Information Photonics 2020 (IP’20)
National Taiwan Normal University, Taipei, Taiwan
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~ Poster session ~
Opening time : 9/7 - 9/12 (full days)
Review time : 9/7 - 9/11 (full days)
Best student poster awards will be awarded at closing ceremony

✧ Poster (Sep. 7 – Sep. 12, Full Days)
Student Paper Award Candidates (Review time : Sep. 7 – Sep. 11, Full Days)
PA1
Multi-view computer-generated holography developed by three-dimensional modified Gerchberg–Saxton algorithm
Chih-Hao Chuang¹, Ching-We Cheng², Hsuan-Ting Chang³, and Chien-Yu Chen²*
¹National Taiwan University, Taiwan. ²National Taiwan University of Science and Technology, Taiwan. ³National Yunlin University of Science and Technology, Taiwan.
This study proposed a method to produce multi-view computer-generated holography based on the three-dimensional modified Gerchberg–Saxton algorithm (MGSA) for phase retrieval. By using the rotation matrices and illuminating the light sources at the corresponding viewing angles, each viewing angle of a 3D object can be generated.

PA2
Preliminary analysis of vibration effect applied on the speckle reduction of laser display
Chih-Hao Chuang¹, Tzu-An Chou², and Chien-Yu Chen²*
¹National Taiwan University, Taiwan. ²National Taiwan University of Science and Technology, Taiwan.
In this study, we analyze how the vibration effect can reduce speckle and hold the light intensity in a laser projection system. From the experimental results, the speckle contrast was reduced from 82% to 4% and light intensity can be keep at 94.89%.
PA3
Effects of Texture Blur in First Person VR Game
Ting-Lan Tsai¹, Chih-Hao Chuang², Chien-Yu Chen¹*, Pei-Jung Wu³, and Hung-Wei Chen¹
¹National Taiwan University of Science and Technology, Taiwan. ²National Taiwan University, Taiwan. ³National Taichung University of Science and Technology, Taiwan.
In order to reduce motion sickness (MS), texture blur (TB) was used on the 3D objects in the First Person Shooting VR game. Simulator Sickness Questionnaire and ECG data were analyzed in our study, and significant differences were found by comparing “with TB” and “without TB” conditions.

PA4
Noise detection and Image Stitching by using Fourier Transform
Yen-Chung Wang¹, Jing-Feng Weng²*, Guo-Hao Lu², Pi-Ying Cheng¹, and Chun-Jen Weng²
¹Department of Mechanical Engineering, National Chiao Tung University, Taiwan. ²Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan.
This study combines the image similarity and Fourier Transform to detect the noise and stitch two images onto the one image. It can distinguish the strong signal, weak signal, and the noise. By contrast, the known sharpness algorithm does not effectively distinguish the signal and the stitching result is failure.

PA5
A high selective reusable enzymatic modified glucose sensor for glucose concentration measurement
Cheng-Chih Hsu¹ and Min-Rui Wu¹
¹Department of Electro-Optical Engineering, National United University, Taiwan.
In this study, we proposed an alternative glucose concentration measurement method which integrated enzymatic modified sensor into a heterodyne interferometer. The proposed method provided high selective detection and sensitivity for glucose concentration measurement of complex samples.

PA6
Optical Detection and Ghost Imaging of AC Magnetic Field Generated from Coil
Takumi Tanaka¹* and Shuji Taue¹*
¹Kochi University of Technology, Japan.
The optical imaging of an AC magnetic field was demonstrated using a ghost imaging
technique and optical magnetometer. The images obtained through ghost imaging are compared with those through optical scanning, and it is seen that the noise floor is reduced.

**PA7**

*Ultrasensitive Flexible Surface-Enhanced Raman Scattering Porous Substrates with Microplasma-Enabled Three-Dimensional Plasmonic Nanoarchitectures*

Yeh Yi-Jui¹* and Wei-Hung Chiang¹*

¹National Taiwan University of science and technology, Taiwan.

