

JUNE 2025

# CAIRS NEWSLETTER



ISSUE 13

## CAiRS at Five:

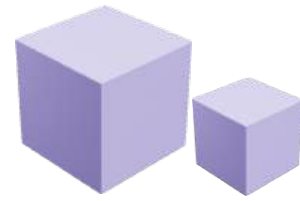
Pioneering Reliability, Powering Innovation



產品可靠性暨系統安全研發中心  
CENTRE FOR ADVANCES IN RELIABILITY AND SAFETY

$\pi$  創新科技署  
Innovation and Technology Commission





# Introduction



The Centre for Advances in Reliability and Safety (CAiRS) is a collaborative initiative between the Hong Kong Polytechnic University (PolyU) and the University of Maryland (UMD), College Park, Maryland, USA. As a research center admitted under the AIR@InnoHK Cluster of the Innovation and Technology Commission of the HKSAR government, we boast world-renowned expertise in artificial intelligence methodologies, industry-based cluster data, and reliability and safety modeling and algorithms.

Over the past five years, CAiRS has evolved from a visionary concept into a leading institution dedicated to advancing reliability and safety through cutting-edge research, innovation, and collaboration. We have produced over 100 high-impact scientific publications, secured 23 granted patents, and filed 15 more. Since our inception, CAiRS has been at the forefront of pioneering research and development initiatives aimed at enhancing the reliability and safety of critical systems across various industries. Our multidisciplinary approach enables us to tackle complex challenges and deliver practical solutions that have a tangible impact on society. Our work spans numerous sectors, including aerospace, automotive, healthcare, and energy, driving progress and fostering a culture of safety and reliability.

One of our most notable achievements was our participation in the International Exhibition of Inventions Geneva 2024. For the first time, CAiRS showcased its innovations on this prestigious international stage and achieved remarkable success, earning 12 awards, including three gold medals and the Prize of the International Federation of Inventors' Association (IFIA). This accomplishment underscores our team's dedication to advancing reliability and safety through innovative technologies and highlights our impact on the global scientific community.

In addition to our success in Geneva, we have made significant strides in expanding our research capabilities and fostering international collaborations. Our partnerships with leading institutions worldwide have enriched our research endeavors and opened new avenues for cross-disciplinary exploration. These collaborations have not only enhanced our scientific knowledge but also provided valuable opportunities for our researchers and students to engage with global experts and contribute to groundbreaking projects.

可靠性與安全性進步中心（CAiRS）是香港理工大學（PolyU）與美國馬里蘭大學（UMD）合作的項目。作為香港特別行政區政府創新科技署AIR@InnoHK集群下的研究中心，我們擁有世界知名的人工智能方法論、行業數據集群以及可靠性和安全性建模與算法的專業知識。

可靠性暨系統安全研發中心，CAiRS從一個富有遠見的概念轉變為一個領先的機構，致力於通過尖端研究、創新和合作來推動可靠性和安全性的進步。我們已經發表了超過100篇高影響力的科學論文，獲得了23項授權專利，並申請了另外15項專利。自成立以來，CAiRS一直處於開創性研究和開發計劃的前沿，旨在提高各行業關鍵系統的可靠性和安全性。我們的多學科方法使我們能夠應對複雜的挑戰，並提供對社會產生實際影響的解決方案。我們的工作涵蓋了航空航天、汽車、醫療保健和能源等多個領域，推動了進步並促進了安全和可靠性的文化。

我們最顯著的成就之一是參加了2024年日內瓦國際發明展。CAiRS首次在這個享有盛譽的國際舞台上展示了其創新成果，並取得了顯著成功，獲得了12個獎項，包括3枚金牌和國際發明家協會（IFIA）獎。這一成就突顯了我們團隊通過創新技術推動可靠性和安全性的奉獻精神，並強調了我們對全球科學界的影響。

除了在日內瓦的成功之外，我們在擴展研究能力和促進國際合作方面也取得了重大進展。我們與世界各地領先機構的合作豐富了我們的研究工作，並開闢了跨學科探索的新途徑。這些合作不僅增強了我們的科學知識，還為我們的研究人員和學生提供了與全球專家交流並參與開創性項目的寶貴機會。

