



**3rd International Workshop on Photonics
Applied to Electromagnetic Measurements
in Ise**

November 18 – 19

Venue: Sinfonia Technology Hibiki Hall Ise

1-13-15 Iwabuchi, Ise City, Mie, Japan 516-0037

IEICE Technical committee on Photonics-applied Electromagnetic Measurement

Sponsor: Mie prefecture

Foreword

As the workshop Chair, I am pleased to welcome you all to the 3rd International Workshop on Photonics Applied to Electromagnetic Measurements –PEM 2019. The PEM workshop, initiated by the Technical committee on Photonics-applied Electromagnetic Measurement (PEM) of the Japanese Institute of Electronics, Information and Communication Engineers (IEICE), is an international workshop devoted to the research, development and application of photonics in electromagnetic (EM) measurements and closely related fields.

After the success of the first workshop held in Kyoto by the PEM committee in 2015, and the second held in Zurich by the IT'IS Foundation in 2017, the third is being organized by the PEM committee with the cooperation of the first and second workshop organizers. The workshop scope goes from basic theory/techniques of photonics-applied EM measurement, to its new applications. Peripheral devices and complementary technologies to PEM are also important topics. The scientific program will include a keynote lecture and talks by eleven guest speakers, also original work related to workshop topics will be presented as oral and poster presentations. I hope everyone will have fascinating opportunities to discuss current work and future developments with colleagues. Please enjoy the workshop, and the Ise in the Mie prefecture.

Finally, PEM2019 has received generous support from the Mie prefecture and several exhibitors in order to hold this workshop. I would like to thank the supporters for their assistance, and I appreciate the dedication of every single member of the workshop organizing committee.

Maya Mizuno
PEM workshop Chair

Workshop Committee

Workshop Chair: Maya Mizuno (NICT, Japan)
Co-Chair: Yukihiisa Suzuki (Tokyo Metropolitan University, Japan)

Local Steering Committee:

Hiroshi Murata (Mie University, Japan)
Sayaka Matsukawa (AIST/Mie University, Japan)

Finance Chair: Kiyotaka Sasagawa (NAIST, Japan)

Secretaries: Ai-ichiro Sasaki (Kindai University, Japan)
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Technical Program Committee:

Shintaro Hisatake (Chair, Gifu University, Japan)
Michitaka Ameya (AIST, Japan)
Jerdvisanop Chakarothai (NICT, Japan)
Takashi Hikage (Hokkaido University, Japan)
Ai-ichiro Sasaki (Kindai University, Japan)
Yuanfeng She (AIST, Japan)
Akihisa Tsuchiya (KISTEC, Japan)

Advisory Committee: Teruo Onishi (NICT, Japan)
Satoru Kurokawa (AIST, Japan)
Niels Kuster (ETH Zurich, Switzerland)
Qiang Chen (Tohoku University, Japan)

Exhibitors

SEIKOH GIKEN Co., Ltd.
Sumitomo Osaka Cement Co., Ltd.
TAMAGAWA ELECTRONICS CO., LTD.
Hanamura Optics Corp.
Advanced Industrial Science and Technology (AIST)
Mie University
Kyoshin Communications Co., Ltd.

Workshop Date

18-19 November 2019

Venue

Large meeting room (Oral and poster sessions) / small meeting room (Exhibition), 4F
Sinfonia Technology Hibiki Hall Ise (Ise Tourism and Culture Hall)
1-13-15 Iwabuchi, Ise City, Mie, Japan 516-0037

Major Topic Areas

1. **Basic theory/techniques of photonics-applied electromagnetic measurement (PEM)**
Microwave photonics, Fiber optics, Microwave engineering, Sensing technology
2. **PEM systems**
Electromagnetic-field measurement systems, Optical measurement systems, EMC measurement systems, Optical sources, Probes and sensors, Remote sensing systems, Optical fiber systems
3. **Applications of PEM**
Antenna measurements, Electromagnetic compatibility (EMC) measurements, Electrical and electronic circuit measurements, Imaging and Radar, spectroscopy, remote sensing
4. **Competitive/complementary technologies to PEM**

Student Best Presentation and PEM Visualization Awards

- The student best presentation award is awarded to a student for outstanding contributed papers, presented either as a poster or an oral talk in the PEM workshop 2019.
- The PEM visualization award is awarded to a researcher for a beautiful electromagnetic field image, presented as a poster in the PEM workshop 2019.

