Industry 4.0
in the Czech Republic

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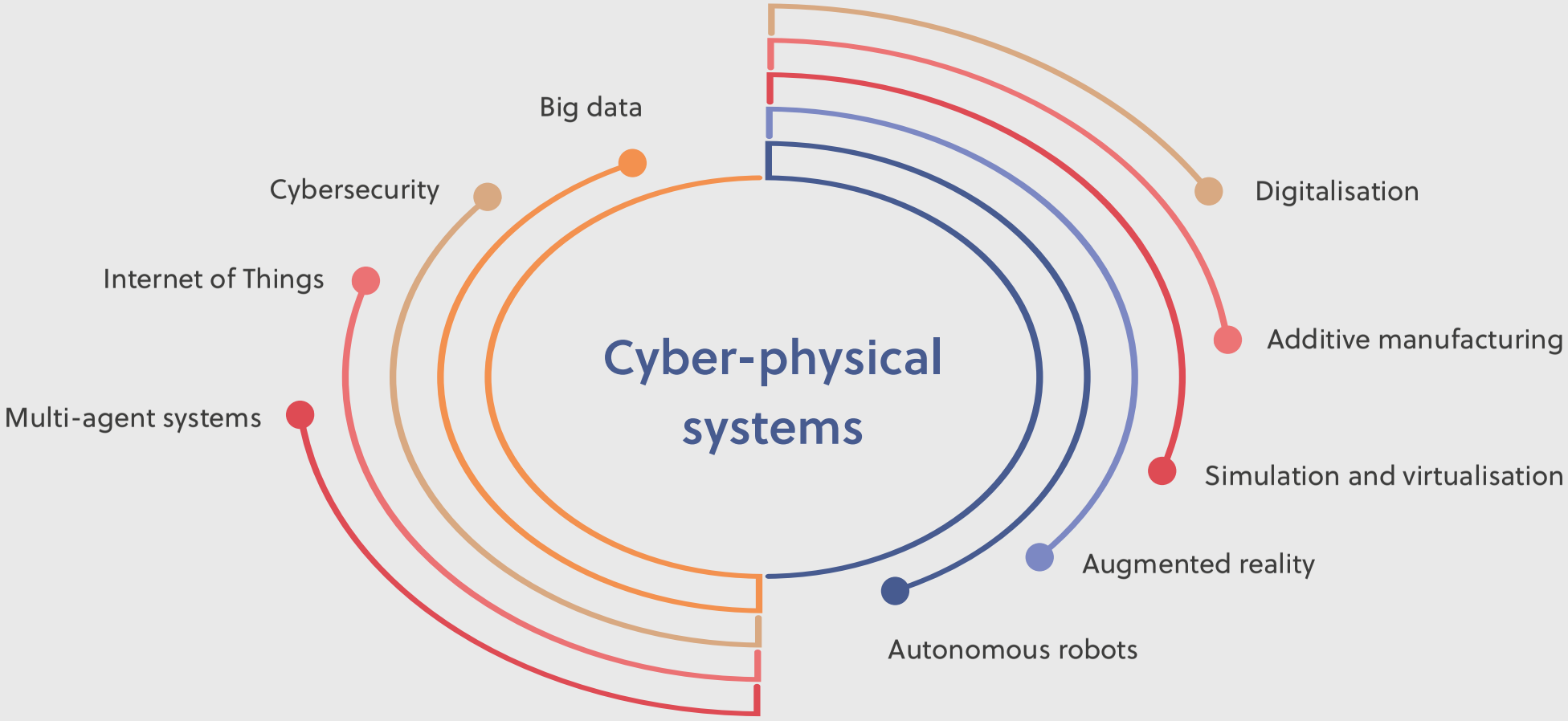
Industry 4.0

Industry 4.0 (sometimes called the Internet of Things) is built around the following concept of cyber-physical systems.



Industry 4.0 in the Czech Republic

National Initiative Industry 4.0

This initiative was coordinated by the Ministry of Industry and Trade of the Czech Republic to guarantee a strategic approach to the challenges of Industry 4.0.

+ Team led by Professor Vladimír Mařík (Czech Technical University in Prague) finished the document in February 2016 and a bound version was published in May. The Czech government approved the initiative on 24 August 2016.
+ Extensive document comprising 11 chapters provides analysis of the current state of Czech industry, future trends and possible risks, and gives suggestions for specific steps to be taken in the future.

