國立臺東大學 理工學院
NATIONAL TAITUNG UNIVERSITY COLLEGE of SCIENCE and ENGINEERING

教師指導學生專題製作與論文競賽補助 成果報告

一、申請補助計畫基本資料

申請教師	劉俊宏	核定經費	10,000
單位系所	綠色與資訊科技學士學位學程	經費執行情況	■已請購核銷完畢 □尚未請購核銷 □經費餘款____________
計畫執行年度/學期	1. 110 年度 1 學期 2. 109 年度 2 學期	參賽期程	1. 110 年 9 月 20 日 ~110 年 9 月 23 日 2. 110 年 5 月 27 日 ~110 年 5 月 27 日
參加競賽/學術活動名稱	1. The 47th edition on the Micro and Nano Engineering Conference (MNE 2021) 2. 2021 資訊科技應用學術研討會 (ITAC 2021)	作品名稱	1. Impact of electron scattering in EUV mask absorber materials on different beam voltages. 2. 四軸無人機之控制器設計與姿態模擬
指導參賽學生姓名	**1.** **謝祥意**、黃冠富、王舜平、許尉庸、黃飛鳴、吳志強、李昀瑾、李捷笙、吳柏成、丁澤安、張詠翔、張愛翎、陳奕璇、許馥竹 **2.** 許馥竹、曾元彤、陳亭瑜、沈尚錡、賴威霖、葉舜斌、王昱健、**謝祥意**	班級	**1.** **應用科學系碩士班**、綠色與資訊科技學士學位學程 **2.** 綠色與資訊科技學士學位學程、**應用科學系碩士班**
競賽性質	■國際性 ■校際 □校內(院級以上)	參賽地點	1. Turin, Italy. (義大利杜林市) 2. 中國科技大學資訊學院

系所主管 簽章		日期	
學院院長 簽章		日期	

二、 參賽作品：(論文摘要或作品說明)

於國際研討會 47th MNE 2021 發表之研討會論文摘要：

Impact of electron scattering in EUV mask absorber materials on different beam voltages

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Extreme ultraviolet (EUV) lithography has been applied to some critical layers at 7-nm node and become the most promising high-volume lithography technologies for 3-nm node and beyond [1]. The EUV 13.5-nm short wavelength characteristic makes mask fidelity directly affect the wafer patterning quality [2]. Variable shaped beam mask writer and multi-beam mask writer are used to fabricate the mask because of its high-resolution patterning capability [3]. The mask patterning process depends on the choice of EUV mask absorber material that has direct impact to the mask quality such as electron scattering events, point spread function, and CD control [4]. A clear understanding of electron scattering in test specimens is necessary for the co-optimization of the mask absorber material and electron beam voltage. In previous works, the impact of electron scattering in the multilayer on the patterning results has been widely investigated for the optimization of the proximity effect correction and of mask process correction at 50 keV [5, 6]. However, the impact of electron scattering in advanced EUV absorbers on various beam voltages has hardly been reported. Therefore, this study is focused on the effect of electron scattering in conventional Argon Fluoride (ArF) and advanced EUV absorbers on its dependency of incident energy. In order to investigate the effect of absorber on electron scattering, four types of absorbers including Cr, TaBN, Te, and $TaTe_2$ are simulated on EUV mask stack. Since Cr is the most common absorber material in ArF mask, we include it as a reference for comparison. From TaBN as starting point we can improve to materials with higher EUV extinction coefficient (k) in optics, which allows for thinner absorber thickness and consequently smaller shadowing effect (M3D). Based on the previous works of rigorous imaging simulations at NA 0.33 for various mask absorbers, 32-nm thickness TaBN absorber has been identified to improve the optical properties including k, reflection index (n), and normalized image log-slope (NILS) [7, 8]. Te is also shown as a promising alternative EUV absorber for binary photomasks, as a high k allows the implementation of thinner absorbers [9]. In addition, $TaTe_2$ performs better thermal stability, stability in the hydrogen environment, oxidation stability, and stability in cleaning solutions than Te [9]. In this study, the electron collision is traced with Monte Carlo method and the mechanism of electron scattering during the resist and mask stack is investigated. In simulation conditions, the 80-nm thickness PMMA mask resist is set according to the International Roadmap for Devices and Systems (IRDS) 2.1-nm technology node in 2025 [10]. Fig 1 (a) to (d), (e) to (h), (i) to (l), and (m) to (p) illustrate 7 representative electron trajectories simulated by 100,000 electrons in the EUV masks with various absorbers at 5 keV, 10 keV, 25 keV, and 50 keV, respectively. Fig 2 (a) illustrates the structure of EUV mask stack including 80-nm PMMA resist (denoted by E1), 10-nm TaBO ARC (denoted by E2), 32-nm absorber of the 4 material candidates (denoted by E3), 2.5-nm Ru capping layer (denoted by E4), 280-nm Si/Mo multilayers (ML) (denoted by E5), 6.35-mm SiO_2 LTEM (denoted by E6), and 70-nm CrN conductive layer (denoted by E7). Fig 2 (b) shows the comparison of scattering events within the resist, absorber, and ML among the 4 different absorber materials at 5 keV, 10 keV, 25 keV, and 50 keV, respectively. Table 1 summarizes the accumulated number of electron scattering events in Fig 2 (b). Fig 3 represents the comparison of deposited energy distribution inside the resist among Cr at 5 keV. TaTe2 at 10 keV, Cr at 25 keV, and TaBN at 50 keV, respectively. According to the electron trajectories shown in Fig 1 (a) to (d) at 5 keV, the back-scattered electrons (BSEs) are almost reflected back from the ARC (E2) and absorber (E3). In addition, the long-range BSEs come from Cr absorber layer show the slightest effect on resist as compared with the other three absorbers. Fig 1 (a), Fig 2 (b), and Table 1 indicate that using Cr absorber produces the narrowest scattering range and the least scattering events within the resist at 5 keV. Comparing with Fig 1 (a) to (d) at 5 keV, the short-range BSEs within the range of 100 nm at 10 keV in Fig 1 (e) to (h) are alleviated at the expense of increased long-range BSEs. Please note that the range of depth-axis and radius-axis between Fig 1 (a) to (d) and Fig 1 (e) to (h) are not identical since one is 250 nm at 5 keV and the other is 500 nm at 10 keV. The BSEs are reflected back from the ML layer (E5) that is the dominated factor influencing the resist resolution in the range of 200 nm to 400 nm at 10 keV. We find that using $TaTe_2$ absorber presents the narrowest scattering range and the least scattering events shown in Fig 1 (h), Fig 2 (b), and Table 1. In Fig 1 (i) to (l), it can be observed that electrons at 25 keV are able to penetrated into the ML (E5) and most of the long-range BSEs are generated from the ML (E5) and LTEM layer (E6). Fig 1 (i), Fig 2 (b), and Table 1 indicate that using Cr absorber produces the narrowest scattering range and the least scattering events within the resist at 25 keV. At 50 keV, most of the electrons penetrate through the mask stack form E1 to E6 layers no matter what kinds of absorber materials are adopted such that no BSEs are appeared within the range of 2000 nm in resist. Using TaBN absorber presents the narrowest scattering range and the least scattering events shown in Fig 1 (n), Fig 2 (b), and Table 1. Fig 2 (b) illustrates the trend of scattering events during the resist, absorber, and ML with different absorbers and beam voltages. Table 1 summarizes the accumulated number of electron scattering events. We find that using Cr, $TaTe_2$, Cr, and TaBN absorbers at 5 keV, 10 keV, 25 keV, and 50 keV, respectively show the least scattering events within the resist. In addition, we compare the deposited energy distribution (i.e., point spread function) inside the resist among the absorber of Cr at 5 keV, TaTe2 at 10 keV, Cr at 25 keV, and TaBN at 50 keV, respectively as shown in Fig 3. The value in radius is proportional to the beam voltage as expect with 100-times simulation and smoothing process to avoid the random noise. The study of curve-fitting proximity effect parameters to determine the range of forward scattering (FS), the transition region between the FS and the BS-dominated regions, and BS are ongoing. The patterning prediction results including the influence on critical dimension and image log slope (ILS) to examine the mask resolution are under. In addition, further absorber materials will be investigated at different beam voltages for finer mask resolution.