# CAiRS – Facts and Figures Revisited 重看CAiRS的數據

Currently, this is where we are,

**104**

Top Tier Journals  
頂尖期刊

**8**

Public Seminars  
公開研討會

**4**

Magazines  
雜誌

**38**

Patents  
專利

**6**

Webinars  
網路研討會

**13**

Newsletter  
通訊

**17**

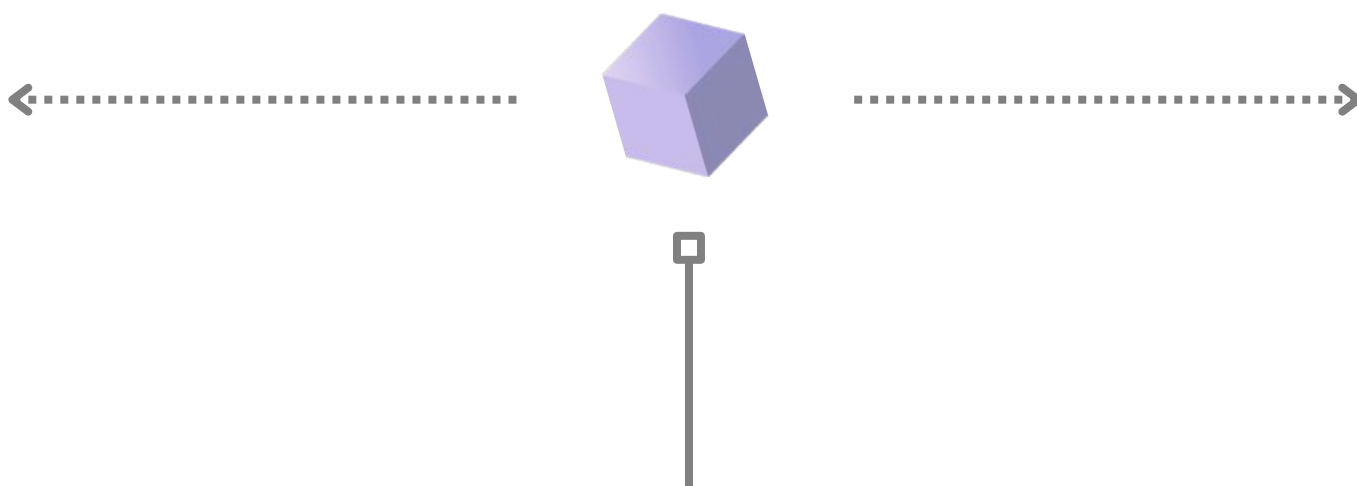
Awards  
獎項

**38**

Online Lectures  
線上講座

**7**

Videos  
影片





# CAiRS Solution

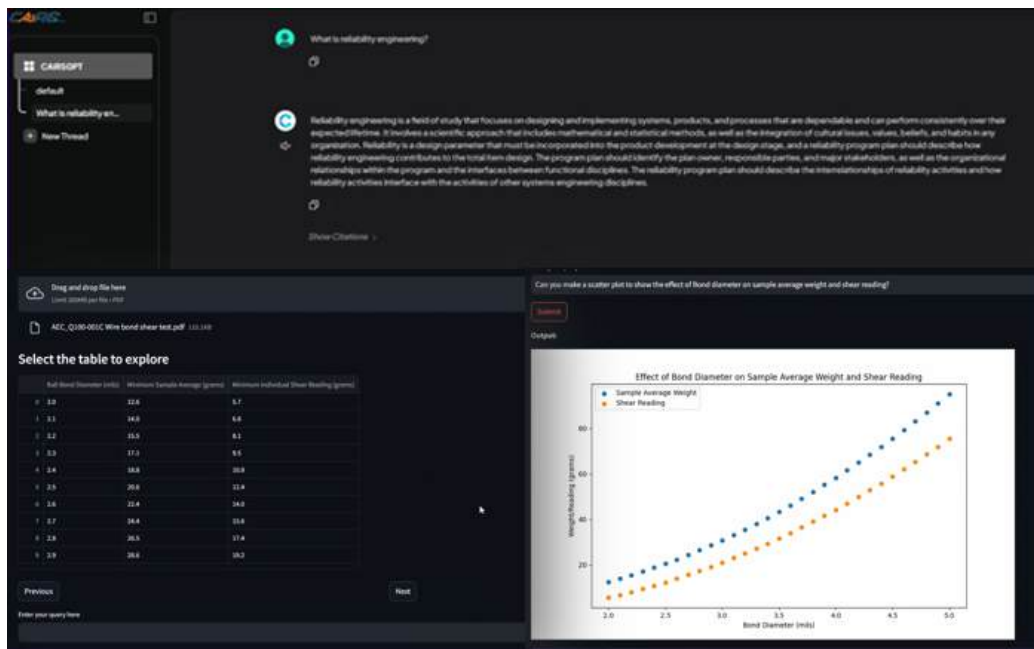


2025

# NEW

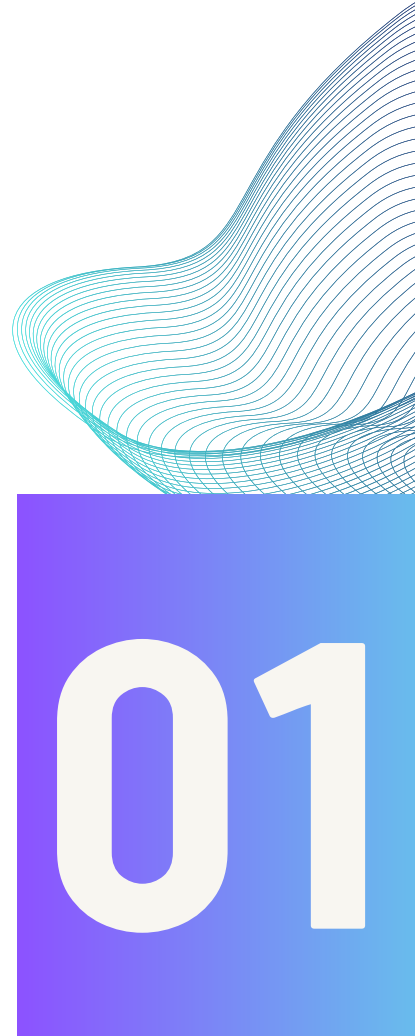






# CAiRSGPT

## AI-Powered Engineering Reliability Assistant 人工智慧工程可靠性助手



In the fast-paced engineering sector, ensuring system reliability and safety is crucial. Many companies, especially in Hong Kong, struggle with a lack of expertise in reliability engineering. To bridge this gap, CAiRSGPT was developed. This advanced chatbot leverages large language models to help engineers by retrieving technical documents, providing insights, and performing complex tasks.

### 1. Enhanced Efficiency

Engineers can save time by quickly retrieving and analyzing technical documents, allowing them to focus on design and innovation.

### 2. Improved Reliability

With expert recommendations and insights, engineers can design more reliable and robust systems.

### 3. Cost Savings

By preventing design flaws and reducing the need for extensive testing, CAiRSGPT can help companies save on development costs.

### 4. Increased Safety

Ensuring the reliability of systems directly contributes to their safety, protecting both users and infrastructure.

CAiRSGPT represents a significant advancement in the field of reliability engineering. By leveraging large language models and retrieval-augmented generation, it provides engineers with the tools and information they need to design reliable and safe systems. As companies in Hong Kong and beyond continue to face challenges in this area, CAiRSGPT stands ready to assist, ensuring that reliability and safety are never compromised.

在快節奏的工程領域，確保系統的可靠性和安全性至關重要。許多公司，尤其是香港的公司，都面臨缺乏可靠性工程專業知識的問題。為了彌補這一差距，我們開發了 CAiRSGPT。這個先進的聊天機器人利用大型語言模型來幫助工程師檢索技術文件、提供見解和執行複雜的任務。

