

OPTM

Tuesday, 20 April

[OPTM-1] 15:30-17:00

OPTM Session 1

Chair: Yukitoshi Otani
Utsunomiya University

OPTM-1-01 15:30

Opening remarks

Yukitoshi Otani¹, Toru Yoshizawa², Takashi Hatsuzawa³, Rainer Tutsch⁴
¹Utsunomiya University, ²NPO 3D association, ³Tokyo Institute of Technology, ⁴Technische Universität Braunschweig

OPTM-1-02 15:45

Invited

Single pixel imaging and its applications

Kouichi Nitta
Kobe University

In this presentation, the principle of SPI is explained. In the SPI, two dimensional spatial modulation for optical signals is an important operations. A procedure for renewal of the modulation has been proposed. This procedure with spatial pattern shift is suitable for a some specific implementation based on SPI. Especially, it is useful for imaging of a target moving at a constant velocity. This procedure is introduced and usefulness of it is discussed.

OPTM-1-03 16:15

Ghost Imaging with Probability Estimation Using Convolutional Neural Network - Improving Estimation Accuracy Using Parallel Convolutional Neural Network -

Shoma Kataoka, Yasuhiro Mizutani, Tsutomu Uenohara, Yasuhiro Takaya
Osaka University

Deep learning ghost imaging (DLGI) is a method to obtain high-quality images from images obtained by ghost imaging with fewer measurements. We improved the accuracy of DLGI by parallelizing the convolutional layers.

OPTM-1-04 16:30

Time of flight three-dimensional imaging camera using temporal compressive sampling technique

Quang Duc Pham^{1,2}, Yoshio Hayasaki²
¹National Center for Technological Progress Vietnam, ²Vietnam Institute of Science Technology and Innovation, ³Utsunomiya University Center for Optical Research and Education

A new type camera constructed by an active light source and a high frame rate imaging sensor was introduced. The intensity of the light encoded by the compressive sensing technique and a gigahertz range carrier wave generator was illuminated the object. The waveform of the carrier wave can be reconstructed with few frames by the compressive sensing technique. Resultantly, 3D image of the object was extracted from the phase of the carrier wave in very short time.

OPTM-1-05 16:45

On the possibility of visualization of relief of rough surfaces via laser induced thermal emission

Kateryna Zelenska¹, Olga Tkach², Serge Zelensky², Olexandr Kolesnik², Toru Aoki¹
¹Research Institute of Electronics, Shizuoka University, ²Faculty of Physics, Taras Shevchenko National University of Kyiv
Computer simulation is performed for pulsed laser heating of a surface with submicrometer-sized truncated-cone-shaped peaks and holes. Transient temperature field is calculated, and the visual appearance of the surface roughness elements is modeled with the laser-induced thermal emission.

Wednesday, 21 April

[OPTM-2] 9:00-10:15

OPTM Session 2

Chair: Masaki Michihata
The University of Tokyo

OPTM-2-01 9:00

Invited

Preparation of Luminescent Si Nanocrystals from Rice Husks

Kimihiisa Matsumoto¹, So Ito¹, Kazuhide Kamiya¹, Mitsuru Inada², Hidehiro Yasuda³
¹Toyama Prefectural University, ²Kansai University, ³Osaka University
Luminescent Si nanocrystals were prepared from rice husks and the optical properties and structure analysis were studied. By the transmission electron microscope observation of the Si powder from rice husks, aggregates that are composed of Si nanoparticles with crystalline structure were confirmed. Room temperature PL with near infrared-red regions were observed from the Si nanocrystals.

OPTM-2-02 9:30

Simulation Study on Diameter Measurement Technique for Submicrometer-sized Tapered Fibers with Standing Wave Illumination

Sojiro Murakami¹, Shotaro Kadoya², Masaki Michihata¹, Satoru Takahashi²
¹School of Engineering, Department of Precision Engineering, The University of Tokyo, ²Research Center for Advanced Science and Technology, The University of Tokyo

In this research, we propose an in-process measurement method of the diameter of sub-micro-optical fiber such as a tapered optical fiber. The proposed technique is based on analyzing optically scattered light generated by standing wave illumination. From the result of numerical simulation based on finite element method (FEM), it was revealed that the optical fiber of 100 nm in diameter can be evaluated with the standing wave illumination.

