



Fraunhofer
IVI

FRAUNHOFER INSTITUTE FOR TRANSPORTATION AND INFRASTRUCTURE SYSTEMS IVI

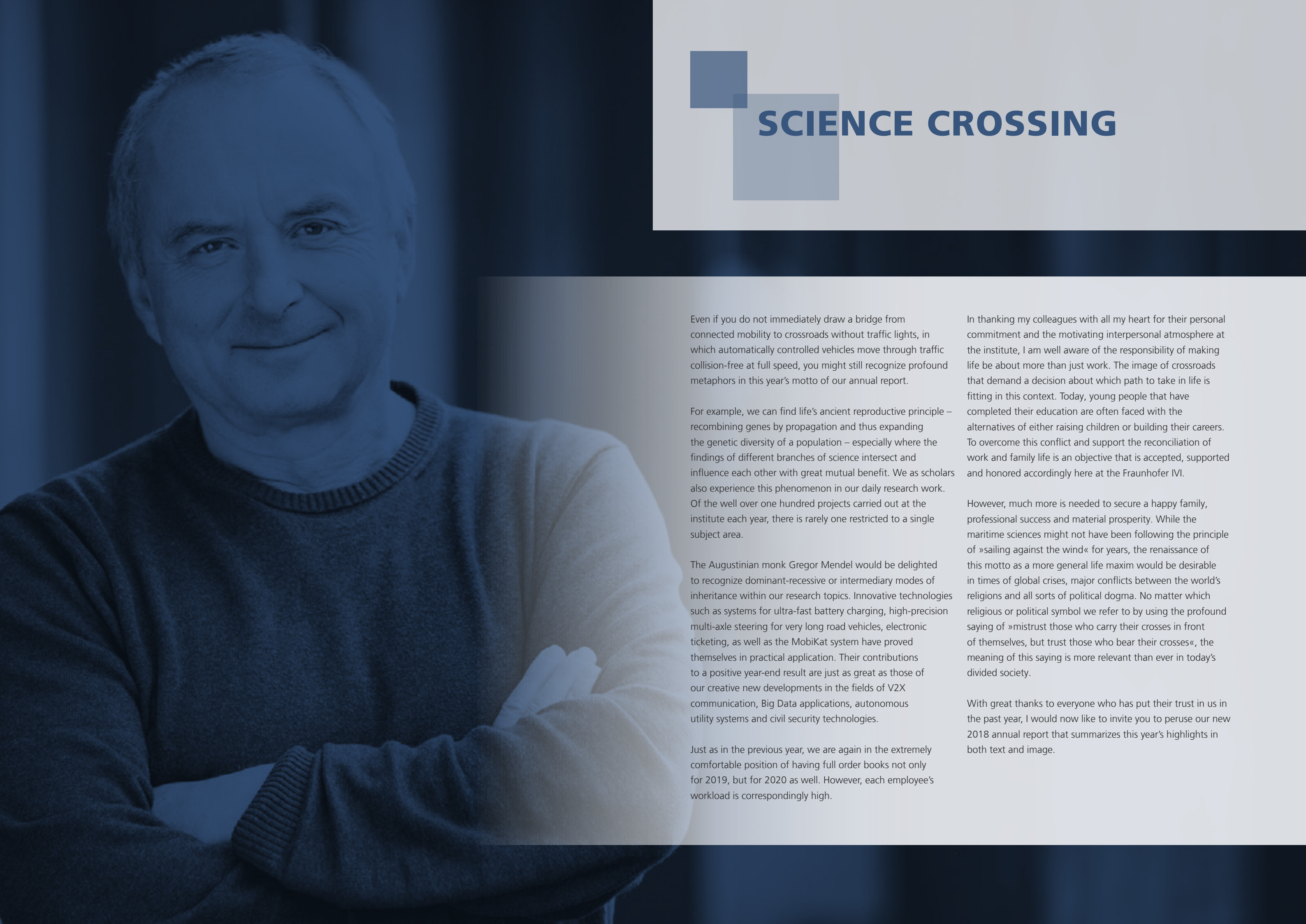


INSTITUTE REPORT **2018**

FRAUNHOFER INSTITUTE FOR TRANSPORTATION AND INFRASTRUCTURE SYSTEMS IVI

INSTITUTE REPORT

2018



SCIENCE CROSSING

Even if you do not immediately draw a bridge from connected mobility to crossroads without traffic lights, in which automatically controlled vehicles move through traffic collision-free at full speed, you might still recognize profound metaphors in this year's motto of our annual report.