### 1. 提高效率

工程師可以透過快速檢索和分析技術文件來節省時間，從而專注於設計和創新。

### 2. 提高可靠性

透過專家的建議和見解，工程師可以設計出更可靠、更強大的系統。

### 3. 節省成本

透過防止設計缺陷並減少大量測試的需要，CAiRSGPT 可以幫助公司節省開發成本。

### 4. 提高安全性

確保系統的可靠性直接有助於系統的安全性，保護使用者和基礎設施。

CAiRSGPT 代表了可靠度工程領域的重大進步。透過利用大型語言模型和檢索增強生成，它為工程師提供了設計可靠和安全系統所需的工具和資訊。隨著香港及其他地區的公司繼續面臨這一領域的挑戰，CAiRSGPT 隨時準備提供協助，確保可靠性和安全性不受影響。



# 02

# ClearParkVision

Revolutionizing Car Park Management with AI-Powered Technology

利用人工智慧技術徹底改變停車場管理

In the dynamic world of car park management, ClearParkVision emerges as a cutting-edge AI-powered solution designed to transform operations. Equipped with advanced license plate recognition technology, ClearParkVision seamlessly captures and processes vehicle license plate numbers at entry and exit points, ensuring accurate gate operations for a smooth and efficient user experience.

## Seamless Access Control

- Advanced license plate recognition enables instant, accurate gate operations
- Reduces congestion with smooth entry/exit processing

## 1. Intelligent Monitoring

- AI detects vehicle presence without expensive loop detectors
- Proactively identifies system issues (camera obstructions, alignment shifts)

## 2. Operational Excellence

- Boosts efficiency and security while lowering infrastructure costs
- Minimizes maintenance needs and maximizes uptime

## 3. Dual Benefits

- Operators: Cost savings + streamlined management
- Users: Hassle-free parking experience

Setting new standards in parking tech, ClearParkVision delivers unmatched reliability, efficiency, and security through AI innovation.

在動態的停車場管理世界中，ClearParkVision 作為旨在改變運作方式的尖端人工智慧解決方案應運而生。ClearParkVision 配備先進的車牌識別技術，可無縫捕捉和處理入口和出口處車輛牌照號碼，確保準確的門禁操作，為用戶帶來順暢高效的體驗。

