工業技術研究院
Industrial Technology
Research Institute

Innovation and creativity

積極創新

百年基石 與時俱進

Establishment and milestones Development and progression

111年年報／簡介

110 ANNUAL REPORT / MMSL OVERVIEW

機械與機電系統研究所

MECHANICAL AND MECHATRONICS SYSTEMS
RESEARCH LABORATORIES, MMSL.

各位公司、學術界先進們，大家好！

歡迎大家打開這本認識機械所的寶典，本人謹以工業技術研究院，機械與機電系統研究所所長的身份，誠摯邀請您了解這一年來機械所的豐碩成果，同時也請給予團隊鼓勵與指教！

機械所持續以智慧化、綠能化、精微化三大組織目標核心與國際接軌。在**智慧製造**領域，著墨於先進綠色製程、智慧工廠、智慧機器人、運動控制核心系統。從產品設計及驗證，零組件及系統設備開發，到產線的節能減碳，均有相關技術開發；在**智慧車輛**領域，也深耕自動駕駛與電動車、無人機技術、以及軌道系統。機械所挾強大的技術背景，與學界、業界、公協會，皆有深度的串連與交流。

去年（111 年）六月，機械所與台灣 21 間大專院校發起全方位「大機械學研合作」，揭開與產學合作的序曲，後續更有多達 11 間大專院校回訪「機械所 Open House 活動」，讓學研關係更為緊密。除了學術界的鏈結，機械所無論是陸空領域、還是創新技術領域，都看得到機械所滿滿的技術能量，如：機器人年度技術發表、機械雲成果展演、亞洲無人機研發中心揭牌、桃園機場自駕車員工接駁車運行、35 噸自駕大卡車至澳洲高速公路實際驗證執行等，未來也很歡迎各界的朋友有機會多來機械所走訪，透過跨界合作的方式，加速機械領域的前瞻研究開發。

而目前全球熱議的淨零碳排主題，機械所也獨立研發出「粉塵終結器」技術，該技術榮獲美國 R & D100 入圍之榮譽成就，協助半導體、光電、燃煤產業捕集尾氣 PM2.5 粉塵達 95% 以上，更能提供一套完整的解決方案，給家庭、個人全方位的空氣清淨照護服務。

另針對製造產業的淨零碳排方案，機械所也協助業者提供幾項可立即減碳的技術，如：透過綠能所開發之**永續碳管理平台**：目前已累積 21 類產業資料庫，能快速找出碳排瓶頸點進而改善之；**IE4+工業用高效率馬達**：工業部門用電中，工業馬達驅動系統用電量約佔 70 %，機械所研發出利用轉子多層的磁極設計，藉由同步運轉，產生磁阻凸極效應，使整體轉矩增大、提升效率，相較同等級磁阻馬達可減少 10% 以上損耗；**電動車充電軟硬整合解決方案**：以非均流專利技術調控充電站裡各個充電樁的配電量，避免充電器和電池系統的損壞，目前起而行綠能、和泰集團、士林電機也攜手成立新創公司「充壩」以強化臺灣充電產業發展；**電動車用動力系統解決方案**：採用寬域高效率及最大定功率轉速域延伸控制，相容於車輛功能安全 ISO26262 設計，也使得車輛的續航力與安全性優於競爭品牌，並可通用於永磁與感應電機。

機械所期許自己要當機械產業的領頭羊，能與您攜手一起解決產業痛點，這本寶典提供當前機械所的研發成果及解決方案，期待您的閱讀以及未來我們一起合作的機會！

Greetings to all distinguished leaders of industry and academia!

Welcome to this guidebook of Mechanical and Mechatronics Systems Research Labs (MMSL). As General director of MMSL at Industrial Technology Research Institute (ITRI), I sincerely invite you to explore this guidebook about our fruitful achievements over the past year, and welcome you to share your encouragement and advice to our team.

Our institute continuously strives to align with international standards while focusing on three core technologies: intelligent transformation, green energy optimization, and precise digitalization in manufacturing. In the field of intelligent manufacturing, we concentrate on advanced green processes, smart factories, intelligent robotics, and motion control systems. We develop relevant technologies ranging from product design and verification, component and system equipment development, to energy-saving and carbon-reducing production lines. In the field of intelligent mobility, the emphasis is on technologies such as autonomous driving and electric vehicles, unmanned aerial vehicles, and railway systems. MMSL has a strong technical background and deep network connections and collaborations with academia, industry, and complementing associations and institutions.

