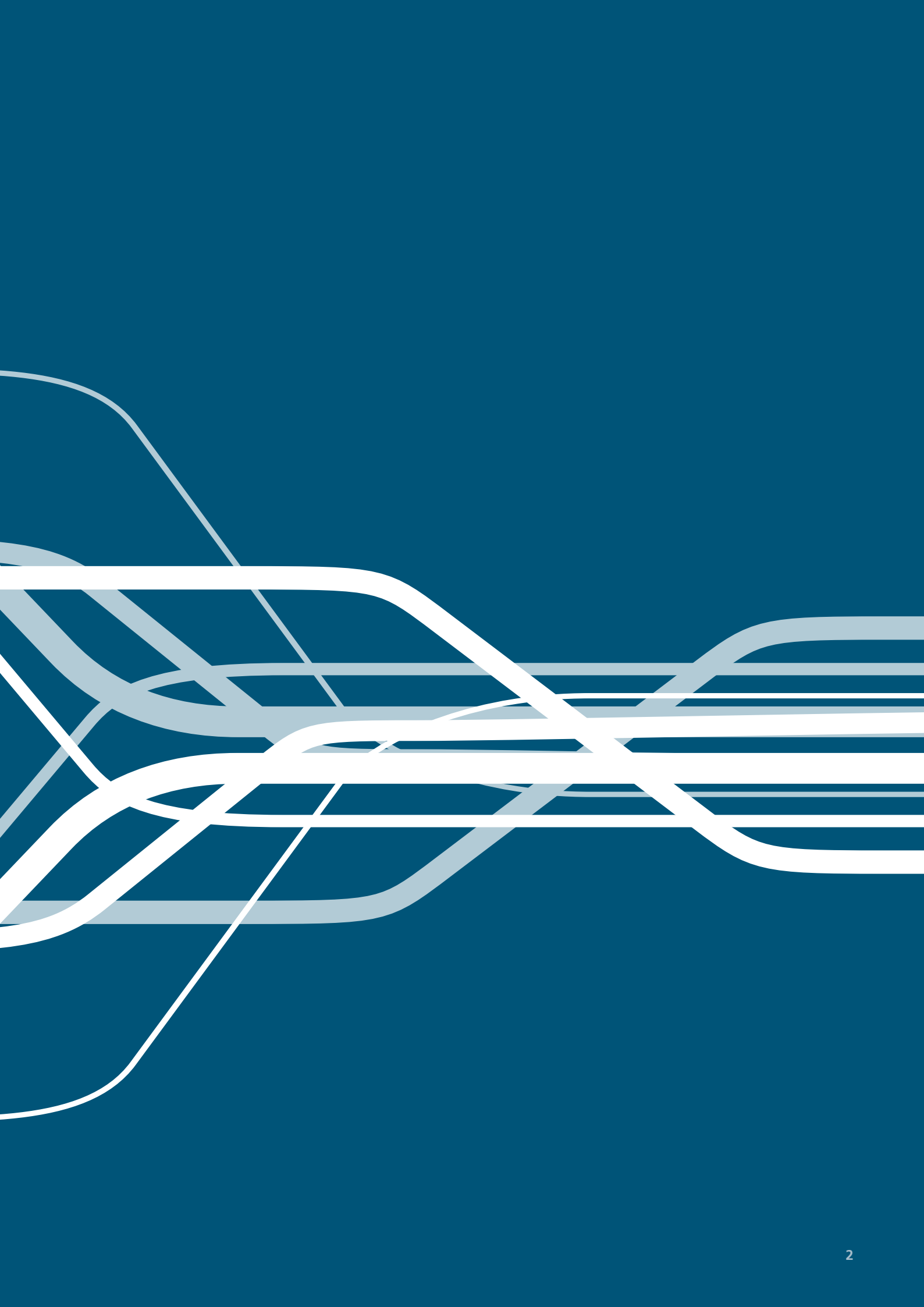
Fraunhofer IFF

2020 Annual Report

Contents



Editorial

Dear Readers,

2020 was certainly an unusual year. The COVID-19 pandemic demanded a lot from us – and still does. The impacts on the economy and society are enormous. The wheels literally stopped turning in many places around the world. Fraunhofer IFF experienced this too since our clients and partners were affected as well. All the same, our employees' hard work enabled the institute to meet these particular challenges too. We were able to bring many innovative projects to a successful conclusion and to launch new ones. We joined forces with other Fraunhofer Institutes to jointly develop technologies to combat the impacts of the coronavirus and future pandemics. And we continued working on our institute's future.

Among other things, we were able to celebrate the topping out of the Elbfabrik, Fraunhofer IFF's new research factory in Magdeburg's Port of Science. It will be finished in the coming year and contribute to Saxony-Anhalt's growth as a center of research and science. At this research factory, we will show companies and other interested parties how advanced factories can manufacture climate-friendly and resource-efficiently. Using examples, we will demonstrate how people can safely work together with cobots or how industrial companies can be reliably supplied and run with green power. And we will develop more new technologies and methods for sustainable and digital business there with our industry, logistics or skilled trade partners, which we will put into practice together.

All this research embraces a compelling concept of sustainability to which we Fraunhofer IFF research scientists are committed. Digitalization offers outstanding opportunities for this. It is an important building block for more efficient work and resource efficiency. This annual report is also intended to reflect this. Shorter than usual, it is resource-efficient. We invite you to learn more about the interesting projects on which we report here on the Internet instead. Simply follow the web links at the end of each article, contact the research scientists directly or share articles in your networks.

I wish you fascinating reading and look forward to being able to welcome you personally at Fraunhofer IFF soon!

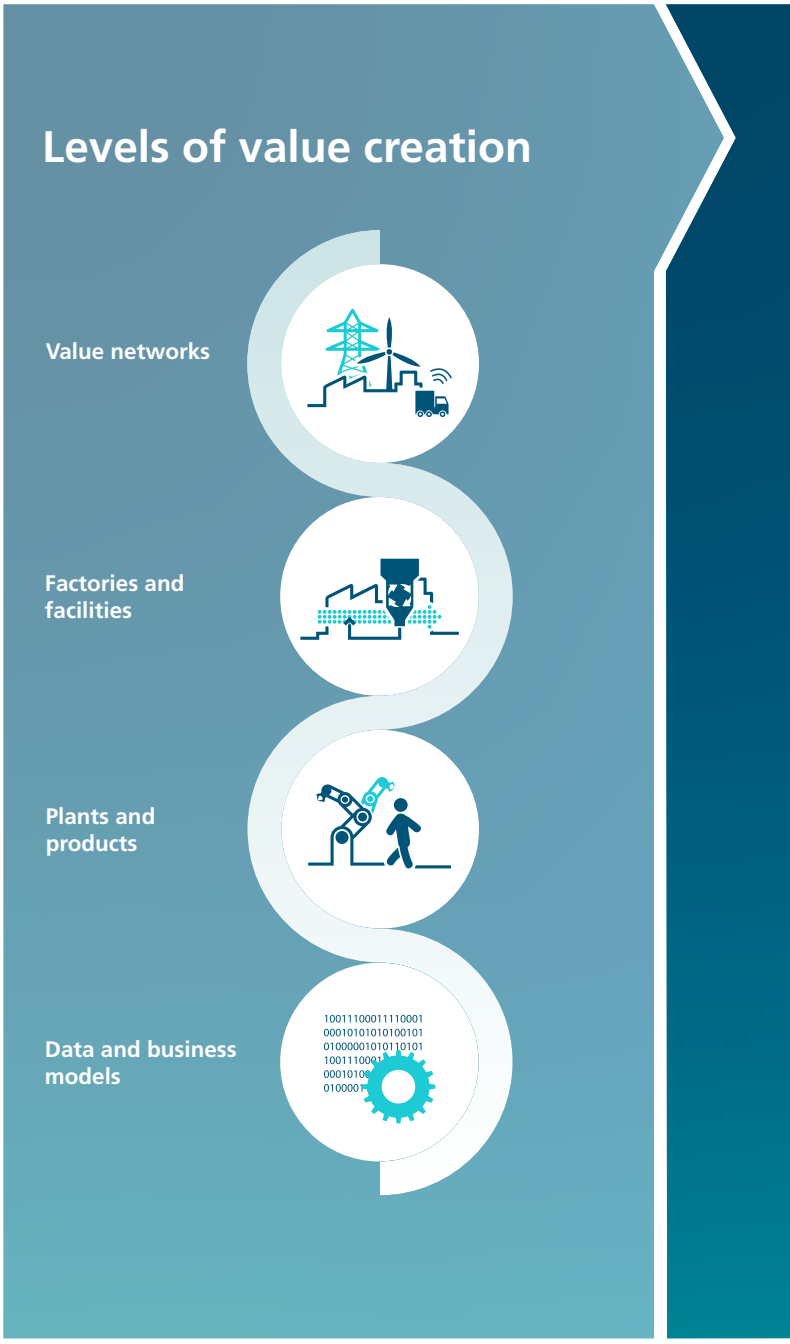
Your,
Prof. Julia C. Arlinghaus
Director of Fraunhofer IFF

Mission

The Fraunhofer Institute for Factory Operation and Automation IFF in the Fraunhofer-Gesellschaft specializes in manufacturing engineering. We stand for excellent applied research and are an important technological trendsetter for the business sector.

