which consists of multiple series-connected uniform Bragg grating sections and a cavity section in the middle of the grating. Each uniform Bragg grating section incorporates an independent lateral PN junction. A pair of electrodes (Signal and Ground) are connected to each independent PN junction for controlling.



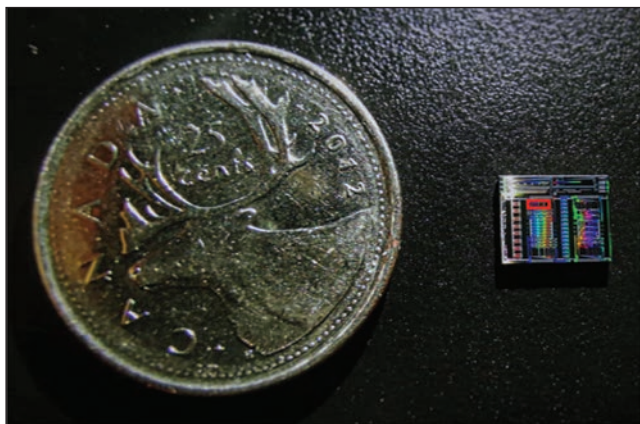


Figure 2. Chip prototype of the programmable grating.

independent lateral PN junction, and between two neighboring sections there is an un-doped grating to function as an insulator. Distributed electrodes are connected to the independent PN junctions. By applying a bias voltage to a PN junction, the refractive index of the grating in that particular section could be tuned locally based on the free-carrier plasma dispersion effect. Thus, the entire index modulation profile of the grating could be electrically reconfigured by field programming all the bias voltages, which enables the grating to have diverse spectral characteristics for diverse applications.

A proof-of-concept demonstration is made in which a programmable grating is designed, fabricated and characterized. Figure 2 shows the chip prototype in which the red line outlines the programmable grating. The device is fabricated at the Institute of Microelectronics (IME, A\*STAR, Singapore) in a complementary metal-oxide-semiconductor (CMOS)-compatible process using 248-nm deep ultraviolet lithography. This grating has a symmetrical configuration, which consists of two identical uniform sub-grating sections (left and right) and a FP cavity section in the middle. Each section has an independent PN junction for local tuning. To have a higher tuning efficiency, an asymmetrical lateral PN junction is adopted, which is slightly shifted to the left from the center of the waveguide, to increase the mode overlap with the p-type doping region, since the free-carrier plasma dispersion effect is more sensitive to the change of the free-hole concentration. Three grating couplers are used to couple light between the chip and the input and output fibers, and a compact Y-branch is used to collect the reflected light. To minimize the chip footprint and reduce the bending loss, a strip waveguide is used to guide the optical signal between the grating coupler and the gratings. Since the grating is implemented in a rib waveguide, a double-layer linear taper waveguide is used for the mode transition between the strip and rib waveguides.

Figure 3(a) shows the microscope camera image of the fabricated programmable grating with a length of 1.560 mm and

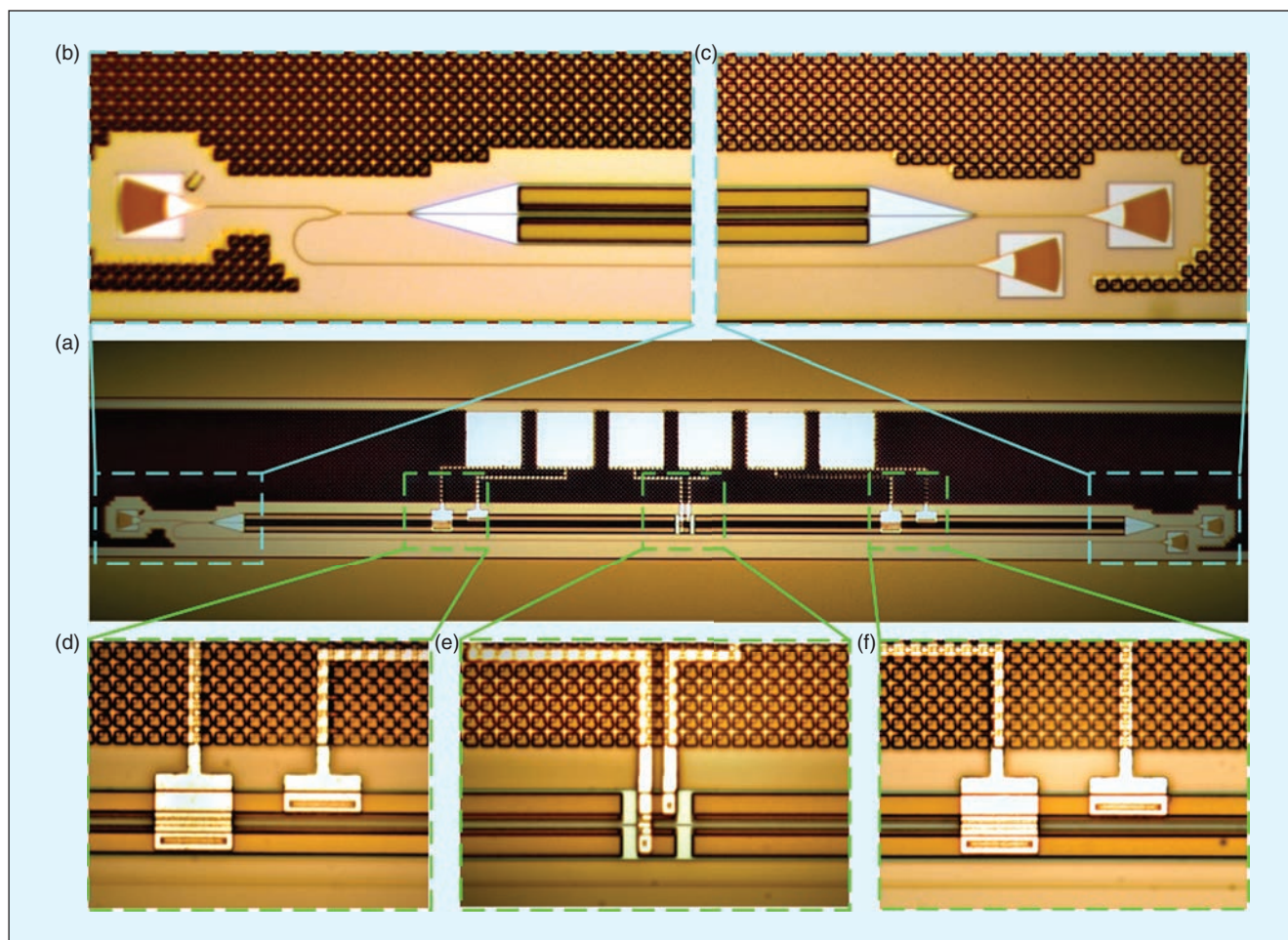


Figure 3. Microscope camera images of the fabricated programmable grating. (a) Entire grating. (b) Input grating coupler and compact Y-branch. (c) Transmission and reflection grating couplers. (d) Left sub-grating section. (e) FP cavity section. (f) Right sub-grating section.

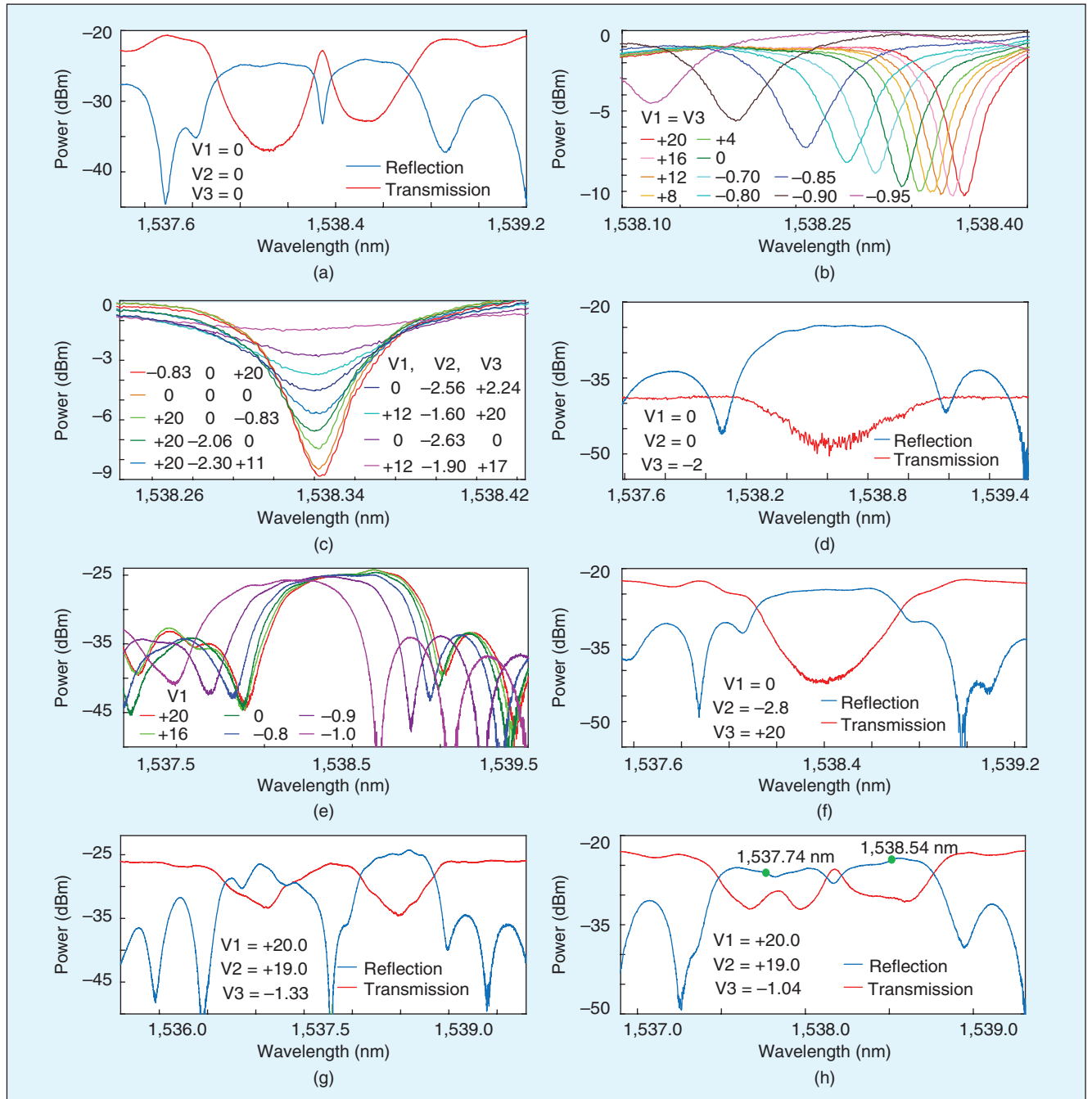


Figure 4. Measured reflection and transmission spectra. (a) Spectra of the fabricated grating in the static state. (b) Notch wavelength shift when the bias voltages applied to the left and right sub-gratings vary synchronously. (c) Extinction ratio tuning while the notch wavelength is kept unchanged. (d) Spectra when the grating is reconfigured to be a uniform grating. (e) Wavelength tuning of the uniform grating. (f) Spectra when the device is reconfigured to be a uniform grating by increasing the cavity loss. (g) Spectra when the device is reconfigured to be two independent uniform sub-gratings. (h) Spectra when the device is reconfigured to be a chirped grating.

a width of 0.196 mm. Figures 3(b-f) give a zoomed-in view of the input grating coupler and the compact Y-branch, the transmission and reflection grating couplers, the left sub-grating section, the FP cavity section, and the right sub-grating section, respectively. Since the local refractive index in each particular section could be tuned by applying a bias voltage to the section PN junction, by field programming three bias voltages, the index modulation profile of the grating can be reconfigured, and thus the grating spectral characteristics can be tailored. Like an amoeba that has the ability to alter its

shape, the fabricated programmable grating has the ability to alter its spectral characteristics. In the following section, we experimentally demonstrated a programmable grating, which is electrically reconfigured to be a phase-shifted, a uniform, and a chirped grating by field programming.

### Programmable Grating Demonstration

A phase-shifted waveguide Bragg grating can be implemented by introducing a phase shift in the middle of a uniform grating. For the fabricated grating, the phase shift can be



introduced by the FP cavity. Figure 4(a) shows the measured reflection and transmission spectra of the fabricated grating in the static state. As can be seen, a resonant window is located within the stopband in the transmission spectra (in red), which is a distinct feature of a phase-shifted Bragg grating.