Registration Fees

	Regular	Student
Up to October 18	8,000 JPY	4,000 JPY
After October 19	10,000 JPY	5,000 JPY

Presentation Time (including discussion)

Plenary Talk: 40 min.

Invited Talk: 30 min.

Regular Talk: 15 min.

Poster Presentation: 105 min., including short presentations (2 min./poster)

Guidelines for Poster Preparations

- Each author of the posters is requested to present his/her poster within two minutes with or without ppt slides in the short presentation session before the actual poster presentation starts.
- The size of the poster board is 1800 mm height × 1200 mm width.
- A portrait (vertical) A0 (1189 mm height × 841 mm width) poster is recommended.

Program at-a-glance

Monday 18 November 2019	
8:30	Registration
9:00	Opening
9:05	Keynote: Prof. Masao Taki (National Institute of Information and Communications Technology)
Session1: PEM system	
9:45	Invited: Dr. Sven Kuehn (IT'IS Foundation)
10:15	Coffee break (15 min)
Session2: PEM Applications	
10:30	Invited: Dr. Nobuhiko Shibagaki (Hitachi Kokusai Electric Inc., HITACHI Ltd)
11:00	Invited: Dr. Naruto Yonemoto (Electronic Navigation Research Institute)
11:30	Lunch break (1.5h)
Session3: Contributed	
13:00	Oral1
13:15	Oral2
13:30	Short presentation (2min./poster) & Poster presentation
15:15	Coffee break & transfer
17:00	Social dinner (about 2h)
Tuesday 19 November 2019	
8:30	Registration
9:00	Opening
Session4: PEM in Terahertz band	
9:05	Invited: Dr. Kaori Fukunaga (National Institute of Information and Communications Technology)
9:35	Invited: Prof. Akihiko Hirata (Chiba Institute of Technology)
10:05	Invited: Prof. Takeshi Yasui (University of Tokushima)
10:35	Coffee break (15 min)
Session5: Techniques for PEM from Microwave to THz	
10:50	Invited: Dr. GKM Hasanuzzaman (University of Cyprus)
11:20	Invited: Dr. Yusuf Nur Wijayanto (Indonesian Institute of Sciences)
11:50	Lunch break (1.5h)
Session6: Techniques of PEM	
13:20	Invited: Dr. Dong Joon Lee (Korea Research Institute of Standards and Science)
13:50	Invited: Dr. Michitaka Ameya (National Institute of Advanced Industrial Science and Technology)
14:20	Invited: Dr. Takashi Mori (Anritsu Corporation)
14:50	Award ceremony, Closing

Workshop Program

18 November 2019

8:30-9:00 *Registration*

9:00-9:45

Keynote Session:

Opening Remark

(Keynote) [Protection against EMF Exposures: Safety or Caution Consideration from the Viewpoint of System of Protection](#)

○Masao Taki^{1,2}

¹ National Institute of Information and Communications Technology, Japan

² Tokyo Metropolitan University, Japan

Session1: PEM System

9:45-10:15

(Invited) [Optical Head for EMC – A Miniature Optical DC to 1 GHz Differential Voltage Probe System](#)

○Sven Kuehn^{1,2}, Oliver Munz¹, Beyhan Kochali², Niels Kuster²

¹ Schmid & Partner Engineering AG, Switzerland

² IT'IS Foundation, ETH Zurich, Switzerland

10:15-10:30 **Coffee break** (15 minutes)

Session2: PEM Applications

10:30-11:00

(Invited) [90GHz-band Foreign Object Debris Detection System and Radar Cross Section Simulation for Runway Surveillance](#)

○Nobuhiko Shibagaki

Hitachi Kokusai Electric Inc., Ltd, Japan

11:00-11:30

(Invited) [Realtime Remote Sensing of Water/Ice layer on the Runways](#)

○Naruto Yonemoto

Electronic Navigation Research Institute, National Institute of Maritime, Port and Aviation Technology, Japan