For example, we can find life's ancient reproductive principle – recombining genes by propagation and thus expanding the genetic diversity of a population – especially where the findings of different branches of science intersect and influence each other with great mutual benefit. We as scholars also experience this phenomenon in our daily research work. Of the well over one hundred projects carried out at the institute each year, there is rarely one restricted to a single subject area.

The Augustinian monk Gregor Mendel would be delighted to recognize dominant-recessive or intermediary modes of inheritance within our research topics. Innovative technologies such as systems for ultra-fast battery charging, high-precision multi-axle steering for very long road vehicles, electronic ticketing, as well as the MobiKat system have proved themselves in practical application. Their contributions to a positive year-end result are just as great as those of our creative new developments in the fields of V2X communication, Big Data applications, autonomous utility systems and civil security technologies.

Just as in the previous year, we are again in the extremely comfortable position of having full order books not only for 2019, but for 2020 as well. However, each employee's workload is correspondingly high.

In thanking my colleagues with all my heart for their personal commitment and the motivating interpersonal atmosphere at the institute, I am well aware of the responsibility of making life be about more than just work. The image of crossroads that demand a decision about which path to take in life is fitting in this context. Today, young people that have completed their education are often faced with the alternatives of either raising children or building their careers. To overcome this conflict and support the reconciliation of work and family life is an objective that is accepted, supported and honored accordingly here at the Fraunhofer IVI.

However, much more is needed to secure a happy family, professional success and material prosperity. While the maritime sciences might not have been following the principle of »sailing against the wind« for years, the renaissance of this motto as a more general life maxim would be desirable in times of global crises, major conflicts between the world's religions and all sorts of political dogma. No matter which religious or political symbol we refer to by using the profound saying of »mistrust those who carry their crosses in front of themselves, but trust those who bear their crosses«, the meaning of this saying is more relevant than ever in today's divided society.

With great thanks to everyone who has put their trust in us in the past year, I would now like to invite you to peruse our new 2018 annual report that summarizes this year's highlights in both text and image.

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FRAUNHOFER-GESELLSCHAFT

FRAUNHOFER IN DRESDEN

Five institutes and five additional research institutions with altogether 2200 employees and an annual turnover of more than 215 million euros (2017) represent the Fraunhofer-Gesellschaft in Dresden.

INSTITUTES

- Fraunhofer Institute for Ceramic Technologies and Systems IKTS
- Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP
- Fraunhofer Institute for Material and Beam Technology IWS
- Fraunhofer Institute for Photonic Microsystems IPMS
- Fraunhofer Institute for Transportation and Infrastructure Systems IVI

BRANCHES AND RESEARCH INSTITUTIONS

- Dresden branch of the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Bremen
- Division EAS (Engineering of Adaptive Systems) of the Fraunhofer Institute for Integrated Circuits IIS, Erlangen
- Dresden branch of the Fraunhofer Institute for Machine Tools and Forming Technology IWU, Chemnitz
- Division Processing Technology of the Fraunhofer Institute for Process Engineering and Packaging IVV, Freising
- Project Group ASSID (All Silicon System Integration Dresden) of the Fraunhofer Institute for Reliability and Microintegration IZM, Berlin

Research of practical utility lies at the heart of all activities pursued by the Fraunhofer-Gesellschaft. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration.

At present, the Fraunhofer-Gesellschaft maintains 72 institutes and research units. The majority of the more than 26,600 staff are qualified scientists and engineers, who work with an annual research budget of more than 2.5 billion euros. Of this sum, over 2.1 billion euros is generated through contract research. Around 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Around 30 percent is contributed by the German federal and state governments in the form of base funding, enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society until five or ten years from now.

International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development. With its clearly defined mission of application-oriented

research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, at universities, in industry and in society. Students who choose to work on projects at the Fraunhofer Institutes have excellent prospects of starting and developing a career in industry by virtue of the practical training and experience they have acquired.

The Fraunhofer-Gesellschaft is a recognized non-profit organization that takes its name from Joseph von Fraunhofer (1787–1826), the illustrious Munich researcher, inventor and entrepreneur.