Figure 4(b) shows a zoomed-in view of the notch wavelength shift in the reflection band when two bias voltages applied to the PN junctions in the left and right sub-grating sections vary synchronously. Thanks to the free-carrier plasma dispersion effect, the free-carrier concentration in the waveguide introduces a change in the refractive index of the waveguide, which leads to the shift of the Bragg wavelength. Figure 4(c) shows the tuning of the extinction ratio while the notch wavelength is maintained unchanged for different bias voltage combinations. It is known that in a conventional phase-shifted Bragg grating, it is not possible to tune the notch extinction ratio while maintaining the notch wavelength unchanged. In the fabricated grating, by field programming the three bias voltages, the notch wavelength shifts induced by the PN junctions could counteract. Thus, the notch wavelength can be preserved, while different bias voltage combinations could lead to a different roundtrip loss, which would result in a different notch extinction ratio.

The fabricated grating can be reconfigured as a uniform grating, which is realized by failing the optical confinement capability of the FP cavity, by applying a large forward bias voltage to the right PN junction. Figure 4(d) gives the measured spectra of the grating when a large forward bias voltage is applied to the right PN junction. The large forward bias voltage enables the injection of massive free-carriers into the waveguide, which would cause a heavy optical absorption loss and thus disable the reflection capability of the right sub-grating. As can be seen, there is one main peak in the reflection or a notch in the transmission spectrum, which is a distinct feature of a uniform grating. In addition, by tuning the bias voltage of the PN junction in the left sub-grating section, the center wavelength of the uniform grating could be tuned as shown in figure 4(e). There is another approach to reconfigure the fabricated grating to be a uniform grating, which is realized by applying a large forward bias voltage to the cavity PN junction. Figure 4(f) gives the measured spectra of the uniform grating when a forward bias voltage is applied to the cavity PN junction. A large forward bias voltage enables the injection of a massive quantity of free-carriers into the cavity to cause a heavy optical absorption loss. Therefore, by programming voltages applied to the PN junctions, the fabricated grating could present some uncommon optical characteristics which are difficult to achieve by using a conventional grating. This is a unique feature of the programmable grating.

Since the PN junctions in the left and right sub-grating sections can be independently controlled, the uniform sub-gratings in the two sections could be tuned independently. Figure 4(g) gives the measured spectra of two uniform sub-gratings when a reverse bias voltage is applied to the left PN junction, and a forward bias voltage is applied to the right PN junction. Thus, the left sub-grating is red shifted and the right sub-grating is blue shifted, which reconfigures the fabricated grating to be two nonidentical uniform sub-gratings. As can

be seen, there are two separate main reflection peaks in the reflection spectra. Additionally, the ability to independently tune (and thereby shift the spectral response of) the left and right uniform sub-gratings, enables the device to be reconfigured as a chirped grating. Figure 4(h) presents the measured spectra of the chirped grating when a maximum reverse bias voltage is applied to the left PN junction and a forward bias voltage is applied to the right PN junction. As observed, the 3-dB bandwidth of the spectra is increased largely, which is much larger than that of the uniform grating. By increasing the grating length and dividing the grating into more sections, the fabricated grating would have a better optical performance in terms of the group delay and chirp rate.

## Conclusion

The programmable grating can find numerous applications. An application example is its use for programmable signal processing, in which three signal processing functions including temporal differentiation, true time delay, and microwave frequency identification have been demonstrated [12]. In fact, a programmable microwave signal processor based on a reconfigurable grating could perform other signal processing functions such as microwave filtering, temporal integration, and Hilbert transformation. In addition to its use in microwave signal processing, the programmable grating could also be employed for arbitrary microwave waveform generation. For example, it can be used as a spectral shaper to generate a chirped microwave waveform for radar and other imaging applications. An array of such gratings can also be used as a beamforming network to generate true time delays for wideband squint-free beam steering. By increasing the number of independent sub-grating sections, the functionalities of the signal processor could be further increased, and the performance could be enhanced.

In summary, thanks to the strong reconfigurability enabled by the three independently controllable PN junctions, an on-chip programmable grating was realized, capable of varying its index modulation profile by field programming to present diverse spectral characteristics. A phase-shifted, a uniform and a chirped grating have been demonstrated. Such a programmable grating device overcomes the long-standing limitation of conventional grating devices that have fixed modulation index profiles and presents overwhelming advantages in terms of strong and fast reconfigurability, compact size, and low power consumption.

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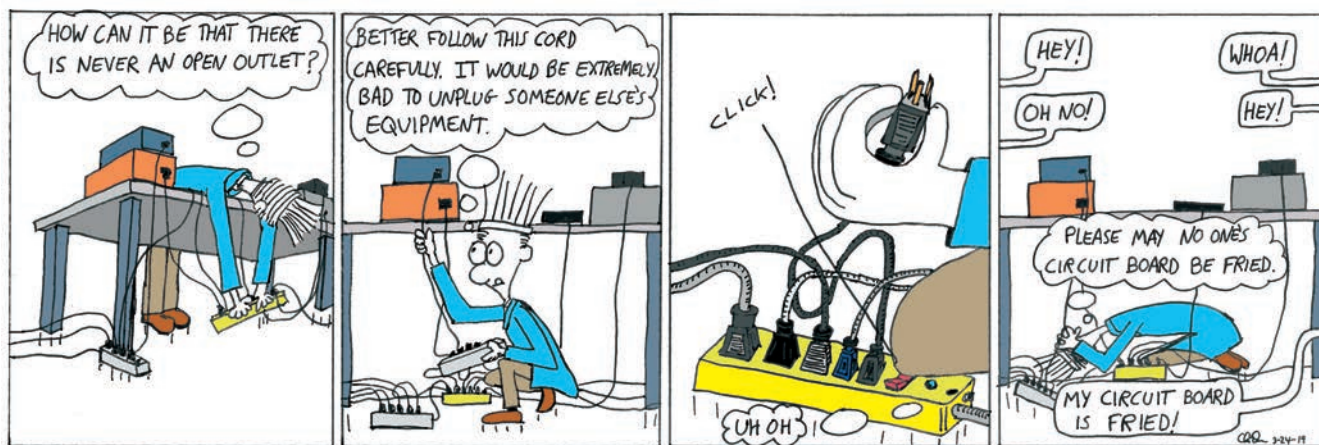
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## Cartoon



# Get to Know Your Photonics Society Leadership

## Matthew Posner, Ph.D. - Process Scientist at Silicon Wafer Fab, Excelitas Technologies Canada—Young Professional Representative for Industry Engagement Committee

### What Is Your Current Professional Job?

I am a process scientist in a Silicon Wafer Fabrication Facility at Excelitas Technologies, Montreal, Canada. My day-to-day role is to help researchers and product managers make their ideas manufacturable and support a cleanroom production line for the fabrication of photon detection devices.



have a broad professional and societal impact. It has helped me form my own “*big picture*” and I feel that I can utilize this as a board member to drive projects that align with the Society’s missions of making the world a better place through photonics technology.

### Why Photonics? What Was Your “Photonics Moment?” (More Personal Background Story, etc.)

I discovered Photonics during my undergraduate studies in electronics engineering at the University of Southampton. I used to consider myself as a maths type of person,

### What Role Does Your Industry Engagement Committee Position Play for IPS? What Challenges Do You Face in Your Role?

The Industry Engagement Committee wants to diversify the Society’s offerings for the industry segment of its membership, which represents a considerable portion of members. One of the challenges will be finding activities that resonate with our very diverse membership segments, as well as platforms for people to make the most of the connections that the society has to offer.

yet when I discovered how you could build optoelectronic devices and use light and explain how to get these to work (with maths!), I was hooked. Gradually I moved towards how to build these devices and became fascinated in the applications enabled by them. Telecommunications, sensing and quantum sciences, to name a few, are applications that I have been able to work on during my postgraduate studies at the Optoelectronics Research Centre. Today I have been able to keep up my work in the manufacturing of photonic devices at Excelitas Technologies.

### What Do You Want to Accomplish as a Committee Member This Year?

I will be working with the Committee to continue the efforts that started with the Industry Day held at IPC in 2018. Having spoken to the Chair, Simon Poole, there are lots of opportunities to further engage with our industry members. On a personal level, building a local network with industry professionals in Montreal is an important cause to me, as having just moved to Canada I am still trying to establish myself in the community!

### What About Our Society’s Mission and Work Really Motivates You?

The Society’s missions align to my values of bringing progress to society through my work and volunteering efforts. The Society enables me to collaborate with members from the community, in particular in areas of outreach education and training. I’m looking forward to the Society’s involvement in the upcoming 2019 Conference on Education and Training in Optics and Photonics (ETOP), that will be happening next May in Quebec City, not far from where I am.

### What Specific Assets Do You Bring to the Table as a Committee Member?

I am a grassroots type of person and have lived some of my most successful projects through local optics and photonics initiatives of the IPS and its sister societies, the OSA and SPIE. This has given me an overview of ways to effectively collaborate to

(continued on page 15)





## News

# Distinguished Professor Chennupati Jagadish Recognized with Australian Academy Award

Outstanding contributions to science have been recognized by the Australian Academy of Science today with 20 of Australia's leading scientists and future superstars receiving prestigious 2019 honorific awards.

The scientists' discoveries cross the breadth of research from how oceanic circulation impacts the climate, to the use of tools that advance the understanding of the chemistry within cells and how the body's immune defenses combat infectious disease.

Distinguished Professor Chennupati Jagadish AC FAA from the Australian National University has been awarded one of the Academy's top honors, the Thomas Ranken Lyle Medal. He helped develop semiconductors used in LED lights. He also designed and developed some of the world's smallest lasers. Born in India, Professor Jagadish grew up without electricity.

"I didn't have much light as a child and studied in front of a kerosene lamp until Year 7. That's why I'm interested in devel-



oping technologies that will benefit humanity," Professor Jagadish said.

President of the Australian Academy of Science, Professor John Shine, congratulated all the award winners for their inspiring research.

"These awards highlight just some of the important and distinguished research being led by Australian scientists, who seek to address some of society's biggest challenges. Recognizing and highlighting outstanding scientific contributions is important, as award recipients are the STEM role models for the next generation," Professor Shine said.

The majority of the honorific awards will be presented at the Academy's annual celebration of science, Science at the Shine Dome on 30 May 2019. Read more about the Academy's 2019 honorific awardees: <https://www.science.org.au/opportunities-scientists/recognition/honorific-awards/honorific-awardees/2019-awardees>

*\*Excerpts taken from Science.org.au*

## Two Photonic Society Members Have Been Inducted into The National Academy of Engineering

*Washington, DC, February 7, 2019*

The National Academy of Engineering (NAE) has elected 86 new members and 18 foreign members, announced NAE President C. D. (Dan) Mote, Jr., today. This brings the total U.S. membership to 2,297 and the number of foreign members to 272.

Election to the National Academy of Engineering is among the highest professional distinctions accorded to an engineer. Academy membership honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education."

Individuals in the newly elected class will be formally inducted during a ceremony at the NAE's annual meeting in Washington, D.C., on Oct. 6, 2019. A list of the newly elect-

ed members and foreign members follows, with their primary affiliations at the time of election and a brief statement of their principal engineering accomplishments.

We are happy to announce the following members of the Photonics Society have been included in this honor:

**Heritage, Jonathan P.**, Professor emeritus, department of electrical and computer engineering, University of California, Davis. For contributions to optical pulse shaping and wavelength selective optical switches.

**Shoop, Barry L.**, Dean and Professor of electrical engineering, Albert Nerken School of Engineering, The Cooper Union, New York City. For leadership in developing engineering systems solutions for national security and contributions to military engineering education.

For more information visit: <https://www.nae.edu/MediaRoom/20095/203308/204037.aspx>

# IEEE and Lockheed Martin Sign Corporate Partnership Agreement

The IEEE and Lockheed Martin, a global security and aerospace company, have signed an agreement to work together under the IEEE Corporate Partnership Program.

As an IEEE Corporate Partner, Lockheed Martin will leverage the benefits of IEEE's global reach, technical expertise, authoritative technical information, and membership opportunities in support of its business focus areas. IEEE and Lockheed Martin will collaborate on identifying opportunities to develop new and expanded plans and programs.

"IEEE is delighted to enter into this agreement with a technology-driven organization like Lockheed Martin. Lockheed Martin and IEEE share a commitment to advancing the state of the art in the fields of aerospace, artificial intelligence, space and security," said Stephen Welby, IEEE Executive Director and Chief Operating Officer.

"Lockheed Martin looks forward to partnering with IEEE on advancing the development of our technical workforce at this pivotal time of rapid technological change and digital transformation," said Lockheed Martin Chief Technology Officer Keoki Jackson. "Lockheed Martin shares IEEE's commitment to advancing critical new technology, and we're excited to see the mutual benefits our partnership will yield."



