ADVANCE PROGRAM

International Workshop on Holography and Related Technologies 2019

IWH2019

November 5 to 7, 2019

Penang School of Toyohashi Tech,

Jalan Biggs, Pulau Tikus,
10350 George Town, Penang, Malaysia

ver.2019.11.01

Dear all IWH2019 participants,

It is my great pleasure to host all of you here in Penang. This is the 13th International Workshop on Holography and technologies. The first workshop was held also here in Penang particularly for discussing volumetric hologram data storage (because of this, the first workshop was named as International Workshop on Holographic Memories, IWHM), so that we came back to the birth place of it.

As shown in the scope, the workshop covers overall aspects on holography and related technologies, holographic memories, displays, holographic measurement, computer generated holograms and digital holography, ranging from their fundamental physics and technologies to practical systems. Since the discovery of "holography" by Gábor Dénes, the Novel price winner in 1947, together with the development of laser, theoretically in 1958 (my birth year!) and experimentally in 1960, it has been founding its important applications in various kinds of human life including volumetric hologram data storage, three-dimensional holographic display, measurement, and so on. Then the term of "holography" has become very popular and attractive for physicists and engineers. Because phase interference of waves is responsible for holography, this phenomenon can be found not only in light propagation but also in any kinds of waves even in electron waves. Therefore, near future, I am expecting to extend the scope of workshop for such non-light holography such as magnetic holography or holographic manipulation of spin waves operating from GHz to THz regime.

On behalf of the workshop, I would like to strongly encourage all of you to discuss the state-of-the-art holography technology. Besides, please enjoy the stay of Penang and its rich nature, historical places and exciting various kinds of Asian foods!

井上光輝

Mitsuteru INOUE, General Chair of IWH2019

INTRODUCTION

International Workshop on Holography and related technologies (IWH2019) will be held at Penang School of Toyohashi Tech, Penang, Malaysia, from Nov. 5 to 7, 2019. This is the Thirteenth workshop which covers overall aspects on holography and related technologies, holographic memories, displays, holographic measurement, computer generated holograms and digital holography, ranging from their fundamental physics and technologies to practical systems. The first International Workshop on Holographic Memories (IWHM2007) was held in Penang, Malaysia. IWHM2008 and IWHM&D2009-2010 were successfully held in Japan, which include overall aspects on holographic memories and display. Since 2011, this workshop has extended the scope furthermore, and IWH covers the holographic display, holographic optical elements, as well as holographic memory. Last year, IWH2018 was held at Suzhou, China with great success. IWH2019 is back to Penang, Malaysia where the birth place of this conference. IWH2019 is jointly organized by the following associations:

- Japan Optomechatronics Association (JOEM)
- Optoelectronics Industry and Technology Development Association (OITDA)
- JSPS Amorphous and Nano-materials and Applications 147 Committee
- IEEE Magnetics Society Nagoya Chapter
- Photonics division, The Japan Society of Applied Physics (JSAP)
- Optical Society of Japan (OSJ)

SCOPE

All topics related to holography including memories, displays, digital holography, computer generated holography, and holographic optical elements are going to be discussed, ranging from their basic physics and technologies to practical applications, such as materials, components, measurements, basic theory and physics, system design, simulations and devices. In what follows is the list of subject areas, which are not restrictive but suggestive:

1. Holographic Memory
2. Holographic Optical Elements
3. Computer Generated Holography
4. Digital Holography
5. Holographic Display
6. Holography Arts and Design
7. Recording Materials
8. Signal Processing for Holography
9. Devices for Holography
10. Simulation for Holography
11. AR, MR, HUD and HMD with Holography
12. Applications
13. Others