Some 190 research scientists from various engineering and scientific disciplines work at our institute. We draw on our long-standing expertise in the field of industrial digitalization and automation and employ machine learning and artificial intelligence to develop custom robotic and assistance systems that directly assist manufacturing staff, high-precision testing and inspection technologies that manufacture products defect-free and resource-efficiently, and unique solutions that supply energy smartly and sustainably. We design manufacturing and logistics processes to be efficient and future-proof and develop ideas for innovative business models. Because we analyze complete value chains, we boost the value of digitalized and connected products and production systems for manufacturers, operators and customers.

At the nexus of basic academic research and corporate practice, we implement our latest research findings in products and applications for industry. In the process, we are always keeping an eye on their evolutionary change and thinking another step ahead. We research for advanced, digitalized and reliable production and logistics systems consonant with Industry 5.0. We assume responsibility for protecting the environment as well as humans' health and participation in manufacturing. Our aim is to contribute to a new sustainability consonant with environmentally balanced and economically effective business development with our ideas and solutions. In these ways, technology and research partner Fraunhofer IFF is helping the public sector meet social challenges and providing cross-industry assistance to industrial companies as well as small and medium-sized businesses transitioning to "manufacturing of tomorrow".

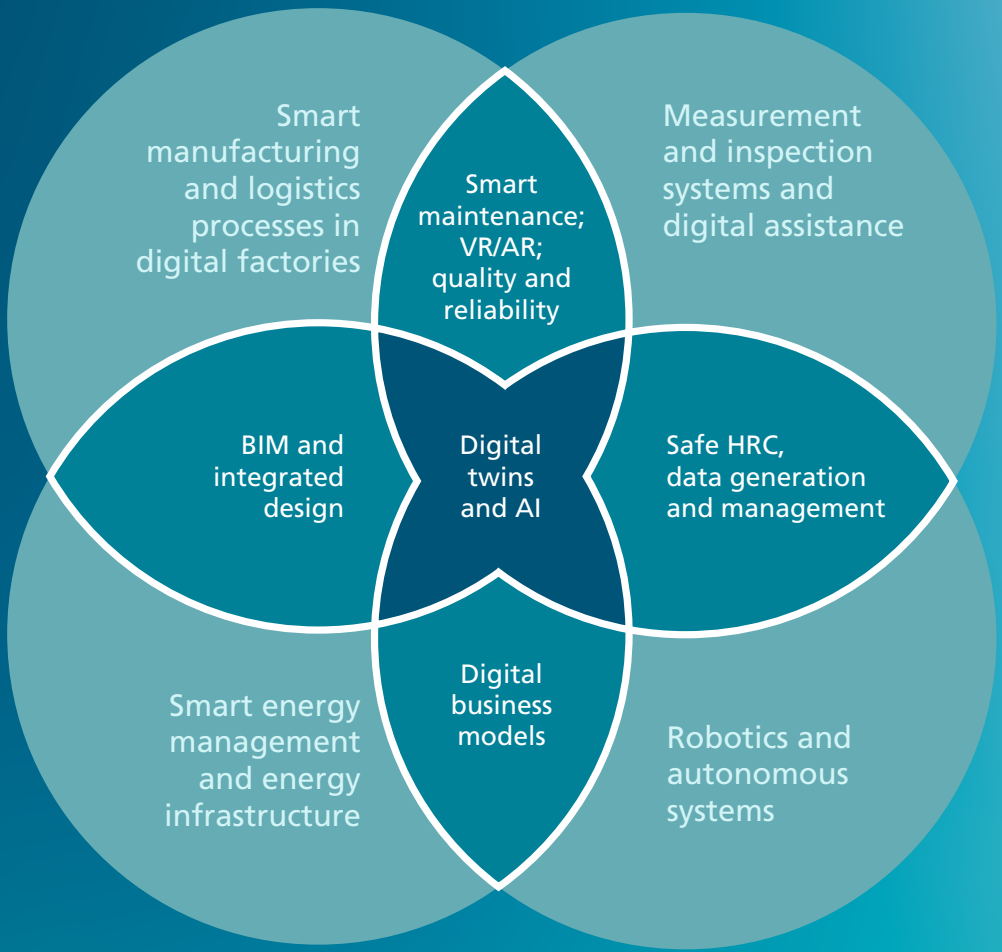


An important actor in applied research, Fraunhofer IFF is one of the dominant research organizations in Saxony-Anhalt. Our research scientists act as regional spokespeople in their fields and are helping shape the innovation processes in our state. The institute thus stimulates economic development and boosts the competitiveness of the businesses here.

We help design efficient, flexible, sustainable and reliable value creation processes across all industries.

Research specializations

Key integrative issues



This requires ensuring the scientific excellence of our research. To this end, we collaborate closely with Otto von Guericke University Magdeburg and Magdeburg-Stendal University of Applied Sciences, among others. We are additionally supported by a network of affiliated academics and industry representatives. This collaboration between academia and business ensures that Fraunhofer IFF and our research and industry partners are sharing knowledge and experience continually and synergistically.

We also assume responsibility in the development of young professionals. Through its close ties with Otto von Guericke University Magdeburg, Fraunhofer IFF mentors young research scientists, who find interesting work and career prospects here at an early stage. At the same time, it provides employees excellent starting conditions for challenging jobs in academia, business and industry later. Fraunhofer IFF thus plays an important role in educating highly qualified professionals for business and industry.

In the fast robotics project, Fraunhofer IFF's robotics experts developed a new wireless control architecture for mobile assistive robots with their development partners with which such robots can even be used in manufacturing,.
Fraunhofer IFF

fast robotics

Wireless Control Technology for Real-Time Control of Smart Mobile Assistive Robots

The possibility of widely using smart mobile robots in the future would furnish industry with prospects for a lasting surge in innovation. New agile manufacturing methods and factory designs would be possible. Although assistive robots and interconnected and collaborating flexible robot systems are able to collaborate with humans in many places, mobile assistive robots have not been able to establish themselves in industry. Versatile robot applications for the widest variety of jobs with no or minimal programming required has been a significant and hitherto insurmountable challenge. Moreover, current systems are too slow to have even rudimentary humanoid capabilities, e.g., object recognition and manipulation.

A team of Fraunhofer IFF robotics experts and industry and research partners succeeded in overcoming these challenges in the fast robotics research project in the Zwanzig20 initiative funded by the Federal Ministry of Education and Research. Employing the latest high-performance wireless technology, they developed a solution comprised of distributed control systems connected wirelessly. This enables wireless real-time communication between distributed smart mobile robot applications and their surrounding infrastructure for the first time, thus making it possible to control them in real time too.

The research team's novel approach is based on transforming the hitherto strictly hierarchized automation pyramid into a highly connected system. This made it possible to relocate the requisite computing to external servers and to have cloud computers provide the robot's core functions, such as sensor data processing and motion generation. The assistive robots were additionally equipped with smart base capabilities that can only be implemented in combination with connected, outside IT services on powerful computers. The engineers at Fraunhofer IFF, which has been successfully researching smart mobile robots for years, developed the hardware and software needed for this themselves.

