

Professor Fujita is a world renowned expert on design, fabrication, and applications of MEMS (Micro-Electro-Mechanical Systems) and NEMS (Nano-Electro-Mechanical Systems). With this background, he aims to strengthen the research and educational activities at the Institute of NanoEngineering and MicroSystems, National Tsing Hua University. Professor Fujita has conducted interview and frequent communication with individual faculty members of the Institute, which identified common research interests and established joint research projects based on the interests. He has also visited research institutes and industries in Hsinchu Science Park and attended MEMS related technical meetings to find promising research directions. In addition, Professor Fujita will use his foreign academic resources to assist the Institute in cooperation and exchanges with special attention to the deepening of the existing global network, named NAMIS that bridges MEMS related universities and research institutes over 11 countries.

# Yushan Fellow Program

## Performance Report

<b>University and Appointed Faculty:</b> National Tsing Hua University (NTHU), Institute of NanoEngineering and MicroSystems (iNEMS)	<b>Academic Field:</b> Engineering
<b>Name of the Yushan (Young) Fellow:</b> Hiroyuki Fujita	<input checked="" type="checkbox"/> <b>Yushan Fellow</b> <input type="checkbox"/> <b>Yushan Young Fellow</b>

Assessment of effectiveness of tangible work (The implementation results can be presented cumulatively, including the annual performance report of the second year, which can include the results of the first year and the second year)

Main points of assessment	The anticipated goals	Concrete work achievements or results	Supporting documents
1. Chief content of the Yushan (Young) Fellows' research work and overview of full research process.	<p>1. Joint research To identify common research interest in MEMS research through individual interview with faculty members of the Institute of NanoEngineering and MicroSystems, National Tsing Hua University in order to establish joint research projects based on the interests. Quick proof-of-the-concept will be conducted allowing to plan more detailed research and development.</p> <p>Expected completion timeframe: three (3) years</p> <p>2. Research orientation search To identify future trend and industrially</p>	<p>1. Joint research Interviews with 5 Professors / Associated Professors have been conducted; this resulted in starting two projects.</p> <p>1.1 Integrated sensors for micro chemical synthesis (with Prof. Chihchen Chen) Meetings: twice We have obtained concept design, research plan for both simulation and fabrication, and the first simulation results. Budget: Front-end Technology Collaboration Project from the National Science and Technology Council.</p> <p>1.2 Printed flexible MEMS devices for bio-medical applications (with Prof. Chengyao Lo) Meeting: twice</p>	

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	<p>relevant targets through visits to research institutes and industries in Hsinchu Science Park and attendance to MEMS related technical meetings.</p> <p>Expected completion timeframe: three (3) years</p> <p>3. International networking Prof. Fujita will take advantages of global network NAMIS which he founded in 2005 to enforce ties with international universities and research institutes for collaboration research and student exchange. (Please refer details to <b>main point of assessment 5.</b>)</p> <p>Expected completion timeframe: three (3) years</p>	<p>Based on the on-going research which Prof. Fujita is conducting in Japan, complementary device development is planned to further extend the research. For example, potential sensing devices that contain micro light emitting diodes (micro-LEDs) and photodetectors (PDs) could be integrated for bio-medical applications in a real-time and durable manner, which sit atop flexible substrates that require non-conventional fabrication techniques. Prof. Lo has professional experiences on inkjet printing and additive manufacturing, and thus could be supportive on realizing prof. Fujita's project in part. We have purchased necessary lab expenditures, such as customized MEMS cartridges for the inkjet printer.</p> <p>2. Research orientation search Prof. Fujita visited two research organizations (ITRI, TSRI) and two companies in Hsinchu. He also attended MEMS Workshop associated with SEMICON Taiwan 2022 and met the top CEOs and managers in MEMS ecosystems (Design, Foundry, Packaging, and Testing) in Taiwan.</p> <p>3. International networking. Prof. Fujita attended NAMIS Marathon Workshop held in NTHU.</p>	