Joseph von Fra

FRAUNHOFER IVI

IN THE ICT GROUP

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The complete list of international partners can be found on the website:
<http://s.fhg.de/partner-international>

PARTNERS

- Research Organizations and Universities
- Industry and Economy
- Public Institutions
- Transport Associations and Providers
- Energy Suppliers

IN ALLIANCES

Fraunhofer Traffic and Transportation Alliance

Chairman of the Alliance
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Fraunhofer Energy Alliance

Spokesperson of the Alliance
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Alliance Manager
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Spokesperson of the Alliance
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ACADEMIC COOPERATION

- Technische Universität Dresden
- Technische Universität Bergakademie Freiberg
- Technische Hochschule Ingolstadt
- University of Nevada, Las Vegas

ORGANIZATION CHART

DIRECTOR



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DEPARTMENTS



Vehicle and Transport System Engineering

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Storage Systems and Converters
Claudius Jehle

Vehicle Control and Sensor Systems
Dr. Sebastian Wagner

Vehicle and Road Safety
Dr. Christian T. Erbsmehl



Intelligent Transport Systems

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Mobility and Travel Assistance
Sebastian Pretzsch

Traffic System Data
N. N.

Ticketing and Fares
Hendrik Wagner

Cooperative Systems
Dr. Andreas Festag



Strategy and Optimization

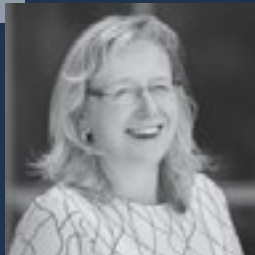
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Disposition
Dr. Kamen Danowski

Digital Business Processes
André Rauschert

Logistics
Denise Holfeld

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FACILITIES AND LARGE EQUIPMENT

- Vehicle hall with adjacent test track
- Test vehicles and demonstrators
- Measurement technology
- Test rigs



- Software for
- Simulation
 - Big Data
 - Construction
 - GIS

COMPETENCIES

Digital business processes
Autonomous utilities systems

Propulsion technologies

Ticketing and fares

Logistics

Identification of traffic situations

Transportation ecology

Mobility and travel assistance

Sensor and actuator systems

Electromobility

Vehicle and road safety

Autonomous systems

Vehicle technologies

Multi-axle steering and guidance systems

Intelligent transport systems

System modeling and process control

Stationary energy storage systems

Operational planning and command

Vehicle connectivity

Transport planning

ADVISORY BOARD

ECONOMIC DEVELOPMENT

MEMBERS (as of March 2018)

Burkhard Ehlen,
CEO, Verkehrsverbund Oberelbe (VVO)

Prof. Dr.-Ing. Viktor Grinewitschus,
Institute for Energy Systems and Energy Business,
Hochschule Ruhr West

Kriminaloberrat Mario Herber,
Commanding Officer of the Special Task Force Saxony,
Saxon State Office of Criminal Investigation

MinR Hans-Peter Hiepe,
Manager, project group »Agency for disruptive innovations«,
Federal Ministry of Education and Research (BMBF)

Prof. Dr.-Ing. habil. Prof. E.h. Dr. h.c. Werner Hufenbach,
Director, Institute of Lightweight Engineering and Polymer
Technology (ILK),
Faculty of Mechanical Science and Engineering, TU Dresden

Prof. Dr. techn. Klaus Janschek,
Managing Director,
Institute of Automation,
Chair of Automation Engineering,
Faculty of Electrical and Computer Engineering, TU Dresden

Prof. Dr. Dirk C. Meyer,
Director, Institute of Experimental Physics,
TU Bergakademie Freiberg

Peter G. Nothnagel,
Staff Unit Structural Development,
Saxon State Ministry of Economic Affairs, Labor
and Transport (SMWA)

Dirk Schillings,
Chief Technical Officer Light Rail Vehicles,
Member of the Executive Board,
Stadler Rail AG, Bussnang, Switzerland

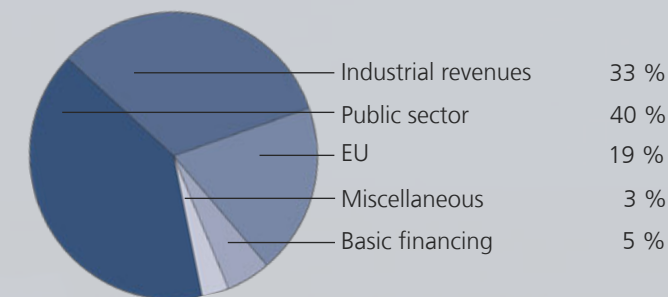
Bernhard Schmidt,
Manager of Operations, Sileo GmbH