11:30-13:00 **Lunch break** (1.5 hours)

Session3: Contributed

13:00-13:15

(Oral) [Short-Focus Lens Design for Terahertz Ray](#)

○Keita Miyazawa¹, Atsushi Kanno², Shingo Saito², Keizo Inagaki^{2,1}, and Tetsuya Kawanishi^{1,2}

¹ Waseda University, Japan

² National Institute of Information and Communications Technology, Japan

13:15-13:30

(Oral) [Evaluation of Antenna Radiation Characteristics at Terahertz Frequency Band Based on an Electrooptic Near-Field Measurement](#)

○Yusuke Tanaka, Shintaro Hisatake

Gifu University, Japan

13:30-15:15 **Poster Presentation**

13:30- **Short Presentation Session**

Each author of the posters is requested to present his/her poster within two minutes with or without ppt slides in this short presentation session before the actual poster presentation starts.

[PE-01 Output Power Enhancement in Photonic-Based RF Generation by Optical Pulse Compression with a Dispersion Managed Fiber –Simplified Compression Fiber –](#)

○Keisuke Oda, Kohei Kudomi, Ryogo Katagiri, Masayuki Suzuki, Hiroyuki Toda
Doshisha University, Japan

[PE-02 InGaAs/InAlAs Multiple Quantum Well Mach-Zehnder Modulator Integrated with Planar Antennas](#)

○Yusuke Miyazeki, Taro Arakawa
Yogohama National University, Japan

[PE-03 Time-Domain Analysis of Microwave Guided-Modes Propagating Along FRPM Pipe Wall for Pipeline Inspection](#)

○ Sayaka Matsukawa^{1,2}, Kosuke Yoshida², Tadahiro Okuda³, Masaya Hazama³, Satoru Kurokawa¹, Hiroshi Murata²

¹ National Institute of Advanced Industrial Science and Technology, Japan

² Mie University, Japan

³ Kurimoto Ltd, Japan

[PE-04 Experimental Evaluation of Spatial Resolution for Optical Electric Field Sensor with Dipole Element](#)

○Kimihiro Tajima, Yoshiharu Akiyama
NTT Advanced Technology Corporation, Japan

[PE-05 Time Domain Analysis of Reflected Microwave Signal for FRPM Pipeline Inspection to Detect Foreign Objects](#)

○Kosuke Yoshida¹, Sayaka Matsukawa^{1,2}, Yoshihiro Nishimura¹, Satoru Kurokawa², Tadahiro Okuda³, Masaya Hazama³, Hiroshi Murata¹

¹ Mie University, Japan

² National Institute of Advanced Industrial Science and Technology, Japan

³ Kurimoto Ltd, Japan

PE-06 28 GHz-Band Antenna-Coupled Electrode Electro-Optic Modulators for 5G Mobile Communication Systems and Antenna Measurement Systems

○Hiroto Yokohashi¹, Sayaka Matsukawa², Yui Otagaki³, Hidehisa Shiomi⁴, Masahiro Sato⁵, Yoshikazu Toba⁵, Satoru Kurokawa², Hiroshi Murata¹

¹ Mie University, Japan

² National Institute of Advanced Industrial Science and Technology, Japan

³ King's College London, United Kingdom

⁴ Osaka University, Japan

⁵ SEIKO GIKEN Co. Ltd, Japan

PE-07 Electro-Optic Polymer Waveguide Devices for Continuous-Wave Terahertz Detection

○Takahiro Kaji, Isao Morohashi, Yukihiro Tominari, Yoh Ogawa, Norihiko Sekine, Toshiki Yamada, Akira Otomo

National Institute of Information and Communications Technology, Japan

PE-08 Analysis of Polarization-Reversed Electro-Optic Modulator with Arbitrary Transfer Function and its Application to Pre-Equalization of Signal Distortion by Fiber Dispersion

○Kenta Takaba, Hiroshi Murata

Mie University, Japan

PE-09 Visualization of a Terahertz Wave Packet Based on an Electrooptic Sensing for Channel Characterization