## About Lockheed Martin

Headquartered in Bethesda, Maryland, Lockheed Martin is a global security and aerospace company that employs approximately 100,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration, and sustainment of advanced technology systems, products, and services. This year the company received three Edison Awards for ground-breaking innovations in autonomy, satellite technology, and directed energy.

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## New Machine Learning Approach Could Give a Big Boost to the Efficiency of Optical Networks

*Jose Suarez-Varela, Albert Mestres, Junlin Yu, Li Kuang, Haoyu Feng, Pere Barlet-Ros and Albert Cabellos-Aparicio, Universitat Politècnica de Catalunya and Huawei.*

*Scientists have developed a new artificial intelligence algorithm that could make optical telecommunications networks more efficient.*

New work leveraging machine learning could increase the efficiency of optical telecommunications networks. As our world becomes increasingly interconnected, fiber optic cables offer the ability to transmit more data over longer distances compared to traditional copper wires. Optical Transport Networks (OTNs) have emerged as a solution for packaging data in fiber optic cables, and improvements look to make them more cost-effective.

A group of researchers from Universitat Politècnica de Catalunya in Barcelona and the telecom company Huawei have retooled an artificial intelligence technique used for chess and self-driving cars to make OTNs run more efficiently. The group presented their research at OFC 2019 in March.

OTNs require rules for how to divvy up the high amounts of traffic they manage and writing the rules for making those

split-second decisions becomes very complex. If the network gives more space than needed for a voice call, for example, the unused space might have been better put to use ensuring that an end user streaming a video doesn't get "still buffering" messages.

What OTNs need is a better traffic guard.

The researchers' new approach to this problem combines two machine learning techniques: The first, called reinforcement learning, creates a virtual "agent" that learns through trial and error the particulars of a system to optimize how resources are managed. The second, called deep learning, adds an extra layer of sophistication to the reinforcement-based approach by using so-called neural networks, which are computer learning systems inspired by the human brain, to draw more abstract conclusions from each round of trial and error.

"Deep reinforcement learning has been successfully applied to many fields," said one of the researchers, Albert

Cabellos-Aparicio. “However, its application to computer networks is very recent. We hope that our paper helps kickstart deep-reinforcement learning in networking and that other researchers propose different and even better approaches.”

So far, the most advanced deep reinforcement learning algorithms have been able to optimize some resource allocation in OTNs, but they become stuck when they run into novel scenarios. The researchers worked to overcome this by varying the manner in which data are presented to the agent.

After learning the OTNs through 5,000 rounds of simulations, the deep reinforcement learning agent directed traffic with 30 percent greater efficiency than the current state-of-the-art algorithm.

One thing that surprised Cabellos-Aparicio and his team was how easily the new approach was able to learn about the networks after starting out with a blank slate.

“This means that without prior knowledge, a deep reinforcement learning agent can learn how to optimize a network autonomously,” Cabellos-Aparicio said. “This results in optimization strategies that outperform expert algorithms.”

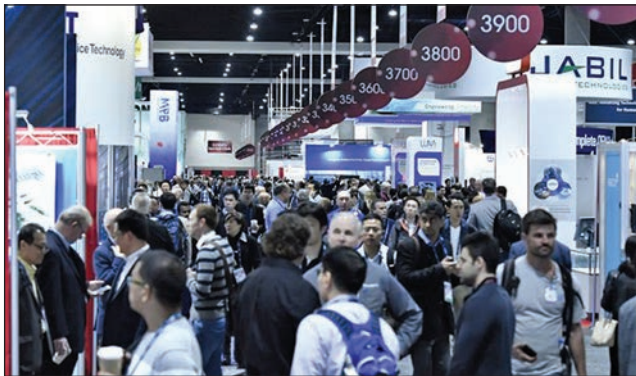
With the enormous scale some optical transport networks already have, Cabellos-Aparicio said, even small advances in efficiency can reap large returns in reduced latency and operational costs.

Next, the group plans to apply their deep reinforcement strategies in combination with graph networks, an emerging field within artificial intelligence with the potential to transform scientific and industrial fields, such as computer networks, chemistry and logistics.

*Press release copyright: OFC®: Optical Fiber Communication Conference®*

## OFC 2019 Closes Strong with Focus on 800G, 400ZR, Real-World 5G and Network Speed and Efficiency

*Leah Wilkinson, Wilkinson + Associates for OFC*



The global optical communications community assembled in San Diego 3–7 March 2019 for OFC (Optical Fiber Communications Conference and Exhibition). This year’s event featured the market’s prevailing topics in standing-room only business and technical sessions; technology and product demonstrations and announcements from the world’s leading companies; plenary talks that explored open networks, communications between self-driving cars, and optical integration for higher data rates; and dynamic presentations on real-world 5G deployments and network build-outs.

“As our world becomes increasingly more connected, the optical communications infrastructure that supports it needs to evolve to be more robust and efficient, and at the same time, cost-effective,” said Gabriella Bosco, Politecnico di Torino, Italy, and OFC 2019 General Chair. “The industry gathered at OFC to debate these business challenges and identify potential technical solutions to meet customer demands.”

### Driving Business Solutions

This year’s OFC convened nearly 15,400 attendees from around the world to celebrate successes, debate new opportunities and push the boundaries of innovation. The show boasted 683 exhibitors on a floor encompassing 189,607 net square feet (500,000 gross square feet). Overall, the OFC exhibit served as a platform for important industry announcements, including developments in coherent DWDM networking, silicon photonics and 400ZR advancements.

“OFC is the place to make major announcements because the whole industry comes together,” stated Yves LeMaitre, Chief Strategy Officer, Lumentum. “Whether you’re working in data centers, telecom networks or access networks, all optical technologies for communications are here.”

OFC 2019 offered a unique experience for attendees, both showcasing technical research and debuting commercial solutions. For example, several live multivendor interoperability demonstrations took place on the exhibit floor: Coherent Transceiver Interoperability, Ethernet Alliance, OIF and Open ROADM MSA SDN. Technologies from approximately 40 companies were featured in the demos, including: 10 Gigabit Ethernet (GbE), 25GbE, 50GbE, 100GbE, 400GbE; Open Source Open ROADM SDN Controller; pluggable CFP2-ACO and CFP2-DCO modules; and Common Electrical I/O (CEI)-112G, FlexE (Flex Ethernet) and 400ZR.

“The sessions, panels and demonstrations at OFC impress me every year,” said Woo Jin Ho, technology analyst, Bloomberg Intelligence. “Vendors continue to push the envelope on driving higher transmission rates in smaller form factors. Key emerging trends to look out for the industry and vendors based



on the conference include 600G/800G optics and systems and 400ZR for the hyperscale cloud data centers.”

## Leading Technical Vision

Conference content, which included more than 450 peer-reviewed papers, 180 invited and tutorial presentations, 10 workshops, 6 panels and 55 short courses, focused on the latest discoveries. For example, technological breakthroughs in data center connectivity, 5G and IoT. In addition, advanced integrations of optics and electronics will open doors for reaching new data limits.

“From solving the open network challenge to advances in modulation formats and the move toward faster optical interface speeds, the discussions at OFC this week explored what’s happening now, what will be possible in the near-term, and where we need to head in the long-term,” continued Bosco.

## Moving the Industry Forward

Leaders in the field agree that OFC 2020, being held 8–12 March in San Diego, will serve as a springboard for the next round of innovations.

“Next year at OFC, we expect to see samples of 400G ZR, with deployment coming later in the year,” predicts Benny

Mikkelsen, Chief Technology Officer, Acacia Technologies and conference plenary speaker. “OFC is a great opportunity to get people together to have a fruitful discussion.”

## About OFC

The Optical Fiber Conference and Exhibition (OFC) is the largest global conference and exhibition for optical communications and networking professionals. For more than 40 years, OFC has drawn attendees from all corners of the globe to meet and greet, teach and learn, make connections and move business forward.

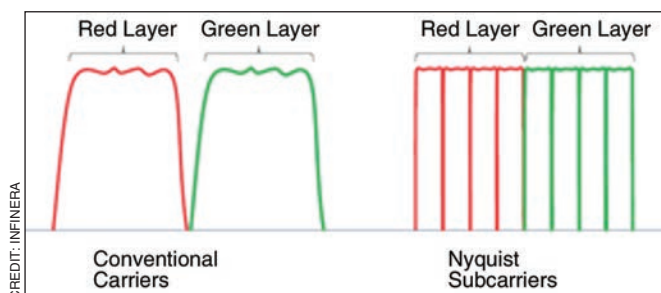
OFC includes dynamic business programming, an exhibition of more than 700 companies, and high impact peer-reviewed research that, combined, showcase the trends and pulse of the entire optical networking and communications industry. OFC is co-sponsored by OSA, the IEEE Communications Society (IEEE/ComSoc), and the IEEE Photonics Society. OFC 2019 will be held from 3–7 March 2019 at the San Diego Convention Center, California, USA. Follow @OFCConference, learn more at OFC Community LinkedIn, and watch highlights on OFC YouTube.

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# Researchers Break Efficiency Record for Data Transfer in Ultra-fast Transatlantic Cable

*Stephen Grubb, Pierre Mertz, Ales Kumpera, Lee Dardis, Jeffrey Rahn, James O’Connor and Matthew Mitchell, Infinera*



Conventional carriers (left) operate as a continuous band of optical spectrum. A subcarrier implementation (right) uses the functions of an advanced transmission circuit to digitally separate the light from each laser into multiple subcarriers, in this case four. Subcarriers are a key contributor to the record breaking reach achieved in the MAREA trial.

*A new experiment has achieved a record fiber optic cable capacity of 26.2 terabits per second across more than 6,000 kilometers of the MAREA transatlantic fiber optic cable.*

If you are making an overseas phone call or using cloud computing, there is a 99 percent chance an undersea fiber optic cable is being utilized. Now, new work with lasers shows promise for squeezing more data through these cables, to help

meet the growing demand for data flow between computers in North America and Europe. The method could increase network capacity without requiring new cables, which can cost hundreds of millions of dollars to build.

A team of researchers from Infinera has achieved new benchmarks for efficiency for transatlantic fiber optic cables. Testing an emerging approach for how the light signals are transmitted—called 16QAM modulation—the group smashed through efficiency records for data transfer, nearly doubling data capacity and approaching the theoretical limit for such a transfer. The team presented their research at OFC 2019 in March.

“In an optical fiber, it’s desirable to carry more data per second, which we call the fiber capacity, and also to be able to send the signal over longer distances, which we call the optical reach,” said Dr. Pierre Mertz, an author on the study. “In simple terms, if you try to push the limits of fiber capacity you will reduce the reach.”

The team managed to extend record-setting capacity for a given reach—across the Atlantic Ocean—using the MAREA transatlantic cable, which spans 6,605 kilometers from Bilbao, Spain, to Virginia Beach, Va., U.S.A. Funded in part by Microsoft and Facebook, MAREA currently holds the record for the highest-capacity cable crossing the Atlantic Ocean.

The MAREA cable came online last year and is made of eight pairs of optic fibers, with each pair designed to carry 20 terabits per second—each one enough to stream more than 4 million HD videos at once.

Demand for new and better cables has risen ever since the first undersea trans-Atlantic communications cable was laid in 1858. That demand has skyrocketed over the last decade, thanks to the shift to cloud-based computing. Indeed, Virginia and North Carolina have become hotbeds for building data centers, especially since the MAREA cable went live in February 2018. The recent construction includes four data centers for Microsoft alone.

Not only does the new experiment mark the first time PM-16QAM signals were sent such distances, Mertz said, the feat was achieved with equipment readily available to the industry.

Information was sent through the MAREA cable via high-speed lasers. Using their own high-tech toolkit to modulate

the lasers, Infinera generated signal speeds topping out at 26.2 terabits per second, a 20 percent increase over what the cable designers originally thought feasible.

The biggest challenge is that the system was operating very close to the Shannon Limit, or the theoretical maximum information transfer rate for a communications channel, according to Mertz. “That means that every gain we make becomes harder and harder,” he said.

This result is already delivering comparable capacity to next-generation chipsets from other vendors that employ a technique called probabilistic constellation shaping (PCS). The good news for service providers demanding ever more capacity, Mertz said, is as the industry moves toward higher-performance systems, their technique can be combined with PCS for even faster speeds in the future.