OPTM-2-03 9:45

Shape Control Using Hologram-Assisted Talbot Lithography

Naoki Ura¹, Yasuhiro Mizutani¹, Ryu Ezaki¹, Tsutomu Uenohara¹, Yoshihiko Makiura², Yasuhiro Takaya¹
¹Osaka University, ²Kurabo Industries Ltd.

To improve the processing flexibility of Talbot lithography, we studied the learning of CNN to improve the accuracy of the method to control the period of the structure by hologram-assisted Talbot lithography.

OPTM-2-04 10:00

Hologram optimized in holographic laser processing system

Honghao Zhang¹, Satoshi Hasegawa¹, Haruyoshi Toyoda², Yoshio Hayasaki¹
¹The university of Utsunomiya, ²Central Research Laboratory, Hamamatsu Photonics K.K.

We proposed an optimization method of a hologram in holographic laser processing. This method provides the holographic laser processing system with high-stability, that is, the ability to dynamically compensate for system imperfections, and has the ability to be suitable for a wide range of high-precision, high-throughput applications in the field of 3D manufacturing.

[OPTM-3] 11:00-12:00

OPTM Session 3

Chair: Motoharu Fujigaki
University of Fukui

OPTM-3-01 11:00

Invited

3D profile measurement of openings with optical caliper

Lianhua Jin¹, Takuma Ashizawa¹, Toru Yoshizawa²
¹University of Yamanashi, ²NPO 3D Associates
We developed an optical caliper for measurement of 3D profiles of openings. It consists of a disk beam generator and a camera. The 3D inner profile of an art craft was measured with this system.

OPTM-3-02 11:30

Modeling the dynamic optical gain in a 3D printed waveguide due to polymer swelling

Kunal Sharma¹, Waleed S Mohammed², Tanujjal Bora¹
¹Asian Institute of Technology, ²Bangkok University

A theoretical model is developed to study the dynamic optical gain in the transmitted optical power through a 3D printed photopolymer waveguide. The developed model shows that the solvent molecules diffused in the photopolymer and develops a swelling layer that acts as cladding. The formation of the cladding layer results in a reduction of surface scattering losses and an increase in the transmitted optical power.

OPTM-3-03 11:45

Single-step fabrication of microfiber long period grating structure through a modulated arc discharge process

Mohammad Javad Khodarahmi², Pedram Hosseini¹, Mohammad Kazemzadeh², Hamidreza Karimi-Alavijeh²
¹Polytechnic University of Turin, ²The University of Isfahan

We present a novel approach to fabricate optical microfiber long period grating (MF-LPG) structures through a single-step technique. This method is based on heating and pulling single-mode fiber optics via a modulated arc discharge process.

[OPTM-4] 13:30-15:00

OPTM Session 4

Chair: Lianhua Jin
University of Yamanashi

OPTM-4-01 13:30

Invited

Noise floor comparison of optical displacement measuring interferometer between air and vacuum environments

Masato Aketagawa¹, Kousuke Sakasai¹, Masato Higuchi¹, Dong Wei¹, Thanh Dong Nguyen²
¹Nagaoka University of Technology, ²Hanoi University of Science and Technology

In this presentation, we discuss noise floor comparisons of an optical displacement measuring interferometer between air and vacuum environments. A heterodyne interferometer and its phasemeter, with the resolution of 10⁻⁶ radian, implemented in a field programmable gate array (FPGA) are utilized for the comparison. A heterodyne laser source consists of a frequency stabilized He-Ne laser and two acoustic optic modulators (AOMs).

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OPTM-4-02 14:00

Radius measurement of large aperture long-focal-length lens using computer-generated hologram

Jian-Peng Cui, Zhi-Gang Li, Zhen-Jun Bao, Heng Zhao, Ning Zhang, Jie Liu, Di-Long Wu, Hua Xu, Ping Ma
Chengdu Fine Optical Engineering Research Center

In this paper, we will present a method of using 450 mm × 450 mm transmission computer-generated hologram (CGH) to measure the radius of curvature of 440 mm × 440mm large aperture long-focal-length lens.

OPTM-4-03 14:15

Out-of-plane displacement measurement using laser parallel fringes generated in camera with diffraction grating

Wei Jiang, Takuya Hara, Motoharu Fujigaki
University of Fukui

For measuring out-of-plane displacement with phase analysis method, a diffraction grating was used to generated laser parallel fringes in a camera. A green laser, a diffraction grating and an industrial camera were used as experimental devices. Phase difference was calculated by images before and after displacement. Laser parallel fringes can be generated in a camera and displacement was successfully measured.