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<p>2. The link between Yushan (Young) Fellows' future research topics and the university's development and the anticipated benefits (including Higher Education SPROUT Project):</p> <p>(1) Fellows' research plan and goals  (2) The link between scholars' research content and the university's development  (3) Specific work performance or achievements, please include the mid-term progress report of the particular research plan  (4) Anticipated goals (including qualitative or quantitative working performance or results)</p> <p>※ If there is a quantitative work achievements, please fill out “Quantitative Assessment Form”</p>	<p>It is expected that Prof. Fujita will bring global impact, in particularly in MEMS/NEMS fields, into iNEMS at NTHU since he is a renowned scholar and pioneer in our MEMS/NEMS community, such as Founder of NAMIS, IEEE JMEMS Senior Editor, the winner of IEEE Robert Bosch Award (highest award in MEMS). With Prof. Fujita's help, iNEMS will be able to closely connect MEMS/NEMS groups in University of Tokyo in Japan, CNRS in France, VTT in Finland, and many others. This helps us to promote the position of Taiwan's MEMS, enhance the international collaboration, strengthen the network and exchange with our global partners. Prof. Fujita will also share his valuable experience and philosophy with our young generations to enable a successful paradigm shift.</p>	<p>With Prof. Fujita's host, we had been successfully running a plenary session of Transducers Conference (more than 900 attendees) where Taiwan Digital Minister, Audrey Tang, served as the plenary speaker. This session was widely recognized as the highlight of the conference.</p> <p>Prof. Fujita also helps us to be appointed as General Chair of 2025 IEEE MEMS Conference in Taiwan (Note: IEEE MEMS Conference is the top flagship international conference in MEMS areas). He even went with us to visit a couple of potential conference venues in Taiwan.</p> <p>Prof. Fujita has conducted several interviews with our faculty members, especially young generation scholars, regarding how to select proper research topics, how to manage a research laboratory, how to get research funding, etc. He also helps supervise our graduate students to design MEMS thermal flow sensors that would be used in NSTC industrial project.</p>	<p>Appendix 1 (quantitative assessment form)</p>
<p>3. Support provided by the university and the project's original goals (please specify the type of support or funds provided by the university to assist in research, such as research equipment and funds, research assistant personnel expenses, accommodation, relocation, children's education assistance, etc.)</p>	<p>The university will provide a fully equipped research room, research starting expenses, living expenses and a roundtrip air ticket.</p>	<p>During the first term, the university already provided a fully equipped research room, research starting expenses, living expenses and a roundtrip air ticket. Full support down to details on administrative issues and everyday life has been perfectly provided.</p>	

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4. Yushan Fellows ' team cooperation (please list team members and cooperation methods) (Yushan Young Fellows don't need to fill in this)	<p>Professor Fujita will form a research team that includes faculty members, young scholars and graduate students which will focus on research topics on MEMS/NEMS.</p> <p>1) Interview Professor Fujita will meet the faculty members of the Institute of NanoEngineering and MicroSystems (iNEMS) individually. He will learn the research topics of each professor, provide advices, and try to find some research topics of common interest which combine the strength of both iNEMS professor and Professor Fujita to form a joint research.</p> <p>2) Joint research Professor Fujita and an iNEMS professor will organize a research team including young researchers and graduate students to conduct the joint research. Regular meetings will be held for project planning, assessing the progress, directing the research, guiding young researchers and graduate students, applying for budget and writing papers.</p>	<p>1) During the first year Prof. Fujita had interviews with five professors: Prof. Yu-Lin Wang on MEMS biosensor Prof. Chih-Chen Chen on micro chemical chip Prof. Chien-Chung Fu on nano 3D printing Prof. Cheng-Yao Lo on flexible electronics Prof. Chao-Ming Cheng on m-RNA panels</p> <p>2) Based on the interview he started two joint projects: 2.1) Integrated sensors for micro chemical synthesis (with Prof. Chihchen Chen) 2.2) Printed flexible MEMS devices for bio-medical applications (with Prof. Cheng-Yao Lo) Please refer to <b>main point of assessment 1</b> for more details.</p>	
5. Yushan (Young) Fellow should aim to cooperate and exchange foreign academic resources, which should be linked to university development. It's suggested to make good use of these global academic network resources to assist the internationalization of the host university and promote international exchanges and cooperation, including teachers and	<p>Promotion of Global Research Network</p> <p>While Prof. Fujita was a full professor with the Institute of Industrial Science, The University of Tokyo, he created NAMIS (Nano and Micro Systems Network) in 2005, a multinational research organization bridging MEMS related universities and research institutes over 11 countries, which has been actively</p>	<p>Professor Fujita attended the NAMIS Marathon Workshop held in NTHU on December 2 to 5, 2022. He also discussed with Prof. Nomura, the vice director of the Institute of Industrial Science, U. of Tokyo, how to further strengthen the tie between iNEMS, NTHU and the Institute.</p>	

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students exchange activity between universities, international research collaborations, dual degree programs and so on.	organizing Workshops and NAMIS School, and promoting joint research and student/researcher exchange. The Institute of NanoEngineering and MicroSystems, National Tsing Hua University is one of the partners in the network. Prof. Fujita will take advantages of NAMIS to enforce ties with international universities and research institutes for collaboration research and student exchange.		

