附：大会主题报告摘要与报告专家简介

1、A Swedish AIM – AI in Manufacturing Research

Abstract： AI technology enables smart manufacturing that depends on the timely acquisition, distribution, and utilisation of information from machines and processes from shop floors and across product lifecycles. Effective AI-based information processing can improve production quality, reliability, resource efficiency and the recyclability of end-of-life products. Smart manufacturing built on digitalisation and AI also aims for better sustainability. As emerging technologies, cyber-physical systems, digital twins and human-centric collaborative assembly provide new opportunities to achieve the goals of smart manufacturing. Within the context, this presentation will focus on *AI in Manufacturing* (AIM) and cover the following topics:

- A brief intro to Swedish research environment
- Latest advancement and future opportunities in smart manufacturing
- Showcases and future research directions

While advanced AI methods show great promise in smart manufacturing, challenges and future trends remain to be identified and will be highlighted in the presentation.

Lihui Wang 瑞典皇家理工学院教授，加拿大工程院院士，CIRP Fellow

Lihui Wang is a Chair Professor of Sustainable Manufacturing and the Director of Centre of Excellence in Production Research (XPRES) at KTH Royal Institute of Technology, Sweden. His research interests are primarily focused on human-robot collaboration, brain robotics, real-time monitoring and control, cyber-physical systems, and adaptive manufacturing systems. Professor Wang is actively engaged in various professional activities. He is the Editor-in-Chief of *Robotics and Computer-Integrated Manufacturing*, *International Journal of Manufacturing*

Research, and *Journal of Manufacturing Systems*. He has published 12 books and authored in excess of 800 scientific publications. Professor Wang is a Fellow of Canadian Academy of Engineering, AET, CIRP, SME and ASME; the President (2020-2021) of North American Manufacturing Research Institution, and the Chairman (2018-2020) of Swedish Production Academy. He was elected one of the *20 Most Influential Professors in Smart Manufacturing* in 2020, and a Gold Medal recipient from Society of Manufacturing Engineers in 2024.

2、Visual Product Quality Control

Abstract： Visual product quality control is a critical aspect of many industries today, ensuring products meet specifications, safety standards, and customer expectations. However, traditional anomaly detection methods often prove inadequate in real-world scenarios. These methods struggle with massive high-resolution images, unpredictable lighting, complex 3D data, and a lack of adaptability to unseen defect types. This talk addresses these challenges, beginning with the mainstream unsupervised anomaly detection setting as the foundation. It then delves into four critical and practical aspects where standard methods are insufficient: high-resolution, multi-illumination, 3D, and zero-shot. For each aspect, state-of-the-art solutions and novel approaches are presented. The talk concludes with a forward-looking perspective on the development of a truly generalized and practical anomaly detection model, outlining the future of autonomous industrial inspection.

Weiming Shen 福耀科技大学/华中科技大学教授，加拿大工程院院士

Dr. Weiming Shen is a Chair Professor at Fuyao University of Science and Technology (FYUST) and a Professor at Huazhong University of Science and Technology (HUST). He worked for about 20 years at National Research Council Canada as Research Officer, Senior Research Officer, and Principal Research Officer. He is Fellow of Canadian Academy of Engineering, Fellow of IEEE, Fellow of Engineering Institute of Canada (EIC), and Fellow of Asia-Pacific Artificial Intelligence Association (AAIA). He is an internationally-recognized expert on Agent-Based Collaborative Technologies and Applications. During the past three decades, he has been leading a number of major projects on Agents, IoT, Big Data, and large language

models with smart applications. He has published several books and over 700 papers in scientific journals and international conferences in the related areas. His work has been cited over 29,000 times with an h-index of 84. He is the Co-Editor-in-Chief of Engineering – Intelligent Manufacturing and IET Collaborative Intelligent Manufacturing, and an Associate Editor or Editorial Board Member of over ten international journals. He is a Vice-Chair of the ICIM Academic Committee, a Co-Chair of the IEEE Technical Committee on Computer Supported Cooperative Work in Design, and served as General Chair/Co-Chair or Program Committee Chair/Co-Chair for over 50 international conferences.