Nils Schmidt,
Director Mobility Division, Siemens AG

Lars Seiffert,
Board of Operations and Human Resources,
Dresdner Verkehrsbetriebe (DVB) AG

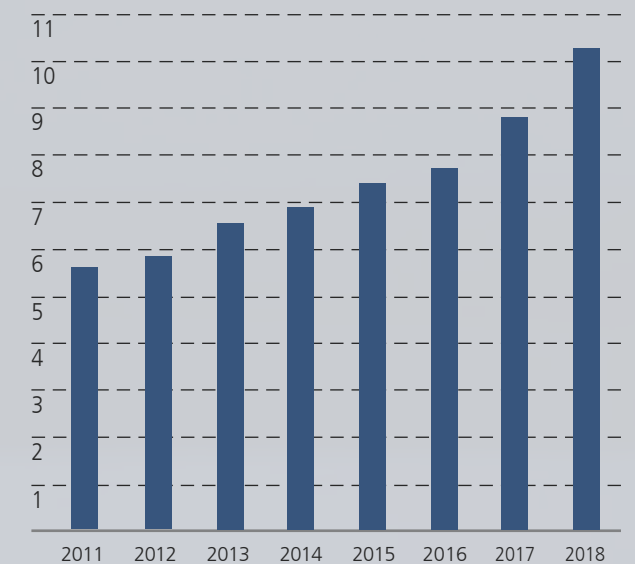
Carsten Utikal,
Consultant – Federal-State-Research Institutions,
Saxon State Ministry of Science and the Arts (SMWK)

OPERATING BUDGET



FINANCIAL DEVELOPMENT

in € million



EMPLOYEES



CHAIRMAN

Prof. Dr.-Ing. Christian Lippold, Institute of Transport Planning and Road Traffic,
Chair of Road Planning and Road Design, »Friedrich List« Faculty of Transport and Traffic Sciences, TU Dresden



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The strategy of consistently working on future-oriented research subjects on a long-term basis in order to be ready to offer innovations in very early market development stages has been one significant factor of the institute's success in the past years. Whether it be electronic ticketing, MobiKat, a precise multi-axle steering system or the ultra-fast charging of high-performance energy storage units – everything that today enables us to successfully acquire orders from all over the world has been developed and continuously improved at the institute over a period of more than ten years. However, the freedom to establish collaborations with other scientific fields, to develop new topics or alternative application areas for existing technologies is currently very limited due to an extremely high project workload within the departments.

By creating the »Strategic Research and Development« Group in the spring of 2018, an independent structural unit was established at the institute that provides ground-breaking acquisition work and project management services for all departments. In addition, the group's staff is involved in creating Fraunhofer networks for projects that are realized together with other Fraunhofer institutes, the cooperation with universities and colleges, as well as the internal supervision of PhD candidates and students working on their Diploma theses.

The group's positive impact on the entire institute even after this short time is demonstrated by achievements such as the successful initiation of the Fraunhofer »Cognitive Agriculture« Lighthouse Project, in which the Fraunhofer IVI is involved as a core institute, the development and structuring of numerous topics within the simul*InnovationHub of Saxony's Ministry for the Environment, as well as the organization of internal workshops on a regular basis.

The lack of a stable university connection was an unsolved problem for the Fraunhofer IVI for a long time. This problem had tangible negative effects in areas such as basic preliminary research, participation in Collaborative Research Centers (SFB) or DFG-funded projects, supervision of PhD candidates and publication activities. The coming years will see great change in this respect. Several appointments to the Technische Universität Dresden, the founding of an application center at the Technische Hochschule Ingolstadt (THI), the appointment of a chair for Artificial Intelligence at the THI, as well as the expansion of the cooperation with the TU Bergakademie Freiberg are planned for the year 2019.

All of these activities are pooled within this new research group and developed further within the on-going strategy process at the Fraunhofer IVI.

STRATEGIC RESEARCH AND DEVELOPMENT

VEHICLE AND TRANSPORT SYSTEM ENGINEERING

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In the future, it will be necessary that large vehicle battery storage units with ranges of over 500 km can be recharged within minutes. For this purpose, the Fraunhofer IVI develops automated electric contact systems that differ from conventional plugs by being able to transmit this extraordinary amount of power.