In collaboration with 21 major universities in Taiwan, MMSL initiated the comprehensive "Machinery Research and Education Platform" last June (2022), marking the beginning of the cooperation between industry and academia. Additionally, up to 11 universities visited the "MMSL Open House Event", which further helped to strengthen the relationship between academia and industry. Besides academic connections, MMSL has also demonstrated its technical prowess in land and air as well as innovative technologies in various publications, events and activities, including the annual publication of robotics technologies, the “iMachinery Cloud” achievements event, the inauguration of the Asia UAV AI Innovation Application R&D Center, the launch of the self-driving employee shuttle bus at Taoyuan International Airport and the field verification of the 35-ton self-driving truck on Australia’s Melbourne M1 freeway. MMSL welcomes visitors from various fields to accelerate innovative research and development through cross-disciplinary collaborations.

Furthermore, in response to the increasing global concerns on achieving net-zero carbon emissions, MMSL has independently developed the "Industrial Particulate Matter Terminator" technology, which has been nominated for the US R&D100 award for its ability to capture PM2.5 particulate matter up to 95% from semiconductor, optoelectronic, and coal industries, while also providing a complete solution for household and personal air purification services.

To achieve net-zero carbon emissions in the manufacturing industry, MMSL has provided several immediate carbon reduction technologies to assist industry players. These include the Sustainable Carbon Management Platform developed by the Green Energy and Environment Research Labs (GEL), which currently has accumulated a database of 21 industrial fields and can quickly identify carbon bottleneck points for improvement. MMSL has also developed the IE4+ high efficiency motor for industrial use, which accounts for about 70% of the electricity consumption in the industrial sector. By using a multi-layer rotor pole design that generates magnetic reluctance torque through synchronous operation, the motor can increase overall torque and efficiency, and reduce energy loss by over 10% compared to similar motors. Additionally, MMSL’s spinoff company, eTreego, along with Hotai Group and Shihlin Electric have established startup Gochabar to enhance Taiwan's charging industry development by integrating a software and hardware charging solution for electric vehicles. The solution is based on a patented non-uniform electric power distribution technology which regulates the distribution of power among various charging equipment in charging stations. This helps to avoid damage to the charging equipment and battery systems. MMSL’s power system solution for electric vehicles adopts a wide-range of high efficiency and maximum power constant speed control, which is compatible with ISO26262 functional safety design, improving the vehicle's driving range and safety performance compared to other competing brands. This solution is also applicable to both permanent magnet and induction motors.

MMSL aspires to lead the mechanical industry and work with industry partners to upgrade their equipment and to realize their products. This guidebook presents MMSL's current research and development achievements, and we look forward to the opportunity to work together in the future!

工業技術研究院機械與機電系統研究所 所長

Da-Jeng Yao

Operation Philosophy
經營理念

百年基石 Establishment And Milestones

機械所經營智慧化、綠能化、精微化核心技術多年，舉凡智慧機器人與自動化、薄膜設計與製造、智慧機電及先進車輛等能量均具備相當水準，我們以此奠基持續深化。

Mechanical and Mechatronics Systems Research Laboratories(MMSL) has invested effort over many years into achieving intelligent, eco-friendly, and micro-precision core technologies. From intelligent robot and automation systems, the design and manufacturing of thin films, to intelligent mechatronics and advanced vehicles, all of the technologies applied have reached a commendable level of sophistication, based upon which MMSL will continue to move forward.

與時俱進 Development And Progression

以創新前瞻技術與國際接軌，在技術上精進突破，在國際舞台深獲肯定並持續創造出多元技術及產品。

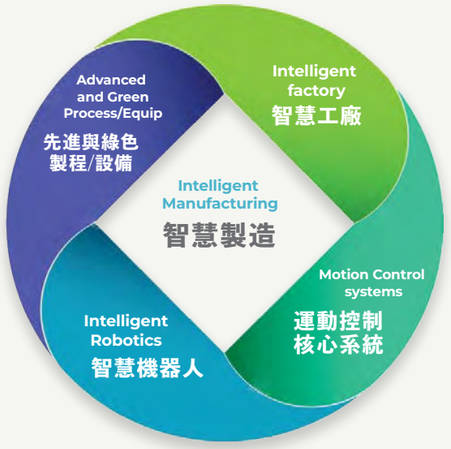
MMSL links up with the world by innovative and advanced technologies. Our technical breakthroughs have been highly recognized in the international arena, and help to create a wider variety of technologies and products.