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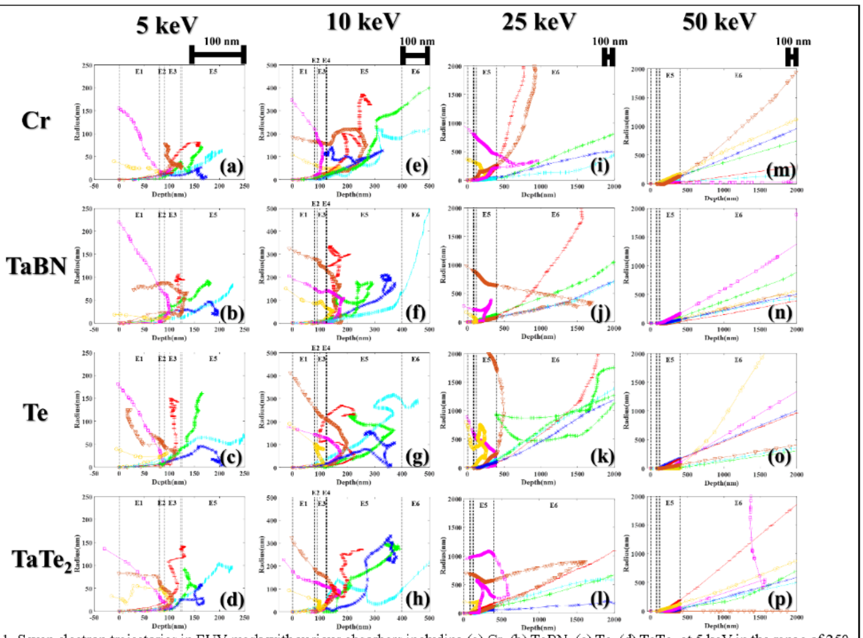


Figure 1. Seven electron trajectories in EUV mask with various absorbers including (a) Cr, (b) TaBN, (c) Te, (d) TaTe$_2$ at 5 keV in the range of 250 nm; (e) Cr, (f) TaBN, (g) Te, (h) TaTe$_2$ at 10 keV in the range of 500 nm; (i) Cr, (j) TaBN, (k) Te, (l) TaTe$_2$ at 25keV in the range of 2000 nm; (m) Cr, (n) TaBN, (o) Te, (p) TaTe$_2$ at 50keV in the range of 2000 nm, respectively. Each marker describes the collision position and the solid line shows the trajectory of electrons between two scattering events.

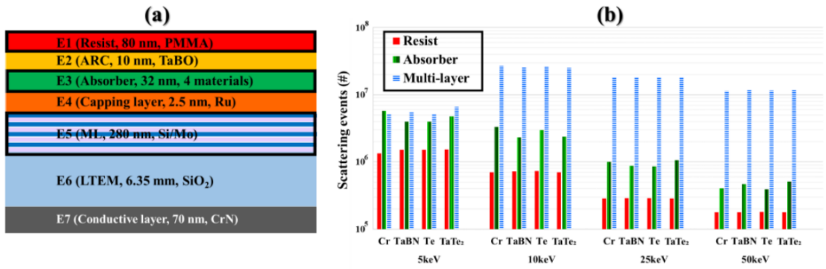


Figure 2. (a) The structure of EUV mask stack. The labels E1, E2, E3, E4, E5, E6, and E7 represent the resist, ARC, absorber, capping layer, multilayers, LTEM, and conductive layer, respectively. (b) Comparison of scattering events within the resist, absorber, and ML among the 4 different absorber materials at 5 keV, 10 keV, 25 keV, and 50 keV, respectively.

Table 1. The accumulated number of electron scattering events in Figure 2 (b).

		5keV	10keV	25keV	50keV
Cr	Resist	1,342,140	701,420	284,330	177,810
	Absorber	5,751,870	3,320,880	996,900	404,250
	Multi-layer	5,177,840	26,695,620	1,799,4860	11,466,180
TaBN	Resist	1,510,540	722,130	288,000	177,560
	Absorber	3,967,470	2,324,830	876,460	466,850
	Multi-layer	5,524,630	25,613,450	18,099,480	11,687,350
Te	Resist	1,515,020	736,140	290,220	179,990
	Absorber	3,997,620	2,960,640	859,230	392,100
	Multi-layer	5,260,580	26,597,040	18,195,930	11,503,450
TaTe$_2$	Resist	1,532,440	700,760	285,430	178,460
	Absorber	4,779,950	2,367,150	1,061,600	512,160
	Multi-layer	6,626,940	25,089,300	18,320,570	11,703,600

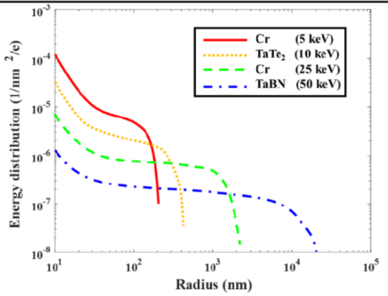
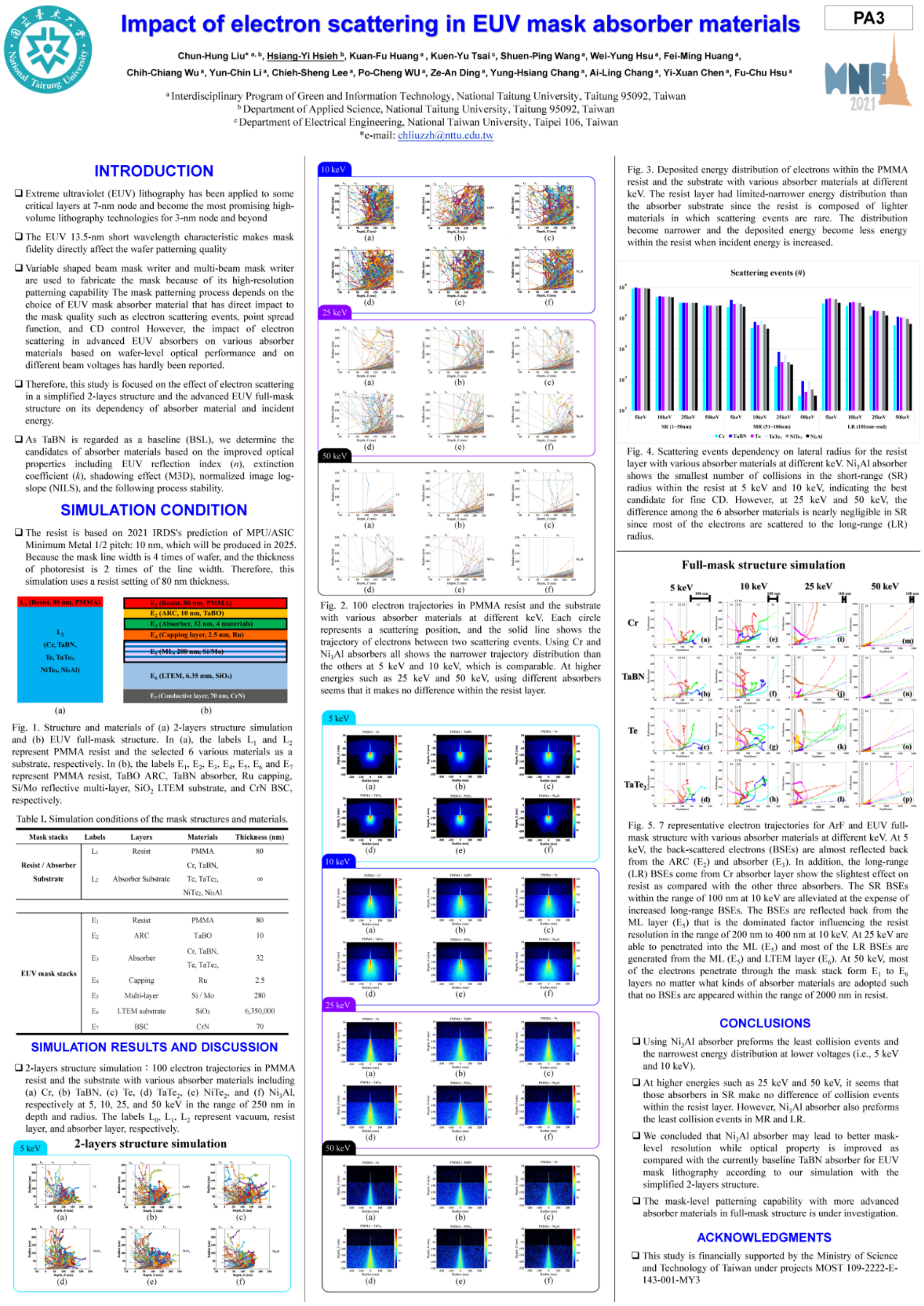