3、Artificial Intelligence as a Driver of Innovation and Disruption in Manufacturing

Abstract： The transformative potential of artificial intelligence (AI) in manufacturing has been recognized since the early days of the field, where it was identified as a powerful tool for engineering problem-solving, leveraging the "efficient use of deficient knowledge." Over the decades, expectations for AI have oscillated between exaggerated promises and well-founded applications, producing cyclic phases of enthusiasm and setbacks. All this is reflected not only in AI research but also in its industrial adoption.

A significant breakthrough occurred with the adoption of the rational agent paradigm, laying the foundation for cyber-physical production systems and what is now known as Industry 4.0. AI was taken as a game-changing technology capable of driving a fourth industrial revolution, advancing automation, and generating substantial productivity gains. More recently, the emergence of generative AI and foundation models represents a new, disruptive, general-purpose technology poised to reshape manufacturing once again.

This talk explores the opportunities and challenges posed by the industrial integration of these technologies, focusing on industrial foundation models, agentic AI and multi-agent systems. We will examine whether this development constitutes a new wave of industrial transformation, making older engineering and business models obsolete while creating new ones. Key questions include: Can AI drive creative destruction in a way that is more creative but less destructive? Will these breakthroughs render decades of previous research and engineering knowledge obsolete? Concrete examples will be drawn from production system configuration and robotic assembly to illustrate these dynamics.

Ultimately, the presentation situates AI in manufacturing within the framework of creative destruction, highlighting its dual role as both a disruptor and a catalyst for industrial innovation.

József Váncza 匈牙利研究院教授，CIRP Fellow

Dr. József Váncza graduated from the Faculty of Electrical Engineering of the Budapest University of Technology and Economics (BME), Hungary in 1984 and received his PhD in Mechanical Engineering in 1994. Since his graduation, he has been working at the Institute for Computer Science and Automation (SZTAKI), where he was one of the founders and Head of the Research Laboratory for Engineering and Management Intelligence. Now he is Chief Advisor of HUN-REN SZTAKI. His research interests include engineering applications of artificial intelligence, production informatics, cyber-physical manufacturing systems, human-robot collaboration, cooperative and sustainable production in networks and platforms. He was awarded among others with the Order of Merit of the Hungarian Republic, Knight Cross (2008), the Dennis Gábor Prize for Innovation (2021) and the Rudolf Kálmán Prize (2025). He has been involved in university education for three decades, teaching at the Faculty of Mechanical Engineering of BME where he is Honorary Professor. He is Fellow of the International Academy for Production Engineering (CIRP), where he has been Chair of the Production Systems and Organisations Committee (2016-2019) and is now Chair of the Editorial Committee and Vice-President Elect. He is Fellow and Vice-President of the International Academy of Engineering and Technology (AET), and associate editor of the CIRP Journal of Manufacturing Science and Technology and the Robotics and Computer-Integrated Manufacturing journals. He published 250+ papers which received 7250+ references as well as registered 8 international patents.

4、Surface Mechanical Strengthening: effective method for lightweight of mechanical structure

Abstract： Lightweight of mechanical structure contributes to the green manufacturing and the green aviation for aeronautic components, and to the reduce of energy consumption during service. Surface mechanical strengthening (SMS) process can increase effectively the durability of the mechanical components by introducing surface compressive residual stress gradient and by surface microstructure gradient; with

surface compressive residual stress introduction and the associated microstructure evolution, surface mechanical strengthening can also reduce efficiently the weight or thickness of treated components keeping the same initial design life.

The principal of classical process of surface mechanical strengthening, such as shot-peening and ultrasonic peening, will be presented. The recent developed new technologies (dual peening, stress peening, laser peening, water peening) will be introduced and discussed.

