IEEE Conference on Industrial Cyber-Physical Systems (ICPS)

Perth, Australia, 11-14 May 2026

https://icps2026.ieee-ies.org/

Proposal for an ICPS 2026 Special Session

- **Title of the proposed Special Session:**

Artificial Intelligence in Industrial Cyber-Physical Systems: Methods, Challenges, and Applications in Network Control, Digital Twins, and Data-Driven Optimization

- **Names, photos, very short bios, and emails of the organizers:**

*Organizer 1: Prof. Herbert Ho Ching Iu (*herbert.iu@uwa.edu.au*, Google scholar)*

Herbert Ho Ching Iu (*Fellow, IEEE*) received the B.Eng. (Hons.) degree in electrical and electronic engineering from the University of Hong Kong, Hong Kong, in 1997, and the Ph.D. degree in electrical engineering from The Hong Kong Polytechnic University, Hong Kong, in 2000.
Currently, he is a Professor with The University of Western Australia, Perth, Australia. His research interests include power electronics, renewable energy, smart grids, nonlinear dynamics, and memristive systems.

Organizer 2: Dr. Tianhao Qie (stewaqie@cityu.edu.hk, *Google scholar)*

Tianhao Qie (*Member, IEEE*) received the B.E. degree in automation from Southwest University, China, in 2020, and the M.E. degree and the Ph.D. degree in electrical and electronic engineering from The University of Western Australia, Australia, in 2021 and 2025, respectively. He joined the City University of Hong Kong as a Postdoctoral Fellow in 2025. His research interests are advanced control algorithms, power electronics converters, battery energy storage system and microgrids.

- **Technical outline and topics of the special session:**

Outline (up to 100 words):
Industrial Cyber-Physical Systems (ICPS) are evolving into highly interconnected, autonomous, and data-intensive infrastructures that integrate physical processes, distributed communication networks, and intelligent computational layers. Artificial intelligence (AI) plays a central role in enabling this evolution by enhancing perception, prediction, control, optimization, and resilience. However, the application of AI in real industrial settings raises significant challenges related to safety, reliability, explainability, interoperability, and computational constraints.

This Special Session aims to gather researchers and practitioners to discuss recent advances, open problems, and emerging opportunities in applying AI techniques to ICPS, with a particular focus on networked control, digital twin technologies, and data-driven industrial intelligence. The session encourages contributions at the intersection of theory, algorithms, hardware implementation, and real industrial applications.
Topics:

- AI-Enabled Networked Control for Industrial Cyber-Physical Systems
- Digital-Twin Intelligence for Cyber-Physical Industrial and Energy Systems

- Data-Driven Monitoring, Diagnosis, and Optimization for Industrial and Transportation Systems
- AI Safety, Explainability, and Standardization in Industrial Cyber-Physical Systems
- Industrial Applications and Emerging Case Studies of AI-Integrated ICPS
- Trustworthy Machine Learning and Graph Neural Networks for Industrial Intelligence
- Stability, Resilience, and Recovery Strategies in Networked Control Systems
- Cooperative and Consensus Control for Multi-Agent Industrial Systems

- **Technical track(s) with similar topics (clearly point out difference to the Track scope)**

The proposed Special Session introduces an integrated perspective on AI-driven network control, digital-twin intelligence, and data-driven optimization within cyber-physical loops. Although related to several ICPS tracks, the session provides a unique and non-overlapping focus by emphasizing AI algorithms, learning-enabled resilience, and physics-aligned intelligence rather than general architectures, data frameworks, or broad AI technologies.

1. Difference from T02 – ICPS Theory and Technologies

T02 focuses on foundational ICPS technologies: communication networks, OT/IT integration, security, and edge/fog/cloud connectivity. T02 explains the enabling technologies; our SS explains how AI can intelligently exploit them to enhance ICPS performance.

This SS studies **AI methods that operate on top of these infrastructures** to

- stabilize networked control loops,
- recover system states under disturbances,
- achieve cooperative behaviors, and
- enhance resilience under network uncertainty.

2. Difference from T03 – ICPS and Data Science

T03 addresses industrial data science foundations: semantics, ontologies, metadata, data management, and synthetic data. T03 provides data foundations; our SS provides AI-driven industrial intelligence built upon those foundations.

Our SS examines how **AI learns from data** to improve:

- diagnosis,
- optimization,
- predictive modeling,
- digital-twin synchronization, and
- real-time industrial decision-making.

3. Difference from T09 – Artificial Intelligence in ICPS

T09 surveys broad AI technologies relevant to ICPS: foundation models, deep learning, generative AI, neuromorphic computing, and AI platforms. T09 advances AI as a technology; our SS investigates how AI transforms ICPS operation, stability, and intelligence.

Our SS focuses on **how AI is embedded into cyber-physical loops**, specifically:

- AI-enabled networked control,
- AI-augmented digital twins,
- data-driven predictive and optimization methods,
- multi-agent cooperation and consensus,
- physics-informed and safety-critical learning.

4. Difference from T10 – Digital Transformation, Paradigms, Methods, and Tools

T10 focuses on digital-transformation frameworks: digital twins, AAS, industrial metaverse, data spaces, digital product passports, and interoperability methods. T10 defines the digital-transformation infrastructure; our SS defines the AI intelligence running inside digital twins and networked industrial systems.

Our SS addresses **AI-enhanced digital-twin intelligence**, specifically:

- learning-based twin–physical synchronization,
- physics-informed AI for twin modeling,
- AI-driven lifecycle optimization and predictive control.

- **IES Technical Committees supporting the special session (if any)**

- **At least 6 potential initial contributing authors (names, affiliations and institutional emails):**

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- The proposers have read and adhere to the overall IEEE IES Special session conditions as shown on the website https://icps2026.ieee-ies.org/for_authors/index.html#call-for-special-sessions: YES