*Press release copyright: OFC®: Optical Fiber Communication Conference®*

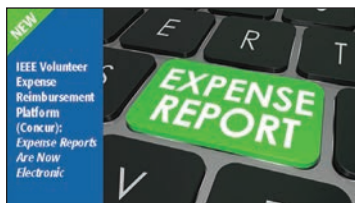
## IEEE Introduces New Volunteer Expense Reimbursement Platform

Thanks to feedback from IEEE’s volunteers, greater ease and efficiency are both just clicks away with the organization’s new Volunteer Expense Reimbursement tool, Concur. This cloud-based expense reporting and reimbursement platform is designed to create a fast and efficient electronic expense reimbursement experience for IEEE volunteers.

IEEE’s implementation of Concur will deliver volunteers a broad range of benefits, including faster reimbursement and the ability to track real-time status of expense reports. In addition, the platform offers integration with other online applications, secure electronic payments, a convenient mobile app that lets you build, update, or approve expense reports while on the go, and the ability to upload images of receipts at any time.

Concur is a robust and user-friendly platform that will deliver volunteers a broad range of benefits, including:

- Faster payments due to reduced cycle time from submission to reimbursement
- Single process for submission of expense reimbursement requests
- Ability to track in real time the status of expense reports
- Ability to capture credit card transaction details and auto-fill expense reports
- Ability to upload images of receipts at any time
- Availability of a mobile app that lets you build, update, or approve expense reports at any time, even during a trip



- Improved processing of international payments
- Improved reporting overall
- Integration with third-party applications such as Uber

Getting started is easy—volunteers simply need an IEEE Account to access the platform and they’ll be on their way to enjoying

the benefits of Concur. To get started, refer to this link: <https://corporate.ieee.org/resources/travel%2C-medical-and-insurance/ieee-expense-report>

Concur is being introduced in a multi-phased rollout beginning in Q4 2018. More information is available as follows:

- View new platform overview including how to contact Concur’s user support desk: [https://www.youtube.com/watch?time\\_continue=121&v=trw1Tvn46E0](https://www.youtube.com/watch?time_continue=121&v=trw1Tvn46E0)
- View a comprehensive video tutorial: <https://corporate.ieee.org/resources/travel%2C-medical-and-insurance/ieee-expense-report/concur-training>.
- Learn more about the Concur platform at [concur.com](http://concur.com).
- For general questions, contact IEEE’s project team at [concurfeedback@ieee.org](mailto:concurfeedback@ieee.org).

Stay tuned for IEEE communications over the coming months designed to help you get started and support your transition to this modern and streamlined new platform.

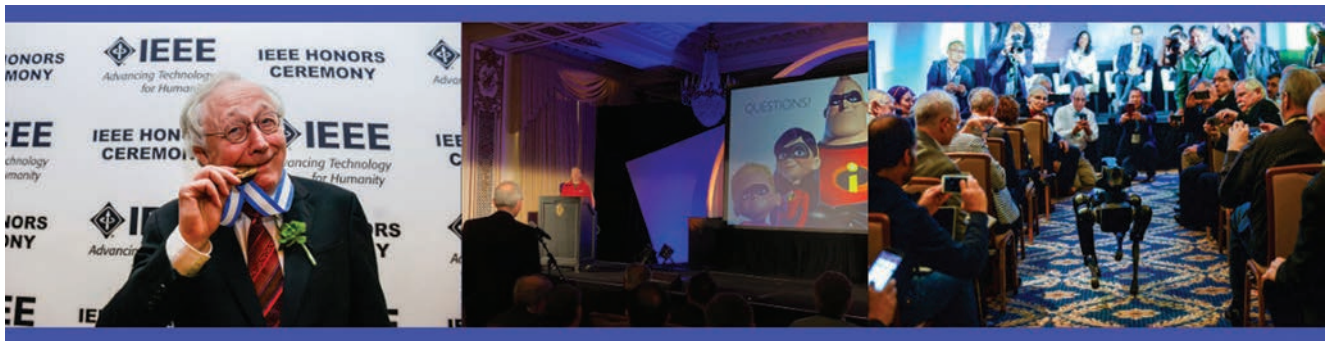
# Register Now For the 2019 IEEE Vision, Innovation, and Challenges Summit & Honors Ceremony Gala!

Registration is open for the annual IEEE Vision, Innovation, and Challenges Summit & Honors Ceremony Gala. The IEEE VIC Summit and Honors Ceremony Gala is taking place on 17 May 2019 at the Marriott Marquis San Diego Marina, San Diego, California, USA. Go to <http://ieee-vics.org/registration/>.

The IEEE VIC Summit showcases the breadth of engineering by bringing together innovators, visionaries, and leaders of technology to discuss cutting-edge topics in the world of tech. The Summit content will continue to fo-

cus on the contributions technology and innovations have had on our lives and society as a whole, includes two more **networking opportunities**, a new **mentoring program**, and an **Afterglow** hosted by the IEEE Young Professionals following the Honors Gala. The evening's IEEE Honors Ceremony Gala will celebrate the pinnacle achievements of this year's recipients whose accomplishments have led to the breakthroughs of today.

To see a Summit program, list of Award Recipients, and for more information, go to: [ieee-vics.org](http://ieee-vics.org).



## Get to Know Your Photonics Society Leadership

*(continued from page 9)*

### How Would You Advise Members Who Want to Become More Involved in the Society?

Ask. If you don't ask, you won't get. The staff and volunteers are all extremely dedicated and willing to engage. The Society is setting up ways for lowering the barriers to volunteering and it's a great time to become involved. If you are reading this, please feel free to reach out to me and ask me more questions about getting involved, as well as changing between academia and industry, as well as outreach education and training.

### Why Do You Think Members Should be Involved as Society Volunteers? What Are the Benefits?

The Society has opportunities to support you in more ways that you can imagine. They listen to you and can help guide

towards causes that align your personal interests with the overarching missions and values of the society. My involvement as a Society volunteer has given me an unmatched access to local networks and experts in the fields that I operate in, which has been extremely valuable in my career development as a Young Professional.

### Tell Us Something Fun About Yourself

I enjoy fancy dress and cycling. Some of my best memories have come from combining both and riding hours through the British countryside. My wife and I were awarded our local university's club best fancy-dress award at our Christmas ride where we dressed up our tandem as a sledge, me as a reindeer and her as Mother Christmas. It's probably an aspect of my personality that you wouldn't usually see at conferences or in the office.



# Careers and Awards

**2019 Graduate Student Fellowship Program: Applications are now being accepted.**

## IEEE PHOTONICS SOCIETY 2019 Graduate Student Fellowship Program

The IEEE PHOTONICS SOCIETY established the Graduate Student Fellowship Program to provide Graduate Fellowships to outstanding Photonics Society student members pursuing graduate education within the Photonics Society field of interest (photonics, electro-optics, lasers, optics, or closely related fields). Fellowships will be awarded, based on the student membership in each of the main geographical regions:

**Americas**

**Europe/Mid-East/Africa**

**Asia/Pacific**

**Prize:** Up to ten Fellowships of \$1,000 each are awarded annually. A complimentary conference registration will be available to each Fellowship recipient to attend the IEEE Photonics Conference for the award presentation.

**Eligibility:** Fellowship applicants **must be an active IEEE Photonics Society student member** pursuing a graduate education within the Photonics Society field of interest. Students should normally be in their penultimate year of study at the time of after the application is submitted (i.e. those applying in 2019 would normally expect to defend their thesis during 2020).

**Schedule:** Electronic submissions are now being accepted. Submission deadline is 30 May. The Fellowship recipients will be notified by 30 July of the same year.

### Fellowship Application Package Requirements:

- Cover letter to include name, address, email, IEEE member number, expected date of submission of the thesis, and a listing of any activities related to Photonics Society, along with the names and contact information of two references.
- A one-page CV, including all degrees received and dates.
- One copy of educational transcripts.
- A 300-word statement of purpose describing the student's research project and interests. The statement is to include the background to the project, what the student has achieved so far and how the research will be continued and developed by the student over the rest of the project. A list of the student's publications with the most significant paper indicated and a 100-word description of the significance of the paper. Please include IEEE Photonics Society journal publications if any.
- Two reference letters from individuals familiar with the student's research and educational credentials.
- Note that additional information and submissions over the specified word count will not be forwarded to the evaluating committee.

Apply here: <https://bit.ly/2LAUEI8>

For more information contact: [PhotonicsAwards@ieee.org](mailto:PhotonicsAwards@ieee.org)



## CALL FOR NOMINATIONS

### IEEE Photonics Society 2019 Distinguished Service Award

**Nomination deadline: 30 April 2019**

The **Distinguished Service Award** was established to recognize an exceptional individual contribution of service that has had significant benefit to the membership of the IEEE Photonics Society as a whole. This level of service will often include serving the Society in several capacities or in positions of significant responsibility. Candidates should be members of the Photonics Society. The award is presented at the IEEE Photonics Conference formerly known as the IEEE Photonics Society Annual Meeting.

[Nomination Submission](#)

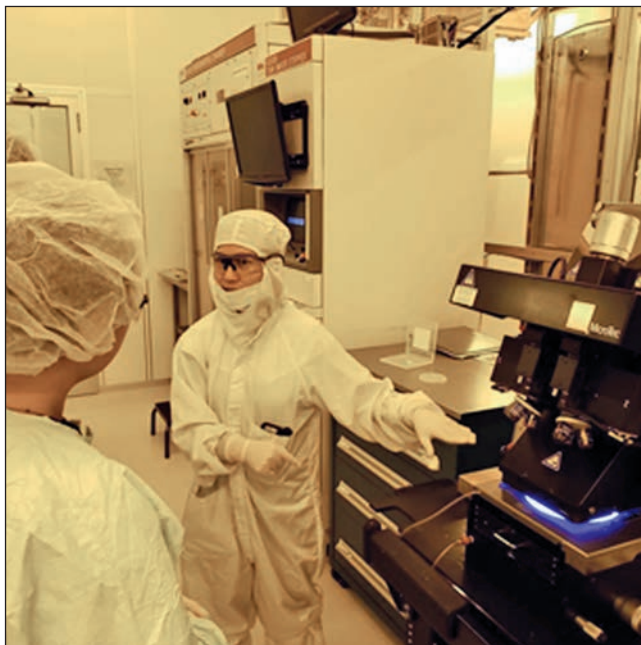
[Previous Recipients](#)

# Membership

## 3rd Annual UCSB Women in Photonics Week

In October 2018, the IEEE Photonics Society Chapter at the University of California Santa Barbara (UCSB) held its third annual Women in Photonics Week. This event aims to educate students from middle school to college levels about photonics and inspire women and girls to enter this field. Photonics suffers from significant underrepresentation of women as do most STEM fields. Anecdotal, we have found that it is often relatively unknown beyond those who join STEM fields in college. Last year, the chapter held a total of five events and hosted an international visitor.

The Chapter organized a tour of the UCSB nanofabrication facility led by female users of the facility. These women are graduate students at UCSB or local industry professionals. This tour saw an attendance of about twenty-five people which comprised mostly of students from the middle school to undergraduate level and their parents. Tour leaders walked attendees through the facility, explaining principles of nanofabrication and cleanroom techniques such as photolithography, wet and dry etching, and deposition, as well as discussing the many types of devices that are fabricated in the cleanroom.



Paula Heu from Innovative III-V Solutions demonstrates photolithography in the UCSB nanofabrication facility.

In collaboration with women scientists and engineers of “Freedom Photonics, a local photonics company,” the local student chapter of the Society organized an event at the company’s facility. This event included a tour of the nanofabrication facility, a short lecture on photonic applications, the career paths of the Freedom Photonics scientists and engineers, and several hands-on activities, including a demonstration of a handheld infrared camera, a DVD spectrom-



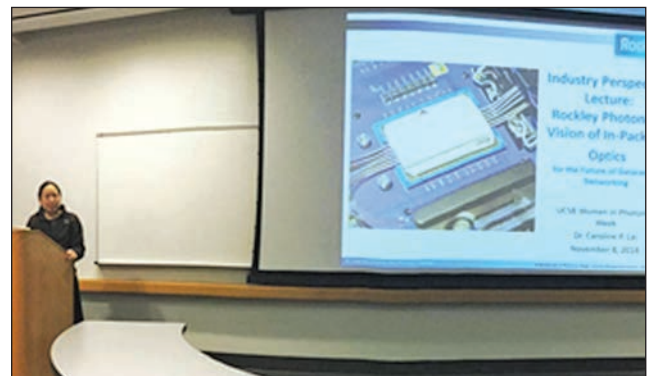
Aligned stencil patterns from Freedom Photonics’ photolithography activity.

eter activity, and the principles of photolithography using sidewalk chalk and stencils.

The IEEE Photonics UCSB Student Chapter also organized talks at local middle schools for students by women graduate students in photonics-related fields at the university. In these talks, the graduate students discussed their work, their interest in science, and their educational paths through college and graduate school. This year, four graduate students gave six talks at Goleta Valley Junior High School, reaching an estimated 75 to 80 middle school students in the 6th to 8th grades.