Vincent Ji 法国巴黎萨克雷大学教授

Vincent Ji graduated in Beihang University on 1984 (Bachelor, Mat. Sci. & Engin.), in Université Paris-Saclay on 1986 (Master deg., Metallurgy and Mat.) and in Arts et Métier ParisTech on 1989 (PhD, Mechanics & Materials). Served successively as assistant, associated professor, PhD supervisor from 1989 to 2007 in Arts et Métier ParisTech in Paris. Since 2007, full professor in Université Paris-Saclay and director of Materials department of Polytech Paris-Saclay, the Engineering school of the Université Paris-Saclay. Distinguished Professor since 2016 and director of department of Materials, Mechanics and Energy between 2018 and 2023. Since 2022, Chief Representative of CSAA Europe office, IAGA Founding Member.

The research activities of Vincent Ji aim to the fundamental mechanisms and industrial applications of alloys' surface strengthening, surface modifications, surface coatings and surface residual stress analysis. Author and co-Author of more than 400 SCI indexed publications (H factor= 50 and more than 9500 citations); supervisor of 26 PhD students and 32 Master students; co-supervisor of more than 20 joint PhD students.

5、Scalar-field and deep learning-based five-axis machining methods of non-spherical cutting tool

Abstract: Five-axis machining with non-spherical cutting tools is garnering significant interest due to its potential to enhance machining efficiency and improve access to workpieces compared to traditional spherical tools. However, the variability in the effective cutting curvature of non-spherical tools, depending on their orientation, complicates the automatic generation of efficient tool paths. This challenge is particularly pronounced when balancing critical constraints such as machining accuracy, efficiency, interference avoidance, and the physical properties of the machine. Current machining methods for non-spherical tools typically treat the generation of tool orientations and Cutter Contact (CC) curves as separate processes. Although this approach is feasible, it presents difficulties in achieving optimal machining solutions that simultaneously address all critical factors in five-axis machining. To overcome this challenge, we introduce a novel framework utilizing a Physics-Informed Neural Network (PINN), termed the Neural Path Planner (NPP). This framework generates five-axis tool paths for non-spherical tools by producing two scalar fields that facilitate the simultaneous planning of the CC curve and tool orientation. The NPP integrates all critical constraints—including the maintenance of a constant scallop height, maximization of cutting width, and assurance of interference-free operations—alongside relevant physical properties of machine tools. The tool paths generated by this framework enable a collaborative optimization of CC curves and orientations, resulting in near-global optimal solutions that significantly enhance machining performance in terms of automation and efficiency.

Kai Tang 香港科技大学（广州）教授

Prof. Kai Tang received BSE in Mechanical Engineering from his hometown university the Nanjing Institute of Technology (now Southeast University) in 1982 and afterward, as sponsored by the Chinese government, went to University of Michigan (Ann Arbor) where he received PhD in Computer Engineering in 1990. From 1991 to 2001, he worked as a software specialist at Schlumberger CAD/CAM (which in 1994 became Applicon and in 1999 became part of Unigraphics), where he developed multi-axis and mill-turn CAM software. In June 2001, he “went back” to school and joined Hong Kong University of Science and Technology

(HKUST), arising from Assistant professor (2001), Associate professor (2006), and Full professor (2011). Since Aug. 2022 he has been with the newly established HKUST (Guangzhou) as the Head of Smart Manufacturing Thrust. Prof. Kai Tang's research interests are broad but mostly concentrating on developing efficient and practical algorithms in CAD/CAM, while his current focal point is on multi-axis machining and printing of complex models. Since joining HKUST in 2001, as sole PI he has obtained in total of HK$50+ million in research funding from Hong Kong RGC and ITC, China's NSFC, and other applied funds. He was on the Stanford List of Top 2% Scientists in 2022, 2023, and 2024. For more details about his research, please refer to: http://mektang.people.ust.hk/.

