



IAS - Institute of Industrial Automation and Software Engineering, University of Stuttgart

The Institute of Industrial Automation and Software Engineering belongs to the Department of Electrical Engineering and Information Technology of the Faculty of Computer Science, Electrical Engineering and Information Technology at the University of Stuttgart. The research and teaching of the institute focuses on the topic of software systems for automation technology. We see ourselves as a connection of the product and plant automation in the research disciplines of information technology, software technology and automation.

Focus and expertise of the institute

- **Flexibility of automation systems:** Future automation systems are agile, i.e. they are highly flexible in adapting to the context of use and varying conditions in the environment. In the process, automation systems are increasingly implemented based on intelligent components and perform tasks autonomously or in cooperation with humans. Two key aspects are the ability to communicate between humans and systems as well as the autonomous character. To achieve their goals, automation systems of the future can interact and cooperate on a semantic level to optimise costs, energy consumption and waste.
- **Dependability of automation systems:** In addition to functionality, the qualitative properties in particular, determine the success of automation systems today. The characteristics of reliability, availability and security are driving innovations for future applications. It is very important to develop systems, which determine quality at an early stage by means of a reliability analysis or ensure the availability.
- **Engineering of cyber-physical automation systems:** Cyber-physical systems increasingly permeate automation technology. Digital images, networking and cooperation by means of information exchange enable new functionalities as well as new work processes and business models. "Connected Industries", "Connected Cars" or "Connected Life" are catchphrases that promise completely new applications in all areas. IAS deals with methods for the development and application of cyber-physical systems and components, dynamically combining new configurations, which at the time of development were unknown or envisaged.

Example projects of the institute in Industrie 4.0

In the context of Industrie 4.0, IAS addresses the following topics:

- Cooperating proactive and adaptive cyber-physical systems
- Reliability and safety
- Planning of value added networks for cyber-physical modules
- Intelligent methods for test of distributed systems

Examples:

Architecture of a Digital Twin: In order to demonstrate the advantages of a Digital Twin, a demonstrator was developed at the IAS. This demonstrator shows the inner structure and provides the functionality of a digital twin. On the physical side it consists of a truck body and on the cyber side it consists of models that are graphically represented. Various scenarios allow interaction both with the physical world and with the cyber world.

Distributed Industrie 4.0 production plant: This distributed hybrid system consists of several production stations, which demonstrates the following aspects:

- Flexible adhoc process planning / scheduling with agent control
- Reconfiguration of automation systems and plug & produce technologies
- Human-machine interaction with Apps

The focus of the demonstrator is the dynamic information exchange of different Industrie 4.0 applications and algorithms for production planning and control of value added networks. Furthermore, the first approaches of possible test procedures for plug and play systems and components in the field are demonstrated.

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Extract from:

„Industrie 4.0 Research at German Research Institutes – An Overview“, VDMA, September 2019

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