

Keynote Manfred Nader, Linz Center of Mechatronics GmbH

"Symbiotic Mechatronics - The evolution of mechatronics in the context of digitalization on the way from components to integrated mechatronic systems."

Abstract

Future mechatronic systems will be increasingly interacting with each other – devices, machines, and industrial plants with human agents and physical as well as digital environments. This strong interaction between various objects and agents will be based on digital models, the connection of distributed systems, higher levels of integration and strong assistance to humans. Furthermore, digitalization, artificial intelligence, autonomous systems and decarbonization are the main drivers of future innovation. Consequently, today's mechatronics must adapt and realign itself in the course of this transformation process. The concept of Symbiotic Mechatronics represents a holistic approach taking these challenges into account.

Digital models are based on a multi-physical or hybrid (combined physics-based and data-driven) modeling and simulation approach. They form the basis for digital product (or system) development, which ranges from virtual prototypes in the design phase, virtual commissioning and testing, to digital twins for predictive maintenance and self-adapting autonomous machines. Modern modeling and simulation concepts rely on state-of-the-art methods and effective implementations, driven by digital platforms and cloud technology. The lecture gives an overview of several applications in the fields of manufacturing and the automotive industry.

The integration of (miniaturized) autonomous mechatronic systems is a trend considered by the Symbiotic Mechatronics approach. The lecture presents examples ranging from traditional approaches in vibration damping using lumped active damping devices over novel implanted mechatronic hearing aids to integrated energy-autonomous sensor systems in roller bearings and functional surfaces. Another approach investigates the concept of impact monitoring for automotive components and aircraft fuselages.

The lecture is concluded by an outlook on our vision for future mechatronics and new strategic research directions.