In addition, Dr. Caroline Lai, from Rockley Photonics in Pasadena, came to speak to photonics graduate students. She spoke about Rockley Photonics’ history and gave a technical overview of the range of technologies on which the company works. She concluded by touching on her career thus far and the importance of having female mentors.

Later in the day, female members of the IEEE Photonics Society participated in the annual “I HEART STEM” conference. The conference was jointly organized by the UCSB Women’s Center and Women in Science and Engineering



Dr. Caroline Lai from Rockley Photonics speaks at UCSB.



(WiSE) student organization and is intended to encourage high-school-aged young women to pursue STEM fields when they enter college through hands-on STEM workshops and a keynote address about the difficulties they may face as a woman in STEM. All attendees and workshop facilitators were women. The IEEE Photonics Student Chapter led a hands-on workshop, using a combination of OSA Optics Suitcase and the Laser Classroom kit. The workshop was repeated two times to different groups of students and attendees explored different optical phenomena, such as polarization and color perception.

Finally, this year, the Chapter hosted an international visitor for Women in Photonics Week. Miki Igarashi is a general science communicator in Japan. In addition to hosting her own YouTube science channel and running science education outreach events for children, she is a graduate student at the University of Tokyo studying science communication with a focus on women in STEM. As she is particularly interested in

increasing the proportion of women in STEM fields, where percentages are the same or below those in the U.S., the IEEE Photonics Society invited her to observe “I HEART STEM” workshops and talks.

Volunteers helped facilitate interviews with other conference workshop facilitators for her research in addition to agreeing to be interviewed. In addition to hosting, some members of the IEEE Photonics Society visited a local science museum with the guest to facilitate her research as well as to find inspiration through the exhibits and demonstrations for our own photonics-related educational outreach activities. Igarashi was given a color-mixing activity, developed at UCSB, with instructions that were translated into Japanese.



IEEE Photonics UCSB Student Chapter Secretary, Victoria Rosborough leads participants in an activity at “I HEART STEM”.



From left to right, a student volunteer, Miki Igarashi, and Photonics Society President Takako Hirokawa after I HEART STEM 2018.

## Chapter Best Practices from the IEEE Photonics Italy Chapter

The IEEE Photonics Society every year honors a select number of chapters that have represented the Society well locally. A chapter that has gone above and beyond is the Italy Chapter. In 2018, the Italy Chapter was honored with both the Chapter of the Year and Senior Member Initiative awards. The chapter is known for its “innovative technical programming as well as for building an environment that reflects the rich diversity of the photonics community”.

The strength of the chapter rests on the composition and commitment of its Executive Committee (ExCo) of volunteers.

Since the foundation of the Chapter, formerly LEOS in 1997, it’s a tradition for the members of the ExCo to work together as a team, sharing proposals and joining in efforts to implement them. Most of the Italy Chapter members are researchers, either academic or working at the National Research Council of Italy; however, the Chapter is looking to diversify its approach towards industrial-oriented initiatives to be a further driving force in the community.

At present, there are eighteen volunteers on the ExCo, five of which are women. The Committee meets formally at least



Participants and winners of the International School on Computational Microscopy organized by the IEEE Photonics Italy Chapter.



The Student Poster Session at the International School on Computational Microscopy.

once a year to plan the activities. Locally, the Chapter collaborates with IEEE Italy Section with shared initiatives, organizing activities monthly.

Chapter Chair Silvia M. Pietralunga, Researcher at CNR-IFN, was recently asked to share further details on her chapter's approach to member engagement, outreach and more. Her responses are below.

### Could You Give an Overview of the Activities Your Chapter Organizes? What Seem to be the Most Successful Activities You Organize?

In collaboration with academic institutions and research centers, the IEEE Photonics Italy Chapter organizes monthly scientific seminars and workshops, by inviting national and international experts as well as IEEE Photonics Society Distinguished Lecturers. Regarding young researchers, each year the Chapter grants a prize for the "Best Doctoral Thesis in Optoelectronics", which has now become a milestone for Ph.D. students of the Italian Universities. The Italy Chapter also generally agrees to sponsor national and international conferences

organized in Italy in the field of photonics. All these initiatives are generally quite participated, but the Chapter's STEM outreach events in the last couple of years have reached the largest audiences ever.

### What Resources Provided by the Larger IEEE Photonics Society Have Been Particularly Helpful in Realizing Your Chapter's Success?

In the last year, the Italy Chapter benefited from an IEEE Photonics Educational Seed Grant, as a sponsorship for the Chapter's "Best Student Talk Award" and "Best Poster Award", held in Amalfi. The school was designed for master degree students, PhD, postdocs, and young scientists interested in acquiring basic elements to implement and manage unconventional microscopy imaging systems. The grant also sponsored a photo exhibition, called a "Lab's Life", that was hosted in the Town Hall of Atrani, i.e. describing the everyday life in research to the general public.

Another school of mention organized by the chapter was the "International School on Nano-Tooling" at ScienceApp in Pozzuoli, Italy. The objectives of the school were to showcase the concepts and basic working principles of Nano-Tools, in Holographic Lithography, Magnetic Nanosensing, Nanomedicine, Femtosecond lasers.

Furthermore, the Chapter benefited from the resources specifically provided for the International Day of Light, to organize events celebrating the key and transversal role of photonics in advancing diverse fields from ICT to lighting, from biotechnologies and health to sensors for the IoT. The Italy Chapter performed a STEM outreach event, entitled "Light, Color and Vision", which was organized in Naples in collaboration with the University and the municipality. The event reached about 1500 participants.

### Do You Have Any Other Partnerships (Academic, Industrial, etc.) that Have Been Instrumental in Improving Your Chapter?

Since the Italy Chapter does not possess a headquarter or regular meeting location, the volunteers generally organize events





PHOTO CREDIT: IEEE PHOTONICS ITALY CHAPTER

Winners of the Italy Chapter's "Best Student Talk Award" and "Best Poster Award" at the International School on Computational Microscopy, held in Amalfi.

in collaboration with the institutions that host the events and contribute to manage them. In case of workshops and seminars, it is usually either an academic or a research institution that supports us. Bigger events may be participated also by industries, trade associations and local authorities. Qualified partnerships represent advertising for the Chapter, particularly at a national level. Therefore, though indirectly, they are beneficial. When dealing with financial co-sponsorship of events, the Italy Chapter also acts in partnership with other technical associations and/or IEEE organizational units to help maintain the sustainability of the budget, enable the initiative to be organized and be technically sound.

### What Do You Believe Are the Keys to Having a Successful Chapter?

Of course, success cannot be granted by default. Many different environmental elements may affect success, even for quite committed and active members. However, one definite key for success is that officers and members of the Executive Committee and larger chapter are committed to organizing initiatives together. Team work is the key to success.

The same, collaboration and synergy with local organizational units improves efficiency. From the Italy Chapter's experience, collaboration with the staff of IEEE Photonics Society is also an essential resource.

### What Advice Do You Have for Other Chapters that Are Seeking to Improve Their Outreach, Membership, and Overall Impact?

The main points are the same as above; collaborating with local organizational units may help in improving visibility and ultimately being effective. Forming a relationship with the staff of the IEEE Photonics Society is important. Above all, the Community Outreach & Development Manager on staff is a great resource in terms of opportunities for extended outreach. Also, utilize and mobilize your academic members, who usually have better access to technical audiences and to extended outreach channels. This is an added value they can bring within the Executive Committee of a chapter and whenever the organization of an event is discussed.



PHOTO CREDIT: IEEE PHOTONICS ITALY CHAPTER

The IEEE Photonics Italy Chapter sponsored a photo exhibition, called a "Lab's Life", that was hosted in the Town Hall of Atrani, i.e. describing the everyday life in research to the general public.

Regarding membership, the IEEE is regarded as a worldwide technical community, especially for Young Professionals; use that to your advantage. Give brief presentations on the IEEE Photonics Society at the start of all events which the Chapter organizes. Explain how the IEEE Photonics Society can be a home within the larger IEEE. In addition, membership is encouraged in the face of benefits. For non-US chapters, benefits are often limited to discount fees at conferences or schools. This is one very good reason to encourage chapters to organize local conferences, workshops, summer schools, etc. Provide local benefit to join.

### Your Chapter Has Been Applauded for Its Diverse Membership, Especially in Relation to Gender Balance. Do You Believe You Do Anything Special to Encourage Diversity?

Actually, the Italy Chapter doesn't necessarily do anything special or overt to encourage gender diversity. Simply, the Chapter leaders

*(continued on page 24)*



## Applications of Optics and Photonics in Space

Wednesday, April 3, 10, 17, 24, May 1, 2019, 7:00–9:30 PM

Located at MIT Lincoln Laboratory – 3 Forbes Road, Lexington, MA, 02420, USA

This workshop will feature talks on different applications of Optics and Photonics in space. Employing Optics and Photonics beyond earth's atmosphere is a new frontier for laser communications, optical sensors, and space exploration, which is being driven by the affordable launch cost of small satellite systems (e.g. CubeSats), the military, NASA's space telescopes, as well as the commercial delivery systems of SpaceX, Blue Origin, and Virgin Galactic.

These applications include secure quantum optical communication systems, optical sensors for earth observation (weather forecasting, climate change, natural resources), space-based Lidar systems, monitoring sun activity for solar storms, the Hubble and James Webb telescopes for deep space observation, planetary missions (e.g. New Horizon Pluto and Kuiper belt mission), the search for extra-terrestrial life and exoplanets, and space based optical interferometers for the detection of gravitational waves. A NASA sponsored program - Lunar Laser Communication Demonstration (LLCD), 622 megabits per second from moon to earth, ushered in a new era in high-speed outer space laser communications, changing the landscape of laser-based space data communication forever. The future NASA Orion Mission (human to moon) will include a lasercom link. In addition, closer to earth, Google and Facebook are exploring high-speed free-space optical communications (Internet in the sky) for expanding their customer base.

This workshop will bring together leading experts in this field to discuss the latest technological applications of Optics and Photonics in space. This workshop also aims to foster communication and collaboration through networking among the individual engineers and researchers attending. Learn more about the rapid innovations in space optics and photonics directly from the foremost researchers in the different specialties involved, by registering for and attending this local Boston workshop on Applications of Optics and Photonics in Space.

Wednesday  
April 3, 2019

### Laser Communication for NASA Mission

Dr. Farzana Khatri, MIT Lincoln Laboratory, Lexington, MA

### Enabling Exoplanet Direct Imaging with CubeSats

Prof. Kerri Cahoy, Massachusetts Institute of Technology, Cambridge, MA

Wednesday  
April 10, 2019

### Wide Field Infrared Survey Telescope (WFIRST) Mission

Prof. Hakeem Oluseyi, Florida Institute of Technology, Melbourne, FL

### Ground-Based and Space Telescopes: Current and Future

Dr. Jane Luu, MIT Lincoln Laboratory, Lexington, MA

Wednesday  
April 17, 2019

### Integrated Photonics for Communications and Sensing in Space

Prof. Jonathan Klamkin, University of California, Santa Barbara, CA

### The Laser Interferometer Space Antenna: Observing mHz Gravitational Waves from Space

Prof. John W. Conklin, University of Florida, Gainesville, FL

Wednesday  
April 24, 2019

### Optical Crosslinks for Data Relay in Low Earth Orbit

Dr. Timothy Yarnall, MIT Lincoln Laboratory, Lexington, MA

### Lower Frequency Bands Emerging as Valid Alternatives to Free-space Lasercom in Terrestrial, Aerial, and Satellite Links

Dr. Hamid Hemmati, Facebook, Pasadena, CA

Wednesday  
May 1, 2019

### The Beginning of Gravitational Wave Astronomy

Prof. Rainer Weiss, 2017 Nobel Laureate  
Massachusetts Institute of Technology, Cambridge, MA

### Positron Propulsion Systems

Dr. Ryan Weed, Positron Dynamics, Livermore, CA

Advance registration and fee required (Open to all IEEE members as well as non-members)

\$75/\$85 (IEEE Member/Non-Member) early registration fee for ten 1-hour talks over five nights; cost includes coffee and cookies each night, as well as downloadable copies of speakers slides. Early registration deadline March 15<sup>th</sup>, 2019. Post deadline fee \$85/\$95 (IEEE Member/Non-Member).