## 無縫存取控制

- 先進的車牌辨識技術可實現即時、準確的門禁操作
- 透過順暢的進出處理減少擁堵

## 1. 智慧監控

- 人工智慧無需昂貴的環路偵測器即可偵測車輛存在
- 主動辨識系統問題（如攝影機被遮蔽、對準偏移等等）

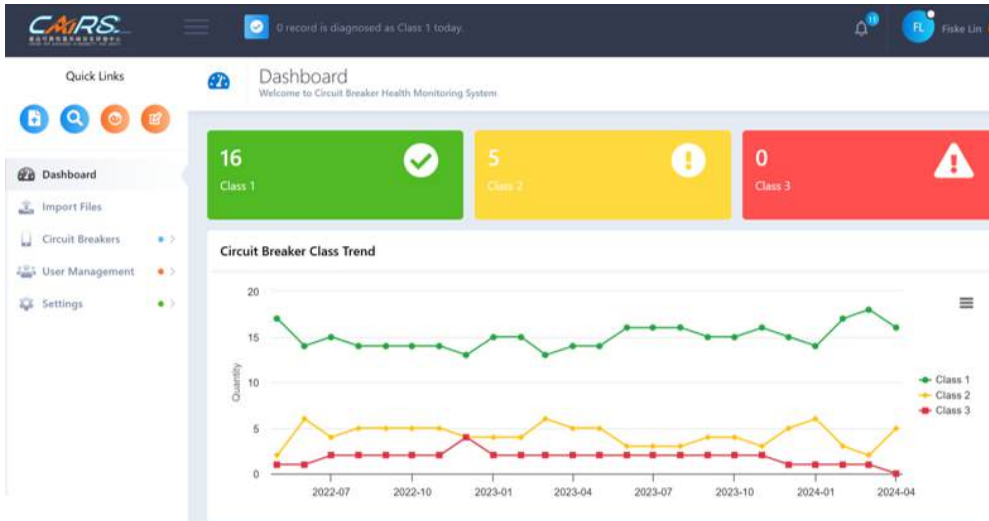
## 2. 卓越營運

- 提升車流進出效率和安全性，同時降低基礎設施成本
- 大幅減少維護需求，使停車場能長期保持最佳營運狀態

## 3. 雙重福利

- 營運商：節省成本+精簡管理
- 使用者：無憂的停車體驗

ClearParkVision 在停車技術方面樹立了新的標準，透過人工智慧創新提供無與倫比的可靠性、效率和安全性。



# CBGuardAI

Automatic circuit breaker  
health monitoring system  
自動斷路器健康監測系統

Circuit breakers play a vital role in safeguarding electrical systems from faults like overcurrents, overloads, and short circuits. However, traditional manual inspections are often inefficient and unreliable. To overcome these limitations, our innovative solution combines physics-based failure analysis, AI, and advanced signal processing to significantly improve circuit breaker maintenance and reliability.

## 1. Improved Accuracy

By analyzing trip coil waveform signals, we can detect degradation trends with greater accuracy, reducing the risk of unexpected failures.

## 2. Proactive Maintenance

This approach enables proactive maintenance, addressing potential issues before they lead to failures.

## 3. Cost Savings

Our method outperforms existing maintenance practices by over 10%, resulting in substantial cost savings.

## 4. Efficient Resource Utilization

By targeting maintenance efforts based on accurate diagnostics, we can optimize the use of manpower and resources.

The development of the online circuit breaker diagnostic tool marks a significant advancement in the field of electrical system maintenance. By integrating the physics of failure, AI, and signal processing, we have created a robust and efficient method for predicting the health of circuit breakers and planning maintenance proactively. This innovative approach not only enhances the reliability and safety of electrical systems but also offers considerable cost savings and resource efficiency. As we continue to refine and expand this technology, the future of circuit breaker maintenance looks brighter and more reliable than ever.

斷路器在保護電氣系統免受過流、過載和短路等故障的影響方面發揮著至關重要的作用。然而，傳統的人工檢查通常效率低且不可靠。為了克服這些限制，我們的創新解決方案結合了基於物理的故障分析、人工智慧和先進的訊號處理，顯著提高了斷路器的維護和可靠性。

## 1. 提高準確性

透過分析跳脫線圈波形訊號，我們可以更準確地檢測退化趨勢，從而降低意外故障的風險。

## 2. 主動維護

這種方法可以實現主動維護，在潛在問題導致故障之前將其解決。

## 3. 節省成本

我們的方法比現有的維護方法高出 10% 以上，從而節省了大量成本。

## 4. 高效率資源利用

透過根據準確的診斷確定維護工作目標，我們可以優化人力和資源的使用。

線上斷路器診斷工具的發展標誌著電氣系統維護領域的重大進步。透過整合故障物理學、人工智慧和訊號處理，我們創建了一種強大而有效的方法來預測斷路器的健康狀況並主動規劃維護。這種創新方法不僅提高了電氣系統的可靠性和安全性，而且還節省了大量成本並提高了資源效率。隨著我們不斷改進和擴展這項技術，斷路器維護的未來看起來比以往任何時候都更加光明和可靠。