OPTM-4-04 14:30

Invited

Optically smooth and optically rough surfaces in 3D profilometry

Pavel Pavlicek
Palacky University Olomouc

The operation of optical 3D measurement methods depends on whether the measured surface is optically smooth or rough. We present an analysis on which conditions the surface is classified as one or the other.

[OPTM-5] 15:30-17:00

OPTM Session 5

Chair: Kazuhide Kamiya
Toyama Prefectural University

OPTM-5-01 15:30

Invited

Mid-infrared (LWIR) Hyperspectral camera for on-site analysis

Ichiro Ishimaru
Kagawa University

For on-site analysis in the remote world, we proposed 3 kinds of Fourier transform spectroscopic imager whose optical configuration were the near-common-path phase-shift interferometer. And to measure suspending solutions and biological samples without preparations like smart toiles and non-invasive blood glucose sensors, we proposed 2 types of the ultrasonic-assisted spectroscopy.

OPTM-5-02 16:00

Invited

Fringe Projection Method for 3D Shape Measurement Using Linear LED Device and Cylindrical Lens Array

Motoharu Fujigaki, Takuya Hara
University of Fukui

Recently, it is required to improve the fringe projection device to develop a compact and fast 3D shape measurement. In this study, a fringe projection method using a linear LED device and a cylindrical lens array to improve the LSSM is proposed. In the case of a conventional light-source-stepping method, the half of the emitted power is wasted at the grating plate.

OPTM-5-03 16:30

The FDTD analysis for diffraction limited microgroove structure with standing wave illumination for the realization of coherent structured illumination microscopy

Yizhao Guan¹, Masahiro Kume¹, Shotaro Kadoya², Masaki Michihata^{2,1}, Satoru Takahashi²
¹*Department of Precision Engineering, The University of Tokyo*, ²*Research Center for Advanced Science and Technology (RCAST), The University of Tokyo*

In this research, the depth measurement of microgroove structures with coherent Structured Illumination Microscopy (SIM) is studied. FDTD analysis is applied for observing the near-field response of microgroove narrower than the diffraction limit under the standing-wave illumination. The near-field phase shows depth dependency in this analysis.

OPTM-5-04 16:45

Resolution evaluation of displacement measuring interferometer with sinusoidal phase modulation and modified phase-locked loop

Masato Higuchi, Tomohiro Sowa, Dong Wei, Masato Aketagawa
Nagaoka University of Technology

A resolution evaluation of displacement measuring interferometer using a sinusoidal phase modulation (SPM) and a modified phase-locked loop (PLL) is described in this presentation. Displacement measuring interferometer with frequency stabilized light source has advantages of high resolution and traceable to the definition, and the combination of the SPM and modified PLL is one of the interpolation methods.

Thursday, 22 April

[OPTM-6] 9:00-10:30

OPTM Session 6

Chair: Nathan Hagen
Utsunomiya University

OPTM-6-01 9:00

Invited

Fourier Demodulation Approach for a Rotating Polarizer Analyzer Polarimeter for Retardance Measurements

David Ignacio Serrano Garcia, Francisco Joel Cervantes Lozano, Geliztle Alejandra Parra Escamilla, Jorge L. Flores Nuñez, Guillermo Garcia Torales
University Center of Exact Sciences and Engineering (CUCEI) - Electronics Department - University of Guadalajara

We present a demodulation approach for a rotating polarizer-analyzer polarimeter dedicated to retardance measurements. Through the Mueller matrix approach and the theoretical Fourier transform, we developed a demodulation algorithm considering the two linear polarizers' initial orientation as calibration. We present experimental results showing the feasibility of our proposal.

OPTM-6-02 9:30

RGB full Stokes imaging by color polarization cameras

Yukitoshi Otani, Shuhei Shibata, Nathan Hagen
Utsunomiya University

RGB full Stokes imaging by color polarization cameras

OPTM-6-03 9:45

Large scale thin film thickness uniformity extraction based on dynamic spectroscopic ellipsometry

Gukhyeon Hwang, Sukhyun Choi, Vamara Dembele, Saeid Kheiryzadehkhaghah, Inho Choi, Chung Song Kim, Daesuk Kim
Jeonbuk National University

This paper describes a new approach for large-scale thin film thickness mapping based on dynamic spectroscopic ellipsometry. The proposed system can provide a real time thin film uniformity measurement capability with high precision. We expect the proposed scheme can be applied for various large-scale thin film deposition process applications such as roll to roll manufacturing where real time process uniformity monitoring becomes crucial.