Figure 3. Comparison of deposited energy distribution inside the resist among absorber of Cr at 5 keV. TaTe$_2$ at 10 keV, Cr at 25 keV, and TaBN at 50 keV, respectively.

於國際研討會 47th MNE 2021 發表之研討會論文海報：



PA3

Impact of electron scattering in EUV mask absorber materials

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INTRODUCTION

- ☐ Extreme ultraviolet (EUV) lithography has been applied to some critical layers at 7-nm node and become the most promising high-volume lithography technologies for 3-nm node and beyond
- ☐ The EUV 13.5-nm short wavelength characteristic makes mask fidelity directly affect the wafer patterning quality
- ☐ Variable shaped beam mask writer and multi-beam mask writer are used to fabricate the mask because of its high-resolution patterning capability The mask patterning process depends on the choice of EUV mask absorber material that has direct impact to the mask quality such as electron scattering events, point spread function, and CD control However, the impact of electron scattering in advanced EUV absorbers on various absorber materials based on wafer-level optical performance and on different beam voltages has hardly been reported.
- ☐ Therefore, this study is focused on the effect of electron scattering in a simplified 2-layes structure and the advanced EUV full-mask structure on its dependency of absorber material and incident energy.
- ☐ As TaBN is regarded as a baseline (BSL), we determine the candidates of absorber materials based on the improved optical properties including EUV reflection index (*n*), extinction coefficient (*k*), shadowing effect (M3D), normalized image log-slope (NILS), and the following process stability.

SIMULATION CONDITION

- ☐ The resist is based on 2021 IRDS's prediction of MPU/ASIC Minimum Metal 1/2 pitch: 10 nm, which will be produced in 2025. Because the mask line width is 4 times of wafer, and the thickness of photoresist is 2 times of the line width. Therefore, this simulation uses a resist setting of 80 nm thickness.

(a) (b)

Fig. 1. Structure and materials of (a) 2-layers structure simulation and (b) EUV full-mask structure. In (a), the labels L_1 and L_2 represent PMMA resist and the selected 6 various materials as a substrate, respectively. In (b), the labels E_1, E_2, E_3, E_4, E_5, E_6 and E_7 represent PMMA resist, TaBO ARC, TaBN absorber, Ru capping, Si/Mo reflective multi-layer, SiO_2 LTEM substrate, and CrN BSC, respectively.

Table I. Simulation conditions of the mask structures and materials.

Mask stacks	Labels	Layers	Materials	Thickness (nm)
Resist / Absorber Substrate	L_1	Resist	PMMA	80
	L_2	Absorber Substrate	Cr, TaBN, Te, $TaTe_2$, $NiTe_2$, Ni_3Al	∞
EUV mask stacks	E_1	Resist	PMMA	80
	E_2	ARC	TaBO	10
	E_3	Absorber	Cr, TaBN, Te, $TaTe_2$,	32
	E_4	Capping	Ru	2.5
	E_5	Multi-layer	Si / Mo	280
	E_6	LTEM substrate	SiO_2	6,350,000
	E_7	BSC	CrN	70

SIMULATION RESULTS AND DISCUSSION

- ☐ 2-layers structure simulation：100 electron trajectories in PMMA resist and the substrate with various absorber materials including (a) Cr, (b) TaBN, (c) Te, (d) $TaTe_2$, (e) $NiTe_2$, and (f) Ni_3Al, respectively at 5, 10, 25, and 50 keV in the range of 250 nm in depth and radius. The labels L_0, L_1, L_2 represent vacuum, resist layer, and absorber layer, respectively.

2-layers structure simulation

(a) (b) (c) (d) (e) (f)

Fig. 2. 100 electron trajectories in PMMA resist and the substrate with various absorber materials at different keV. Each circle represents a scattering position, and the solid line shows the trajectory of electrons between two scattering events. Using Cr and Ni_3Al absorbers all shows the narrower trajectory distribution than the others at 5 keV and 10 keV, which is comparable. At higher energies such as 25 keV and 50 keV, using different absorbers seems that it makes no difference within the resist layer.

(a) (b) (c) (d) (e) (f)

Fig. 3. Deposited energy distribution of electrons within the PMMA resist and the substrate with various absorber materials at different keV. The resist layer had limited-narrower energy distribution than the absorber substrate since the resist is composed of lighter materials in which scattering events are rare. The distribution become narrower and the deposited energy become less energy within the resist when incident energy is increased.

Fig. 4. Scattering events dependency on lateral radius for the resist layer with various absorber materials at different keV. Ni_3Al absorber shows the smallest number of collisions in the short-range (SR) radius within the resist at 5 keV and 10 keV, indicating the best candidate for fine CD. However, at 25 keV and 50 keV, the difference among the 6 absorber materials is nearly negligible in SR since most of the electrons are scattered to the long-range (LR) radius.

Full-mask structure simulation

Fig. 5. 7 representative electron trajectories for ArF and EUV full-mask structure with various absorber materials at different keV. At 5 keV, the back-scattered electrons (BSEs) are almost reflected back from the ARC (E_2) and absorber (E_3). In addition, the long-range (LR) BSEs come from Cr absorber layer show the slightest effect on resist as compared with the other three absorbers. The SR BSEs within the range of 100 nm at 10 keV are alleviated at the expense of increased long-range BSEs. The BSEs are reflected back from the ML layer (E_5) that is the dominated factor influencing the resist resolution in the range of 200 nm to 400 nm at 10 keV. At 25 keV are able to penetrated into the ML (E_5) and most of the LR BSEs are generated from the ML (E_5) and LTEM layer (E_6). At 50 keV, most of the electrons penetrate through the mask stack form E_1 to E_6 layers no matter what kinds of absorber materials are adopted such that no BSEs are appeared within the range of 2000 nm in resist.