Ultimately, mobile and stationary robots can now be wirelessly monitored, located, configured and controlled in real time with the aid of a wireless infrastructure. This also simplifies the integration of external sensors, e.g., stationary cameras monitoring the robot's environment and services building upon them. Moreover, lighter and more flexible mobile robots and manipulators can be built since they no longer have to carry their entire computer hardware and power supply. In the future, this will make it possible to develop entirely new robot systems for industry and sectors in which assistive robots have not been usable because of their inefficiency.

More information and contacts:

Cobot Designer

More information and contacts:

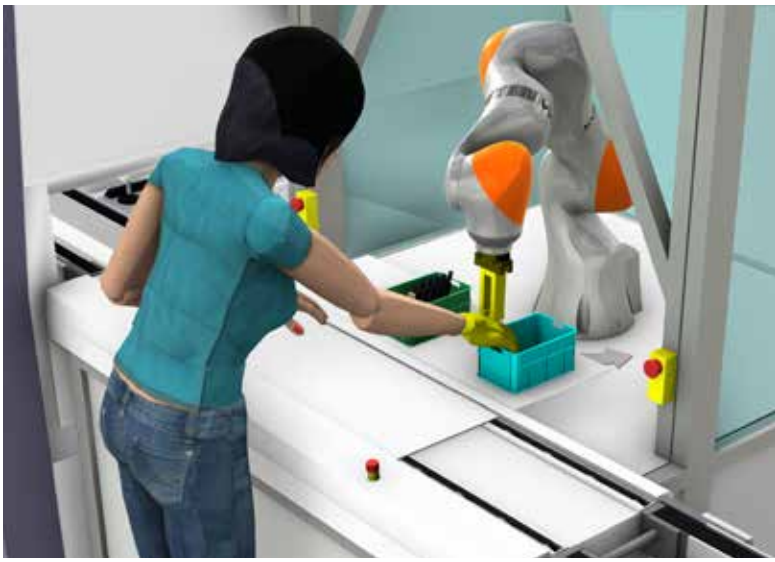
Simple Design Tool for Safe Human-Robot Collaboration

Collaborative assembly jobs performed by humans and robots at a workstation must be meticulously designed and validated beforehand. Determining the speeds cobots, i.e., robots that collaborate with humans without additional safety equipment, may not exceed in order not to harm any humans they touch has only been possible with the aid of a complex measured risk assessment. The robot system must be fully built and programmed to be measured. The speed of a robot that exceeds the acceptable limit during measurement must be reduced. This increases the robot system's cycle time and reduces its economic efficiency.

Contracted by the German Social Accident Insurance Institution for the Woodworking and Metalworking Industries (BGHM), Fraunhofer IFF developed a new web-based design tool in the research project Digital Hazard Prevention for Cobot Workstations with the Aid of a Web-Based Design Tool (Cobot Designer, for short), which helps users design their cobots safely and efficiently for improved job safety. Cobot Designer already identifies the speeds of safe human-robot collaboration (HRC), especially when humans and robots can touch, in the design stage.

The interactive Cobot Designer web app is available to businesses and anyone designing a HRC workstation on www.cobotplaner.de. Users enter information on their robot system and existing impact hazards in Cobot Designer's intuitive user interface in just three steps. Then, Cobot Designer simulates the hazardous situations and uses the results to ascertain the maximum speeds at which the robot still complies with ISO/TS 15066 limits.

Different models that accurately reproduce the effect of contact between humans and robots are the technological basis of Cobot Designer. These include a hazard and robot model and a biomechanical model of a human. The parameterized robot model fundamentally makes it possible to use any type of robot suitable for collaborative operation in Cobot Designer. The biomechanical model of a human draws from data and findings from Fraunhofer IFF's human-subject studies conducted on behalf of the DGUV and BGHM to ascertain biomechanical limits. Fraunhofer IFF validated Cobot Designer's simulation results experimentally in stress tests with human subjects together with physicians from Otto von Guericke University Hospital's Traumatology Clinic and with the involvement of the appropriate ethics commission.



Accurate models of humans and robots are the foundation of Cobot Designer, which is used to design human-robot workstations easily and safely.
Fraunhofer IFF

LiSA

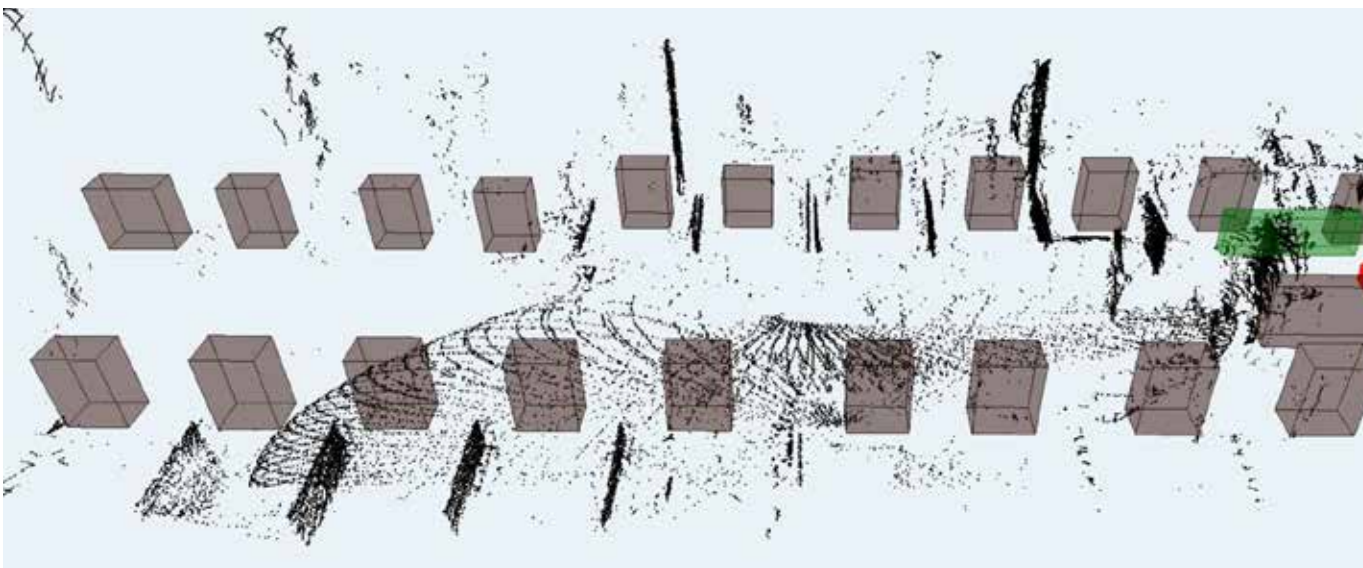
Smart Workspace Monitoring

Automating logistics requires new ideas for process analysis and monitoring. Conventional methods of situation analysis require the use of additional hardware at the facilities of those involved in the process and thus significant labor for integration and maintenance. Furthermore, there is a risk that objects cannot be detected without appropriate tracking hardware. The emergence of novel and cost-effective light detection and ranging (LiDAR) technologies is enabling the creation of flexible solutions for workspace monitoring.

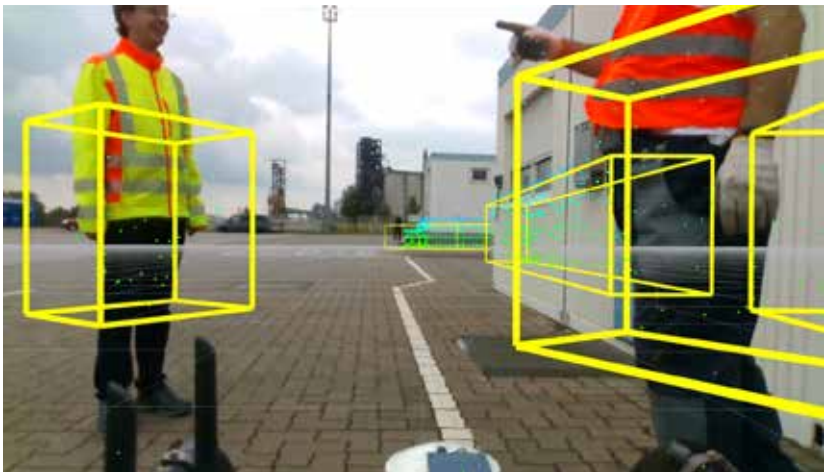
The LiDAR workspace monitoring system LiSA is a solution that enables companies to monitor and analyze their internal processes and to take countermeasures. Potential applications include dynamic order picking without safety fencing (safety zone monitoring) and supermarket picking processes (logistics process analysis). All objects are separated from the 3D data, tracked and reliably classified using AI methods. This enables early detection and correction of mistakes and protection of humans interacting with autonomous robots and machines.