積極創新 Innovation And Creativity

我們掌握技術平台核心、以前瞻計畫持續拔尖，透過產業、學界、國合等方式，來發展創新前瞻技術，鼓勵同仁創新創業，將機械精神開枝散葉。

MMSL masters technology platforms, and takes the lead in related industries with projects based on foresight. Through cooperation among industry, academia and international communities, we have developed innovative and advanced technologies, and encourage our staff to establish innovation-oriented startups, thereby promoting the spirit of mechanics.

Core Tech
組織定位



111 年大事紀 History

02.22
打造智慧化動力組件—減速機
智慧化動力組件—減速機如虎添翼，助廠商提高附加價值

03.26
高負重農業用無人機首度亮相
工研院機械所開始推動農工跨域合作，首度展示「長時間高負載無人機物流」

04.08
饒達仁博士升任機械所所長
胡竹生協理免兼機械所所長，所長職務由饒達仁博士擔任

04.20
自主研發整車線傳控制器
自主研發的整車現傳控制器，推動國產整車控制器產業落地

05.19
全臺第一座轉向架走行測試設備(BRT)
工研院機械所與台灣高鐵合作開發出全臺第一座轉向架走行測試設備

06.21
「大機械學研合作」平台
工研院機械所與17所大專院校共同宣布成立「大機械學研合作」平台

08.03
研發電動巴士車道維持輔助系統
工研院機械所攜創奕能源合作智慧運輸，推出電動巴士車道維持輔助系統

08.26
「自主移動機器人聯盟」
「自主移動機器人聯盟」發布首份移動機器人安全標準

09.27
推動智慧機械雲平台
工研院機械所推動智慧機械雲平台，助塑橡膠產業轉型搶國際大單

10.25
開發「碳化矽動力馬達驅控器」
工研院機械所與康舒科技合作，開發下一代電動車關鍵動力系統「碳化矽動力馬達驅控器」

10.31
打造「人機協作自主移動機器人」
工研院機械所與軟板廠嘉聯益、臺灣科技大學三方合作，共同打造「人機協作自主移動機器人」

11.08
自駕車用高精地圖快速製圖策略研究案成果展示會
工研院機械所自主開發技術，舉行自駕車用高精地圖快速製圖策略研究案成果展示會

12.13
簽署智慧機械雲合作意向書
工研院攜手法國達梭推智慧機械雲，接軌國際並與中華電信合作，搶攻新南向市場商機

Honor

111年 榮耀

整合型智慧關節模組

榮獲工研院111年「傑出研究獎」銅牌獎

先進半導體薄膜設備智慧製程系統

榮獲工研院111年「傑出研究獎」金牌獎

05.30

推動智慧移載機器人產業升級與生態系建構

榮獲工研院111年「產業化貢獻獎」銀牌獎

微通道反應器技術應用於高價值醫藥與特化產品生產

榮獲工研院111年「產業化貢獻獎」銀牌獎

07.05

10.30

粉塵終結器

榮獲2022 R&D100 Finalist

International Awards: RD100, CES, Drone X Challenge2020

歷年國際獎項

2021
- Software-defined Augmented Robot Joint (SARJ)
- Dual Arm Robot System (DARS)