CONCLUSIONS

- ☐ Using Ni_3Al absorber preforms the least collision events and the narrowest energy distribution at lower voltages (i.e., 5 keV and 10 keV).
- ☐ At higher energies such as 25 keV and 50 keV, it seems that those absorbers in SR make no difference of collision events within the resist layer. However, Ni_3Al absorber also preforms the least collision events in MR and LR.
- ☐ We concluded that Ni_3Al absorber may lead to better mask-level resolution while optical property is improved as compared with the currently baseline TaBN absorber for EUV mask lithography according to our simulation with the simplified 2-layers structure.
- ☐ The mask-level patterning capability with more advanced absorber materials in full-mask structure is under investigation.

ACKNOWLEDGMENTS

- ☐ This study is financially supported by the Ministry of Science and Technology of Taiwan under projects MOST 109-2222-E-143-001-MY3

於國內研討會 ITAC 2021 發表之研討會論文摘要：

四軸無人機之控制器設計與姿態模擬

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摘要

無人機最早從軍事偵察機而來，最初只是為了在戰爭中使用，但漸漸地人們發現將軍事偵察機變小，不但能降低成本，也能在戰場上比常規戰鬥機更具有靈活性。近年來無人機相關產業日漸蓬勃發展，無人機也開始大量運用在空拍影像、商業表演、偵查辦案、工業、救災甚至在農業領域使花果授粉等，無人機都能完成任務。本文研究關於四旋翼無人機在 Simulink 中，進行比例-積分-微分的模擬控制（Proportional–Integral–Derivative, PID）以及其設計過程結果，藉由 Ziegler-Nichols 方法調整 PID 之參數，並找出三個控制參數 K_p、K_i 和 K_d 對整體飛行系統之影響，使無人機能夠迅速起飛並達到穩定懸停飛行在指定高度，再透過實際模擬出的數值進行人工調整，並比較人工調整前後之差異以求最大超越量之最小化。

關鍵字：無人機、比例-積分-微分控制器、Ziegler-Nichols 調整方法、最大超越量

ABSTRACT

The drones first came from military reconnaissance aircraft. They were originally used in warfare, but gradually people discovered that making military reconnaissance aircraft smaller can not only reduce costs, but also be more flexible on the battlefield than conventional fighters. In recent years, drone-related industries have been booming. It has been widely used in aerial photography, commercial performances, investigation, industry, disaster relief, and even pollination of flowers and fruits in agriculture. In this paper, the proportion-integral-derivative (PID) control of quadcopter in the commercial software called Simulink has been discussed. The design process with Ziegler-Nichols method to adjust the parameters of PID including three control parameters K_p, K_i, and K_d is studied on the overall flight system, so that the drone can take off rapidly and achieve a stable hover flight at a specified altitude. Then through the actual simulation of the parameters with manual adjustment to reduce the maximum percent overshoot. Simulation results between before- and after-optimized performance have been compared.

Keyword: Unmanned Aerial Vehicle (UAV), PID Controller, Z-N method, overshoot performance

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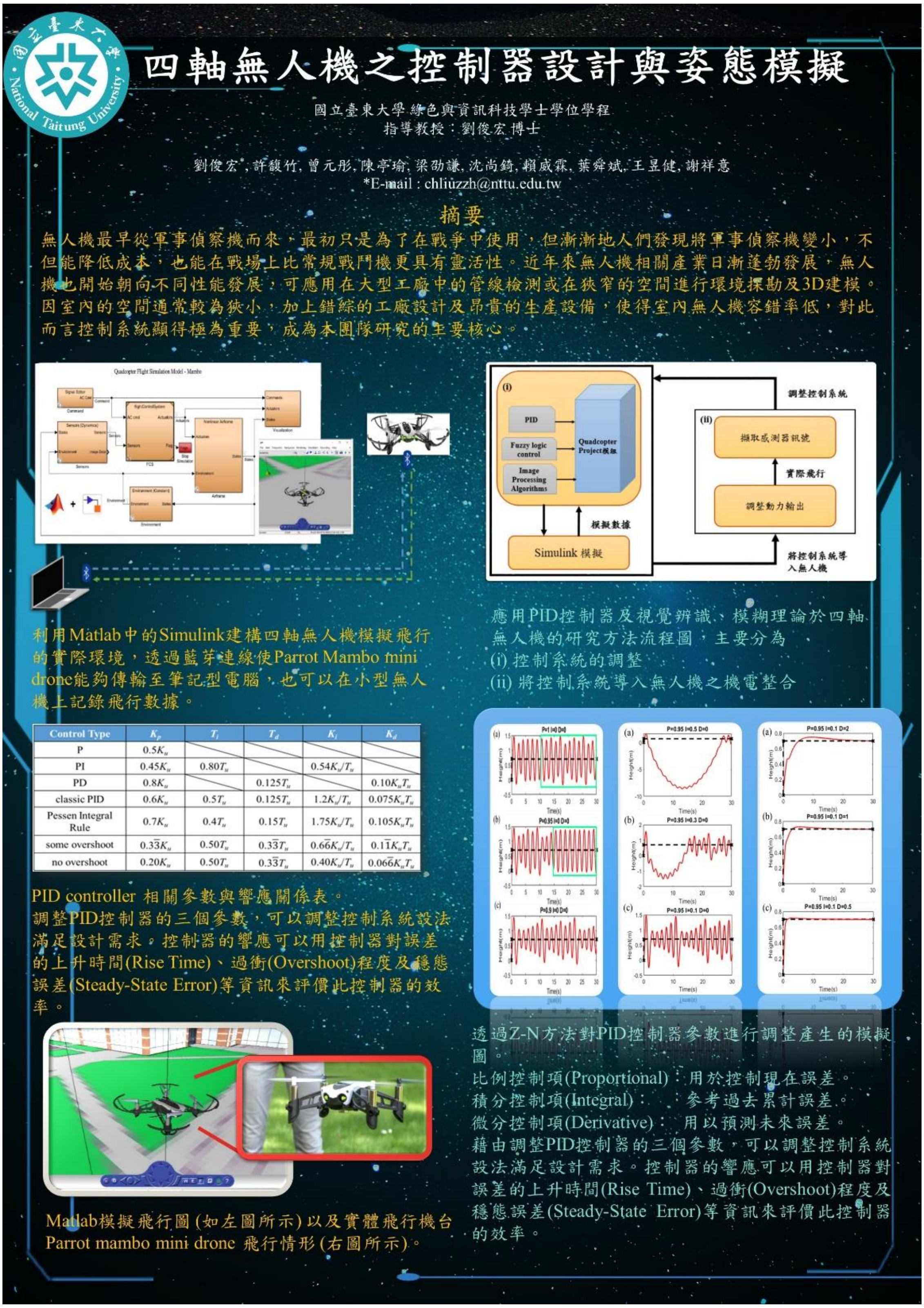

四軸無人機之控制器設計與姿態模擬

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摘要

無人機最早從軍事偵察機而來，最初只是為了在戰爭中使用，但漸漸地人們發現將軍事偵察機變小，不但能降低成本，也能在戰場上比常規戰鬥機更具有靈活性。近年來無人機相關產業日漸蓬勃發展，無人機也開始朝向不同性能發展，可應用在大型工廠中的管線檢測或在狹窄的空間進行環境探勘及3D建模。因室內的空間通常較為狹小，加上錯綜的工廠設計及昂貴的生產設備，使得室內無人機容錯率低，對此而言控制系統顯得極為重要，成為本團隊研究的主要核心。