○Hana Arisesa, Shintaro Hisatake

Gifu University, Japan

PE-10 Interference Voltage Measurement Set-up for Beam-Type WPT Using an Electro-Optic Converter for Active Implantable Medical Device EMI Assessment

○Suzune Ito¹, Jintao Sun¹, Takashi Hikage¹, Junji Higashiyama², Teruo Onishi²

¹ Hokkaido University, Japan

² NTT DoCoMo Inc., Japan

PE-11 Measurement of Microwave Field Distribution Propagating along FRPM Pipe-Wall Using Electro-Optic Sensor for Non-Destructive Inspection

Yoshihiro Nishimura¹, Kosuke Yoshida¹, Sayaka Matsukawa^{1,2}, Tadahiro Okuda³, Masaya Hazama³, Satoru Kurokawa², ○Hiroshi Murata¹

¹ Mie University, Japan

² National Institute of Advanced Industrial Science and Technology, Japan

³ Kurimoto Ltd, Japan

PE-12 Heterodyne Detection of THz Waves by Electro-Optic Sampling Using a Modulator-Based Optical Comb Source Toward Frequency Stabilization of THz Sources

○Isao Morohashi, Norihiko Sekine, Akifumi Kasamatsu, Iwao Hosako
National Institute of Information and Communications Technology, Japan

PE-13 Port Extender for Vector Network Analyzer Using Bi-Directional Optical Transceiver up to 20 GHz

○ Satoru Kurokawa, Masanobu Hirose, Michitaka Ameya, Sayaka Matsukawa

National Institute of Advanced Industrial Science and Technology, Japan

PE-14 Wavelength Conversion Between Terahertz Wave and Infrared for Frequency Measurement

○Shin'ichiro Hayashi¹, Seigo Ohno², Norihiko Sekine¹

¹ National Institute of Information and Communications Technology, Japan

² Tohoku University, Japan

PE-15 Calibration of an Optical Electric-Field Probe at Frequencies Below 30 MHz Using a Shortened Monopole Antenna

○Jerdvisanop Chakarothai, Katsumi Fujii, Kanako Wake, Soichi Watanabe
National Institute of Information and Communications Technology, Japan

PE-16 Phase-Conjugated Signal Processing for Opto-Electronic Signal Measurements

○Takahide Sakamoto

Tokyo Metropolitan University, Japan

15:15-17:00 **Coffee Break and Transfer to Dinner Venue**

17:00-19:00 **Social Dinner**

Venue: [“Noasobidana”](#)

1-11-5, Ujiurata, Ise, Mie, Japan

19 November 2019

8:30-9:00 **Registration**

Session4: *PEM in Terahertz Band*

Opening Remark

9:05-9:35

[\(Invited\) Progress and Propects of THz Time-Domain Imaging for Nondestructive Testing – Case Studies on Cultural Heritage in 10 Years –](#)

○Kaori Fukunaga

National Institute of Information and Communications Technology, Japan

9:35-10:05

[\(Invited\) Characterization of Terahertz Antenna for beyond 5G Systems](#)

○ Akihiko Hirata¹, Katsumi Fujii², Norihiko Sekine², Issei Watanabe², Akifumi Kasamatsu²

¹ Chiba Institute of Technology, Japan

² National Institute of Information and Communications Technology, Japan

10:05-10:35

[\(Invited\) THz Dual-Comb Spectroscopy Using a Free-Running Single-Cavity Wavelength-Multiplexed Mode-Locked Fiber Laser](#)

○Takeshi Yasui^{1,2}

¹ Tokushima University, Japan

² ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS), Japan

10:35-10:50 **Coffee break** (15 minutes)

Session5: *Techniques for PEM from Microwave to THz*

10:50-11:20

[\(Invited\) Optical Frequency Comb Techniques for mm-Wave Radio over Fibre and THz over Fibre](#)

○G.K.M. Hasanuzzaman, Stavros Iezekiel

University of Cyprus, Cyprus

11:20-11:50

[\(Invited\) Microwave Antennas on Electro-Optic Modulators for Wireless Electromagnetic Measurement](#)

○Yusuf Nur Wijayanto

Indonesian Institute of Sciences, Indonesia

11:50-13:20 **Lunch break** (1.5 hours)