Here we present the one-step green fabrication of bimetallic nanoparticles Au/Ag (3D porous stricture) loaded on filter paper using a microplasma system. However, we further extend this technology to fabricated Au@Ag NP/paper and characterized them by SEM, Raman, XRD, and UV-Vis spectroscopies.

**PA8**

*Liquid Hollow Core Fiber Fabry–Perot Interferometer with Metal Al Nanoparticles for Laser Heating*

Xue-Min Weng¹*, Cheng-Ling Lee¹*, and Chien-Hsing Chen²

¹National United University, Taiwan. ²National Pingtung University, Taiwan.

This study, we demonstrate a liquid hollow core fiber FABRY–PEROT interferometer with metal Al-nanoparticles for achieving laser heating performance. The LHCFFPI with a microhole-pair symmetrically drilling on the sidewall of the HCF by fs laser micromachining can greatly reduce the filling time of the liquids into the fiber device.

**PA9**

*A Slanted Cleaved Fiber Tapered Polymer Inclinometer for Asymmetrical Tilt Angles Measurement*

Po-Shen Chang¹*, Cheng-Chuan Liu¹, and Cheng-Ling Lee¹*

¹National United University, Taiwan.

In this study, we proposed a novel, highly sensitive, very simple structured and directional fiber-optic inclinometer sensor that is consists of an asymmetrical tapered polymer connected by a slanted cleaved endface fiber and a flat fiber.

**PA10**

*Analysis on Optimal Aperture Ratio in Aerial Display by Use of an LED Panel Covered with Apertured Retro-Reflector*

Daiki Nishimura¹*, Masaki Yasugi²*, and Hirotugu Yamamoto²*

¹Utsunomiya University, Japan. ²Utsunomiya University, JST, ACCEL, Japan.
We propose an optical system to form aerial signage over an LED panel. A half mirror is placed in front of the LED panel that is covered with retro-reflector with square-shaped holes. This paper shows analytical model and discuss the optimal aperture ratio to maximize the luminance.

**PA11**

**Binary Holograms Generated by Localized Random Down-Sampling and Intensity Accumulation**

Ming-Hsuan Wu¹ and Jung-Ping Liu¹

¹Feng Chia University, Taiwan.

We proposed to generate multiple binary holograms of the same scene by localized random down-sampling (LRDS) and direct sign-thresholding. The holograms are displayed by direct intensity accumulation (DIA) with a digital micromirror device (DMD). A high-quality reconstructed image without artifacts can be obtained by this method.

**PA12**

**Computational Imaging by Millimeter Wave**

Kun-Chi Tsai¹, Kun-huang Chen¹, and Jung-Ping Liu¹

¹Feng Chia University, Taiwan.

A millimeter wave (100 GHz) light source together with a diffuser is applied to generate a structured beam. The object is raster-scanned by the structured beam to get an intermediate image. Finally, the image is retrieved by the correlation of the system point spread function.

**PA13**

**Microplasma-assisted one-step synthesis of silicon quantum dots for detection of dopamine**

Gui-Yi Chang¹ and Wei-Hung Chiang¹

¹National Taiwan University of Science and Technology, Taiwan.

Silicon quantum dots (SiQDs), a semiconductor nanocrystals with quantum-confined induced properties has represented the major emerging materials in biologic filed owing to its properties. Here, we report a facile and rapid method, a microplasma synthesis of SiQDs for photoluminescence (PL) and ultraviolet–visible spectroscopy (UV-Vis) sensing of dopamine (DA).
Refractive index measurement system based on maximum phase difference of total internal reflection

Tzu-Yang Weng\textsuperscript{1*}, Chia-Yu Chiang\textsuperscript{1*}, Ju-Yi Lee\textsuperscript{1*}, Jing-Heng Chen\textsuperscript{2*}, and Cheng-Chih Hsu\textsuperscript{3*}

\textsuperscript{1}National Central University, Taiwan. \textsuperscript{2}Feng Chia University, Taiwan. \textsuperscript{3}National United University, Taiwan.