IWH2019 TIME TABLE

	4 Nov.	5 Nov.	6 Nov.	7 Nov.
8:30			BUS (from Evergreen hotel to TUT Penang) 8:30 deperture	BUS (from Evergreen hotel to TUT Penang) 8:30 deperture
9:00			**Registration**	**Oral** 9:00~10:30 (90 min)
10:00			**Oral** 9:00~10:40 (100 min)	**break** (10:30~11:00)
11:00		BUS (from Evergreen hotel to TUT Penang) 11:00 deperture	**break** (10:40~11:10)	**Oral** 11:00~12:20 (80 min)
12:00		**Registration** (11:00~) **Lunch** (12:00~13:00)	**Oral** 11:10~13:00 (110 min)	**Summary of Round Table Discussion** (12:20~12:40) **Closing** (12:40~13:00)
13:00		**Opening** **Keynote** 13:10~13:50 (40 min)	**Lunch** (13:00~14:00)	BUS (from TUT Penang to Evergreen hotel) 13:10 deperture
14:00		**Oral** 13:50~15:00 (70 min)	**Oral** 14:00~15:50 (110 min)	
15:00	**Registration & Get together** (15:00~17:00)	**break** (15:00~15:30)		
16:00		**Oral** 15:30~17:10 (100 min)	**berak** (15:50~16:10) **Round Table Discussion** 16:10~17:00 (50 min)	
17:00		BUS (from TUT Penang to Evergreen hotel) 17:20 deperture	BUS (from TUT Penang to Evergreen hotel) 17:10 deperture	
18:00				
19:00		BUS (from Evergreen hotel to Banquet) 18:30 deperture		
21:00		**Banquet** (19:15~21:15)		
		BUS (from Banquet to Evergreen hotel)		

Presentation Schedule

Day1 (5 Nov.)

No,	start	end	presenter	affiliation	type	title
	13:00	13:10	Opening			
Presider : Tsutomu Shimura, The University of Tokyo, Japan						
5p-1	13:10	13:50	Takuji Yoshida	Sony Corporation	Keynote	A Plastic Holographic Waveguide Combiner for Light-weight and Highly-transparent Augmented Reality Glasses
5p-2	13:50	14:10	Tso-Hua Wu	National Taiwan University		Multi-focal plane holographic differential confocal microscopy
5p-3	14:10	14:30	Toshihiro Kasezawa	Egarim		Holographic thin film type Polarized Beam Splitter ~Egarim PBS ~
5p-4	14:30	15:00	Osamu Matoba	Kobe University	invited	3D fluorescence imaging techniques for biomedical applications
	15:00	15:30	break			
Presider : Osamu Matoba, Kobe University, Japan						
5p-5	15:30	16:00	Yuki Nagahama	Tokyo University of Agriculture and Technology	invited	Interactive refraction correction system for holographic retinal view display
5p-6	16:00	16:30	Xiaodi Tan	Fujian Normal University	invited	Four-Channel Recording by Orthogonal Polarization Holography
5p-7	16:30	16:50	Yoshiki Terashima	Utsunomiya University		Aerial Image Augments a Flat-Panel Display
5p-8	16:50	17:10	Yusuke Hirai	Utsunomiya University		Facets acquisition method of real 3D objects with unclear texture from multi-viewpoint images

Day2 (6 Nov.)

No,	start	end	presenter	affiliation	type	title
Presider : Hideyoshi Horimai, HOLOMEDIA, Japan						
6a-1	9:00	9:30	Shuo Wang	Beijing Institute of Graphic Communication	invited	An Exploration of Holomontage for Creative Design Applications of Digital Holograms
6a-2	9:30	10:00	Daisuke Barada	Utsunomiya University	invited	Principle of Acoustic Wave Source Measurement by Digital Holography with Spatial and Temporal Carrier
6a-3	10:00	10:20	Takumi Ujiie	Utsunomiya University		Digital holography with burst imaging method
6a-4	10:20	10:40	Yuta Goto	(NICT)National Institute of Information		Fundamental Experiment for Displacement Measurement by Digital Holography with Spatially Divided Images
	10:40	11:10	break			
Presider : Xiaodi Tan, Fujian Normal University, China						
6a-5	11:10	11:40	Xiao Lin	Fujian Normal University	invited	Improved phase retrieval method for phasefor collinear phase-modulated holographic data storage

6a-6	11:40	12:10	Yuichi Nakamura	Toyohashi University of Technology	invited	Design and Properties of Heat Dissipation Multi-Layered Media for Magnetic Hologram Memory
6a-7	12:10	12:40	Tsutomu Shimura	The University of Tokyo	invited	Phase modulated time series signal holographic memory
6a-8	12:40	13:00	Naru Yoneda	Wakayama University		Holographic Data Storage Based on Compressive Sensing
	13:00	14:00	Lunch			
Presider : Ryushi Fujimura, Utsunomiya University, Japan						
6p-1	14:00	14:30	Wei-Chia Su	National Changhua University of Education	invited	The Design of Holographic Illumination Element for LCoS Panels
6p-2	14:30	14:50	Tomohiro Maeda	Hokkaido University		Experiment on Mode Conversion Based on Wavefront Superposition Method
6p-3	14:50	15:10	Sunil Vyas	National Taiwan University		Volume holographic method for generation of abrupt autofocusing beams
6p-4	15:10	15:30	Sih-Yuan Chen	National Central University		Wavelength-division multiplexing with spherical waves by a volume holographic optical element
6p-5	15:30	15:50	Shota Okazaki	Utsunomiya University		Preparation of cylindrical wave diffractive lens for wide band light by volume hologram
	15:50	16:10	break			
	16:10	17:00	Round Table Discussion			

Day3 (7 Nov.)