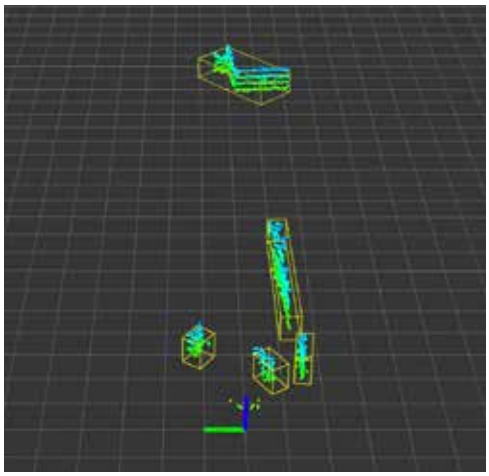
This product is being developed together with our industry partner Hannweber Engineering to meet TÜV and Berufsgenossenschaften standards of functional safety.

More information and contacts:



The LiSA workspace monitoring system can be used to analyze so-called picking processes, e.g., in supermarkets, to analyze logistics processes.
Fraunhofer IFF





Multiple mobile sensor object tracking with active IR stereo vision and LiDAR sensors with rotating prisms.
Fraunhofer IFF

RavE-Bike

On-Demand and Control System for Autonomous Connected E-Bikes

Autonomous electric vehicles operating as differently organized smart sharing systems can be the foundation of future transportation plans. The RavE-Bike project aims to combine the benefits of bicycle-based personal transportation with on-demand services intended for the automotive sector. This is the basis for developing cost effective transportation and movement, e.g., for internal personal transportation at large industrial facilities. Apart from the cost effective and efficient utilization of shared bicycle fleets, the value added lies in constant availability and reduced need for parking. Automation of the entire ride process and efficient coordination of the connected elements are the foundations of this vision.

This requires a connected system of smart e-bikes, local and stationary environmental sensors and a central scheduling tool, thus enabling reliable and coordinated autonomous vehicle movement in industry.

Fraunhofer IFF developed and evaluated technologies and methods with which an effective, robust and integrated environment scanning system can be implemented in such outdoor scenarios in the collaborative RavE-Bike research project funded by the Federal Ministry of Education and Research. Among other things, the researchers fused multiple infrastructure and mobile sensors to do this.

More information and contacts:

Quality Assurance

Collaborative, Portable 3D-Kosyma Inspection System

This optical inspection system detects geometry, assembly and manufacturing errors in medium to large volume parts.
Fraunhofer IFF

More information and contacts:

Geometry inspection of large parts with dimensions of several meters confronts inspection systems with particular challenges. Solutions in the form of coordinate measuring machines have been expensive and not very flexible. Likewise, robotic optical sensors can only be operated with high installation costs and their use for small lot sizes is often not economically viable.

This is why Fraunhofer IFF developed a novel optical inspection system in collaborations with its partners KOLBUS GmbH & Co. KG and GITTA mbH, which is particularly suited for detecting geometry, assembly and manufacturing errors in medium to large volume parts. This solution, which was funded by the Federal Ministry of Education and Research and the Zwanzig20 innovation program, is an interactively controlled 3D sensor combined with an augmented reality solution.

The newly developed system's intuitive control makes it particularly suited for diversified large parts that have to be inspected in short runs and one-offs. Professional users' valuable experiential knowledge is harnessed to guide the sensors manually. Fast algorithms make it possible to objectively scan objects three-dimensionally. The system has been successfully tested in custom equipment manufacturing to inspect castings and welded structures for geometry flaws before CNC machining.

The 3D hydraulic valve assembly assistant technology demonstrator. Fraunhofer IFF

3D Assembly Assistant

Intuitive Instructions for and Optical Inspection of Manual Assembly of Diversified Products

Our society and industrial world are experiencing sweeping changes. Demographic change and growing product customization are confronting industrial manufacturing with new challenges. The redesign of existing workspaces and manufacturing technologies is becoming a key lever for sustaining competitiveness.

The flexibility increasingly necessary in industrial assembly processes is often only economically feasible when assembly is done manually. Complexity and wide variety are imposing very high demands on employees' performance and resilience, though. At the same time, demands on product quality are growing.

Intuitive assistance systems can make an important contribution here. They guide workers through the assembly process situationally and contextually aware and detect errors made during assembly.

Fraunhofer IFF developed technologies and methods for producing such assistance systems customized for specific applications in the collaborative research project 3D Assembly Assistant funded by the Federal Ministry of Education and Research. They were successfully prototyped and evaluated in an assembly process for hydraulic valves. They function based on a digital twin that allows for augmented reality-based assembly templates, 3D model visualizations of current work in progress and image-based inspection of the completed assembly, among other things.

More information and contacts:

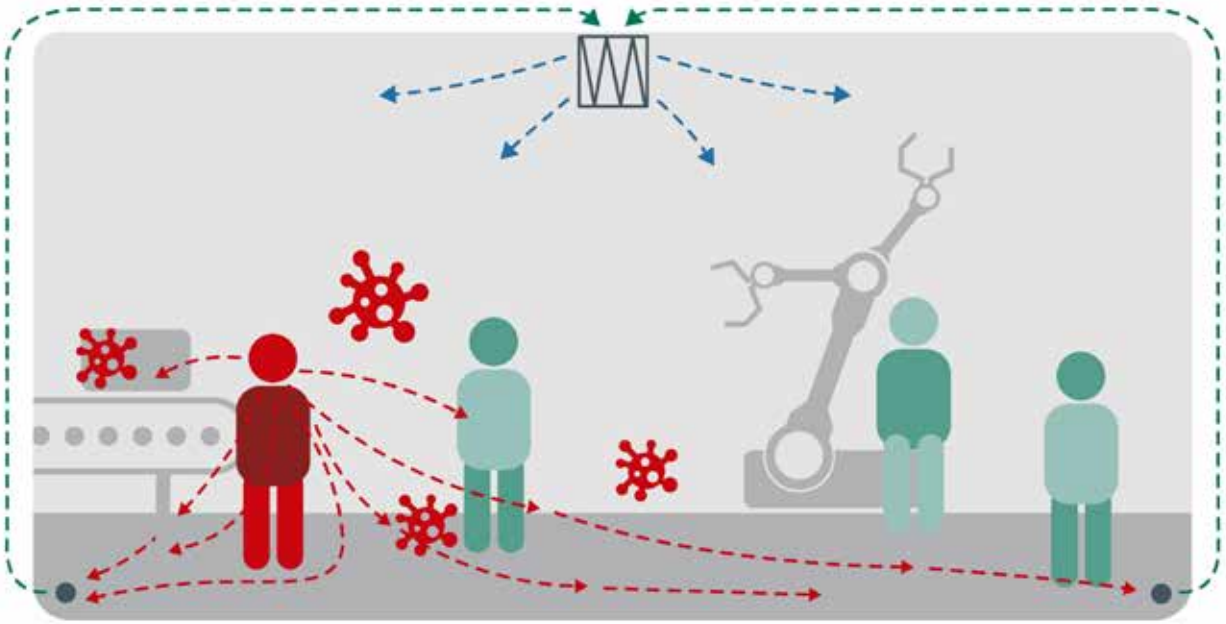
United against Corona

Anti-Virus-Aerosol: Testing, Operation, Reduction AVATOR

More information and contacts:

Aerosols are crucial to the transmission of SARS-CoV-2 (coronavirus). These minute droplets expelled by breathing, talking, sneezing or coughing people provide an environment in which viruses can survive several hours. They can remain airborne for distances of several meters. The Fraunhofer-Gesellschaft is working on the AVATOR research project in its fast track anti-corona program from October 2020 to September 2021. Among other things, numerical simulations are being performed to study the dispersion of coronavirus through the air in different settings, such a buses, airplanes, shopping centers or manufacturing facilities.