OPTM-6-04 10:00

Invited

Spectroscopic polarization measurement and control using channeled spectrum

Kazuhiro OKA¹, Keisaku YAMANE², Moritsugu SAKAMOTO³, Ryuji MORITA²
¹*Hirosaki University*, ²*Hokkaido University*, ³*Nagaoka University of Technology*

Polarization measurement and control using channeled spectrum has several unique features and useful for various spectroscopic instruments. Its basic features and several applications are described in this presentation.

[OPTM-7] 11:00-12:00

OPTM Session 7

Chair: Kazuhiko Oka
Hirosaki University

OPTM-7-01 11:00

Invited

Extended range dynamic calibration for channeled spectropolarimetry

Nathan Hagen¹, Benjamin D. Chrysler²
¹*Utsunomiya University*, ²*University of Arizona*

We show how to extending the temperature range of channeled spectropolarimetry's dynamic calibration method to handle virtually all practical scenarios. This is demonstrated by running a channeled spectropolarimeter continuously over a temperature change of 40 degC, achieving stable reconstruction of the spectrally-resolved polarization state over this entire range.

OPTM-7-02 11:30

Ellipsometric characterizations of individual nanoform structures

Tim Kaeseberg¹, Jana Grundmann¹, Sven Teichert¹, Matthias Wurm¹, Thomas Siefke^{1,2}, Stefanie Kroker^{1,3}, Bernd Bodermann¹

¹*Physikalisch-Technische Bundesanstalt Braunschweig*, ²*Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena*, ³*Laboratory for Emerging Nanometrology, Technische Universität Braunschweig*

We constructed an imaging Mueller matrix ellipsometer for measurements in both transmission and reflection. Additionally, we designed, fabricated, and characterized nanostructures with simple shapes to examine the link between Mueller matrix elements and geometrical features.

OPTM-7-03 11:45

Optical and Anisotropic Stress Properties of Flexible (Ta₂O₅/SiO₂)² Anti-reflection Film Deposited by E-gun Evaporation with Ion-beam Assisted Deposition

Kun-Hong Chen, Chen Hsi Chao, Chen Sheng Bin, Chen Guan Yu, Wu Tsung Tse, Kuo Chou Kai
National Yunlin University of Science and Technology

The research proposal was used tantalum pentoxide (Ta₂O₅) and silicon dioxide (SiO₂) as the high and low refractive index for the multilayer anti-reflection (AR) films were deposited on a flexible polyethylene terephthalate (PET) by electron-beam evaporator with ion-beam assisted deposition (IAD). The optical and stress properties of these multilayer (Ta₂O₅/SiO₂)² films were investigated.

OPTM

Poster

**[OPTM-P]
Poster Session****OPTM-P-01****Calibration of the astigmatism errors induced by misalignment of quadri-wave lateral shearing interferometer**

Yiwei Si, Ke Liu, Yanqiu Li, Peng Qin,
Hui Zhong

Beijing Institute of Technology

In this paper, the astigmatism errors induced by misalignment of quadri-wave lateral shearing interferometer are analyzed using the optical wave interference and wavefront reconstruction theory. This paper can provide technical support for the alignment of QWLSI with small shearing ratio and high precision.

OPTM-P-02**Quality Map guided parallel Phase unwrapping algorithm for multi-lateral shearing interferometry**

Liang Wang, Ke Liu, Yanqiu Li

Beijing Institute of Technology

The quality map guided algorithm is a reliable algorithm in the phase unwrapping of two-dimensional interferogram. In this paper, the computer unified device architecture (CUDA) programming platform is used to realize the parallel processing of the phase derivative variance map, the maximum phase gradient map, and the pseudo-correlation quality map, in order to improve the speed of phase unwrapping.

OPTM-P-03**Fast calibration for Star test polarimetry via polarization orthogonal basis mapping**

Tianlei Ning, Guodong Zhou, Jiazhi Wang,
Yanqiu Li

*School of Optics and Photonics, Beijing
Institute of Technology*

This paper develops a fast calibration method for Star test polarimetry by measuring three intensity distribution of orthogonal polarization state and an intensity distribution of left-handed circular polarization to rapidly calibrate the theoretical model.