Registration form, abstracts, speaker's bios at: <http://www.bostonphotonics.org/workshops/aops19/>

For more information contact:

- 1) Farhad Hakimi, (fhakimi@ieee.org), Workshop Chair
- 2) Bill Nelson, (w.nelson@ieee.org), Workshop Co-Chair
- 3) Dean Tsang, (tsang@ieee.org), Workshop Co-Chair

# IEEE Photonics Society Annual “Photonics Workforce Development” Mixer at Photonics West 2019

*Participants included mentors, community college students, technicians and community partners interested in discussing the vital role community colleges play in cultivating the photonics industry of tomorrow.*

The IEEE Photonics Society understands that technicians are needed more than ever in the growing photonics industry, especially with the manufacturing of photonic integrated circuits (PIC). PIC's are expected to enable substantial advances in several areas, including cloud computing and storage data centers, ultrahigh bandwidth radio and microwave communications, sensors for medical, military, and autonomous vehicles applications. Through our coalition work, the IEEE Photonics Society continues to provide opportunities where associations, companies and academia can come together to share best practices in these areas. SPIE's Photonics West Exposition was no exception.

In February, the IEEE Photonics Society sponsored an “Photonics Workforce Development” Mixer for the second year for the Indian Hills Community College (IHCC), OP-TEC, the Midwest Photonics Education Center (MPEC), LASER-TEC and AIM Photonics. The event included a networking reception for nearly 200 conference attendees, college alumni, local IEEE members and industry partners to discuss the vital role community and technical colleges play in cultivating the photonics industry of tomorrow. This was an opportunity for alumni from community and technical colleges to meet prospective employers and IEEE fellows.

PHOTO CREDIT: IEEE PHOTONICS SOCIETY



Mentors speak with mentees during the “Photonics Workforce Development” Mixer organized by the IEEE Photonics Society and IHCC.

PHOTO CREDIT: IHCC



Students from the IHCC Midwest Photonics Education Center learning from cross-collaborations with community partners from industry.



This “Meet & Greet” was organized in conjunction with IHCC’s annual “Alumni & Friends Reception” at Tabletop Tap House, a popular gathering place near the Moscone Center with pool tables and live-music. IHCC President Dr. Marlene Sprouse spoke about the college’s Associate of Applied Science Degree (A.A.S.) in Laser & Optics Technology and the program graduates and scholarships all made possible through collaborations like this event.

IHCC is a two-year public community college, with campuses located in Ottumwa, Iowa and Centerville, Iowa. IHCC’s A.A.S Laser & Optics courses prepare students in high- and low-power laser systems; operation, testing, maintaining, troubleshooting optical systems; optics cleaning & handling; laser, optical alignment & collimation techniques; LSO (Laser Safety Officer) equivalent laser safety training; training on how to operate optical measuring equipment; and properties of light. The IHCC alumni in attendance work in a wide range of careers including: Program Managers, Business Development Managers, Vice Presidents, Sales Managers, Product Manag-

ers, Applications Engineers, Sales Engineers, and Engineering Technicians.

The college also participated in the IEEE Photonics Society’s Mentor Match program, designed to help students expand their professional networks while at the conference, gain personalized career insights, and receive guidance from senior professionals in photonics. Attendees signed up to be either a mentor or mentee for the conference week. Over 30 students, technicians, student members and young professionals, participated.

Seventeen IHCC students traveled to California for the event and to attend Photonics West. They also had the opportunity to tour Lawrence Livermore National Laboratory, Spectra Physics, and the Lick Observatory. The students raised travel funds throughout the year by having food vendor tables, raffles, and other fundraising activities. The IEEE Photonics Society is currently developing a student chapter with the college’s Laser Club within the college’s IHCC Midwest Photonics Education Center.

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## Chapter Best Practices from the IEEE Photonics Italy Chapter

*(continued from page 21)*

do not discourage it. For instance, if we consider the human resources active in the field of photonics in Italy, the percentage of women has increased in these latest years. The Chapter invites women colleagues to join IEEE Photonics Society organically. However, the chapter occasionally will hold Women in Photonics programming in conjunction with Society initiatives, like “Introduce a Girl to Photonics” Week, “IEEE Day” and “International Women’s Day”.

The fact that two women are presently the President of the IEEE Italy Section and the Chair of the IEEE Photonics Society Italy Chapter, respectively Tiziana Tambosso and me, this may encourage female scientists and engineers to join. All the same, maybe they are also encouraged by meeting qualified women scientists, who are also very active members.

### Do You Have Any Advice for Chapters that Are Looking to Improve Member Engagement?

If you mean to improve the membership of your Chapter, my advice would be: improve membership at a student grade or

Young Professional level by organizing attractive programs and events, highlighting the professional and career opportunities supported by your chapter and Society. These members are future of the IEEE Photonics Society and prospective members of your chapter.

If you mean to improve engagement of active members, my advice would be: besides sending out invitations to members to apply to upgrade their membership status, make members aware of the fact that the Chapter leadership is also there for support. Chapter leaders are the Society’s advocates representing the organization around the world at the local level. Such volunteers can provide valuable opportunities to network and collaborate—promoting professional growth and continuing education within the photonics community.

If you would like more information on the IEEE Photonics Italy Chapter’s best practices or would like to connect further with the chapter chair, please contact Silvia M. Pietralunga at [silvia.pietralunga@polimi.it](mailto:silvia.pietralunga@polimi.it).



## IEEE Photonics Society Conference Calendar

### **2019 Optical Fiber Communications Conference and Exhibition (OFC)**

San Diego Convention Center  
San Diego, CA USA  
Mar 3, 2019 - Mar 7, 2019  
[www.ofcconference.org](http://www.ofcconference.org)

### **2019 IEEE Research and Applications of Photonics in Defense Conference (RAPID)**

Hilton Sandestin Beach Golf Resort & Spa  
Miramar Beach, FL USA  
Aug 19, 2019 - Aug 21, 2019  
<https://ieee-rapid.org>

### **Conference on Lasers and Electro-Optics 2019 (CLEO)**

San Jose Convention Center  
San Jose, CA  
May 5 2019 – May 10, 2019  
[www.cleoconference.org](http://www.cleoconference.org)

### **16th International Conference on Group IV Photonics (GFP)**

Hilton Singapore  
Singapore  
Aug 28, 2019 – August 30, 2019  
<https://ieee-gfp.org>

### **2019 IEEE Optical Interconnects Conference (OI)**

Hilton Santa Fe Historic Plaza  
Santa Fe, NM USA  
Apr 24, 2019 - Apr 26, 2019  
<https://ieee-oi.org>

### **2019 IEEE Photonics Conference (IPC)**

Hilton Palacio Del Rio  
San Antonio, TX USA  
Sep 29, 2019 - Oct 3, 2019  
<http://ieee-ipc.org>

### **2019 IEEE Photonics Society Summer Topical Meeting Series (SUM)**

The Westin Fort Lauderdale Beach Resort  
Fort Lauderdale, FL USA  
Jul 8, 2019 - Jul 10, 2019  
[www.sum-ieee.org](http://www.sum-ieee.org)

### **2019 IEEE Avionics and Vehicle Fiber-Optics and Photonics Conference (AVFOP)**

The Westin Arlington  
Arlington, VA USA  
Nov 5, 2019 - Nov 6, 2019  
<http://ieee-avfop.org>

For more information, visit: <https://www.photonicsociety.org/conferences>



# 4th IEEE International Conference on BioPhotonics

September 15-18 | Taipei, Taiwan

## Call for Papers

After the past successful editions in Parma (Italy), Taipei (Taiwan) and Firenze (Italy), each attended by more than 150 delegates, we are proud of announcing the 4<sup>th</sup> appointment of the series, the 2019 IEEE International Conference on Biophotonics (IEEE-ICB2019), will be held in Taipei, Taiwan. The event has established as a high-level meeting in the area of photonics techniques for medicine, life science, agriculture, environmental science and related areas of application. Aim of the Conference is to bring together researchers worldwide to networking and exchanging their research developments in a stimulating multidisciplinary forum. As usual, the program will feature invited lectures, as well as oral and poster sessions.

### Topics of BioPhotonics 2019 include:

- **Microscopy and Imaging**  
Optical coherence tomography  
Confocal microscopy  
Optical acoustic tomography  
Coherent anti-Stokes Raman spectroscopy  
FLIM-FRET/ Multi-photon microscopy  
Tissue imaging
- **Nano-Biophotonics**  
Molecular sensing  
Nano sensors and contrast agents
- **Diagnostic and Therapeutic Applications**  
Point-of-care testing  
Laser treatments and welding  
Photo dynamic therapy
- **Optical and Fiber Sensing**  
Sensing in plasmonic platforms  
Sensing in optofluidic platforms  
Sensing in Si-photonics platforms
- **Spectroscopy and Imaging**  
Cellular and sub-cellular events  
Applications to food and drug analysis  
Light-tissue interactions
- **Modelling**  
Deep learning in medical image  
Algorithms in optical diffusion

### Submissions:

Perspective Author shall submit electronically to the conference website <http://ICB2019.ntu.edu.tw>

- a 35-word abstract and
- a 2-pages paper, written on the conference template, and
- indicate the preference for oral/poster presentation

by the deadline of **June 15, 2019**.

Authors will be informed about the acceptance by **July 15, 2019**.

Papers (oral and poster) accepted and presented at the Conference will be published on IEEE Xplore.

### Sponsored and Organized by



國立臺灣大學  
National Taiwan University



### Supported by



# The British and Irish Conference on Optics and Photonics

The United Kingdom and Ireland have long been considered world-leaders in research and technology development in optics and photonics. It was with the intention of consolidating the activities and achievements of these two regions, and expanding opportunities for collaboration between academia and industry that the UK and Ireland Photonics Chapter was reinstated in 2017. The Chapter is comprised of both academic staff and experienced industry leaders with a common goal to promote and co-operate in educational and technical activities, contributing to the useful expansion of the field of photonics and its applications.

We quickly identified the need for a UK and Ireland flagship event that showcased both industrial and academic advances in optics and photonics and promoting collaboration.



Last December we held the 1st IEEE British and Irish Conference on Optics and Photonics (BICOP 2018). The Royal Society, the oldest scientific institution in the world, proved to be the perfect venue and, with Christmas round

the corner, London made for a beautiful and magical setting.

The conference was opened by Carol Monaghan (MP) who is globally recognised for her contributions as Chair of the All Parliamentary Group on Photonics. Our guest speaker, scientist and broadcaster Maggie Adrin-Pocock MBE gave an inspiring account of her journey to become one of the foremost astronomers in the country and described how photonics may provide the key to interstellar travel in our lifetimes.

The theme for our first BICOP conference was "Women in Photonics", so we were very pleased to hear a talk from



Maggie Adrin-Pocock MBE, Carol Monaghan MP and Dr Richard Pitwon (from L to R) with the conference delegates.



Discussions and collaborations at BICOP 2018.





All smiles at the conference.

Dr. Lidia Galdino, who was named as one of the 2017 “Top 50 Women in Engineering under 35” by The Telegraph and Women in Engineering Society. She is currently the Associated Vice President of IEEE’s Women in Photonics initiative, a cause that is of significance to the organizing committee of BICOP.

The essence of the conference was of course the rich diversity of superb talks spanning both industry and academia including talks from IBM, BT, Microsoft, BAE Systems, Toshiba, Huawei, Seagate, Senko, PureLifi, Kaiam, IQE, NPL, Cobham, mBryonics, University of Cambridge, University College Cork, University of Southampton, University of St Andrews, Keio University and the Fraunhofer Institute.

The broad range of topics addressed included photonic integrated circuits, laser effects, graphene-based photonics, photonics in healthcare, cloud solutions for optics, challenges in optics and photonics with the rise of 5G, and optical circuit board technologies.

The best paper, best invited talk and best poster awards went to Dr. Sebastian Schulz (University of St Andrews), Prof. Graham Reed (University of Southampton) and Ryosuke Hatai (Keio University), respectively.

After almost a year of intense preparation and organisation by our committee, this conference proved a resounding success and we look forward to welcoming you to the 2nd IEEE British and Irish Conference on Optics and Photonics (BICOP 2019) this December.



Our winners: Dr. Sebastian Schulz, Prof. Graham Reed and Mr. Ryosuke Hatai.

One important goal of this chapter continues to be support of other optics and photonics meetings in the region. We were proud to support Photonics Ireland 2018, Enlighten Conference at Photonex 2018 and 6th Symposium for Optical Interconnect in Data Centres (ECOC 2018). We have had the privilege of our committee member, Mr. Akhil Kallepalli, chairing the Optical Sensing and Spectroscopy Session at Photonics Ireland 2018. We were also proud to be associated with the Biophotonics Session of the conference.