Alliance Society 4.0

The Alliance Society 4.0 was formed as a continuation of government efforts with the National Initiative.

+ Led by the Czech Republic Digital Agenda Coordinator, involves several ministers and key government councils. It was officially approved by the Czech government in February 2017.
+ In September 2017, the Czech government approved the Action Plan for Society 4.0, which is aimed at implementing the transformation of the country. The main pillars of the document include connectivity and mobility, education and the labour market, e-governance, security, industry, entrepreneurship and competitiveness.

International Cooperation

Germany

+ Advantage of geographical and economic proximity, concept leader
+ Visit of Chancellor Angela Merkel in August 2016 revolved around Industry 4.0, memorandum of understanding signed between the Czech Institute of Informatics, Robotics and Cybernetics and the German Research Centre for Artificial Intelligence (DFKI)
+ Call for Czech-German research cooperation in May 2017 under the DELTA Programme of the Technology Agency of the Czech Republic focused on Industry 4.0

Japan

+ Memorandum of understanding between the Japanese Robot Revolution Initiative and Czech Alliance Society 4.0 / Confederation of Industry of the Czech Republic signed in Tokyo on 28 June 2017

Internet of Things

The public policy approach to Internet of Things in the Czech Republic is outlined in the National Initiative Industry 4.0. Multiple IoT networks are already being constructed and ready for use in the country.

In cooperation with T-Mobile Czech Republic, SimpleCell Networks is operating a nationwide IoT network based on Sigfox technology, which uses UNB (Ultra Narrow Band) technology and runs at a speed of 100 bits/sec. The network already covers more than 95% of Czech population and is ready for utilities, Industry 4.0, health devices, intelligent buildings, automotive industry, consumer electronics, smart cities and other sectors. More than 100 pilot projects as well as commercial projects using Sigfox technology are already running in the country.

Another network, based on the LoRa technology, is being developed by the company České Radiokomunikace. All larger cities are already covered, while the network is still expanding. It is ready for all kinds of IoT devices and provides two-way communication. LoRa sensors have low energy consumption, are easy to install, use encrypted data, and run on the 868 MHz frequency.

Vodafone is the first operator in the Czech Republic and one of the first in Europe to finish building its own nationwide NB-IoT network. Narrow Band Internet of Things is one of the most secure low-power wide area (LPWA) technologies. It uses a licensed frequency and, thanks to the 3GPP standard, it employs standard LTE security mechanisms and also brings a high level of compatibility and synergy with other mobile technologies. NB-IoT technology is connected to the global Vodafone IoT platform and includes a web portal with access to relevant services and technical data.