The developed system can find the refractive indices of the material by analyzing the maximum of the phase difference with the total-internal reflected light. The experiment results the measurement resolution can be better than 0.0025.

Application of Digital Optical Coding to IoT Device Communication

Ryo Watanabe\textsuperscript{1*} and Jun Tanida\textsuperscript{1*}

\textsuperscript{1}Osaka University, Japan.

Digital optical coding was applied to device communication in an experimental testbed of Internet of Things (IoT) to clarify the effectiveness of the method and the issues toward practical implementation. Assuming the data transmission from multiple edge devices, a series of processing was performed, and the correct operations were confirmed.

Basic experimental verification of spatially parallel pulsed-I/O optical reservoir computing

Yuki Miyata\textsuperscript{1*}, Shunichi Sakai\textsuperscript{1}, Suguru Shimomura\textsuperscript{2}, Takahiro Nishimura\textsuperscript{2}, Naoya Tate\textsuperscript{1}, Yusuke Ogura\textsuperscript{2}, and Jun Tanida\textsuperscript{2}

\textsuperscript{1}Kyushu University, Japan. \textsuperscript{2}Osaka University, Japan.

We propose an optical reservoir computing scheme based on quantum-dot (QD) networks, which utilize the energy transfer between QDs. To demonstrate the feasibility of our idea, here we present experimental results using a spatial light modulator (SLM), a pulsed laser, a spectrometer, and a photodiode.

Wavelength coded volume holographic gratings based fluorescence imaging system

Yu-Hsin Chia\textsuperscript{1*}, Yi-You Huang\textsuperscript{1*}, and Yuan Luo\textsuperscript{1*}

\textsuperscript{1}National Taiwan University, Taiwan.

We proposes a wavelength coded volume holographic gratings (VHGs) based
fluorescence imaging system to capture multi-wavelength fluorescence images in one shot. The system utilizes wavelength coded recording technique to generate the high wavelength selectivity holographic gratings. In addition, the system combines HiLo image processing to improve the optical sectioning ability.

**PA18**

**Isotropic quantitative differential phase contrast microscopy using deep neural networks**

An-Cin Li*, Sunil Vyas*, Yu-Hsiang Lin*, Hsuan-Ming Huang*, and Yuan Luo*

1National Taiwan University, Taiwan. 2National Tsing Hua University, Taiwan.

Isotropic quantitative differential phase contrast (iDPC) microscopy based on pupil engineering has made significant improvements in phase imaging. DNN here is adapted for enhancing acquisition speed in iDPC. We propose U-net model for phase recovery from 2-axis reconstruction to 12-axis one. The final loss can achieve about 5.7e-5 after normalized.

**PA19**

**Monte Carlo Simulation of Super Gaussian Beam in Turbid Media**

Ying-Ju Tsai*, Sunil Vyas*, Kung-Bin Sung, and Yuan Luo*

1National Taiwan University, Taiwan.

Accurate modeling of scattering of light inside biological tissues is important. One of the most common modeling tool is Monte Carlo simulation. Here, we present MC simulation for the super-Gaussian beam and compared the effect of spatial distribution on the energy deposition inside the medium for different optical coefficients.

**PA20**

**An Efficient Adiabatic Convex Curve Tapered Waveguide Combined With Multimode Waveguide On a SOI Chip**

Bo-Lin Huang*, Yen-Hsun Liao, and Chien-Liang Chiu*

1National Kaohsiung University of Science and Technology(Department of Electronic Engineering), Taiwan.