Fraunhofer IFF's job as a member of the research consortium is to define manufacturing environments for this study and to collect real data. Furthermore, the research scientists in Magdeburg are developing a standard description methodology for all simulated use cases to keep the accuracy and range of the modeling on a comparable level. Moreover, they are significantly involved in the evaluation of a suitable mathematical model that assesses risk of infection in the simulated use cases and estimates the impact of different safety measures. Individual safety plans are derived for the respective use cases from the risk assessment and the ensuing information for optimal safety measures.



Among other things, Fraunhofer IFF is defining manufacturing environments for study with computer simulations of aerosol dispersion in the joint research project AVATOR.
Fraunhofer IBP

The DoPEP platform is easily integrated in existing IT environments. Suggestions that support decision-making can be generated for different user groups and easily visualized.
Rolls-Royce

Digital Platform for Digital and Collaborative Staff Scheduling

Dynamically changing customer demands make staff scheduling a complex task. On the one hand, existing capacities ought to be utilized expediently, On the other hand, staff scheduling ought to be organized to have an optimal impact on employees' motivation and performance. Lacking IT support and heterogeneous data structures often exacerbate this additionally. Given this situation, Fraunhofer IFF developed an integrative web app with Rolls-Royce Deutschland Ltd. & Co.KG in the project Digital Collaborative Staff Scheduling (DoPEP), which reliably schedules staff in day-to-day business operations. The special thing about it is that operational practitioners can use it to mediate potential time conflicts and conflicts of interest transparently.

The platform factors in the requirements of the production schedule and synchronizes this with shift schedules and employees' personal qualifications. DoPEP employs mathematical optimization to boost predictability among everyone involved, especially in bottleneck processes. Once the platform had been implemented, the work required for coordination was reduced, "Alibi work" by employees was eliminated and the workforce productivity of the teams involved increased by as much as thirty percent. The intuitively navigable user interface makes the system easily understandable by all users and enables high responsiveness, specifically to unexpected events.

More information and contacts:

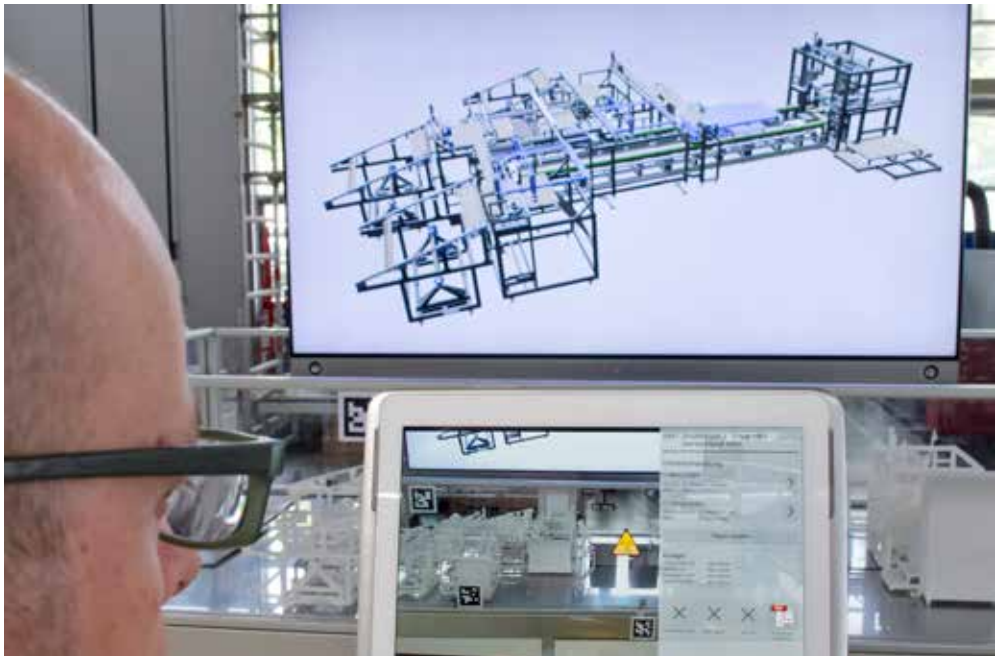
Early Detection of Potential Manufacturing Disruptions through Machine Learning

Six Fraunhofer Institutes in the ML4P flagship project lead managed by Fraunhofer IOSB are researching methods and tools to develop the capabilities of machine learning (ML) in manufacturing systematically.

In an implementation module, Fraunhofer IFF is studying the use of ML models for early detection and prevention of potential disruptions in manufacturing processes. A water filter manufacturing plant operated in multiple shifts by SUEZ WTS Germany GmbH at its Bitterfeld facility is serving as the use case. The objective is to boost the plant's productivity and quality rate. To this end, the plant was equipped with additional sensors that enable continuous monitoring of stacking and winding processes that significantly affect the quality of the finished product. The recorded data are connected to a configurable ML processing pipeline in which data are processed and analyzed, Appropriate ML models are trained and evaluation results are provided to plant operators on an assistance system. The procedural model is run in edge computing, i.e.,. locally on the plant, because of current security standards.

The procedural model will also be employed in a demonstration plant at Fraunhofer IFF where operational data will be analyzed and evaluated by cloud modules of the ML processing pipeline. This will make it possible to predict potential disruptions reliably.

More information and contacts:



The assistance system connected to the ML processing pipeline informs plant operators about possible disruptions in the process and helps them reduce their occurrence or impact through recommended actions.. Fraunhofer IFF

Automated straddle carriers at the container terminal in Wilhelmshaven – efficient and secure.
EUROGATE

Protection against Cyberattacks

More IT-Security in Port Terminals

The digitalization of port logistics processes in the Industry 4.0 environment is establishing the basis for developing greater capabilities to boost efficiency. They also harbor security risks, though, which not only can have economic impacts but also can affect process stability and IT security against cyberattacks. Moreover, there are no system security standards for port automation projects.

The AUTOSEC project aims to increase IT security in ports and supply chains and to defend IT systems and cyber-physical systems from cyberattacks preventively. In collaboration with the port operators EUROGATE and Magdeburg Port and METOP GmbH, Fraunhofer IFF developed a novel scalable method set and process model for the design and implementation of automation projects in ports and their validation from August 2017 to December 2020. Prototypes of the approaches developed were evaluated at the ports of the operators involved in the project, successfully demonstrating their function and applicability.

More information and contacts:

Stable Energy Supply in Future Grids

Smart Control System for Integrated Energy Systems

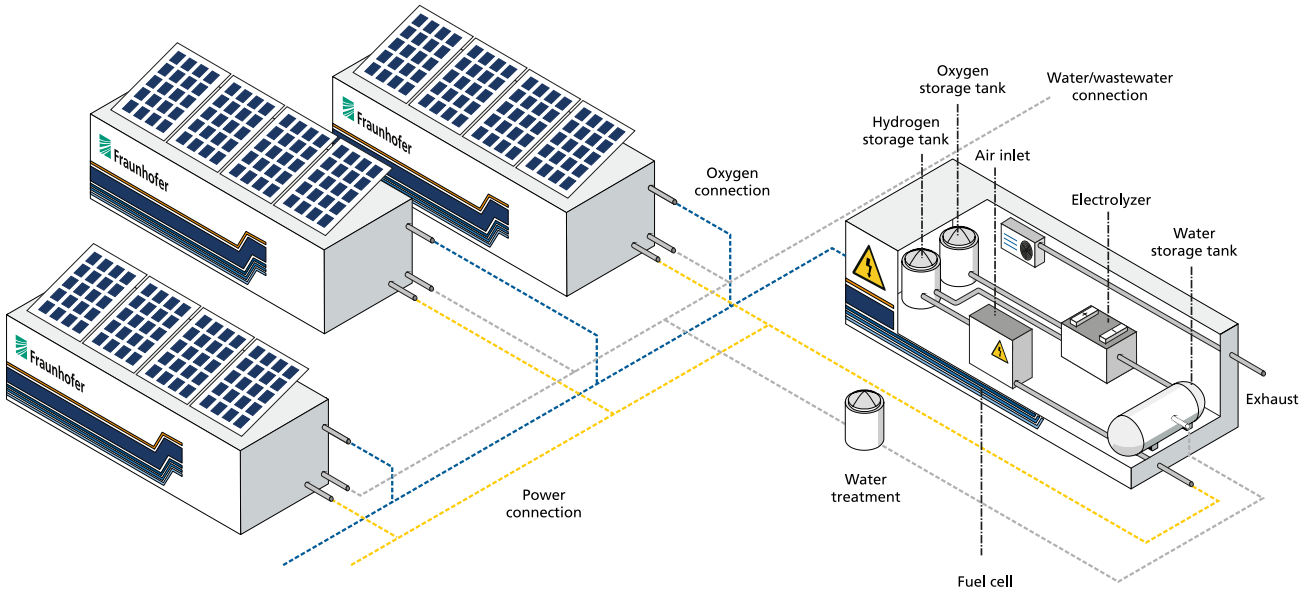
More electric transportation or more injection plants? The way we produce and consume electricity is changing rapidly. This is increasing the demands on our electricity grids. Fraunhofer IFF will develop a smart control system for integrated energy systems together with Siemens AG by 2022. It is intended to help electric infrastructures interact optimally with other infrastructure sectors. The idea behind this envisions different infrastructures, e.g., for heat, water, transportation or power, serving as mutually supportive backup storage and load balancing elements in a future demand-responsive grid. This will enable infrastructure operators, such as public utilities, to ensure their system's stability in the future. This will make it possible to postpone or even avoid potentially necessary grid upgrades in part.

Fraunhofer IFF researchers will be developing the requisite technologies in three stages. The first stage will focus on integrating charging infrastructure and electricity grid operation for electric transportation. Depending on the situation, this will enable reducing the load of charging, thus permitting a maximum charge rate by means of smart control without any risk of overloading the existing infrastructure.

Fraunhofer IFF's Energy Operation Center.
Fraunhofer IFF

Simple user interfaces and control elements, which facilitate simplified operation and situational awareness will be created in the second stage. The research scientists intend to integrate other sectors and extend this integration to the electricity, heat and water supply in the third stage, which will conclude by the time the project ends.

More information and contacts:



The complete Demo-medVer design.
Fraunhofer IFF

Demo-medVer

Mobile Medical Emergency Centers for Global Use

Mobile distributed systems that provide medical care to the public can be a crucial addition to the existing healthcare infrastructure in the event of crises and catastrophes, such as the current coronavirus pandemic. Six Fraunhofer Institutes under the lead management of Fraunhofer IFF in Magdeburg are developing a modular system for mobile distributed medical care in the Demo-medVer project. All of the complete system's components are modularized, interconnected, and complementary. A functional prototype is intended to be built by the end of 2021.

The research scientists have opted for a standardized modular system so that centers can be set up and dismantled quickly and flexibly. They can be custom built for the country of operation, the reason for their use and the emergency response organization (THW, fire department, emergency medical services, Doctors Without Borders, universal healthcare), and the infrastructure on hand.

Along with coordinating the project, Fraunhofer IFF is working on the complete design and the product design. The most important subtasks include development of a self-sufficient power and heat supply, primarily covered by renewables and using current technologies, such as electrolyzers and fuel cells. The team will be employing power-to-X technologies (P2X) for this and is developing a modular P2X systems container. An electrolyzer will produce oxygen and hydrogen. Fuel cells will subsequently convert the hydrogen into electricity. The oxygen produced and the waste heat from electrolyzers and fuel cells will also be available to emergency centers.

More information and contacts:

Digital Twins of Manufacturing Facilities

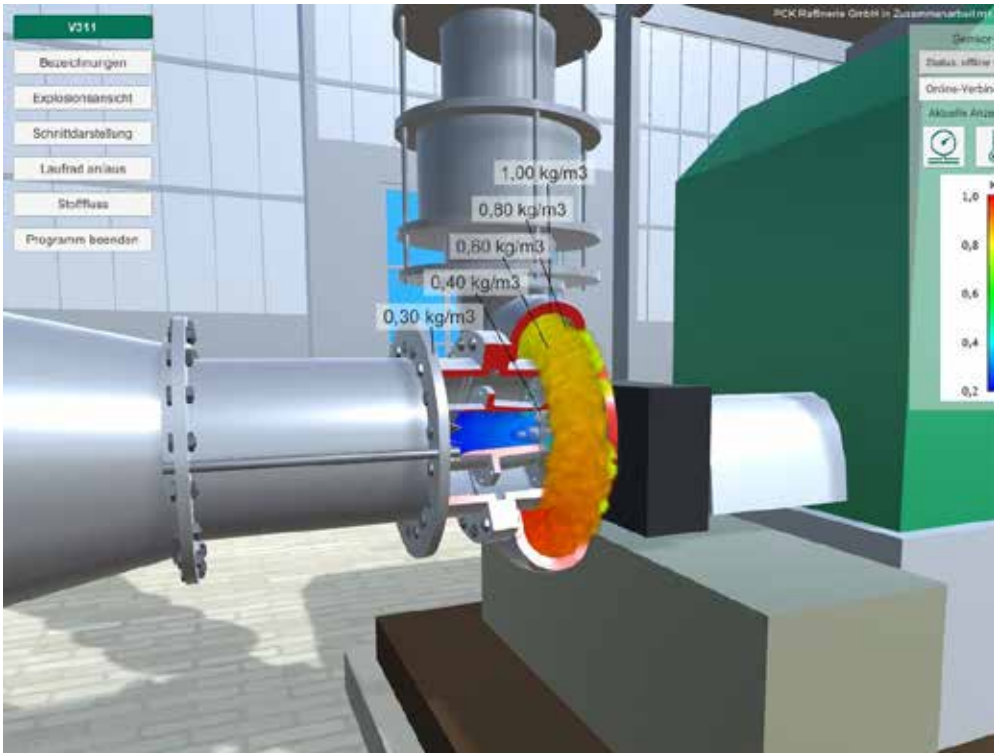
Industry, including chemical plant construction and process manufacturing, is gaining a major edge with the digitalization and integration of digital twins of manufacturing facilities. Fraunhofer IFF is helping PCK Raffiniere GmbH build a digital twin of its manufacturing facility in Schwedt. The digital twin creates new value added for design, operation and training, thus facilitating the facility's viable future development.

A detailed digital model of the entire 20 km² facility, including infrastructures and building and local companies and their services, was created for PCK Raffiniere GmbH and converted into a virtually interactive 3D facility information system, which can be used to present the facility and support construction project planning.

What is more, the digital twin has various connections to other systems and to the real equipment. Process simulations can be connected in offline or online mode, for instance.

Basic and advanced training profits from the related digital detailed images and interactive function model of equipment. The online connection is used to integrate real equipment's sensor values in the digital model. The digital twin thus delivers a current real image of the real equipment. The status data can additionally be used for data analyses or to initiate communication processes for specific services.

Digital compressor twin with a process simulation and a live data connection, Fraunhofer IFF



More information and contacts

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Topping out Ceremony for the Institute's Elbfabrik Addition

September 4, 2020

Fraunhofer IFF is building a new research factory at its second facility in Magdeburg 's Port of Science. A modern building for industrial research will have been built there by 2022 for €18.5 million, the European Union providing half of the funds and the state of Saxony-Anhalt and the federal government each providing one quarter. The institute celebrated the new building's topping out on September 4, 2020 with its guests and in the presence of Saxony-Anhalt Minister of Economic Affairs, Science and Digitalization Armin Willingmann (r.) , Magdeburg Mayor Lutz Trümper (m.) and Director of Research Strategy and Policy at the Fraunhofer-Gesellschaft Mathias Rauch.

The future Elbfabrik research factory is an addition to Fraunhofer IFF's Virtual Development and Training Center VDTC in Magdeburg's Port of Science and will be home to several of the institute's new research specializations. An integrated research and demonstration factory, which replicates the entire production cycle from digital development to manufacture and maintenance up through smart, sustainable energy management, is being built on 4,500 m².