利用Matlab中的Simulink建構四軸無人機模擬飛行的實際環境，透過藍芽連線使Parrot Mambo mini drone能夠傳輸至筆記型電腦，也可以在小型無人機上記錄飛行數據。

Control Type	K_p	T_i	T_d	K_i	K_d
P	$0.5K_u$				
PI	$0.45K_u$	$0.80T_u$		$0.54K_u/T_u$	
PD	$0.8K_u$		$0.125T_u$		$0.10K_uT_u$
classic PID	$0.6K_u$	$0.5T_u$	$0.125T_u$	$1.2K_u/T_u$	$0.075K_uT_u$
Pessen Integral Rule	$0.7K_u$	$0.4T_u$	$0.15T_u$	$1.75K_u/T_u$	$0.105K_uT_u$
some overshoot	$0.3\bar{3}K_u$	$0.50T_u$	$0.3\bar{3}T_u$	$0.6\bar{6}K_u/T_u$	$0.1\bar{1}K_uT_u$
no overshoot	$0.20K_u$	$0.50T_u$	$0.3\bar{3}T_u$	$0.40K_u/T_u$	$0.06\bar{6}K_uT_u$

PID controller 相關參數與響應關係表。

調整PID控制器的三個參數，可以調整控制系統設法滿足設計需求。控制器的響應可以用控制器對誤差的上升時間(Rise Time)、過衝(Overshoot)程度及穩態誤差(Steady-State Error)等資訊來評價此控制器的效率。

Matlab模擬飛行圖 (如左圖所示) 以及實體飛行機台 Parrot mambo mini drone 飛行情形 (右圖所示)。

應用PID控制器及視覺辨識、模糊理論於四軸無人機的研究方法流程圖，主要分為
(i) 控制系統的調整
(ii) 將控制系統導入無人機之機電整合

透過Z-N方法對PID控制器參數進行調整產生的模擬圖。

比例控制項(Proportional)：用於控制現在誤差。
積分控制項(Integral)：　參考過去累計誤差。
微分控制項(Derivative)：　用以預測未來誤差。
藉由調整PID控制器的三個參數，可以調整控制系統設法滿足設計需求。控制器的響應可以用控制器對誤差的上升時間(Rise Time)、過衝(Overshoot)程度及穩態誤差(Steady-State　Error)等資訊來評價此控制器的效率。

三、 參加之競賽活動：(請依據參加活動次數，依序附上相關活動簡章或海報、議程與參加證明等佐證資料)

Program at a glance

	September 20		
09:00-16:30	MNE2021 International School		
16:30-20:00	Registration and Welcome Reception		
	September 21		
	Auditorium		
08:30-08:45	Opening Ceremony		
08:45-09:30	Plenary 1: **Andrea Onetti** (STMicroelectronics - Italy) *Sensors: Cogito, Ergo Sum*		
09:30-10:15	Plenary 2: **John A. Rogers** (North Western University - USA) *Mechanical Assembly as a Route to 3D Micro/nanosystems*		
10:15-10:45	Coffee Break		
	Auditorium	**500 Room**	**Londra Room**
10:45 -12:45	Session A1: Imprinting & Soft Lithography	Session B1: Micro-Nanofab for photonics	Session C1: MEMS/NEMS Technology
12:45-14:00	Lunch Break		
14:00-15:30	Session A2: 3D Lithographies	Session B2: Micro-Nanofab for electronics	Session C2: Fluidic Technologies
15:30-18:00	POSTER SESSION I (ODD NUMBERS) & INDUSTRIAL SESSION (Londra Room)		
	September 22		
	Auditorium		
08:45-09:30	Plenary 3: **Boris N. Chichkov** (Leibniz University Hannover - Germany) *Laser bioprinting*		
09:30-10:15	Plenary 4: **Anja Boisen**, 2021 MNE Fellow Award (DTU - Denmark) *Micro/Nano Engineering and Drug Delivery*		
10:15-10:45	Coffee Break		
	Auditorium	**500 Room**	**Londra Room**
10:45 -12:45	Session A3: Functional Structures & Materials	Session B3: Micro & Nano structures and devices	Session C3: Biosensors technologies
12:45-14:00	Lunch Break		
14:00-15:30	Session A4: Nanostructures and applications	Session B4: Technologies for micro and nano photonics I	Session C4: Iteractions with biosystems
15:30-18:00	POSTER SESSION II (EVEN NUMBERS)		
19:30-23:30	SOCIAL DINNER		
	September 23		
	Auditorium	**500 Room**	**Londra Room**
8:30 -10:30	Session A5: Electron & Ion beam technologies	Session B5: Technologies for Metasurfaces	Session C5: Technologies for micro and nano Photonics II
10:30-11:00	Coffe Break		
11:00-12:30	Session A6: Technologies for organic/biological matter	Session B6: Wearable technologies	Session C6: Implantable devices
12:30-13:45	Lunch Break		
13:45-15:00	Session A7: Advanced Photon Lithography	Session B7: Late Abstracts	Session C7: Interacting with cells and bacteria
15:00-15:30	Coffe Break		
	Auditorium		
15:30-16:15	Plenary 5: **Paolo Vineis** (Imperial College London - UK) *Technological developments in the study of the health impact of environmental exposures*		
16:15-17:00	Plenary 6: **Zhenan Bao** (Stanford University - USA) *Skin-Inspired Organic Electronics*		
17:00-18:00	CLOSING CONCERT AND REMARKS		

2021資訊科技應用學術研討會

The Information Technology and Applications Conference 2021

論文徵稿

會議地點：中國科技大學　台北校區
主辦單位：中國科技大學　資訊學院
協辦單位：資訊管理系、資訊工程系

論文主題

2021資訊科技應用學術研討會(ITAC)訂於2021年05月27日(星期四)於中國科技大學台北校區舉行，歡迎各界人士踴躍投稿。稿件具原創性，未曾發表論文。研討會主題包括如下：

- 人工智慧
- 智慧生活
- 行動通訊
- 網際網路
- 資通安全
- 無線感測
- 家庭娛樂
- 嵌入系統
- 物聯網應用
- 數位學習
- 創新科技
- 數位家電
- 虛擬實境
- 遊戲動畫
- 知識管理
- 軟體品質
- 電子商務
- 大數據
- 雲端運算
- 數位學習
- 機器人
- 資訊實務
- 資料探勘
- 網路管理
- 個案專題
- 其他相關

論文審查

- ■論文審查結果採隨到隨審方式並E-mail通知論文聯絡人
- ■接受論文修正後版本及授權書於2021年05月17日前寄回

研討會聯絡處

中國科技大學資訊學院資管系秘書
(116-95 台北市文山區興隆路三段56號)
聯絡電話：(02)2931-3416 #2352
E-mail：itac@cute.edu.tw
網址：https：//www.cute.edu.tw/ccs/itac/