Session6: *Techniques of PEM*

13:20-13:50

[\(Invited\) Photodiode Calibration up to 100 GHz Based on Electro-Optic Sampling for National Waveform Standard](#)

○Dong-Joon Lee, Chihyun Cho, Young-Pyo Hong

Korea Research Institute of Standards and Science, Republic of Korea

13:50-14:20

[\(Invited\) Performance Evaluation of Electric-Field Sensor for Power Density Measurement by Back-projection Method](#)

○Michitaka Ameya

National Institute of Advanced Industrial Science and Technology, Japan

14:20-14:50

[\(Invited\) Phase Measurement of Millimeter-Wave 3-Tone Signal Using Electro-Optic Frequency Conversion with Bandwidth Reduction](#)

○Takashi Mori, Shigenori Mattori

Anritsu Corporation, Japan

14:50-15:20

Closing Session

Award ceremony: Student Best Presentation Award
 PEM Visualization Award

Closing remark

Exhibition

FCC-1 Optical E-field sensor
 ○Yoshikazu Toba (SEIKOH GIKEN Co., Ltd.)

Abstract

Optical E-field sensors perform signal measurement including accurate measurement of electric field intensity distribution and broadband frequency, which were not possible under conventional methods. This is because these sensors are based on the measurement principle of an independent Pockels-effect and do not use metal coaxial cables. In addition to primary applications in research and product development, optical E-field sensors are used for identifying and resolving the causes of EMC problems.

FCC-2 Optical modulator for R&D
 ○Junichiro Ichikawa (Sumitomo Osaka Cement Co., Ltd.)

Abstract

High Extinction Ratio Modulator for Two Tone Optical Signal Generation.
 Applications of Two tone Modulator: RoF system, RoF sensing system, Millimeter-wave observatory, Evaluation for O/E device

FCC-3 RF components and systems
 ○Yoshiki Yanagisawa (TAMAGAWA ELECTRONICS CO., LTD.)

FCC-4 High power DFB and DBR lasers
 ○Akinobu Nihonyanagi (Hanamura Optics Corp.)

Abstract

Characteristics :

DFB Laser : Output power 100 mW at 1064 nm & 1310 nm
 High SMSR(> 40 dB), PER (> 20 dB), ISO (> 45 dB),
 Low RIN (< -155 dBc/Hz)

DBR Laser : > Output power 300 mW
 778 nm to 1064 nm Wavelength range
 150 mW at 1064 nm

Manufacturer : G&H Boston

FCC-5 National Institute of Advanced Industrial Science and Technology
○Satoru Kurokawa (AIST)

Abstract

AIST, one of the largest public research organizations in Japan, focuses on the creation and practical realization of technologies useful to Japanese industry and society. Electromagnetic Fields Standards Group of AIST is focused on antenna property measurement using RoF (Radio over fiber) technologies and antenna calibration service up to 325 GHz.

FCC-6 Development of millimeter-wave-band EO sensors for advanced radar systems for security applications
○Hiroshi Murata (Mie University)

Abstract

A new research project entitled 'Research and development of radar fundamental technology for advanced recognition of moving objects for security enhancement' started with the support from the MIC, Japan. A key device of this project, an antenna-coupled-electrode EO sensor for the calibrations of millimeter-wave radars and imagers, is presented.

FCC-7 Proposal of measuring probe and system using optical sensor
○Hiroshi Ishikawa and Kaoru Someno (Kyoshin Communications Co., Ltd.)

Abstract

We introduce measuring instruments using optical sensors developed by Schmid & Partner Engineering AG.
Products include TDS, OH4VNA, iCEy, SIM4LIFE Optics Solutions.

Social dinner and event

Social dinner and event will be held in Noasobidana on Nov. 18. Noasobidana is a Japanese restaurant that has the old-style atmosphere. Please enjoy the local cuisine and cultures.

Regular	Student
3,000 JPY	1,500 JPY

Noasobidana

1-11-5, Ujiurata, Ise, Mie, Japan

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Issue date: November 18, 2019

IEICE Technical committee on Photonics-applied Electromagnetic Measurement