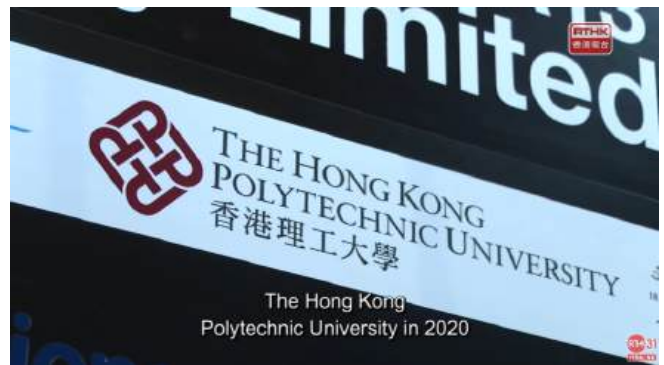


# InnoEX

## 香港國際創科展 2025

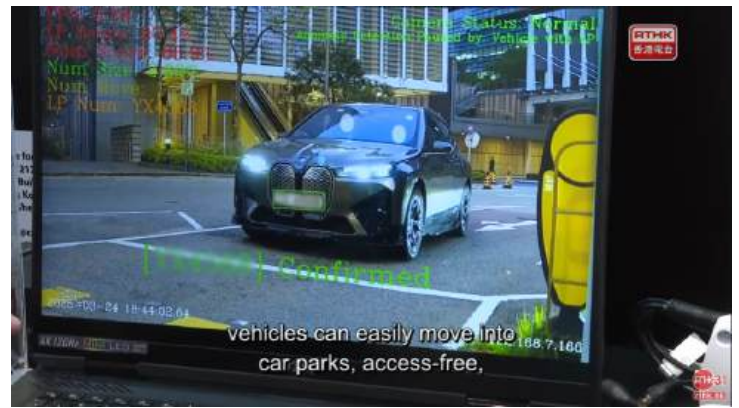
From April 13–16, the Centre for Advances in Reliability and Safety (CAiRS) proudly showcased its latest innovations at InnoEX 2025, highlighting how cutting-edge technologies are shaping the future of smart, safe, and sustainable cities.

從2025年4月13日至16日，可靠性與安全性進步中心（CAiRS）在InnoEX 2025上自豪地展示了其最新的創新成果，突顯了尖端技術如何塑造智慧、安全和可持續城市的未來。





# CAiRS Activities



In a world where urban infrastructure depends on interconnected systems, CAiRS is leading the way with groundbreaking solutions that ensure reliability, efficiency, and safety:

- CAiRSGPT:** An AI-powered chatbot offering expert guidance in reliability engineering and system safety, helping engineers make informed decisions faster.

- CBGuardAI:** Predictive maintenance for circuit breakers using AI and failure physics, ensuring uninterrupted power supply and reducing operational costs.

- ClearParkVision:** Smart parking made seamless with automated license plate recognition and anomaly detection, improving traffic flow and user experience. ClearParkVision was invited to the InnoEX 2025 - Exhibitor Showcase at the Press Conference on April 8, 2025, under the category of smart mobility. It was also featured in the RTHK programme, Vibrant Hong Kong: Episode 88.

- MotorGuard:** Real-time motor anomaly detection and diagnostics for critical infrastructure like public transport, water treatment, and energy grids. Say goodbye to unexpected downtime!

- WireInspect:** A revolutionary non-destructive inspection system for steel wire ropes, enhancing the safety of elevators, bridges, and cable-driven transit systems.

These innovations are more than just tools—they are the backbone of resilient and intelligent urban ecosystems, supporting the integration of AI, IoT, and advanced analytics into city infrastructure. Together, we're building cities that are not only smarter but also safer, more sustainable, and future-ready.

在這個城市基礎設施依賴於互聯系統的世界中，CAiRS正以突破性的解決方案引領潮流，確保可靠性、效率和安全性：

**CAiRSGPT：**一個由人工智能驅動的聊天機器人，提供可靠性工程和系統安全方面的專家指導，幫助工程師更快地做出明智決策。

**CBGuardAI：**使用人工智能和故障物理學進行斷路器的預測性維護，確保不間斷的電力供應並降低運營成本。

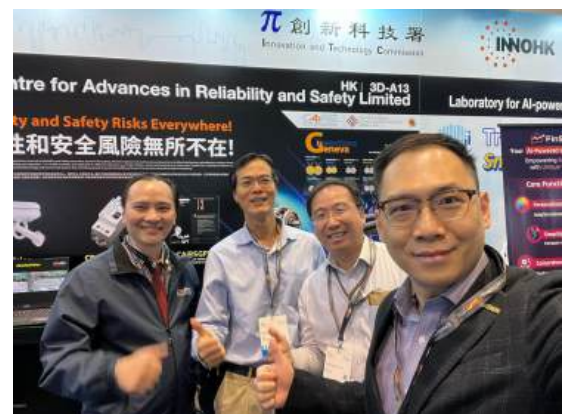
**ClearParkVision：**通過自動車牌識別和異常檢測實現無縫智慧停車，改善交通流量和用戶體驗。ClearParkVision受邀參加2025年4月8日的InnoEX 2025展商展示會新聞發布會，並在RTHK節目《活力香港》第88集中亮相。