The convex tapered waveguide combined with MMI on a SOI chip demonstrates adiabatic mode conversion. The ratio of TE0 mode in this tapered waveguide increases 1.26% than linear. The output power of a 1x1 MMI combined with this convex tapered waveguide is 0.96, 134.15% more than without tapered waveguide.
PA21

Wide-field Digital Holography for Ophthalmic Lens Metrology and Its Application in Ocular Vision Correction.
Pragati Shukla¹, Vinoth Balasubramani¹, Chung-Hsuan Huang¹, and Chau-Jern Cheng¹*¹
¹National Taiwan Normal University, Taiwan.
A novel wide-field digital holography system with 40X40mm field of view is proposed. Measurement of the ophthalmic test lens physical properties such radius of curvature, diameter and height was performed. The measured test lens parameters are utilized in ocular vision correction using ZEMAX.

PA22

Deep learning-enabled particle detection and sorting in threedimensions with digital holography
Yang-Jie Gao¹, Vinoth B.¹, Li-Chien Lin², and Chau-Jern Cheng¹*¹
¹National Taiwan Normal University, Taiwan. ²Feng Chia University, Taiwan.
This study proposes a novel deep learning-enabled particle’s orientations in lateral and axial directions and particle’s size prediction with digital holography, which adapts U-net and convolutional neural network learning models.

PA23

Magneto-Optical Properties of Ferrofluid in the THz Frequency Range
Yi-Jie Ciou¹, Yi-An Wei¹, Yun-Chi Ruan¹, Kuen-Lin Chen², Shu-Hsien Liao¹, and Chan-Shan Yang¹,³*¹
¹Institute of Electro-Optical Engineering, National Taiwan Normal University (NTNU), Taiwan. ²Department of Physics, National Chung Hsing University, Taichung, Taiwan. ³Micro/Nano Device Inspection and Research Center, NTNU, Taipei, Taiwan.
There are few studies using magneto-optical modulators for terahertz (THz) application. In this work, we applied the THz time-domain spectroscopy (THz-TDS) to measure the properties of the hydrophilic and the lipophilic ferrofluid, respectively. Here, we can successfully modulate the phase of the ferrofluid in the frequency regime of 0.2-1.0 THz.
Normal Contributed Poster

PN1
A modified moiré projection method for measuring the object surface profile
Kun-Huang Chen1*, Chih-Hsiung Lin1*, Jiun-You Lin2*, Jing-Heng Chen1*, Dan-Jia Shen1*, and Kuan-Chen Chen1*
1Feng Chia University, Taiwan. 2National Changhua University of Education, Taiwan.
This paper proposes a modified moiré projection approach to measure the object surface profile. It is based on the moiré projection method, combined with the concept of programmable modulation of moiré fringe period, and the heterodyne shift frequency technology introduced to the moiré fringes, along with special phase resolution technology.

PN2
Novel Algorithm Combined with Interference Slope Changes and Modified Fourier Transform without Phase Unwrapping
Jing-Feng Weng1*, Yen-Chung Wang2, Guo-Hao Lu1, Pi-Ying Cheng2, and Chun-Jen Weng1
1Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan. 2Department of Mechanical Engineering, National Chiao Tung University, Taiwan.
This study proposes a novel algorithm to reconstruct the three dimension image of the step height sample and the dirty positions by using interferometry techniques. By contrast, the traditional algorithm with the zero-order interference fringes fails to reconstruct the dirty positions. Both of the step height accuracy are 0.9%.

PN3
Recording of a Curved Hologram by Optical Scanning Holography
Wen-Ting Chen1 and Jung-Ping Liu1*
1Feng Chia University, Taiwan.
Optical scanning holography (OSH) is a scanning-type digital holography. By modifying the scanning path, we have successfully recorded a curved hologram by OSH. The viewing angle of the curved hologram can be as large as seventy degrees.

PN4
Application of Augmented Reality Head Up Display in Full - Face Helmet
Jun-You Li1 and Cheng-Mu Tsai1*
1National Chung Hsing University, Taiwan.
This paper is to propose an Augmented Reality Head Up Display (AR-HUD) that is
used in motorcycle or scooter for improvement of traffic safety.