Selected Research Institutions

Czech Technical University in Prague

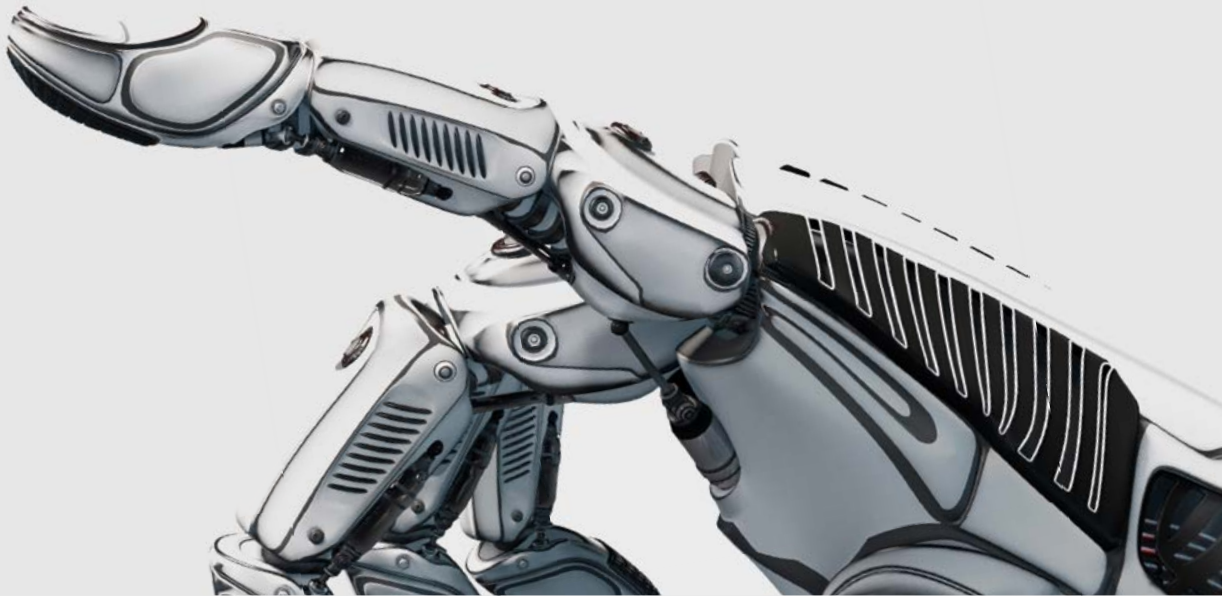
CZECH INSTITUTE OF INFORMATICS ROBOTICS AND CYBERNETICS CTU IN PRAGUE

Czech Institute of Informatics, Robotics and Cybernetics

This institute is at the forefront of activities in the area of Industry 4.0 in the Czech Republic. It actively promotes international cooperation in the field and synergies between the private sector and academia. It has opened the Testbed for Industry 4.0 as a new research and experimental workplace for testing innovative solutions and processes for smart factories. CIIRC also carries out several lines of relevant research in the fields of intelligent systems for industry, big data, cloud computing and machine learning, among others.

The main research areas and teams are:

+ Cyber-physical systems
+ Cognitive systems and neurosciences
+ Intelligent systems
+ Industrial informatics
+ Industrial production and automation
+ Robotics and machine perception
+ Biomedical and assistive technologies
+ Shared platforms group



Faculty of Electrical Engineering

FACULTY OF ELECTRICAL ENGINEERING CTU IN PRAGUE

Department of Computer Science

The Department of Computer Science provides excellent research results in the fields of artificial intelligence, bioinformatics and software engineering. Its focus is on foundational computer science as well as cross-disciplinary fields such as AI, agent-based computing, machine learning, game theory, automated planning, optimisation, cybersecurity and computational robotics. The department has experience in building complex, large-scale prototypes of software systems in areas ranging from next-generation transportation systems and massive cyber-attack detection to genomic data analysis. Its international cooperation involves such institutions as the US Air Force, US Army, US Office for Naval Research, US Federal Aviation Administration and NASA, as well as corporations such as Google, IBM, Boeing, BAE Systems, Toyota, Procter Gamble, Škoda Auto, Liftago and Foxconn.

Department of Cybernetics

This department is a research and teaching unit in the fields of artificial intelligence, machine perception, cybernetics, robotics and biomedical engineering. It focuses on computer vision, pattern recognition, machine learning, mobile and collaborative robotics, autonomous vehicles, unmanned aerial vehicles, data mining, knowledge systems, assistive technologies, medical data processing and biological and medical signal and image processing. Research in these areas is carried out by several cooperating research groups and teams.

VŠB – Technical University of Ostrava

The University is active in Industry 4.0 in many respects. The Faculty of Electrical Engineering and Computer Science has several departments and research groups dedicated to the issue, e.g. the Department of Cybernetics and Biomedical Engineering and its Industrial Automation and Computer Control Systems Group and the Department of Computer Science and the Data Analysis and Processing Group. Part of VŠB-TUO is also home to the IT4Innovations National Supercomputing Center.

University of West Bohemia

Industry 4.0 is one of the key elements of this university's strategy for the period 2016-2020. Bodies within the main structure of the institution are already active in this field, such as the Department of Industrial Engineering and Management (Faculty of Mechanical Engineering). The university also has two research centres that are relevant for Industry 4.0:

+ New Technologies for the Information Society (NTIS)
+ New Technologies Research Centre (NTC)

Brno University of Technology

Brno University of Technology is active in Industry 4.0 on several levels. For example, the Department of Control and Instrumentation (Faculty of Electrical Engineering and Communication) pursues education and research in control and measurement technology, industrial automation, robotics, artificial intelligence and computer vision. The Department of Intelligent Systems (Faculty of Information Technology) synthesises knowledge from several fields of science, such as artificial intelligence, system modelling, simulation and formal analysis of system models, neural nets, genetic algorithms and fuzzy systems.

Other significant activities of the university include:

+ Central European Institute of Technology (CEITEC)
+ Research Centre of Sensor, Information and Communication Systems (SIX)

An I4.0 testbed is being constructed at BUT with the participation of several faculties and CEITEC.