資訊學院 College of Computer Science　資訊管理系　資訊工程系

論文格式

- ■論文用中文或英文撰寫，依本會論文格式(參見網址)撰寫投稿論文
- ■請同時提供Word與PDF兩種格式E-mail至itac@cute.edu.tw

重要日期

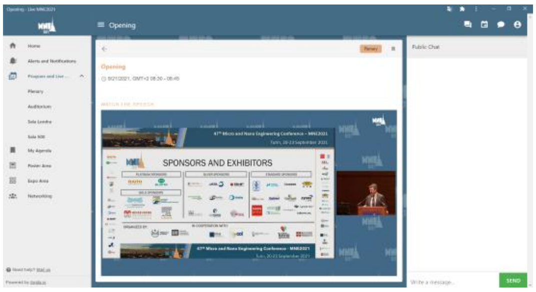
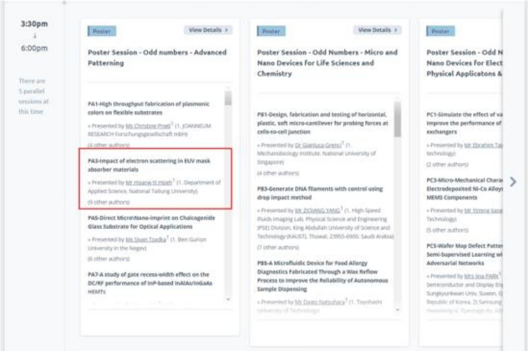
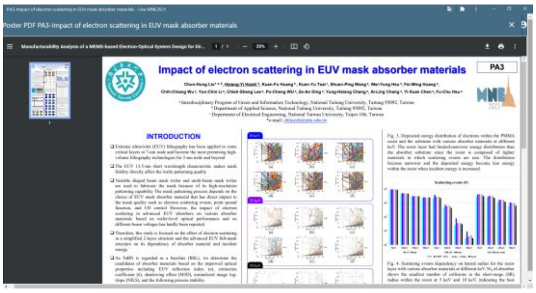
- ■徵稿開始日期：即日起
- ■投稿截止日期：2021年04月22日 (E-mail投稿)
- ■論文接受通知：2021年05月06日
- ■研討會報名截止：2021年05月20日(E-mail報名)
- ■研討會日期：2021年05月27日(星期四)

2021年資訊科技應用學術研討會議程表

2021 年 05 月 27 日（星期四）			
時間	議程		地點
09:00~09:10	報到		格致樓 101
09:10~09:15	開幕式/校長		
09:15~10:45	【專題演講】 主持人：資院/張劍平院長 主講人：鑑智資相科技(股)公司陳振楠執行長 題目：AIoT 創新科技之探討		格致樓 101
10:45~10:55	休息		前往論文發表區
10:55~12:15	論文發表 A 前瞻資訊科技與智慧生活應用	議程主席/主持人： 資工系 張裕良 博士	格致樓 103
	論文發表 B 人工智慧應用	議程主席/主持人： 資管系 游政憲 博士	格致樓 101
12:15~13:10	午餐		
13:10~15:30	論文發表 A 前瞻資訊科技與智慧生活應用	議程主席/主持人： 資工系 張裕良 博士	格致樓 103
	論文發表 B 人工智慧應用	議程主席/主持人： 資管系 游政憲 博士	格致樓 101
15:30	賦歸		

四、參賽準備與活動記錄

於國際研討會 47th MNE 2021 發表之研討會活動照片：

 47th Micro and Nano Engineering Conference – MNE2021 Turin, 20-23 September 2021 WELCOME to MNE2021 Conference Chairs: - Massimo De Vittorio - Chair - Fabrizio Pirri – Co-Chair - Massimo Gentili – Honorary Chair Programme co-Chairs: - Matteo Cocuzza - Andrea Lamberti - Ferruccio Pisanello 圖說明：國際研討會 47th MNE 2021 開幕典禮。	 Opening SPONSORS AND EXHIBITORS Public Chat SEND 圖說明：贊助廠商與參展廠商。
 47th Micro and Nano Engineering Conference – MNE2021 Turin, 20-23 September 2021 Requirements for Commercial Metalenses and Gratings sub-100 nm features, high AR (> 8), high RI (> 1.9), optical/ material stability (no organics), high transparency, low haze, low roughness Einck, V. J.; Torfeh, M.; McClung, A.; Jung, D.; Mansouree, M.; Arbabi, A.; Watkins, J. J. ACS Photonics 2021, 8, 2400-2409 - TiO_2 is an excellent candidate material - Acceptable fabrication cost and scalability are critical for commercialization Watkins Research Group 圖說明：其他現場與會人員之演講。	 3:30pm ↓ 6:00pm There are 5 parallel sessions at this time Poster — View Details › — Poster Session - Odd numbers - Advanced Patterning PA1-High throughput fabrication of plasmonic colors on flexible substrates » Presented by Ms Christine Prietl[1] (1. JOANNEUM RESEARCH Forschungsgesellschaft mbH) (4 other authors) PA3-Impact of electron scattering in EUV mask absorber materials » Presented by Mr Hsiang-Yi Hsieh[1] (1. Department of Applied Science, National Taitung University) (9 other authors) PA5-Direct Micro\Nano-imprint on Chalcogenide Glass Substrate for Optical Applications » Presented by Ms Shan Tzadka[1] (1. Ben Gurion University in the Negev) (6 other authors) PA7-A study of gate recess-width effect on the DC/RF performance of InP-based InAlAs/InGaAs HEMTs Poster — View Details › — Poster Session - Odd Numbers - Micro and Nano Devices for Life Sciences and Chemistry PB1-Design, fabrication and testing of horizontal, plastic, soft micro-cantilever for probing forces at cells-to-cell junction » Presented by Dr Gianluca Grenci[1] (1. Mechanobiology Institute, National University of Singapore) (4 other authors) PB3-Generate DNA filaments with control using drop impact method » Presented by Mr ZIQIANG YANG[1] (1. High-Speed Fluids Imaging Lab, Physical Science and Engineering (PSE) Division, King Abdullah University of Science and Technology (KAUST), Thuwal, 23955-6900, Saudi Arabia) (7 other authors) PB5-A Microfluidic Device for Food Allergy Diagnostics Fabricated Through a Wax Reflow Process to Improve the Reliability of Autonomous Sample Dispensing » Presented by Mr Daiki Natsuhara[1] (1. Toyohashi University of Technology) Poster — Poster Session - Odd N… Nano Devices for Elect… Physical Applicatons &… PC1-Simulate the effect of va… improve the performance of… exchangers (2 other authors) PC3-Micro-Mechanical Chara… Electrodeposited Ni-Co Alloy… MEMS Components (5 other authors) PC5-Wafer Map Defect Patte… Semi-Supervised Learning wi… Adversarial Networks 圖說明：線上與會人員報告與海報展示之時程表 (本論文於會議之代號為 PA3)。
 PA3-Impact of electron scattering in EUV mask absorber materials Chun-Hung Liu, Hsiang-Yi Hsieh, Kuan-Fu Huang, Kuan-Yu Tsai, Shuen-Ping Wang, Wei-Yung Hsu, Fei-Ming Huang, Chih-Chiang Wu, Yun-Chin Li, Chieh-Sheng Lee, Po-Cheng Wu, Zo-An Ding, Yung-Hsiang Chang, Ai-Ling Chang, Yi-Xuan Chen, Fu-Chu Hsu Poster PDF PA3-Impact of electron scattering in EUV mask absorber materials REPRESENTATIVES Chun-Hung Liu Assistant Professor @ Interdisciplinary Program of Green and Information Technology, National Taitung University Hsiang Yi Hsieh Master student @ Department of Applied Science, National Taitung University, Taitung 95092, Taiwan VIDEO APPOINTMENT CHAT 圖說明：線上報告與海報展示之指導教授與與報告人員。	 Poster PDF PA3-Impact of electron scattering in EUV mask absorber materials Impact of electron scattering in EUV mask absorber materials PA3 INTRODUCTION 圖說明：本論文於會議之海報展示。

五、参加競賽成果 (参賽證明、得獎證明或學生心得)

20 - 23 September 2021

MNE2021 - 47th international conference on Micro and Nano Engineering

https://mne2021.exordo.com

Dear Chun-Hung (Jimmy),

Thank you for your submission to MNE2021.