PN5
Phase encoded off-axis common-path digital holographic microscopy
Yu-Chih Lin
1Feng Chia University, Taiwan.
This study presents a novel phase encoded method in common-path DHM (CP-DHM). The virtual filter of CP-DHM is generated by phase coded CGH. The designed low-pass virtual filter can accurately stop the high frequency part of the diffraction term to generate the reference beam for recording without complicated mechanical adjustment.

PN6
Study of graphene oxide coupled with noble metal nanoparticle for refractive index sensor
1National Pingtung University of Science and Technology, Taiwan. 2National Yunlin University of Science and Technology, Taiwan. 3National United University, Taiwan. 4National Yunlin University of Science and Technology, Taiwan.
Graphene oxide coupled with noble metal nanoparticle sensor for the optical response by a discrete dipole approximation. The responses of extinction cross section as a function of refractive index sensitivity, suggesting that graphene oxide coupled with noble metal nanoparticle is an effective approach to enhance the sensitivity.

PN7
Ray tracing model of optical force simulation in optical tweezers: the preliminary results
Yi-Syuan Wu1* and Hui-Chi Chen1
1Department of Physics, Fu Jen Catholic University, Taiwan.
We developed the ray tracing model of optical force for the arbitrary sample and light. The multi-dimensional matrices were used to simulate the optical ray through the sample. Of this study, the spherical sample in the water within the Gaussian beam was applied to testify the simulation model.

PN8
Implementation of Diffractive Optical Elements of Wide Angle Patterns to Structured Light 3D Scanning
Shih-Hsiang Lu1, Tsz Li1, Shun-Ping Zhuang1, and Wei-Feng Hsu1*
1National Taipei University of Technology, Taiwan.
This paper presents a work of preparation, design, manufacture, and evaluation of diffractive optical elements to producing wide-angle diffraction patterns which can be used in structured light illumination for 3D scanning.

**PN9**

Fast Quantization Method for Phase-Only Diffractive Optical Elements (DOEs)
Cheng-Kai Liu¹, Cheng-Ju Yang¹, Wei Han Chen¹, and Wei-Feng Hsu¹*
¹National Taipei University of Technology, Taiwan.

We present a method for phase quantization of diffractive optical element (DOE) which combines the iterative Fourier transform algorithm and a backward quantization operation. The method has been effectively and in high efficiency applied to binary-phase DOEs.

**PN10**

Measurement of Curvature and Focal Length for Lenses and Mirrors by Using Virtual-grating Moiré Interferometry
Jing-Heng Chen¹*, Hung-Lung Tseng¹*, Kun-Huang Chen²*, Ju-Yi Lee³*, and Chien-Hung Yeh¹*
¹Department of Photonics, Feng Chia University, Taiwan. ²Department of Electrical Engineering, Feng Chia University, Taiwan. ³Department of Mechanical Engineering, National Central University, Taiwan.

The research proposes the use of virtual-grating moiré interferometry for measuring the focal lengths and curvatures of lenses and mirrors. The experimental results successfully demonstrated the feasibility and high accuracy of the proposed method; the percent errors for focal length and curvature measurement were less than 0.50% and 0.41%, respectively.

**PN11**

Atmospheric Microplasma Assisted Synthesis of Graphene Quantum Dots Decorated with AuAg Alloy for Synergistic Effect on SERS
Hao-Dong Yang¹* and Wei-Hung Chiang¹*
¹National Taiwan University of Science and Technology, Taiwan.

A facile and state-of-the-art approach to synthesize bimetallic nanoparticles incorporated with the graphene quantum dots (GQDs) for surface-enhanced Raman scattering. Tailoring of different localized surface plasmon resonance (LSPR) of the AuAg alloy nanoparticles were synthesized by microplasma using the sodium citrate as the capping agent and incorporated with the GQDs.
PN12
Cyclic Method of Diffractive Optical Elements (DOEs) Achieving Diffraction Image of High Quality

Hsiang-Yu Yang¹, Hsin-Ju Yao¹, Yun-Xin Zhang¹, and Wei-Feng Hsu¹*
¹National Taipei University of Technology, Taiwan.