Message from the Chapter Chair Dr. Richard Pitwon

*This is a particularly critical time for the UK as it prepares to leave the European Union after almost half a century. In the coming years it is more important than ever before that we promote the virtue and value of collaborative engineering, science and technology not only across all educational and technical sectors of our countries, but also at the highest levels of government. Photonics represents an emerging technology field that will provide crucial advancements to many key sectors including communication, medicine, automotive, computing, lighting, sensors, renewable energy and defence. The UK and Ireland are well placed to exploit photonics in order to enhance our collective ability to compete on the global stage in this increasingly relevant and competitive field.*

*We continue this joint society in the spirit of international scientific partnership, which must endure.*



The conference organizing committee from left to right are Dr. Richard Pitwon, Mr. Aytun Erdentug, Dr. Filipe Ferreira, Mr. Akhil Kallepalli, Dr. Kin Kee Chow.

# **IEEE Photonics Society Co-Sponsored Events**

## **2019**

### **PHOTOPTICS**

*25-27 February*

*2019 International Conference  
on Photonics, Optics and Laser  
Technology  
Prague, Czech Republic  
<http://www.photoptics.org>*

### **CSW**

*19-23 May*

*2019 Compound Semiconductor  
Week  
Nara, Japan  
<http://www.csw-jpn.org>*

### **OECC/PSC**

*7 - 11 July*

*2019 24th OptoElectronics and  
Communications Conference and  
2019 International Conference  
on Photonics in Switching and  
Computing  
Fukuoka, Japan  
<http://www.oeccpsc2019.org>*

### **FOAN**

*2-4 September*

*2019 International Workshop on  
Fiber Optics in Access Networks  
Bosnia and Herzegovina  
<http://foan.info>*

### **ECOC**

*22-26 September*

*2019 European Conference on  
Optical Communications  
Dublin, Ireland  
<http://www.ecoc2019.org>*

### **MOC**

*17-20 November*

*2019 24<sup>th</sup> Microoptics Confernce  
Toyama, Japan  
<http://www.moc2019.com>*



## **Announcement of an *IEEE/OSA* *Journal of Lightwave Technology* Special Issue on: DSP in Next Generation Optical Access Networks**

Intensity modulation with direct detection (IM-DD) has been widely used in nearly all optical networks for several decades at rates of 10 Gb/s and lower. Starting in approximately 2010, DSP based coherent technology began being deployed for long-haul optical networks allowing much higher data rates (e.g. 100 Gb/s vs 10 Gb/s) to be sent over long spans of fiber (>1,000 km). Currently, optical access networks still rely on IM-DD at 10 Gb/s and lower. However, new services like 5G mobile X-haul, edge computing and HD video distribution combined with stringent requirements like low latency, flexibility, and scalability are transforming the need for future access networks. To keep up with increased bandwidth demand and support future mobile traffic, next generation access networks supporting over 50 Gb/s per single wavelength, while ensuring coexistence with legacy access systems in a cost-effective manner will be needed. An attractive approach to enable this is the use of advanced modulation and detection techniques, enabled by digital signal processing (DSP), to provide these high-speed transmissions with low-cost limited bandwidth optical components as well as being able to compensate for dispersion and nonlinearities. Furthermore, DSP based optical access technology could be a good fit for future converged optical, wireless and copper based broadband access networks to meet the stringent requirements of these new services across the whole network.

The special issue will address the following topics:

- How to modify long-haul DSP technology for optical access
- Burst mode DSP
- Interoperability and DSP
- Reusing DSP in wireless and copper-based access networks for optical access
- Coherent PON
- DSP-based equalization
- Power consumption
- New services enabled by DSP
- Flexible optical access
- Next generation services for optical access
- Joint optical and wireless DSP for 5G networks
- Optimize DSP for low latency, flexibility, and scalability

On behalf of the Guest Editors and the Editor-in-Chief, we encourage you to submit your work for inclusion in this Special Issue. Accepted papers will appear in the Jan/Feb 2020 hardcopy issue with accepted papers posted online within one week of author final file upload. Mandatory page charges of \$260.00 per page are enforced for Original Contributions in excess of 7 pages and in excess of 10 pages for Invited Papers. Tutorial presenters will be invited to write articles that are up to 16 pages in length. The same mandatory fees apply to each Tutorial paper in excess of 16 pages.

Submissions by website only: <http://mc.manuscriptcentral.com/jlt-ieee>

Manuscript Type: "DSP 2019"

Submission questions: Doug Hargis, Journal of Lightwave Technology [d.hargis@ieee.org](mailto:d.hargis@ieee.org)

No copyright infringement is intended

Guest Editors: **Dora van Veen (Nokia Bell Labs, USA), Marco Presi (Scuola Superiore Sant'Anna, Italy), Naoki Suzuki (Mitsubishi Electric, Japan), Vincent Houtsma (Nokia Bell Labs, USA),**

**Submission Deadline: 30 April 2019  
Publication: Jan/Feb 2020**





## **Announcement of an *IEEE/OSA* *Journal of Lightwave Technology* Special Issue on: Microwave Photonics**

### **Scope**

This special issue covers all topics in the field of microwave photonics, a special issue for the 2019 IEEE International Topical Conference on Microwave Photonics (MWP'2019). Microwave photonics is concerned with the use of photonic devices, systems and techniques for applications in microwave, millimeter, and THz wave engineering, and also encompasses the development of high-speed photonic components for microwave system applications. The field is continuing to experience significant growth, fueled by the recent interest and development in integrated microwave photonics and microwave/millimeter-wave photonics for 5G applications and beyond. Topics include (but are not limited to):

- High-speed optoelectronic devices
- Integrated microwave photonics
- Photonic techniques for microwave signal generation and distribution
- Photonic microwave processing, sensing, and measurements
- THz techniques and applications
- Radio over fiber techniques, fiber-wireless communications, and 5G
- Innovative applications of microwave photonics (astronomy, traffic and automotive, electronic warfare, radar, medicine and health care, etc.)

A portion of this issue will feature expanded versions of accepted papers presented at the 2019 IEEE International Topical Conference on Microwave Photonics in Ottawa, Canada from October 7-10, 2019.

We will have a total of ~10 invited papers and 2 tutorial review articles. We expect to receive up to 100 regular submissions from expanded versions of oral and poster papers (contributed) that are presented at the conference.

On behalf of the Guest Editors and the Editor-in-Chief, we encourage you to submit your work for inclusion in this Special Issue. Accepted papers will appear in the Sep/Oct 2020 hardcopy issue with accepted papers posted online within one week of author final file upload. Mandatory page charges of \$260.00 per page are enforced for Original Contributions in excess of 7 pages and in excess of 10 pages for Invited Papers. Tutorial presenters will be invited to write articles that are up to 16 pages in length. The same mandatory fees apply to each Tutorial paper in excess of 16 pages.

Submissions by website only: <http://mc.manuscriptcentral.com/jlt-ieee>

Manuscript Type: "MWP 2020"

Submission questions: Doug Hargis, Journal of Lightwave Technology [d.hargis@ieee.org](mailto:d.hargis@ieee.org)

The Guest Editors for this issue are: Lawrence R. Chen, McGill University, Canada; Jason D. McKinney, Naval Research Labs, US; Ivana Gasulla, Universitat Politècnica de València, Spain; and Ming Li, Chinese Academy of Sciences, China.

<p><b>Submission Deadline: 1 February 2020</b> <b>Publication: Sep/Oct 2020</b></p>
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## Preliminary Call for Papers

Announcing an Issue of the IEEE  
JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on  
**Silicon Photonics**

**Submission Deadline: June 1, 2019**  
**Hard Copy Publication: March/April 2020**

The **IEEE Journal of Selected Topics in Quantum Electronics** (JSTQE) invites manuscript submissions in the area of **Silicon Photonics**. Silicon Photonics is the overall name for photonic integrated circuit technologies that combine the functionality of high-density circuits of high-contrast waveguides with the economic potential for volume manufacturing in a microelectronics fab. Over the past two decades, Silicon Photonics has grown out of the niche of academic research into an industrially viable technology, largely driven by applications in data communication. We have seen the material palette of silicon photonics extend well beyond silicon to incorporate low-loss waveguides, efficient modulators and detectors, as well as optical gain. This special issue focuses on the recent progress of silicon photonics. Topics include

- Active and passive devices (e.g., waveguide structures, switches, WDMs, resonators, modulators, photodetectors, amplifiers, light sources, and sensors; sub-wavelength structures); New developments in area of photonic crystals, plasmonics;
- Application Specific Integrated optical circuits for datacom, RF-photonics, WDM networks and coherent communications with high baud rate devices and high-order modulation format;
- Programmable Silicon Photonic devices and circuits for optical information processing, quantum optics and microwave photonics.
- Strategy and implementation status of optoelectronic integration (e.g., III-V laser, organic-Si devices, Isolators, optical-interposer, 2.5D/3D IC), and thermal management;
- Efforts in the technology development towards productization, e.g., low cost packaging, design enablement, test and yield enhancement;
- Quantum photonics devices and integrated circuits and their applications in communication and future computing;
- Novel concepts in device and integrated photonic circuits and applications, e.g., aerospace, automotives, bio-imaging, bio-photonics, non-linear, mid-IR, spectrometers, opto-mechanical and opto-acoustic sensors, and
- Silicon photonic design, theory, modeling and simulations.

The Primary Guest Editor for this issue is **Prof. Wim Bogaerts**, Ghent University – IMEC, Belgium. The Guest Editors of the issue are: **Dr. Eric Bernier**, Huawei, Canada; **Dr. Sun Jie**, INTEL, USA; **Prof. Delphine Marris-Morini**, University of Paris-Sud, France; **Dr. Thomas Van Vaerenberg**, Hewlett-Packard Laboratories, USA.

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**For inquiries, please contact:**

**IEEE Photonics Society JSTQE Editorial Office - Chin Tan Lutz (Phone: 732-465-5813, Email: [c.tanlutz@ieee.org](mailto:c.tanlutz@ieee.org))**

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## Call for Papers

Announcing an Issue of the IEEE

JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on

## Photonics for Quantum Information Technologies

Submission Deadline: August 1, 2019

Hard Copy Publication: May/June 2020

The **IEEE Journal of Selected Topics in Quantum Electronics** (JSTQE) invites manuscript submissions in the area of **Photonics for Quantum Information Applications**:

- Quantum communication
- Quantum cryptography
- Quantum random-number generation
- Single-photon sources and detectors
- Quantum memories
- Quantum networks
- Quantum sensing and metrology
- Quantum opto-mechanics
- Quantum software
- Quantum computation
- Quantum annealers and optimizers
- Quantum simulators
- Certification of quantum devices
- Quantum engineering
- Quantum control
- Quantum machine learning
- Quantum information theory
- Foundations of quantum physics

The Primary Guest Editor for this issue is **Antonio Acin**, ICFO- The Institute of Photonics Sciences, Barcelona, Spain. The Guest Editors are: **Eleni Diamanti**, CNRS, France; **Kae Nemoto**, National Institute of Informatics, Tokyo, Japan; **Fabio Sciarrino**, Universita di Roma La Sapienza, Rome, Italy.

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## Call for Papers

Announcing an Issue of the IEEE

JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on

### Emerging Applications of Multimode, Multicore and Specialty Fibers

Submission Deadline: October 1, 2019

Hard Copy Publication: July/August 2020

The **IEEE Journal of Selected Topics in Quantum Electronics** (JSTQE) invites manuscript submissions in the area of **Emerging Applications of Multimode, Multicore and Specialty Fibers**. For the past few decades, research on optical communications has focused on developing new optical fibers and systems to solve the capacity saturation of conventional singlemode fibers. The addition of the spatial dimension to the portfolio of optical multiplexing technologies, widely known as Space-Division Multiplexing (SDM), boosted the development of novel optical fibers including among others multicore, multimode and few-mode fibers. The growing interest on these novel fibers has very recently opened up new avenues for research in emerging fields of application including radio access networks, imaging, optical fiber sensing or astrophotonics. This special issue will address the current progress and latest breakthroughs in emergent applications of space-division multiplexing and specialty fibers, covering among others the following areas of interest:

- Multicore, multimode and specialty fibers for high-capacity digital communications
- Space-division multiplexing in fiber-wireless and 5G communications
- Imaging through multimode fibers
- Space-division multiplexed submarine links
- Multicore, multimode and specialty fibers for optical sensing
- Space-division multiplexing in astrophotonics
- Multimode- and multicore-based quantum optics
- Space-division multiplexing for radiofrequency photonics
- Nonlinear multimode optics
- Application of multicore, multimode and specialty fibers in data center links
- Industrial applications of multicore, multimode and specialty fibers

The Primary Guest Editor for this issue is **Ivana Gasulla**, Universitat Politècnica de València, Spain. The Guest Editors of the issue are **Rodrigo Amezcua Correa**, University of Central Florida, USA; **Nicolas Fontaine**, Nokia Bell Labs, USA; **Sergio Leon-Saval**, University of Sydney, Australia; **Dan Marom**, The Hebrew University of Jerusalem, Israel and **Ben Puttnam**, NICT, Japan.