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Advisory Board Chair is Johannes Krafczyk.**

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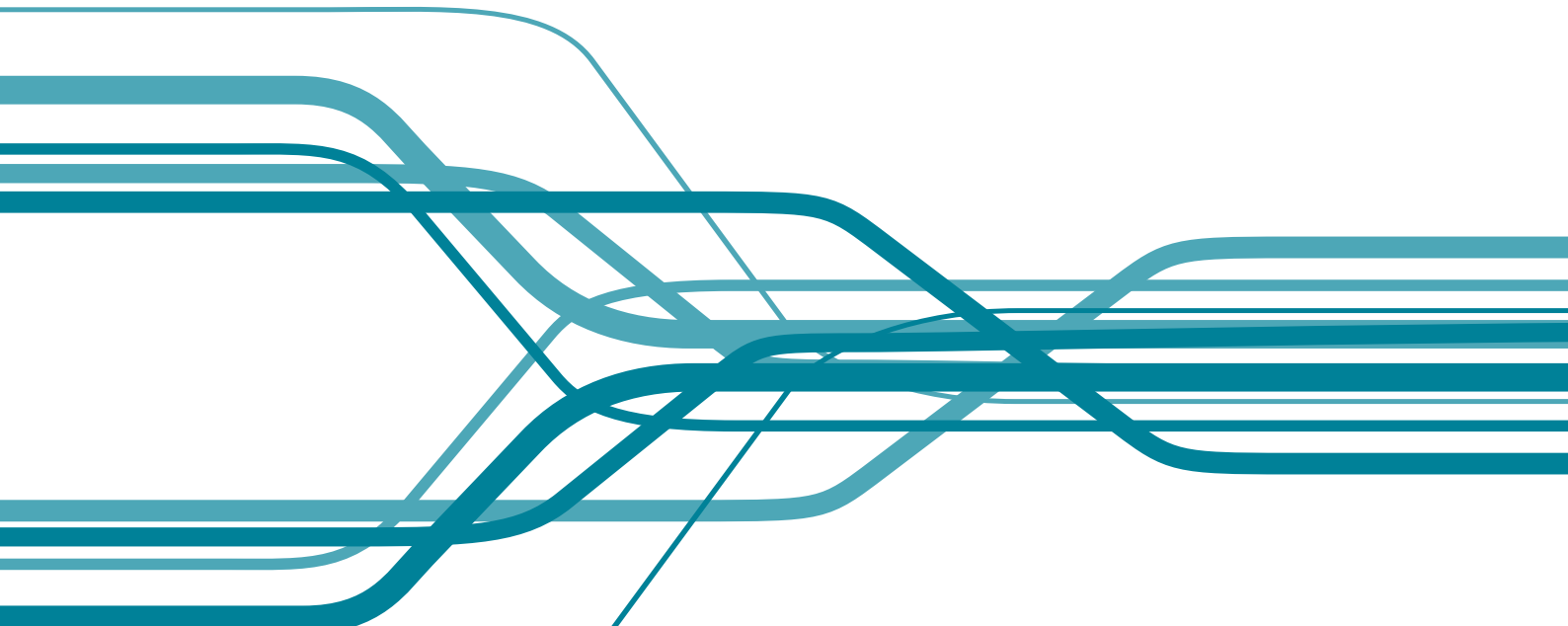

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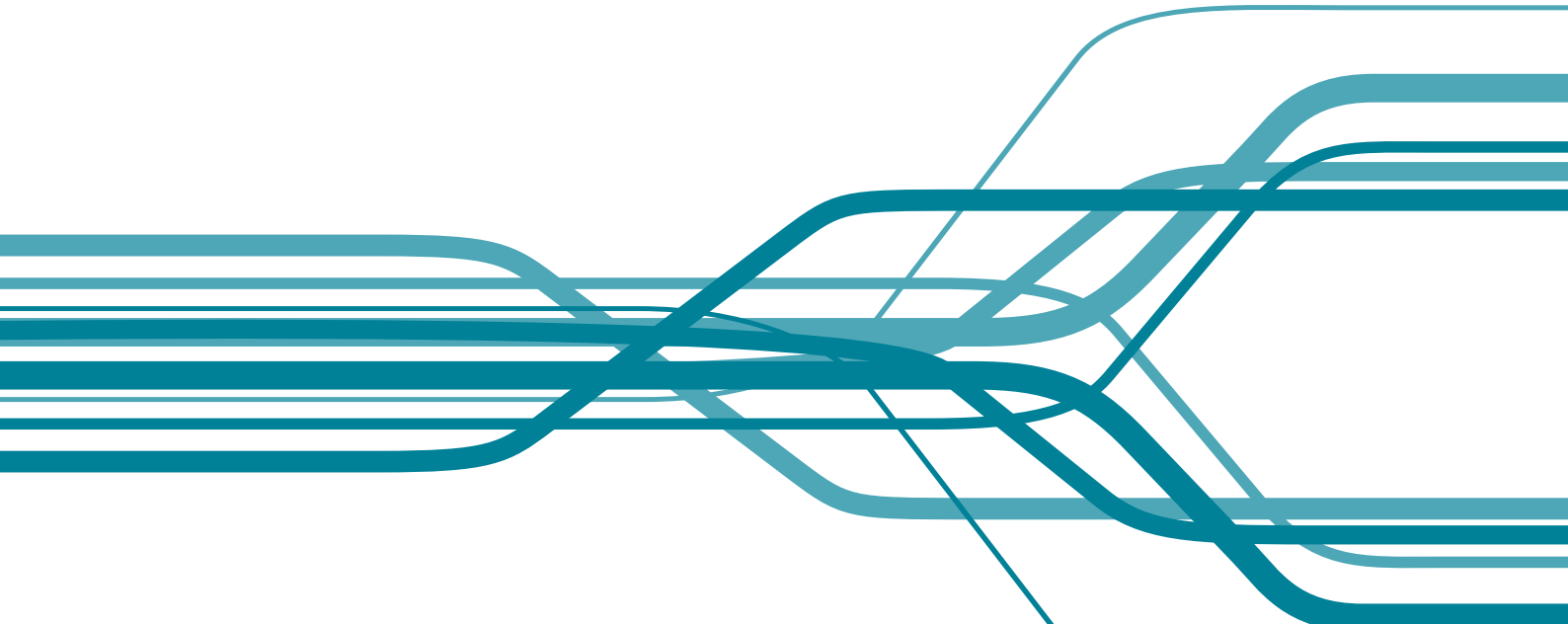
Managing Director, Eureka Association AISBL



The Institute in Numbers

Budget and Revenue*

Fraunhofer IFF's total budgetary expenditures in the year 2020 were € 19.1 million. Budgeted capital expenditures totaled € 0.5 million. Total revenues were € 19.7 million. Business revenue accounted for € 4.4 million of that. € 9.4 million came from the public sector and other funding. € 5.9 million was institutional funding.

Human Resource Development

Fraunhofer IFF employed 185 full-time employees as of December 31, 2020. The majority of our research scientists have a degree in an engineering discipline. We have had the good fortune to be able to enlarge our percentage of employees in the field of computer science and information technology despite industry's strong demand for such qualified professionals. Staff with degrees in human sciences, economics, mathematics, physics and business work at the institute as well. They all work together in interdisciplinary research teams and administrative services.

Education and Training

One hundred two student assistants and nineteen interns additionally supported our research work. We are also pleased to have supervised three professional apprentices.

Forty-nine of Fraunhofer IFF's employees worked as instructors and adjunct instructors at universities and universities of applied science. We advised ninety-two master's and Diplom theses and six successfully completed dissertations. Furthermore, the institute's research scientists published 125 articles and publications in 2020.