**MotorGuard：**對公共交通、水處理和能源網絡等關鍵基礎設施進行實時電機異常檢測和診斷，告別意外停機！

**WireInspect：**一個革命性的鋼絲繩無損檢測系統，提高電梯、橋樑和纜索驅動交通系統的安全性。

這些創新不僅僅是工具——它們是彈性和智能城市生態系統的支柱，支持人工智能、物聯網和先進分析技術在城市基礎設施中的整合。我們共同建設的不僅是更智慧的城市，還是更安全、更可持續和面向未來的城市。

## InnoEX 2025 香港國際創科展





## BOAO Forum for Asia 2025 – Hong Kong Conference

We are proud to share that our Deputy Chief Operating Officer, Mr. Spencer Ling, attended the International Science, Technology and Innovation Forum of the BOAO Forum for Asia 2025, held in Hong Kong from 6 to 7 June 2025.

This year's theme, "Transitioning Towards The Future: Powered by Science, Technology and Innovation," brought together global leaders and innovators to explore how science and technology are shaping a smarter, more sustainable future.

As part of the event, the Centre for Advances in Reliability and Safety (CAiRS) proudly showcased a poster presentation highlighting our latest research and innovations in reliability engineering and safety technologies. It was a great opportunity to share our work with a global audience and connect with fellow experts in the field.

We remain committed to advancing science and technology for a better tomorrow.





## 博鰲亞洲論壇國際科技與創新論壇2025年香港會議 INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION FORUM OF BOAO FORUM FOR ASIA 2025 HONG KONG CONFERENCE

科技引領未來 創新驅動轉型  
TRANSITIONING TOWARDS THE FUTURE:  
POWERED BY SCIENCE, TECHNOLOGY AND INNOVATION

06-07.06.2025



## 博鰲亞洲論壇 2025 國際科技與創新論壇 -香港會議

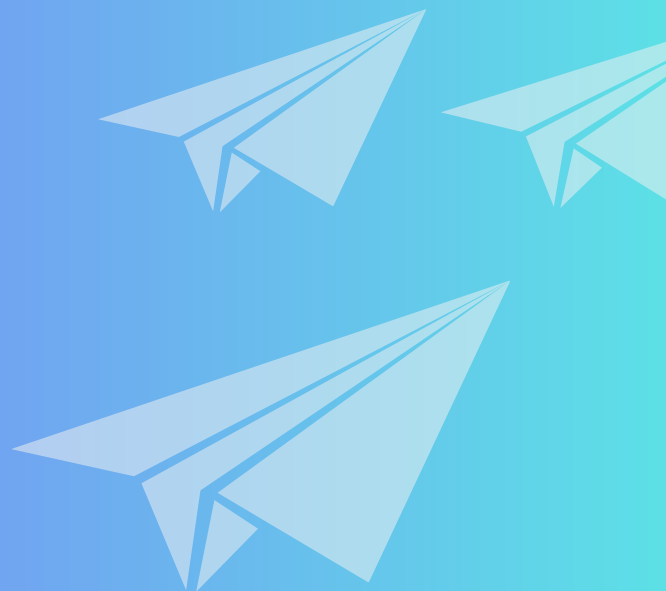
很高興與大家分享，我們的副營運長 Spencer Ling 先生出席了於 2025 年 6 月 6 至 7 日在香港舉行的 博鰲亞洲論壇 2025 國際科技與創新論壇。

本屆論壇以「邁向未來的轉型：以科技與創新為動力」為主題，匯聚了來自全球的領袖與創新者，共同探討科技如何推動更智慧、更可持續的未來。

作為論壇的一份子，產品可靠性暨系統安全研發中心（CAiRS）在論壇上介紹在可靠性工程與安全技術方面的最新研究成果。這是一次難得的機會，讓我們向國際社群展示我們的創新工作，並與業界專家交流互動。

我們將持續致力於推動科技創新，為未來創造更多可能。





產品可靠性暨系統安全研發中心  
CENTRE FOR ADVANCES IN RELIABILITY AND SAFETY



[WWW.CAIRS.HK](http://WWW.CAIRS.HK)



[INFO@CAIRS.HK](mailto:INFO@CAIRS.HK)