No,	start	end	presenter	affiliation	type	title
Presider : Yeh-Wei Yu, National Central University, China						
7a-1	9:00	9:30	Zehao He	Tsinghua University	invited	Designed random phase modulation for computer generated hologram
7a-2	9:30	10:00	Tomoyoshi Shimobaba	Chiba University	invited	Hologram compression using deep-learning and complex amplitude encoding using binarized amplitude
7a-3	10:00	10:30	Hideyoshi Horimai	HOLOMEDIA	invited	New product development integrating hologram technology
	10:30	11:00	break			
Presider : Daisuke Barada, Utsunomiya University, Japan						
7a-4	11:00	11:30	Yeh-Wei Yu	National Central University	invited	A position servo of holographic data storage system using disc embedded volume holographic optical element
7a-5	11:30	12:00	Ryushi Fujimura	Utsunomiya University	invited	Optimization of recording parameters for large density holographic data storage
7a-6	12:00	12:20	Soki Hirayama	The University of Tokyo		Noise Analysis of a Surface Collinear Holographic Memory
	12:20	12:40	Summary of Round Table Discussion			
	12:40	13:00	Closing			

TECHNICAL PROGRAM

Day1（5 Nov.）

13:10 5p-1 **A Plastic Holographic Waveguide Combiner for Light-weight and Highly-transparent Augmented Reality Glasses**

Takuji Yoshida Sony Corporation **（Keynote Talk）**

We have developed a unique production process of a full-color plastic holographic waveguide combiner with a light-weight and see-through capability. The novel plastic waveguide technology enables us to expand the market for augmented reality (AR).

13:50 5p-2 **Multi-focal plane holographic differential confocal microscopy**

Tso-Hua Wu National Taiwan University

Confocal microscopy is commonly utilized to obtain a high-contrast optical-sectioning image. However, confocal point-by-point scanning is time-consuming. Here, we propose a non-axial-scanning differential confocal microscopy which integrates multiplexed volume holographic gratings (MVHGs) and differential confocal microscopy (DCM) to acquire multi-focal information and three-dimensional reconstructed images.

14:10 5p-3 **Holographic thin film type Polarized Beam Splitter ~Egarim PBS ~**

Toshihiro Kasezawa Egarim

Based on the orthogonal optical axis theory, a new exposure system for Egarim PBS was established, the angular dependence of reflective and transmissive Egarim PBS was investigated, and theoretical analysis was performed.

14:30 5p-4 **3D fluorescence imaging techniques for biomedical applications**

Osamu Matoba Kobe University **（invited Talk）**

Three-dimensional fluorescence imaging techniques are presented. One is the off-axis common-path incoherent digital holography. The experimental results using live plant cells are presented. The other technique is discussed.

15:00 **Coffee Break**

15:30 5p-5 **Interactive refraction correction system for holographic retinal view display**

Yuki Nagahama Tokyo University of Agriculture and Technology **(invited Talk)**

In this research, a real-time hologram generation for the holographic retinal view display is realized using GPU and we correct the refractive errors of the user's eye lens interactively.

16:00 5p-6 **Four-Channel Recording by Orthogonal Polarization Holography**

Xiaodi Tan Fujian Normal University **(invited Talk)**

Four-channel volume holographic recording with linear polarization-sensitive holography, based on the null reconstruction effect (NRE) of polarization holography. The presented technique can be expected to improve holographic data storage recording density by additional channel.

16:30 5p-7 **Aerial Image Augments a Flat-Panel Display**

Yoshiki Terashima Utsunomiya University

We have created an optical system for displaying aerial image on the surface of the flat-panel display. Furthermore, we verified the difference between the proposed method and the conventional method.

16:50 5p-8 **Facets acquisition method of real 3D objects with unclear texture from multi-viewpoint images**

Yusuke Hirai Utsunomiya University

In this study, a method to acquire facet data from real 3D objects used by generating CGHs for 3D display is proposed. The facets are acquired from multi-viewpoint images.

Day2 (6 Nov.)