Following review by the Programme Committee, I am pleased to inform you that your submission entitled '**Impact of electron scattering in EUV mask absorber materials**' has been accepted for **Poster presentation** at the conference - congratulations.

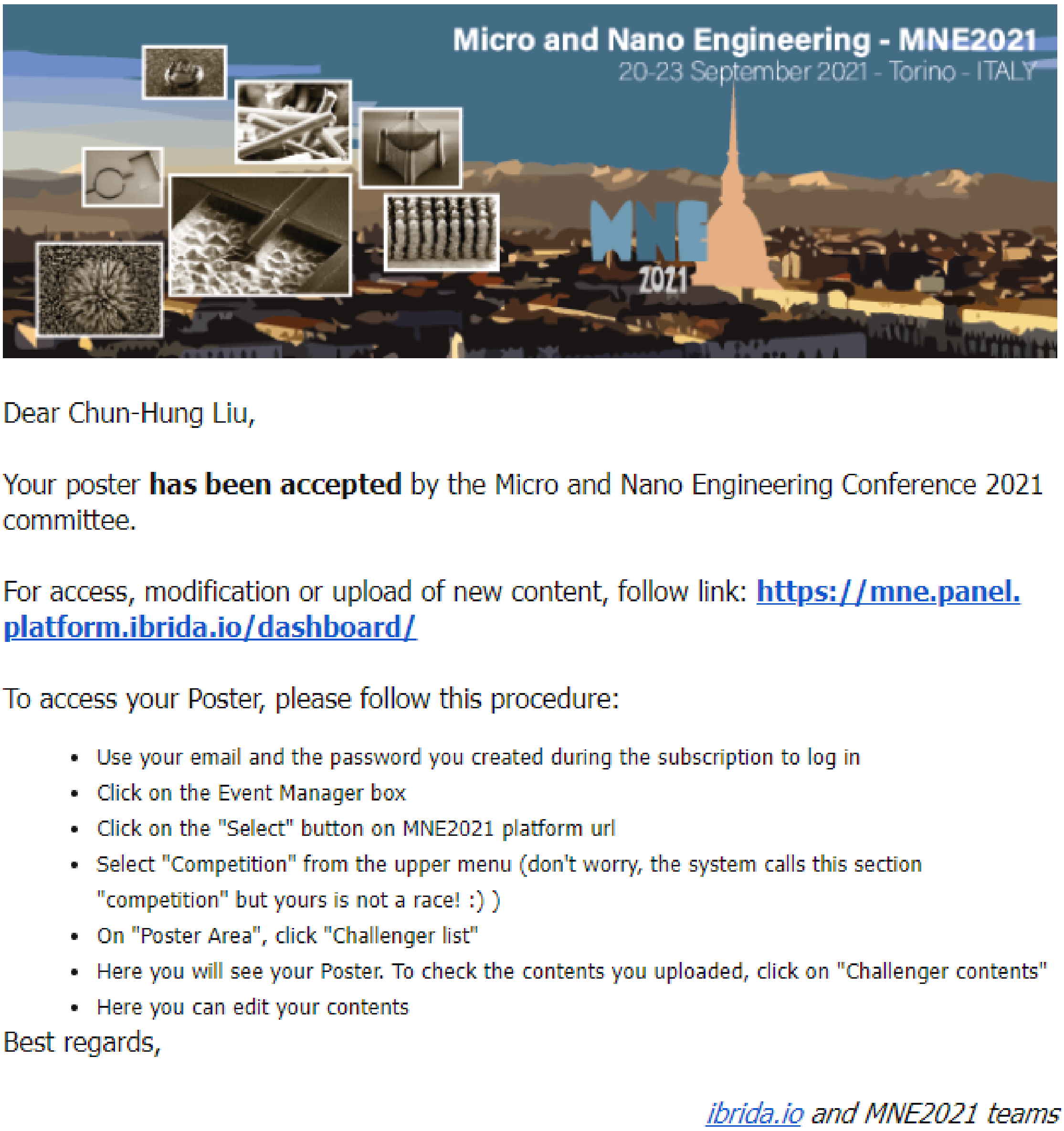
Registration at MNE2021 is already open, you can find additional information at https://www.mne2021.org/fees/

Again, congratulations on your acceptance. We look forward to meeting you at MNE2021!

Yours Sincerely,

Massimo De Vittorio and Fabrizio Pirri,

MNE2021



Dear Chun-Hung Liu,

Your poster **has been accepted** by the Micro and Nano Engineering Conference 2021 committee.

For access, modification or upload of new content, follow link: **https://mne.panel.platform.ibrida.io/dashboard/**

To access your Poster, please follow this procedure:

- Use your email and the password you created during the subscription to log in
- Click on the Event Manager box
- Click on the "Select" button on MNE2021 platform url
- Select "Competition" from the upper menu (don't worry, the system calls this section "competition" but yours is not a race! :))
- On "Poster Area", click "Challenger list"
- Here you will see your Poster. To check the contents you uploaded, click on "Challenger contents"
- Here you can edit your contents

Best regards,

ibrida.io and MNE2021 teams

MNE2021 - 47th international conference on Micro and Nano Engineering 20 - 23 Sep 2021

Continued from **Tuesday, 21 September**

3:15pm **Pillar Supported Soft X-Ray Compatible Liquid Cells**
» Dr. Alokik Kanwal[1], Dr. Robert Ilic[1], Dr. Glenn Holland[1], Dr. Subhrangsu Mukherjee[1], Dr. Eliot Gann[1], Dr. Dean DeLongchamp[1], Dr. J. Alexander Liddle[1] (1. National Institute of Standards and Technology)

3:30pm **Poster Session - Odd numbers - Advanced Patterning**

PA1-High throughput fabrication of plasmonic colors on flexible substrates
» Ms. Christine Prietl[1], Mr. Stephan Ruttloff[1], Dr. Susanne Schweitzer[1], Mr. Florian Kolb[1], Dr. Anja Haase[1] (1. JOANNEUM RESEARCH Forschungsgesellschaft mbH)

PA3-Impact of electron scattering in EUV mask absorber materials
» Prof. Chun-Hung (Jimmy) Liu[1], Mr. Hsiang-Yi Hsieh[2], Prof. Kuen-Yu Tsai[3], Mr. Shuen-Ping Wang[1], Mr. Kuan-Fu Huang[1], Mr. Wei-Yung Hsu[1], Mr. Fei-Ming Huang[1], Mr. Chih-Chiang Wu[1], Ms. Yun-Chin Li[1], Mr. Chieh-Sheng Lee[1] (1. Interdisciplinary Program of Green and Information Technology, National Taitung University, 2. Department of Applied Science, National Taitung University, 3. Department of Electrical Engineering, National Taiwan University)

PA5-Direct Micro\Nano-imprint on Chalcogenide Glass Substrate for Optical Applications
» Prof. Mark Schvartzman[1], Ms. Sivan Tzadka[1], Mrs. Natali Ostrovsky[1], Mrs. Esti Toledo[1], Dr. Guillaume Le Saux[1], Mr. Evyatar Kassis[2], Dr. Shay Joseph[2] (1. Ben Gurion University in the Negev, 2. Optical Component Center, Rafael Advanced Defense Systems)