We presented a method to achieving high-quality diffraction images of the diffractive optical elements (DOEs). The DOEs obtained using the proposed were far superior to those obtained using the iterative Fourier transform algorithm in terms of PSNR (1301.2%) and uniformity (96.1%).

PN13
Application of the 2D fringe pattern for tele-centric Fourier transform profilometry

Zhi-Hsiang Liu¹, Huai-Syuan Huang¹, and Wei-Hung Su¹*
¹National Sun Yat-Sen University, Taiwan.

An application of the 2D fringe-encoded pattern for the tele-centric Fourier transform profilometry is presented. The 2D pattern provides additional information to identify the fringe order. Only one shot measurement is required for data processing. Even though the surface color or reflectivity varies with positions, fringe orders can be identified.

PN14
Phase-shifting projected fringe profilometry using pulse-encoded patterns

Sih-Yue Chen¹, Huai-Syuan Huang¹, and Wei-Hung Su¹*
¹National Sun Yat-Sen University, Taiwan.

A pulse-encoded projection scheme is presented. There is no need to take additional projections for phase unwrapping. The fringe patterns used for phase extraction can be analyzed to obtain the absolute phase directly.

PN15
3D shape measurements with 1D scanning fringe projection

Jen-Ho Wang¹, Sheng-Kai Tsai¹, Nai-Jen Cheng¹, and Wei-Hung Su²*
¹National Kaohsiung University of Science and Technology, Taiwan. ²National Sun Yat-Sen University, Taiwan.

A 1D scanning technique based on fringe projection for 3D shape measurements is presented. A 2D sinusoidal pattern is employed as the projected pattern. For objects with large depth discontinuities, the profile could be retrieved.
PN16
Fabrication of holographic materials using azobenzene incorporated with 4,4’-diaminodiphenyl oxide
Meng-Chia Shih¹, Hao-Wei Sung¹, Tzu-Chien Hsu¹, and Wei-Hung Su¹*
¹National Sun Yet-Sen University, Taiwan.
A surface relief grating using azobenzene incorporated with 4,4’-diaminodiphenyl oxide is fabricated for holographic storage. Diffraction efficiencies with various thicknesses and concentrations are studied.

PN17
Inspection to the temperature distribution for a heating surface using fringe projection techniques
Yu-Heng Lo¹, Hao-Wei Sung¹, Chien-Ann Chen¹, and Wei-Hung Su¹*
¹National Sun Yet-Sen University, Taiwan.
A fringe projection technique embedded into a microscope to perform temperature measurements for a heating object is presented. Only one-shot measurement is required. The full-field property makes it possible to inspect several objects at the same time.

PN18
Dual-channel time-resolved inline digital holography for studying samples with inhomogeneities of nonlinear refractive index
Nikolay V. Petrov¹*, A. A. Belashov¹, ², I. A. Shevkunov³, S. E. Putilin¹, S. S. Nalegaev¹, and Chau-Jern Cheng⁴
¹ITMO University, Digital and Display Holography Laboratory / International Institute “Photonics and Optical Information Technology”, Saint Petersburg, Russian Federation. ²Ioffe Institute, Laser Center, Saint Petersburg, Russian Federation. ³Tampere University, Faculty of Information Technology and Communication, Tampere FI-33014, Finland. ⁴National Taiwan Normal University, Information Optics & Photonics Laboratory /Institute of Electro-Optical Engineering, Taipei, Taiwan.
Time-resolved inline digital holography is a promising technique for the measurement of optical nonlinear properties of materials. Here we adapt it for the study samples with inhomogeneities in the spatial distribution of the nonlinear refractive index.