9:00 6a-1 **An Exploration of Holomontage for Creative Design Applications of Digital Holograms**

Shuo Wang Beijing Institute of Graphic Communication **(invited Talk)**

The narration of the Chinese porcelain is a significant project. For building on these results, an experimental artwork will be presented based a novel concept: holomontage, as well as its narrative language will be explored

9:30 6a-2 **Principle of Acoustic Wave Source Measurement by Digital Holography with Spatial and Temporal Carrier**

Daisuke Barada Utsunomiya University **(invited Talk)**

In convetional digital holography, acoustic wave propagation cannot be calculated. In this work, it is theoretically proved that the acoustic wave source can be measured by digital holography with spatial and temporal carrier.

10:00 6a-3 **Digital holography with burst imaging method**

Takumi Ujiie Utsunomiya University

Application of a burst imaging method to a digital holography (DH) that needs to capture multiple images is demonstrated. The burst imaging method was applied to the phase-shifting DH and it is experimentally demonstrated.

10:20 6a-4 **Fundamental Experiment for Displacement Measurement by Digital Holography with Spatially Divided Images**

Yuta Goto (NICT) National Institute of Information

Digital holography (DH) can detect displacement the object. In this study, we propose the 3D displacement measurement by DH with spatially divided images, and confirmed the potential for displacement measurement with a single image sensor.

10:40 **Coffee Break**

11:10 6a-5 **Improved phase retrieval method for phasefor collinear phase-modulated holographic data storage**

Xiao Lin Fujian Normal University **(invited Talk)**

We proposed the advanced non-interferometric phase retrieval method based on the collinear system to increase the code rate and storage density by 2 times and accelerate phase retrieval further.

11:40 6a-6 **Design and Properties of Heat Dissipation Multi-Layered Media for Magnetic Hologram Memory**

Yuichi Nakamura Toyohashi University of Technology **(invited Talk)**

Heat dissipation multilayered media (HDL media) for magnetic hologram were designed, and performances of fabricated HDL medium were evaluated. It showed diffraction efficiency higher than single layer film and non-error reconstruction was achieved.

12:10 6a-7 **Phase modulated time series signal holographic memory**

Tsutomu Shimura The University of Tokyo **(invited Talk)**

In order to increase data storage density, we developed a time-series signal holographic memory system. The advantage of this system is that RLL coding can be adopted. Recently we applied phase modulation to this system in angle multiplexing and colinear system.

12:40 6a-8 **Holographic Data Storage Based on Compressive Sensing**

Naru Yoneda Wakayama University

To increase the recording density of holographic data storage, the introduction of three-dimensional data-page is proposed. The proposed method is realized by using a computer-generated hologram technique and compressive sensing. Its feasibility is numerically confirmed.

13:00 **Lunch**

14:00 6p-1 **The Design of Holographic Illumination Element for LCoS Panels**

Wei-Chia Su National Changhua University of Education **(invited Talk)**

In this paper, the holographic waveguide backlight for LCoS panels was proposed. The element can be operated with white LED. Then the full-color display can be achieved with LCoS panel.

14:30 6p-2 **Experiment on Mode Conversion Based on Wavefront Superposition Method**

Tomohiro Maeda Hokkaido University

We experimentally demonstrated that the wavefront superposition method, in which the converted light includes components of target and radiation modes, could perform more efficient mode conversion than the conventional method without degradation of modal crosstalk.

14:50 6p-3 **Volume holographic method for generation of abrupt autofocusing beams**

Sunil Vyas National Taiwan University

We experimentally demonstrate the generation of abrupt autofocusing beam through volume holographic optical element. PQ: PMMA photopolymer substrate is used for fabricating volume phase gratings. Present results may find important applications in optical-tweezers and laser-material processing.

15:10 6p-4 **Wavelength-division multiplexing with spherical waves by a volume holographic optical element**

Sih-Yuan Chen National Central University

In this study, we analyze the characteristics on the spatial and temporal domains of a volume holographic optical element(VHOE) which is constructed by interference of spherical waves. We applied the characteristics to dense wavelength-division multiplexing(DWDM).

15:30 6p-5 **Preparation of cylindrical wave diffractive lens for wide band light by volume hologram**

Shota Okazaki Utsunomiya University

In this study, a cylindrical wave diffraction lens for wide band light was prepared using volume hologram technology to improve the performance and cost of a HMD.

15:50 **Coffee Break**

16:10 **Round Table Discussion**

Day3 （7 Nov.）

9:00 7a-1 **Designed random phase modulation for computer generated hologram**

Zehao He Tsinghua University **（invited Talk）**

The effect of the random phase range on the display quality is evaluated. A designed random phase modulation method for computer generated hologram is proposed based on the evaluation results.