Financial Support

Projects related to Industry 4.0 can be supported by various funds. On the national level, those are mainly the programs of the Technology Agency of the Czech Republic and the TRIO programme (subsequent programme to be announced) of the Ministry of Industry and Trade. The Operational Programme Enterprise and Innovation for Competitiveness is also relevant for Industry 4.0, as is the EU framework programme Horizon 2020.

Other Institutions

Institute for Nanomaterials, Advanced Technology and Innovation (Cxi), Technical University of Liberec; Institutes of the Czech Academy of Sciences (e.g. Institute of Information Theory and Automation); Faculty of Mathematics and Physics at Charles University; Faculty of Applied Informatics at Tomas Bata University in Zlín; Masaryk University; Palacký University Olomouc; University of Pardubice etc.

Specialised Study Programs

Czech Technical University in Prague – Master's Programme Industry 4.0; VŠB – Technical University of Ostrava - Computer Systems for the Industry of the 21st Century (Bachelor's Programme); Czech Technical University in Prague + Brno University of Technology – Industry 4.0 (Joint Doctoral Programme, in preparation)

National Centre for Industry 4.0

This centre was established in September 2017 through collaboration between research organisations, industry and professional organizations. Its goals are to raise awareness about Industry 4.0 and to strengthen cooperation between academia and industry. The main founding partners include CIIRC CTU, Brno University of Technology, VŠB – Technical University of Ostrava, Siemens, ŠKODA Auto and others.

Selected Horizon 2020 Projects

European Commission | Horizon 2020 European Union funding for Research & Innovation

RICAIP: Research and Innovation Centre on Advanced Industrial Production

+ Duration: 2017-2018; Czech participation: CIIRC, CTU in Prague (coordinator) and CEITEC Brno University of Technology
+ Establishment of the Research and Innovation Centre on Advanced Industrial Production by leading research organisations from the Czech Republic and Germany.
+ The centre will provide the EU's first distributed, but virtually integrated experimental testbed.

I-MECH: Intelligent Motion Control Platform for Smart Mechatronic Systems

+ Duration: 2017-2020; Czech participation: University of West Bohemia and Brno University of Technology
+ The objective of I-MECH is to provide augmented intelligence for a wide range of cyber-physical systems with actively controlled moving elements and thus to support development of smarter mechatronic systems.

CloudiFacturing: Cloudification of Production Engineering for Predictive Digital Manufacturing

+ Duration: 2017-2021; Czech participation: VŠB – Technical University of Ostrava
+ Use of ICT for digitalisation of the manufacturing sector in SMEs, creation of a consolidated platform between

Advanced Manufacturing

Research Institutions dealing with advanced manufacturing in cooperation with companies – a step closer towards smart factories.

NETME Centre

The center New Technologies for Mechanical Engineering is designed as a regional research and development centre, based on the advanced simulation models and high-quality science and research base of the Faculty of Mechanical Engineering, Brno University of Technology.

VÚTS LIBEREC

VUTS is an engineering R&D centre which focuses on research, development and manufacturing of machinery and equipment for the processing industry. The activities of VUTS are characterized by the offer of a comprehensive set of services including research and development, design processing and implementation of complete technology units.

Research Center of Manufacturing Technology

RCMT at the Czech Technical University is the main research base for manufacturing technology in the Czech Republic. Cooperation with industry is among RCMT's core activities and the research topics cover advanced simulation models, virtual prototyping and virtual testing, development of advanced feed drive control techniques and vibration suppression methods, advanced monitoring and diagnostics of machine tool condition, multi-axis machining technology etc.