## Quantitative Assessment Form

Item	Results and concrete work performance	Explanation
1. Manpower training	Doctoral courses: _____ Graduate courses: _____ 2 _____ Undergraduate courses: _____ Doctoral students: _____ persons Master's students: _____ 1 _____ persons Undergraduate students: _____ persons Others: _____ persons	1. Forum on nano/microsystem technology 奈微系統技術論壇 2. Micro & Nano Technology (微奈米科技) 3. Master's student: 洪紹揚
2. Papers and research works	Domestic	Journal papers: _____ Academic books and papers in books: _____ Conference papers: _____ Technical reports: _____ Others: _____ 1 (Hirose Award 2022) _____
	Overseas	Journal papers: _____ 3 _____ Academic books and papers in books: _____ Conference papers: _____ 1 _____ Technical reports: _____ Others: _____  Journal papers: <ul style="list-style-type: none"> <li>Hapsianto, Benediktus Nixon; Kojima, Naoshi; Kurita, Ryoji; Yamagata, Hitoshi; Fujita, Hiroyuki; Fujii, Teruo; Kim, Soo Hyeon                "Direct capture and amplification of small fragmented DNAs using nitrogen-mustard-coated microbeads"                Analytical Chemistry May 16, (2022)                doi.org/10.1021/acs.analchem.2c00531</li> <li>Takaaki Sato, Zachary B. Milne, Masahiro Nomura, Naruo Sasaki, Robert W. Carpick, Hiroyuki Fujita</li> </ul>

		<p>“Ultrahigh Strength and Shear-Assisted Separation of Sliding Nanocontacts Studied in situ” Nature Communications, 13, 2551 (2022). DOI: 10.1038/s41467-022-30290-y</p> <ul style="list-style-type: none"> <li>Y. Wu, J. Ordonez-Miranda, L. Jalabert, S. Tachikawa, R. Anufriev, H. Fujita, S. Volz and M. Nomura Observation of heat transport mediated by the propagation distance of surface phonon-polaritons over hundreds micrometers Applied Physics Letters, Vol.121, Issue 11 (2022.9.15) DOI: 10.1063/5.0100506</li> </ul> <p>Conference papers:</p> <ul style="list-style-type: none"> <li>Zheng Shengqi, Daiki Tanaka, Hiroyuki Fujita, Takashiro Akitsu, Tetsushi Sekiiguchi, and Shuichi Shoji, “SELECTIVE CHEMICAL PRODUCTS SEPARATION FROM ORGANIC MICRO DROPLETS USING SURFACTANT FREE SINGLE MICRON DROPLET GENERATION” microTAS 2022, Qianjiang, China</li> </ul>
3. Keynote speaker	<u>2</u> panels /sessions	<ul style="list-style-type: none"> <li>「超高効率データ抽出機能を有する学習型スマートセンシングシステム（LbSS）の研究開発と実証実験成果」 LbSS 成果報告会 (2022) 東京ビッグサイト “Research and Development of Learning-Based Smart Sensing System (LbSS) with Highly-Efficient Data Extraction and its Demonstration Experiments” Seminar on LbSS Final Report (2022), Tokyo Big Sight, Tokyo, Japan (in Japanese)</li> <li>「ミクロの機械を作って役に立てる」東京都市大学総研セミナー (2022) 東京都市大学世田谷キャンパス</li> </ul>



			"Making Microscopic Machines Useful" TCU-ARL Seminar (2022) Setagaya Campus, Tokyo City University (in Japanese)
4. Patents ( including patents pending )	Domestic	Quantity: _____	
	Overseas	Quantity: _____	
	<input type="checkbox"/> N/A		
5. Industry-Academia Cooperation		Number of partnered enterprises : _____	
		Number of industry-academia research projects: _____	
6. Technology licensing		Technology licensing cases: _____	
		Total technology licensing royalties ( amount ) NT\$ _____	
		<input type="checkbox"/> N/A	
7. Others			