9:30 7a-2 **Hologram compression using deep-learning and complex amplitude encoding using binarized amplitude**

Tomoyoshi Shimobaba Chiba University **（invited Talk）**

We introduce our latest studies for holographic display: “a dynamic-rage compression technique using a DNN” and “complex amplitude encoding of phase-only hologram.” The details will be shows in the presentation.

10:00 7a-3 **New product development integrating hologram technology**

Hideyoshi Horimai HOLOMEDIA **（invited Talk）**

We have been developing several new products by integrating the unique features and functions of hologram technology. Our developing field expanded to 3D-Display, BIPV, Illuminator, Holographic-PBS, Glossy-Surface Inspection etc. We will introduce all of them.

10:30 **Coffee Break**

11:00 7a-4 **A position servo of holographic data storage system using disc embedded volume holographic optical element**

Yeh-Wei Yu National Central University **（invited Talk）**

We proposed a volume holographic optical element embedded in the disc of holographic data storage system for position servo. The concept was proved by both simulation and experiment. In the experiment, astigmatism was induced in the reference beam of the volume holographic optical element to improve the lateral tolerance.

11:30 7a-5 **Optimization of recording parameters for large density holographic data storage**

Ryushi Fujimura Utsunomiya University **(invited Talk)**

In order to investigate effect of an aperture in Fourier plane of signal images, a holographic simulator considering a realistic hologram shape was developed. The recording parameters were optimized for achieving largest storage density.

12:00 7a-6 **Noise Analysis of a Surface Collinear Holographic Memory**

Soki Hirayama The University of Tokyo

New type of a holographic read-only memory using a surface hologram is proposed. This method enables collective duplication and stable read-out performance. In this study, we investigate inherent noise factors of the proposed method.

12:20 **Summary of Round Table Discussion**

12:40 **Closing**

COMMITTEE MEMBERS

General Chair:

M. Inoue. (Toyohashi Univ. Tech.)

Advisory committee:

L. Hesselink (Stanford Univ,)
K. Hsu Natl. (Chiao Tung Univ.)
G. Jin (Tsinghua Univ.)
T. Kubota (Kubota Holography Lab.)
K. Kuroda (Utsunomiya Univ.)
C. Sun (Natl. Central Univ.)
T. Yatagai (Utsunomiya Univ.)
H. Yoshikawa (Nihon Univ.)

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Y. Nakamura (Toyohashi Univ. Tech.)

Vice-Chair;

H. Horimai (EGARIM)

Members;

T. Kasezawa (EGARIM)
H. Tabuchi (Okamoto Glass)
R. Fujimura (Utsunomiya Univ.)
S. Mito (Tokyo college. NIT)
R. Hashimoto (Suzuka college. NIT)

Program committee

Chair;

T. Shimura (Univ. Tokyo)

Members;

Y. Awatsuji (Kyoto Inst. Tech.)
D. Barada (Utsunomiya Univ.)
L. Cao (Tsinghua Univ.)
N. Hashimoto (Citizen)
Y. Hayasaki (Utsunomiya Univ.)
S. Lin (Natl. Chiao Tung Univ.)
Y. Luo (Natl. Taiwan Univ.)
O. Matoba (Kobe Univ.)
K. Matsushima (Kansai Univ.)
T. Muroi (NHK)
T. Nomura (Wakayama Univ.)
X. Tan (Fujian Norm. Univ.)
T. Utsugi (Hitachi)
M. Yamaguchi (Tokyo Inst. Tech.)
H. Yamamoto (Utsunomiya Univ.)
Y. Yu (Feng Chia Univ.)

REGISTRATION FEES

	Advance On or before October 10	Standard On-site On or after October 11
Regular	**JPY 40,000** **(RM 1,600)**	**JPY 50,000** **(RM 2,000)**
Student / Retired Accompany person	**JPY 20,000** **(RM 800)**	**JPY 30,000** **(RM 1,200)**

All payments, should be made in Japanese Yen and only by bank transfer, and are non-refundable. On-site registration should be made with cash in Japanese Yen or Malaysia Ringgit. The detail of which will be informed to the pre-registered participants through e-mail.
For details of the transfer account, please see the downloaded "Registration Form".

URGENT ANNOUNCEMENT!! to the participant from abroad.
If it is difficult to transfer the fee from overseas to the Japanese bank, you can register by e-mail to IWH and pay the fee determined by the registered date by cash at the conference site.

