



Editorial: System-Integrated Intelligence – Intelligent, Flexible and Connected Systems in Products and Production

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Abstract

The editorial introduces the SysInt conference series and the motivation behind it. It describes the structures and content as well as the scientific and technological background of the SysInt 2020 conference held online and hosted in Bremen from November 11th to 13th, 2020. It provides an outline of the organizing institutions, detailing their individual perspectives on the general topic of the system-integrated intelligence. Furthermore, the editorial acknowledges the collective contribution of the program committees for the benefit of the successful scientific event.

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1. Introduction on System-Integrated Intelligence

For a long time, intelligence was reserved for humans. Due to our cognitive capabilities, we can communicate, as well as receive process and infer information from a wide range of perceptions. As technology advances, objects can be equipped with artificial intelligence features and behavior, i.e., additivity, learning, planning actions, gaining knowledge from the perception of the surrounding world, and reacting to and dealing with unknown environments and situations, respectively. Using modern microsystems technology, combined with advanced concepts from computer science, it is possible to equip objects with perceptive capabilities inspired from nature supporting artificial intelligence, enable them to self-organize, communicate, process information, and decide actions autonomously.

The implementation of intelligent systems requires the use of several technologies that harmonize computer science and engineering. In production, for example, cyber-physical

systems act as the necessary interface between the digital and the real world. Their networks enable them to communicate or interact with one another and with the outside world. This creates a technological basis for Industry 4.0 that unfolds important potential for process optimization and increased efficiency. In modern factories, people are already working hand in hand with robots; some warehouses even operate autonomously.

The technological feasibility of intelligent systems is therefore complete. Is the human-machine society the next step into the future? In any case, it should be carefully considered to what extent humans should allow smart systems to influence their way of life and work. Particularly in the private sphere, we are increasingly implementing the Internet of Things and artificial intelligence. The “smart home” is no longer a vision of the future; its appliances are increasingly becoming a comfortable reality for many households. Also, the integration of intelligent systems in the industry is increasing. Digital technologies are being transferred to new products and

business models. Some interesting examples and applications of intelligent, connected systems are introduced in these proceedings.

2. Scope of the conference

This volume contains the collected research and development activities presented at the 5th International Conference on System-integrated Intelligence (SysInt) held online and hosted in Bremen from November 11th to 13th, 2020. The SysInt conference series deals with the integration of new intelligent functionalities into materials, components, systems and products. The conference 2020 offers a virtual platform for science and industry and focuses six main topics:

- Intelligent Systems: Enabling Technologies and Artificial Intelligence
- The Future of Manufacturing: Cyber-Physical Production and Logistic Systems
- Pervasive and Ubiquitous Computing
- Structural Health Monitoring
- Systems Engineering
- Soft Robotics and Human-Machine-Interaction

In 2020, this setting has attracted contributions from ten countries worldwide. All submissions underwent a double-blind peer reviewing by members of the international program committee. The conference program has been structured into ten sessions featuring presentations of submitted papers, a digital poster session and virtual guided tours. Special highlights were set by our three keynote speakers: Professor Ravinder Dahiya of the University of Glasgow took the lead on the first day, presenting his research in the field of soft electronic skin solutions. Professor Eric MacDonald of the University of Texas in El Paso contributed his experience in 3D printing as a technology platform to facilitate multifunctional and smart systems in the afternoon of the same day. On the second day, Professor Annika Raatz of the Leibniz Universität Hannover showcased the topic of soft material robotic systems in her speech introducing the session on soft robotics and human-machine interaction.

3. The organizers behind SysInt 2020

The SysInt conference series is a cooperative event between the Universities of Bremen, Hanover and Paderborn. Within this range, all three research centres set their very own specific focus.

The University of Bremen is represented among the chairs by Prof. Thoben and Prof. Lang. Prof. Thoben is the head of BIBA - Bremer Institut für Produktion und Logistik GmbH and the spokesperson of the Bremen Research Cluster for Dynamics in Logistics (*LogDynamics*). Prof. Lang is the director of the Institute for Microsensors, -actuators and -systems (IMSAS) and member of *LogDynamics*.

LogDynamics is a cooperating network of several research groups from different faculties of the University of Bremen. It provides research on logistics' topics, an international doctoral program, and a bidirectional transfer of knowledge and technology between business and academia. *LogDynamics* combines research into business processes, IT, production

technology and electrical engineering to solve logistics problems in an interdisciplinary and cooperative manner. Important research areas are autonomous control in logistic processes and networks, cyber-physical systems for Industrie 4.0, Internet of Things as well as services and supply chain (event) management.

The Leibniz Universität Hannover, represented among the chairs by Prof. Denkena, stresses the concept of intelligent materials and components. According to this vision, products are to be equipped with a memory of their experiences that covers their full life cycle from beginning to end. The idea is that the development of new products should incorporate knowledge from the past in an analogy to the way genes and their expression control who we are concerning the experiences of our ancestors.

The Heinz Nixdorf Institute of Paderborn University is represented among the conference chairs by Prof. Trächtler as the head of the chair for "Control Engineering and Mechatronics" and as the director of the Fraunhofer Research Institution for Mechatronic Systems Design IEM. The Heinz Nixdorf Institute is an interdisciplinary research institute with a primary focus on Intelligent Technical Systems that are based on the interplay between engineering and computer science. Typically, such systems yield products in the field of information technology, communication technology, mechanical engineering, automotive and transport engineering, and the electrical and medical industry. The Heinz Nixdorf Institute aims to establish a new school of thought for the design of intelligent technical systems.

4. Conclusion and Acknowledgement

To organize an international conference is without any doubt a collective effort. Many people are involved to bring together all contributors, to fairly review their work and to provide them with the lively, motivated and open-minded environment that allows interdisciplinary exchange. We would therefore like to take the opportunity to thank all those people who contributed to the success of the SysInt 2020 conference. This includes especially the members of the Organizing Committee as well as the International Program Committee and our keynote speakers. Moreover, we would like to acknowledge the smooth cooperation with the Elsevier publisher.

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