PA7-A study of gate recess-width effect on the DC/RF performance of InP-based InAlAs/InGaAs HEMTs
» Dr. Yuying Xie[1], Dr. Mingsai Zhu[1], Prof. Yifang Chen[1] (1. Fudan University)

PA9-Etch behaviour of an Al2O3 hard mask in Silicon Deep Reactive Ion Etching
» Dr. Martin Drost[1], Dr. Steffen Marschmeyer[1], Mr. Mirko Fraschke[1], Dr. Oksana Fursenko[1], Mr. Florian Baerwolf[1], Dr. Ioan Costina[1], Dr. Marco Lisker[1] (1. IHP - Leibniz-Institut für innovative Mikroelektronik)

PA11-High-resolution etching of nanophotonic cavities using a chromium hard mask
» Mr. Ali Nawaz Babar[1], Mr. Marcus Albrechtsen[1], Dr. Babak Vosoughi Lahijani[1], Prof. Rasmus Ellebæk Christiansen[2], Prof. Jesper Mørk[1], Prof. Henri Jansen[3], Prof. Søren Stobbe[1] (1. DTU Fotonik, Technical University of Denmark, 2. Department of Mechanical Engineering, Technical University of Denmark., 3. DTU Nanolab - National Centre for Nano Fabrication and Characterization Technical University of Denmark)

PA13-3D printing of bioinspired super black microstructures
» Mr. Alexandre Wetzel[1], Ms. Nuria del Castillo Iniesta[1], Dr. Einstom Engay[1], Dr. Kirstine Berg-Sørensen[2], Dr. Ada-Ioana Bunea[1], Prof. Rafael Taboryski[3] (1. DTU Nanolab - National Centre for Nano Fabrication and Characterization Technical University of Denmark, 2. DTU Health Tech - Department of Health Technology Technical University of Denmark, 3. DTU Nanolab)

PA15-Implementation of concave vacuum chuck in laser interference lithography to reduce period variation on large area gratings
» Mr. Ratish Rao Nagaraj Rao[1] (1. University of Lyon, UJM saint etienne, Laboratoire Hubert Curien UMR 5516)

PA17-The effects of flame-treated PDMS robust micro-structure on the enhancement of hydrophobicity and bacterial anti-adhesion properties
» Dr. Nithi Atthi[1], Ms. Pemika Eiamworasin[2], Ms. Apitsara Horbud[2], Dr. Suthichai Samart[2], Prof. Sutee Chutipaijit[2], Mr. Witsaroot Sripumkhai[1], Ms. Pattaraluck Pattamang[1], Dr. Pawasuth Saengdee[1], Mrs. Suphichaya Radomyos[1], Mrs. Oraphan Thongsook[1], Dr. Wutthinan Jeamsaksiri[1], Dr. Nongluck Houngkamhang[2] (1. National Electronics and Computer Technology Center, 2. King Mongkut's Institute of Technology Ladkrabang)

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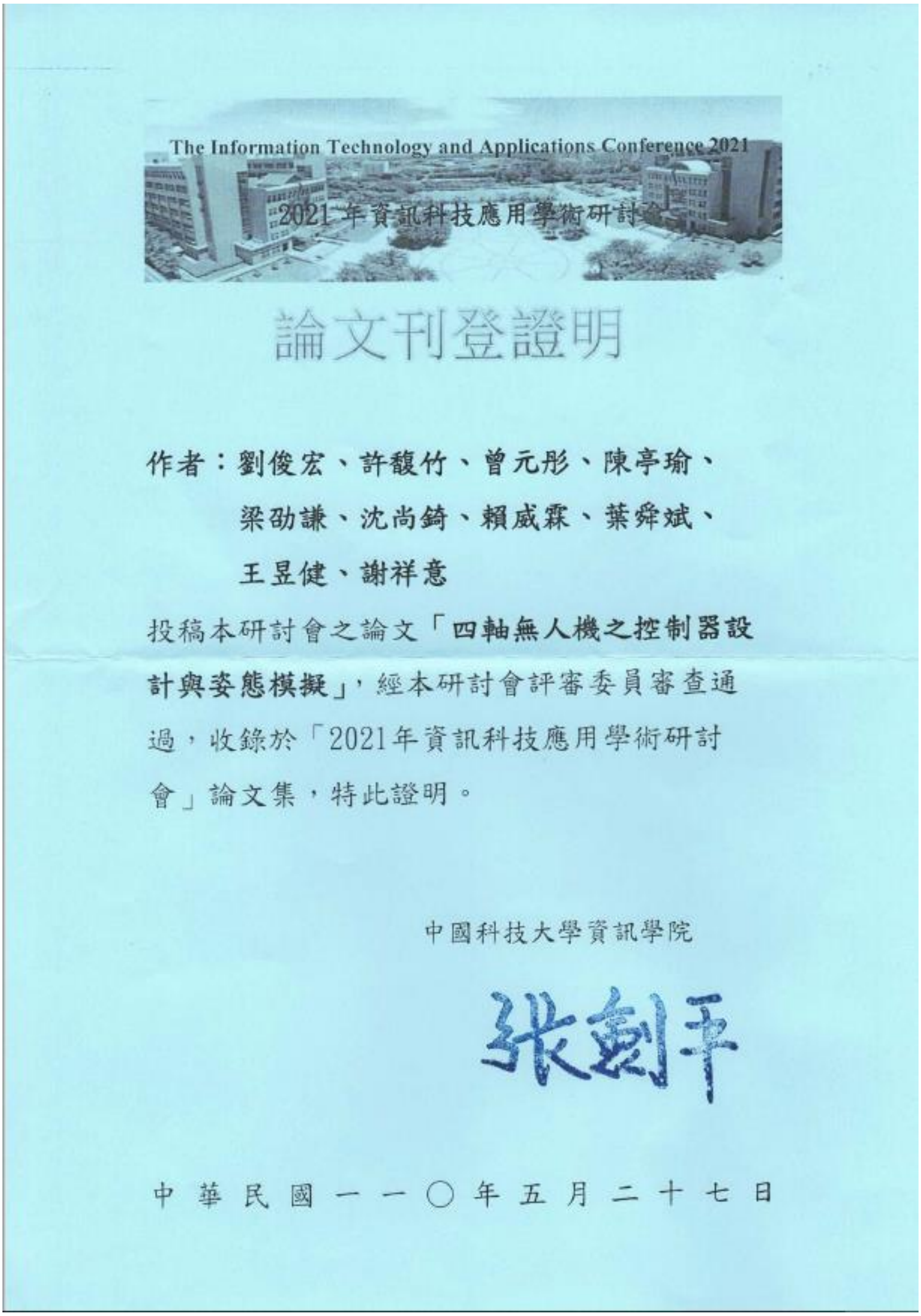

The Information Technology and Applications Conference 2021

2021 年資訊科技應用學術研討會

論文刊登證明

作者：劉俊宏、許馥竹、曾元彤、陳亭瑜、
梁劭謙、沈尚錡、賴威霖、葉舜斌、
王昱健、謝祥意

投稿本研討會之論文「**四軸無人機之控制器設計與姿態模擬**」，經本研討會評審委員審查通過，收錄於「2021年資訊科技應用學術研討會」論文集，特此證明。

中國科技大學資訊學院

張劍平

中華民國一一〇年五月二十七日