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## Preliminary Call for Papers

Announcing an Issue of the IEEE  
JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on  
[Programmable Photonics](#)

Submission Deadline: December 1, 2019  
Hard Copy Publication: September/October 2020

The **IEEE Journal of Selected Topics in Quantum Electronics (JSTQE)** invites manuscript submissions in the area of **Programmable Photonics (PP)** featuring state-of-the-art reconfigurable optical devices

- Programmable photonic circuits
- Integrated microwave photonic circuits
- Phase-change photonic devices
- Optomechanically tunable components
- Low-temperature programmable optics
- Reconfigurable electro-optical devices
- Heterogeneous integration with active materials
- Tunable quantum photonic systems
- Adaptive 2D-3D photonic components
- All-optical programmable photonic circuits
- Erasable integrated optic components
- Programmable photonics for quantum technologies
- Reconfigurable metasurfaces
- Thermo-optic devices and materials
- Piezoelectric tunable devices
- Acousto-optic tunable devices
- Reconfigurable waveguide arrays
- Multipurpose optical circuits
- Field-programmable photonic devices
- Microwave and optical oscillators
- Machine learning photonics
- Training of photonic neural network
- Wavefront shaping
- Programmable multimode devices
- Energy efficient tunable devices
- Large-scale photonic circuits
- MEMS-based tunable circuits
- Topological photonics

Related topics not included in the list above are also welcomed. The Primary Guest Editor for this issue is **David Marpaung**, University of Twente, the Netherlands. The Guest Editors of the issue are **Radan Slavik**, ORC Southampton, UK, **Leimeng Zhuang**, IMEC, USA, and **Wolfram Pernice**, University of Muenster, Germany.

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## Call for Papers

Announcing an Issue of the IEEE

JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on

### Photonics for Synthetic Dimension and Topological Insulators

Submission Deadline: February 1, 2020

Hard Copy Publication: November/December 2020

The **IEEE Journal of Selected Topics in Quantum Electronics** (JSTQE) invites manuscript submissions in the area of **Photonics for Synthetic dimension and topological insulators** submissions in the area of topological photonics and of optoelectronic devices whose operation relies on topological features:

- analogue quantum Hall systems
- analogue quantum spin Hall systems
- Floquet topological insulators
- topological pumps
- honeycomb lattices and Dirac points
- three-dimensional Weyl systems
- synthetic dimensions and high-dimensional photonics
- non-Hermitian topological photonics
- gyromagnetic photonic crystals
- topological metamaterials
- spin-orbit coupling for light
- exciton-polariton systems in microcavities
- topological matters based on cavity- and circuit-QED
- topological nonlinear optical systems
- topological optical solitons and vortices -optical-nonlinearity-induced topological phase transitions
- optical isolators and robust transport
- angular-momentum- and frequency-multiplexing
- topological lasers
- valleytronics
- quantum interference of topological edges
- Photonic molecules

The Primary Guest Editor for this issue is **Lorenzo Pavesi**, University of Trento, Italy. The Guest Editors of the issue are **Iacopo Carusotto**, CNR Trento, Italy; **Zheng-Wei Zhou**, USTC, China; **Oded Zilberberg**, ETH Zurich.

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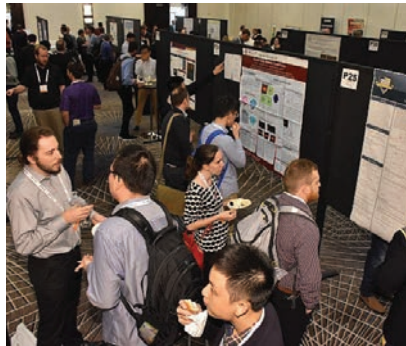
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IEEE Photonics Society News

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## Photonics Society Mission Statement

Photonics Society shall advance the interests of its members and the laser, optoelectronics, and photonics professional community by:

- providing opportunities for information exchange, continuing education, and professional growth;
- publishing journals, sponsoring conferences, and supporting local chapter and student activities;
- formally recognizing the professional contributions of members;
- representing the laser, optoelectronics, and photonics community and serving as its advocate within the IEEE, the broader scientific and technical community, and society at large.

## Photonics Society Field of Interest

The Society's Field of Interest is lasers, optical and photonic devices, optical fibers, and associated lightwave technology and their systems and applications. The society is concerned with transforming the science of materials, optical phenomena, and quantum electronic devices into the design, development, and manufacture of photonic technologies. The Society promotes and cooperates in the educational and technical activities which contribute to the useful expansion of the field of quantum optoelectronics and applications.

The Society shall aid in promoting close cooperation with other IEEE societies and councils in the form of joint publications, sponsorships of meetings, and other forms of information exchange. Appropriate cooperative efforts will also be undertaken with non-IEEE societies.

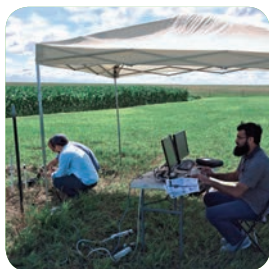


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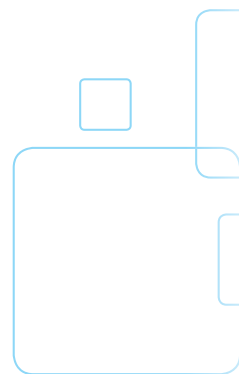


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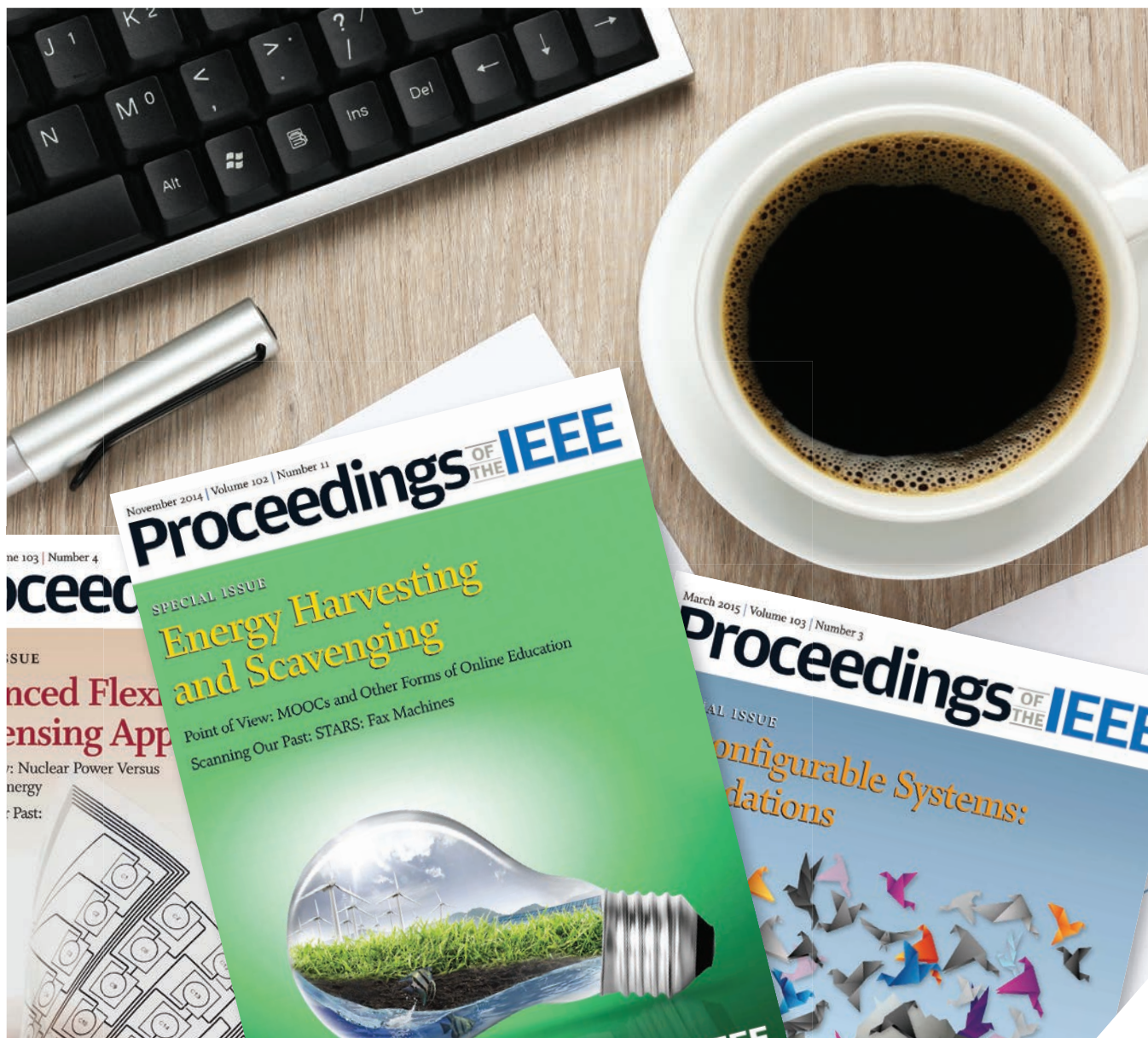
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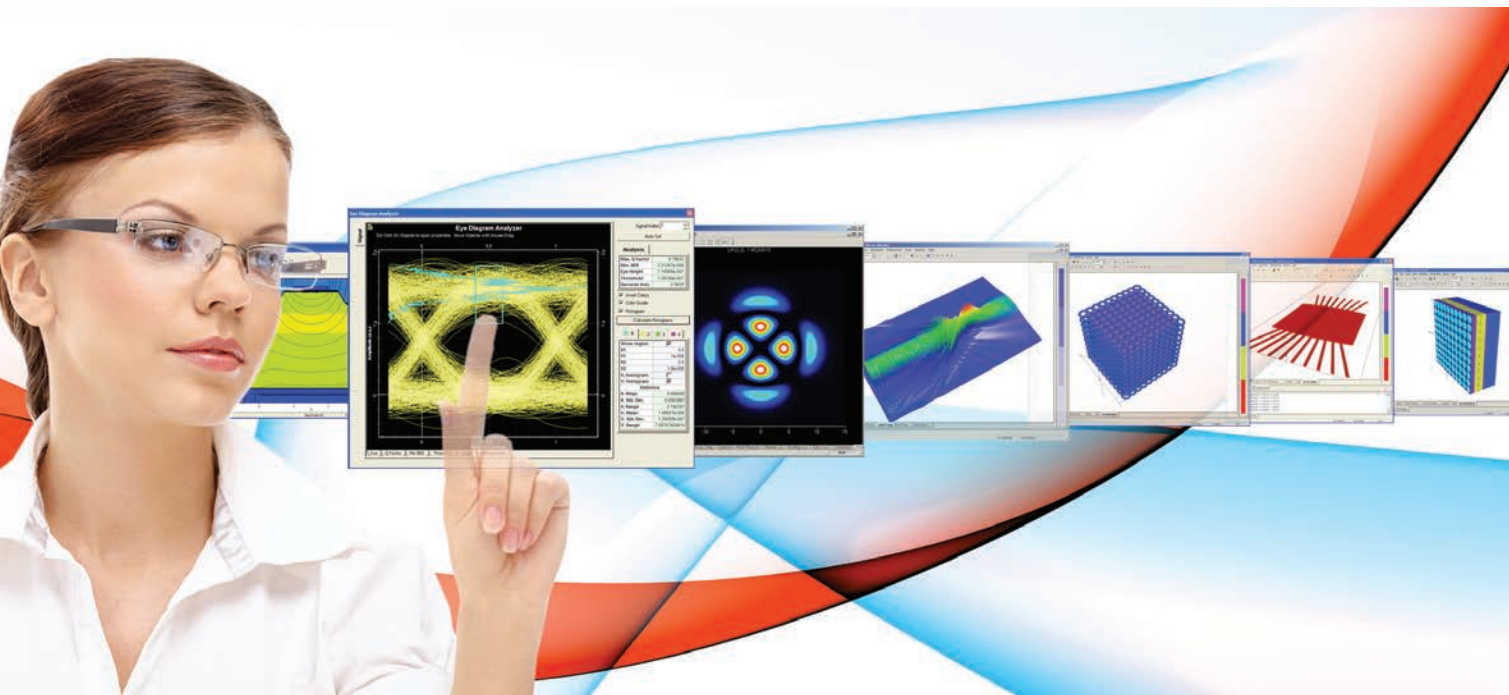
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