6、Product Engineering in the Age of Digital Twins

Abstract： Digital twins (DTs) are reshaping the landscape of manufacturing, offering a dynamic, information-rich bridge between physical assets and their virtual counterparts throughout the product lifecycle. This talk, reflecting the International Academy for Production Engineering (CIRP) perspective, will explore the evolution, foundational concepts, and state-of-the-art methodologies that underpin digital twin development and deployment in product engineering. The presentation will clarify the fundamental building blocks and architectures of DTs, the integration of accurate digital representations and models, advanced data flows, and uncertainty management as foundational elements of Digital Twin Engineering (DTE). Emphasis will be placed on the rapidly growing ecosystem of DT tools and standards and their critical impact on interoperability and lifecycle integration. Drawing on industrial case studies and recent research advances, the presentation will also address emerging paradigms, open challenges, and future research directions for advancing digital twin to transform product engineering.

Nabil Anwer 法国巴黎萨克雷大学教授

Nabil Anwer is Director of the Automated Production Research Laboratory (LURPA) and Professor at University Paris-Saclay, France. He is the Chairman of the Scientific Technical

Committee on Design (STC Dn) of the International Academy for Production Engineering (CIRP) and coordinates the digital twin research program at the Institute for Technological Research on Complex Systems (IRT SystemX) in France.

His research focuses on digital twin for production engineering, with expertise in product digital twins, design for additive manufacturing, geometric tolerancing, reverse engineering, and dimensional metrology. He is a Fellow of the CIRP, Fellow of the International Academy of Engineering and Technology (AET). His work contributes to national and international standardization as a member of ISO TC 213 (Dimensional and geometrical product specifications and verification) and ISO/IEC JTC 1/SC 41 (Internet of things and digital twin). He published more than 250 journal and conference papers, and serves as Associate Editor for the journals Digital Twin and Digital Engineering.

7、Geometrical quality prediction of machining process by Exechon X-mini PKM through deformation modelling and error compensation

Abstract： Parallel Kinematic Machines (PKMs) offer enhanced motion dynamics and flexibility, bridging the gap between conventional CNC machines and industrial robots. Stiffness, a key determinant of machining accuracy, is often modelled with limited consideration of gravitational effects, leading to reduced predictive accuracy. This talk introduces a novel stiffness modelling approach that integrates a theoretical model without gravity and gravity-based parameter optimisation through experimental analysis. Comprehensive stiffness measurements were conducted to isolate gravitational effects on the machine structure, enabling precise calibration of the theoretical model for accurate stiffness prediction. A six-dimensional stiffness analysis of the X-Mini machine tool using the optimised model demonstrated improved prediction accuracy, reducing errors by 14%, 21%, and 8% in the X, Y and Z directions, respectively. Predicted stiffness and estimated cutting forces were used to compute machine tool deformations, which were then compensated by modifying the depth of cut in slot milling. Experimental validation demonstrated the method's effectiveness, achieving a machined shape error prediction accuracy of 6-9μm. This approach can be well applied to geometrical quality prediction of machined parts by robots and machine tools.

Yan Jin 英国贝尔法斯特女王大学教授

Dr Jin is a Professor in the School of Mechanical and Aerospace Engineering at Queen's University Belfast, Fellow of the Institute of Mechanical Engineers of UK, and head of Smart Manufacturing and Robotics Research group. His research interest includes parallel robots, robotics automation, aircraft assembly, high performance machining and digital manufacturing. Prof. Jin has been an investigator for many research programmes, funded by DTI, EPSRC, Royal Academy of Engineering, EU H2020, Invest Northern Ireland and industry, with a total value of £14 million. He is an associate editor of IMechE Journal of Engineering Manufacture, a member of editorial board of Chinese Journal of Mechanical Engineering. He is a Marie Skłodowska-Curie fellow, and a member of technical committee of UK-RAS network. He was the general chair of ICMR2019 and Parallel2020 international conferences. Prof. Jin has published over 180 peer-reviewed technical papers. He is the recipient of the prestigious A. T. Yang Memorial Award in Theoretical Kinematics in 2019 and best paper awards at prestigious international conferences (e.g., MeSRob2025, MEDER2024, iDECON2023, ICCSMT2023, IEEE_MeetroAeroSapce2022). He is a chartered engineer, chair of robotics committee in UK IFToMM, and a board member of IMechE MICG.