Cutting-Edge Manufacturing Technologies in Practice

3D Printing

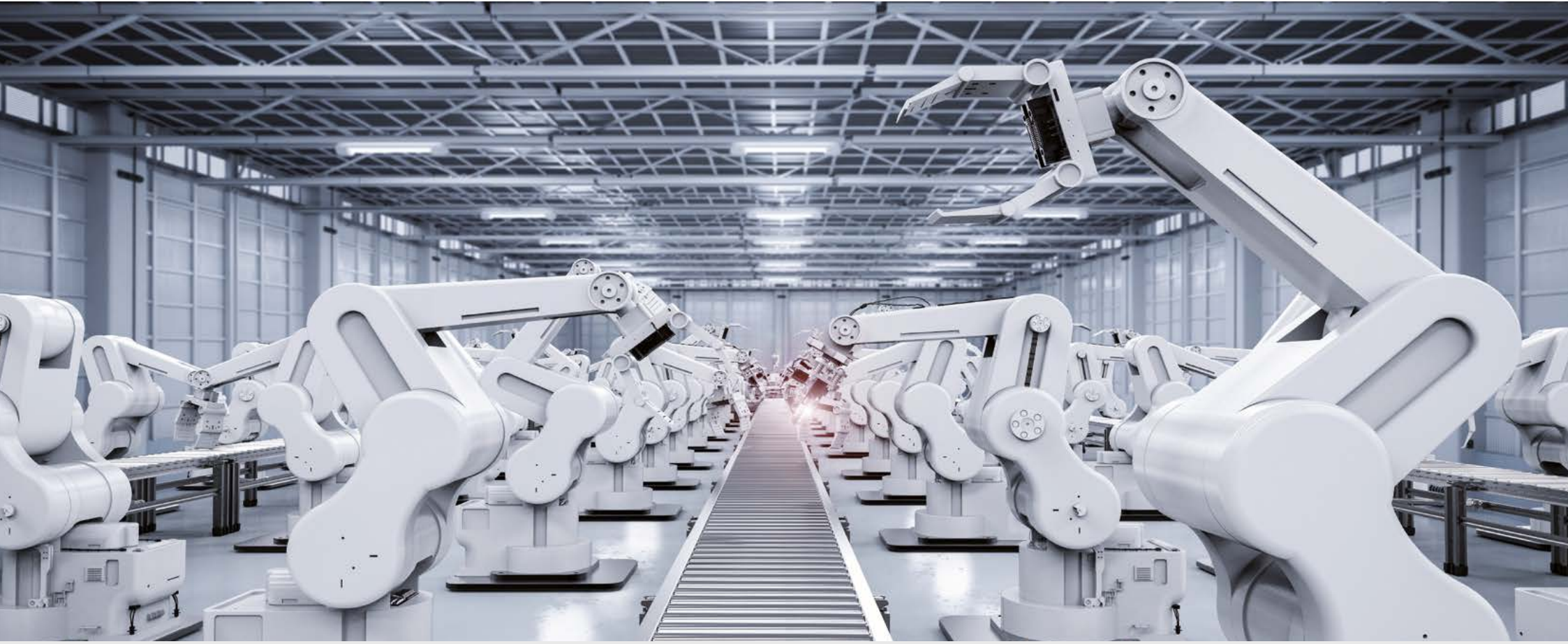
Prusa Research is a pathfinder in 3D printing since 2012. The company focuses on manufacturing of 3D printers and is a global leader in its category. According to 3D Hubs, Prusa i3 is the most used 3D printers globally, thanks to the Innovative approach through the full metal nozzle and the famous red pcb heated bed. Prusa Research is in the process of automation and robotization of production. It's a 3D printed 3D printer!

Hybrid MFG

This hybrid manufacturing technology developed by Kovosvit and RCMT enables manufacturing with additive technology and welding of various combinations of materials; welding of functional surfaces, parts and details; repairs; creation of full parts with internal channels, shell parts and hollow parts - all in combination with machining. The rate of growth of parts of different steels is in the range of 0.2 to 1.0 kg/hour. It is the only technology of AM for industrial use fully developed in the Czech Republic.

Precise MFG

Wikov launched the remote diagnostic tool WiGuard for online monitoring of gearbox condition. WiGuard is a system for the complete driveline and enables optimisation of the maintenance plan for maximum availability and minimum downtime. Various data, such as vibration, temperature, speed, pressure and other parameters are monitored and postprocessed. Outputs are accessible in real time via a web-base interface. The software's advanced algorithms can detect gear-teeth and bearing damages in a very early stage, and thus prevent major gearbox damage.



Smart Factories – Concept for Advanced Manufacturing

+ Vertically and horizontally integrated IT systems
+ Virtual designing and prototyping, digital simulation instead of physical
+ Total decentralisation of decision-making and autonomy of production capacities
+ Individualised mass production, customisation and personalisation
+ Flexible localisation of production thanks to additive manufacturing

Selected Czech Companies in Industry 4.0

ABRA software for your business

AUTOCONT

ELKO ep

FCC PS STROJOVÉ VIDĚNÍ A ROBOTIKA PRŮMYSLOVÉ SYSTÉMY

Gaben

SIDAT AUTOMATION-INFORMATICS

Merica

MERZ

CERTICON

sewio

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