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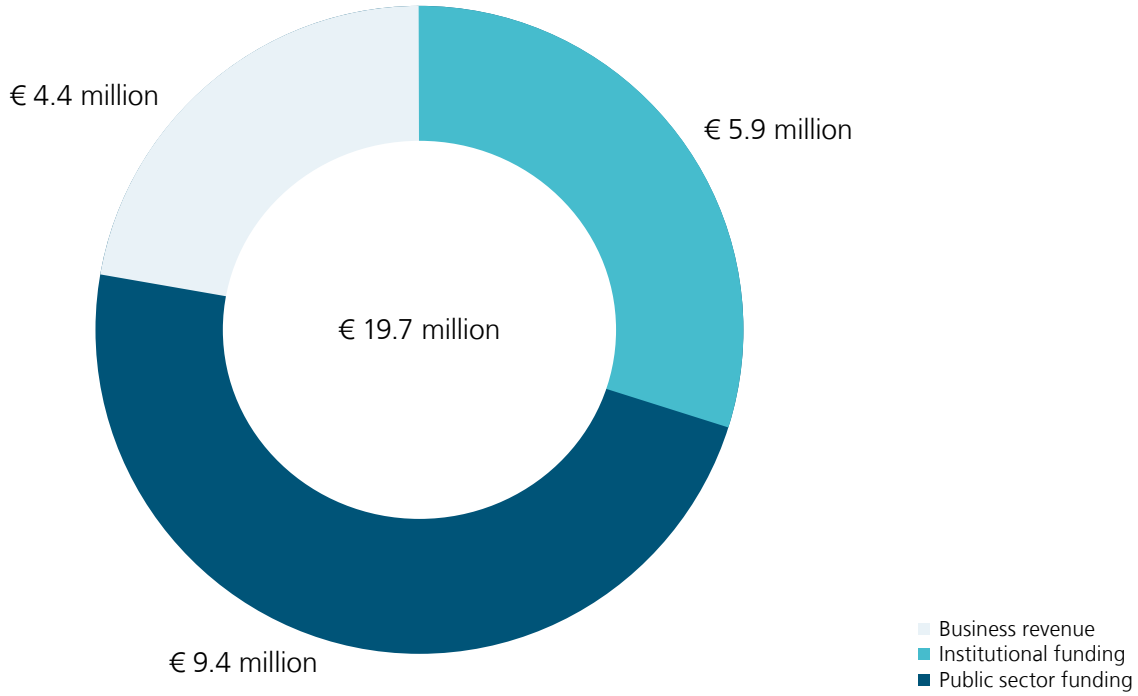
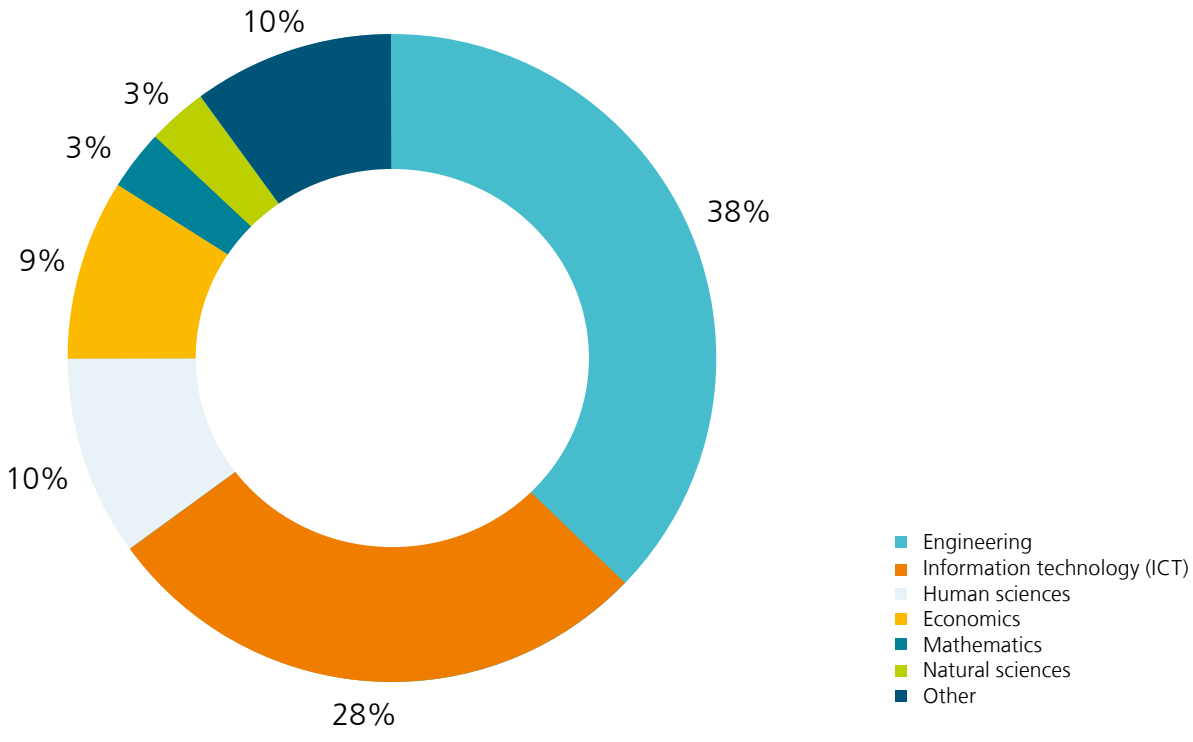
*All amounts are rounded

Fraunhofer IFF's total revenue in 2020*



Employees at Fraunhofer IFF in 2020: 185



The Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft based in Germany is the world's leading applied research organization. Prioritizing key technologies relevant to the future and commercializing its findings in business and industry, it plays a key role in the innovation process. It is a trailblazer and trendsetter in innovative developments and scientific excellence. The Fraunhofer-Gesellschaft supports research and industry with inspiring ideas and sustainable scientific and technological solutions and is helping shape our society and our future.

The Fraunhofer-Gesellschaft's interdisciplinary research teams turn original ideas into innovations together with contracting industry and public sector partners, coordinate and complete essential key research policy projects and strengthen the German and European economy with ethical value creation. International collaborative partnerships with outstanding research partners and businesses all over the world provide for direct dialogue with the most prominent scientific communities and most dominant economic regions.

Founded in 1949, the organization currently operates seventy-five institutes and research units in Germany. Around 29 000 employees, predominantly scientists and engineers, work with an annual research budget of € 2.8 billion. Fraunhofer generates € 2.4 billion of this from contract research, industry contracts and publicly funded research projects accounting for around two thirds of that. The federal and state governments contribute around another third as base funding, enabling institutes to develop solutions now to problems that will become crucial to the economy and society in the near future.

The impact of applied research goes far beyond its direct benefits to clients: Fraunhofer Institutes enhance businesses' performance, improve social acceptance of advanced technology and educate and train the urgently needed next generation of research scientists and engineers.

Since highly motivated employees up on cutting-edge research constitute the most important success factor for us as a research organization, Fraunhofer provides opportunities for independent, creative and, simultaneously, goal-driven work and thus for professional and personal development, qualifying individuals for challenging positions at our institutes, at higher education institutions, in industry and in society. Practical training and early contacts with clients opens outstanding opportunities for students to find jobs and experience growth in business and industry.

The prestigious nonprofit Fraunhofer-Gesellschaft's namesake is Munich scholar Joseph von Fraunhofer (1787–1826).
He enjoyed equal success as a researcher, inventor and businessman.

Figures as of January 2021

Internet


Hauptstandorte
Nebenstandorte
Itzehoe
Rostock
Lübeck
Stade
Bremerhaven
Hamburg
Oldenburg
Bremen
Berlin
Wolfsburg
Hannover
Fraunhofer IFF
Braunschweig
Potsdam
Teltow
Wildau
Magdeburg
Lemgo
Goslar
Münster
Paderborn
Gelsenkirchen
Hamm
Oberhausen
Soest
Göttingen
Halle
Cottbus
Schwarz-heide
Schkopau
Dortmund
Bochum
Leipzig
Duisburg
Kassel
Leuna
Willich
Schmallenberg
Dresden
Zittau
Sankt Augustin
Jena
Freiberg
Aachen
Erfurt
Hermsdorf
Bonn
Euskirchen
Gießen
Chemnitz
Wachtberg
Ilmenau
Zwickau
Remagen
Frankfurt
Hanau
Alzenau
Coburg
Münchberg
Mainz
Aschaffenburg
Bayreuth
Bamberg
Darmstadt
Würzburg
Erlangen
Waischenfeld
Kaiserslautern
Wertheim
Sulzbach
Fürth
Sulzbach-Rosenberg
St. Ingbert
Mannheim
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Pfinztal
Regensburg
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