8、Human-in-the-loop Digital Twin for Human-Machine Symbiosis

Abstract： In modern intelligent factories, automation and robotics are often introduced to reduce workers' exposure to physically demanding and repetitive activities. While these technologies successfully remove many manual tasks, highly automated environments can unintentionally concentrate human work around cognitively intensive activities such as system monitoring, anomaly detection, troubleshooting, and high-precision quality inspection. This shift can elevate mental workload and introduce new forms of strain for operators. Achieving an optimal balance between physical and mental workload is therefore essential for sustaining workforce performance and well-being in smart manufacturing settings.

This keynote addresses these emerging challenges by developing human-in-the-loop digital-

twin framework that position workers as active, informed collaborators within the intelligent production ecosystem. Rather than allowing automation to displace human capability, our goal is to ensure that digital tools and systems enhance human performance and support meaningful, sustainable roles on the factory floor. By designing cooperative systems that intentionally balance cognitive and physical workloads, we seek to create "good jobs" that maintain operator engagement, preserve expertise, and foster meaningful human–machine symbiosis.

Mey Goh 拉夫堡大学教授

Mey Goh is Professor of Transdisciplinary Design Engineering at the Wolfson School of Mechanical, Electrical and Manufacturing Engineering, Loughborough University, UK. She holds a BEng (Hons) in Mechanical Engineering from Universiti Tenaga Nasional, Malaysia (2001), and a PhD in Mechanical Engineering from the University of Bristol (2005).

Prof Goh is Associate Director of the Intelligent Automation Centre, a multidisciplinary research centre advancing robotics and digital automation. As Centre Lead for the Made Smarter Innovation Centre on People-Led Digitalisation, she works with academic and industry partners to advance the adoption of digital technologies. Her research focuses on human-centric design within Industry 5.0, with contributions spanning user-centred digital twins, human–robot interaction, and explainable AI.

Prof Goh is a Fellow of the Higher Education Academy, Co-Editor-in-Chief of the *Journal of Integrated Design and Process Science*, and holds leadership roles within several professional bodies, including the Consortium of UK University Manufacturing and Engineering (COMEH), International Society of Transdisciplinary Engineering (ISTE), and the Society of Design and Process Science (SDPS).

9、Paradigm shift of engineering design and product development towards data-driven and AI-empowered design

Abstract： Data science and artificial intelligence are reshaping engineering design by

transforming heterogeneous data, user generated content, design artefacts, sensor logs, and operational records, into actionable insights and decisions. Data-driven design provides the foundation for evidence-based reasoning across the product lifecycle, while AI extends this capability by learning patterns, predicting outcomes, and generating design knowledge at scale. Together, they are shifting design from experience-led iteration toward more systematic, adaptive, and intelligent decision-making. This keynote explores how data-driven and AI-driven approaches enhance core design activities, from capturing the voice of customers and modelling functions, to generating and evaluating concepts, and enabling design customisation, optimisation, and decision automation. By coupling high-quality data with computational intelligence, organisations can accelerate innovation, reduce uncertainty, improve quality, and support more sustainable design outcomes. Additionally, this keynote also addresses practical and governance challenges, including data quality and interoperability, privacy and security, bias and fairness, transparency and explainability, and responsible deployment. We emphasise human–AI collaboration to ensure AI augments professional judgement, creativity, and accountability. Ultimately, the convergence of data-driven design and AI-driven design points to a future in which engineering design becomes more predictive, adaptive, and responsibly evidence-based.

