Keynote: Physical AI and Reasoning

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Abstract

The rapid evolution of artificial intelligence and advanced robotics is reshaping manufacturing and redefining the relationship between humans and machines. Rather than viewing automation primarily as a means to replace human effort, this keynote presents a vision of collaborative manufacturing in which human expertise and intelligent systems complement one another to improve safety, productivity, flexibility, and operational resilience.

Drawing on recent advances in AI and robotics, the talk will explore how agentic AI can support troubleshooting and predictive maintenance, how dexterous robotic manipulation can enable more adaptive automation in dynamic industrial environments, and how open robotic infrastructures can facilitate data sharing, teleoperation, and deployment across heterogeneous platforms. Central to this vision is the integration of structured knowledge with AI. Common data models, ontologies, and semantic representations can provide the connective tissue needed to make industrial data interoperable, support reusable AI pipelines, and transfer knowledge across tasks, machines, and manufacturing environments.

Through applications ranging from intelligent troubleshooting and adaptive assembly to process optimization and AI-enhanced quality control, the keynote will illustrate both the potential and the current limitations of AI-enabled manufacturing. It will conclude by examining key challenges—including data quality and curation, cross-platform generalization, and scalable knowledge integration—and discuss how the convergence of AI, robotics, and knowledge engineering can enable a new generation of collaborative manufacturing systems in which human expertise and intelligent automation work together.

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