Instructions for the presentation

- **Invited presentation:** Presentation 25 min. / Discussions 5 min.
- **Contributed oral presentation:** Presentation 15 min. / Discussions 5 min.

VENUE

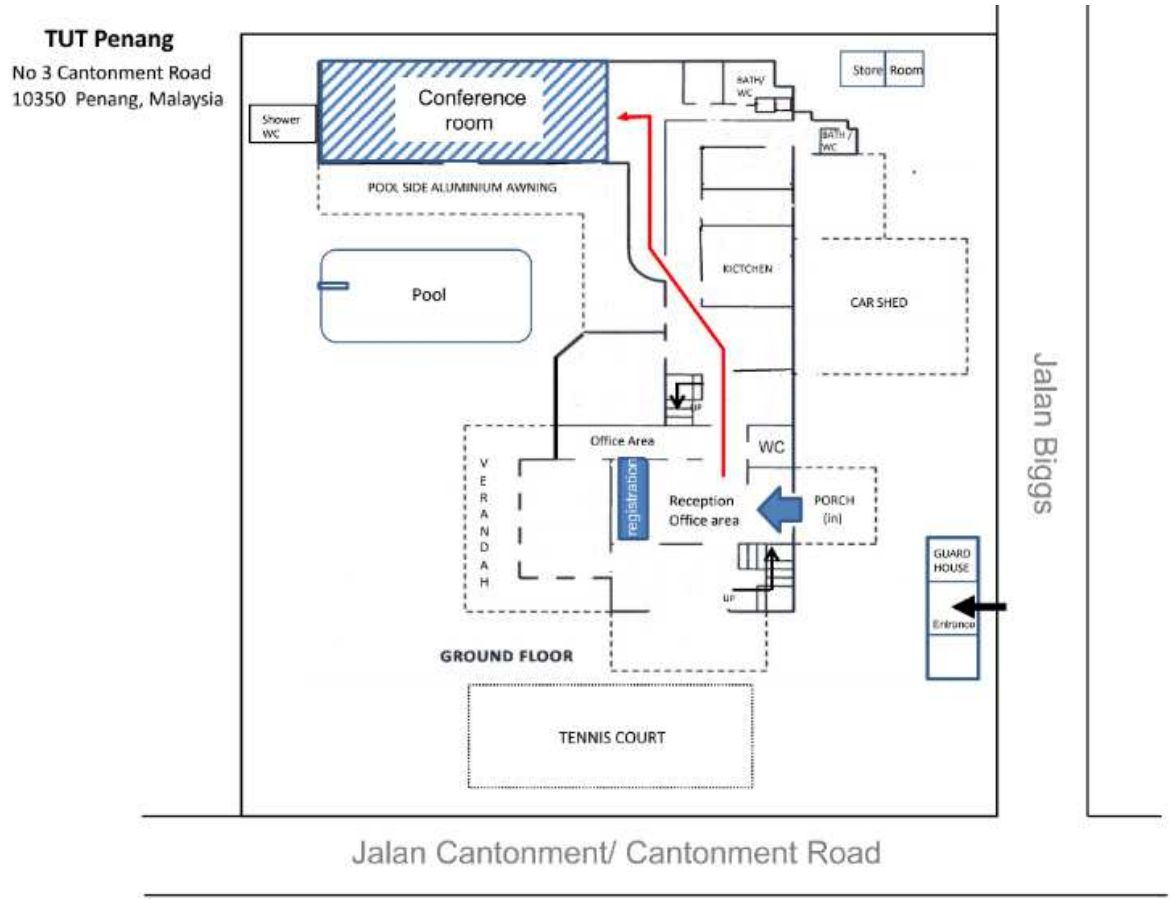
Penang School of Toyohashi Tech

Jalan Biggs, Pulau Tikus, 10350 George Town, Penang, Malaysia

Access to Penang School of Toyohashi Tech

There will be **a shuttle bus** between Penang School and Evergreen Laurel Hotel Penang in the morning and evening for the meeting.

FLOOR MAP



HOTEL ACCOMMODATIONS

You can reserve hotels via internet. Please make a reservation on your own. There will be a shuttle bus between Penang School and Evergreen Laurel Hotel Penang in the morning and evening for the meeting. So we recommend to make a reservation to the Evergreen Laurel Hotel Penang.

■ Evergreen Laurel Hotel Penang
53 Persiaran Gurney, George Town, Penang, Malaysia
https://www.evergreenlaurelhotelpenang.com/

MEMO

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