Ang Liu 新南威尔士大学教授

Prof. Ang Liu is Professor of Engineering at the University of New South Wales (UNSW), Australia. He received his Ph.D. in Mechanical Engineering from the University of Southern California (USC). His research interests include design thinking and methodology, intelligent manufacturing, digital twins, artificial intelligence, and engineering education. Prof. Liu is a Fellow of the American Society of Mechanical Engineers (ASME), an Associate Member of the International Academy for Production Engineering (CIRP), an Invitational Fellow of the Japan Society for the Promotion of Science (JSPS), a Fellow of the PLuS Alliance, a Fellow of

Engineers Australia (FIEAust), and a Senior Fellow of the Higher Education Academy (SFHEA). He serves as Vice-Chair of the CIRP Scientific Technical Committee on Design (2025–2028) and has held leadership roles including Chair of International Conference on Axiomatic Design (2019), Chair of the 2nd Digital Twin International Conference (2022), and Chair of the 33rd CIRP Design Conference (2023). His recognitions include the UNSW Vice-Chancellor's Award for Outstanding Contributions to Student Learning (2021), inclusion in The Australian's Top 250 Researchers (2021–2026), a Citation for Outstanding Contributions to Student Learning in the Australian Awards for University Teaching (2022), Digital Twin Young Scientist Award (2024), and multiple best paper awards. He is an Associate Editor of the Journal of Intelligent Manufacturing and Digital Twin and serves on the editorial boards of multiple prestigious journals.

10. Artificial Intelligence and Sustainability

Abstract： Artificial Intelligence (AI) is increasingly recognised as a powerful enabler of sustainable development across industrial, environmental, and societal domains. By leveraging advanced data analytics, machine learning, and autonomous decision-making, AI technologies offer new opportunities to improve resource efficiency, reduce environmental impacts, and support informed policy and management decisions. This paper examines the role of Artificial Intelligence in advancing sustainability goals, focusing on its applications across key sectors and its implications for sustainable systems. The paper reviews current and emerging AI-driven solutions in areas such as energy optimisation, smart manufacturing, sustainable supply chain management, environmental monitoring, and climate modelling. These applications demonstrate AI's potential to enhance efficiency, minimise waste, and enable predictive and adaptive responses to complex sustainability challenges. At the same time, the paper highlights critical concerns about the sustainability of AI, including the high energy consumption of data centres, growing electronic waste, data governance issues, and ethical considerations associated with algorithmic decision-making. The analysis emphasises that while AI can significantly contribute to sustainability transitions, its benefits are not automatic. Responsible deployment, transparent governance frameworks, and alignment with lifecycle-based sustainability principles are essential to achieving net-positive environmental and social outcomes. The paper concludes by identifying research priorities and policy directions needed to harness Artificial Intelligence as a key driver of sustainable development.

Konstantinos Salonitis 都柏林大学学院教授

Prof Konstantinos (Kostas) Salonitis (MEng, MSc, PhD, MBA, MEd, PGCAP, CEng FIMechE, FHEA) has been a Professor of Advanced Manufacturing at University College Dublin, Ireland, since 1st April 2026. He was a Professor of Manufacturing Systems and the head of the Sustainable Manufacturing Systems Centre at Cranfield University, UK (2012-2026). From 2001 to 2011, he worked as a Senior Research Engineer at the University of Patras (Greece) on many research projects funded by the European Commission. He has participated in and led more than 20 projects funded by EPSRC, Horizon, Innovate-UK, ATI and more than 340 industrial projects. Prof Salonitis has successfully supervised over 100 PhD and MSc students. He has published more than 350 research papers in major international journals and internationally referred conferences and authored two books. He serves as an associate editor for the Journal of Manufacturing Systems and the Journal of Cleaner Production, and as co-editor-in-chief for the Journal of Cleaner Manufacturing. Prof Salonitis is a Chartered Engineer, a Fellow of the Institute of Mechanical Engineering (IMEchE) and IET, a member of the Technical Chamber of Greece. He is also a Fellow of the Higher Education Academy. He is a visiting professor at Nanjing University of Aeronautics and Astronautics.