2020
- UAV

2019
- UAV

2017
- CINmat Microwave Annealing Technology
- CyberEpi

2016
- Exoskeleton robot

2015
- Tactile-film System for Wearable Orthosis

2013
- FluxMerge™ motor

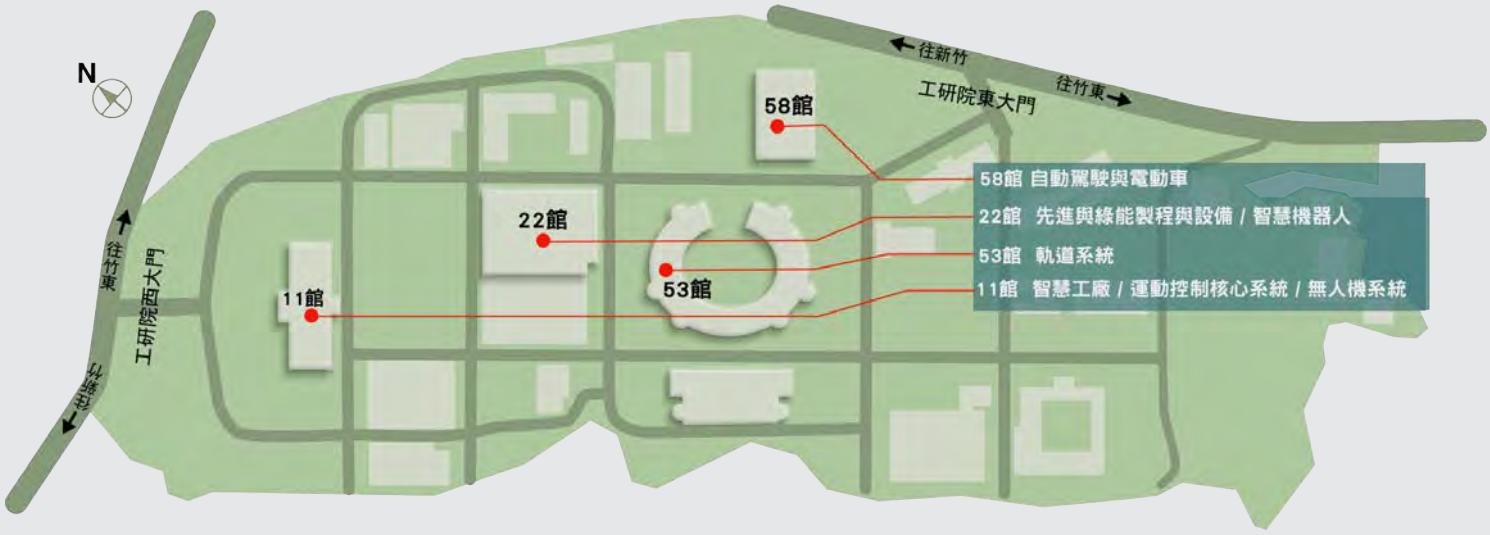
2012
- aePLASMA

Startups

新創公司

- 111 科飛數位股份有限公司 [整車控制平台]
  Kopherbit Co., Ltd. [Drive-by-Wire Vehicle Platform]
- 110 智連工控 [SECS/GEM 通訊協定 / 介面]
  Adirtek Co., Ltd. [SECC/GEM Solution]
- 108 盟英科技 [諧波減速機]
  Main Drive Co., Ltd. [Harmonic Reducer]
- 107 安埔創新科技 [MOCVD 磊晶關鍵模組★ 2017 R&D100]
  NEW UP INNOVATION TECHNOLOGY Co., Ltd. [The Epitaxy Optimum Coupling System]
- 107 原見精機 [安全觸覺機器人★ 2015 R&D100]
  TOUCHÉ SOLUTIONS [Higher Sensitivity Tactile-film System for Wearable Orthosis]
- 107 起而行綠能 [互動式充電管理系統]
  eTreego Co., Ltd. [Interactive Charging Management System and Method Thereof]
- 107 漢朋科技 [流體機械能源服務]
  HEN PENG TECHNOLOGY Co., Ltd. [The Construction Technology of Fan Energy Test System]
- 106 黑木 [全加成印刷電子產品]
  KUROKI INDUSTRIAL Co., Ltd [Additive Process for Printing Circuit]
- 106 福寶科技 [外骨骼行動輔助機器人★ 2016 R&D100]
  FREE BIONICS TAIWAN INC. [Wearable Walking Assistive Exoskeleton Robot]
- 105 創星淨聯科技 [PM2.5 可攜式空氣清淨機]
  Purus tek. Co., Ltd. [Portable Air Purifier]

Location
位置資訊



MMSL Youtube

聯絡窗口

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