

# Advanced Robotics and Artificial Intelligence with the Digital Twin of Production for the Factory of the Future

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## Abstract

Starting with a brief review of the history of manufacturing system, we explore possibilities of the factories of tomorrow with advanced robotics. We discuss the challenges in design, validate, and commission robotics for a non-deterministic working environment that is necessary to achieve the level of flexibility in the future manufacturing industry. As Siemens Digital Industries Software has been providing software with cutting edge technologies to the manufacturing industry and robotics users for decades, we therefore lay out a potential evolution roadmap of the manufacturing system with robotics in four phases: entrants, veterans, pioneers and visionaries, with most companies today in the first two phases. Entrants widely adopt available fixed automation robotics or similar technology and most of their operations are performed manually using shopfloor teach in or offline programming tools. Veterans begin adding some higher-level features such as virtual commissioning in addition to what is available in the entrant phase. Pioneers of their industries begin to automate and accelerate their production design and deployment with more advanced technologies such as smart sensors and artificial intelligence. Visionaries in their field are those that implement advanced robotics trying to reach the goal of flexibility in the production processes and manufacturing systems. We then show examples in each phase of the evolution roadmap to indicate how the industry can advanced in technology and innovation, orchestrated by the digital twin of production. Partnerships and ecosystem comprised of industry world, entrepreneurship, and research institutions are extremely important to form the driving force of the journey towards the factory of the future.

## Keywords

Advanced Robotics, Artificial Intelligence, Low Code, Sensor, Industry 4.0

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