At present, the market offers different charging systems for electric vehicles. If large energy amounts are to be transmitted, only conductive, i. e. contact-based systems (charging cable and plug), can be applied. These flexible solutions limit the system's charging capacity to approx. 150 to 200 kW and are therefore not suitable for fast-charging systems with higher performance.

In close cooperation with industry partners, the Fraunhofer IVI has developed a fully automated, reliable and safe charging system for this application scenario that overcomes the performance restrictions of conventional plug-and-cable combinations and has the following features:

- Power transmitted at the vehicle underfloor,
- No relevant transmission limitations,
- Improved usability through full automation, as well as
- High safety standard in accordance with relevant norms for automated recharging.

With the help of this new technology, it is possible to transmit one megawatt to electric passenger cars and two megawatts to electric trucks. The entire procedure is carried out fully automatically, safely and reliably without the involvement of a human operator.

A close cooperation with the automotive industry, which sees these charging systems as a relevant future technology and plans to further improve them for use in large-scale production, was created within the course of the different development stages.

Driven by the requirements of manufacturers, the high-performance charging system for public areas (e. g., centralized fast-charging terminals) was complemented by the option for moderate charging performance to be used in a home garage. The overall system was developed in compliance with the specification sheets of the automotive manufacturers.

In spite of the great performance differences, the same charging interface located at the vehicle underfloor is used in both cases. Thus, the system is downward compatible with the current state of technology and therefore sustainably fit to withstand the next 20 years. This intermediate step creates a continuous migration path from recharging current vehicle types in private use to the centralized fast-charging of tomorrow's vehicles.

RANGE OF SERVICES

- ▶ Design and dimensioning of electric powertrains in commercial and special-purpose vehicles
- ▶ Implementation concepts for electric buses
- ▶ Fast-charging concepts for electric vehicles
- ▶ Fully automated maneuver planning for heavy goods vehicles
- ▶ Analyses, surveys and development work in the field of vehicle and traffic safety
- ▶ Characterization and monitoring of energy storage systems

Recharging System of the Future – Ultra-Fast, Fully Automated, Safe

INTELLIGENT TRANSPORT SYSTEMS

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Smartphone apps have become indispensable for connection information and ticket purchases in public transport. However, comfortable ticket purchase options for travel chains across fare zones are currently the exception.

Today, information on ticket prices is usually limited to single fares in local information systems due to the insufficient interconnection of systems and fares. The MobilitätsHub (MobilityHub) research project funded by the Federal Ministry of Transport and Digital Infrastructure (BMVI) demonstrated a flexible and economical solution for determining prices and relevant public transport ticket types. This way, the subsequent purchase of a ticket in one single process is possible in spite of different transport fares.

The basis for this technology is a fare-specific configuration language developed by the Fraunhofer IVI that is currently being implemented throughout Germany as »Tarifmodule nach PKM« industry standard (»fare modules according to PKM«). The core of this solution consists of a fare calculator that contains relevant fare modules for two local public transport fares and is able to connect them with an online information service for local trains. Thus, access to public transportation is simplified for passengers.

After the stops at the departure and destination have been entered, the connections selected by the customers are split up in terms of fares with the help of the PKM technology and assigned to the fare modules configured to suit the individual transport fares. A coordinating module especially created within the project is used for this step.

The necessary knowledge about the fares was incorporated in accordance with the current fare provisions and conditions of carriage. This includes stops, routes, products and prices, temporal validities, fare zone borders, fare change locations, texts displayed, data used for 2D barcodes, and many other items. Via the fare-specific configuration language, the rules and algorithms for the determination of prices and products can be produced and linked with the aforementioned data.

Thus, the fare modules enable the fare calculator to calculate the relevant fares, prices and ticket types for a specific connection information service. Thanks to the standardized XML data structure, it will be possible to quickly and cost-efficiently add further modules to the fare calculator without the need for additional software development.



RANGE OF SERVICES

- ▶ Testing of connected automated driving within the Digital Test Bed Dresden/Saxony
- ▶ V2X communication, roadside units (RSUs), C-ITS facilities
- ▶ Traffic detection, information and management
- ▶ Information and navigation applications
- ▶ Data /semantic technologies for mobility services
- ▶ Mobile apps, applications for frontend, backend, cloud
- ▶ Fare-based solutions for conventional, electronic and mobile ticketing

MobilitätsHub – Pricing of Cross-Fare Rides in Public Transport

STRATEGY AND OPTIMIZATION

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The MobiKat technology has supported operative-tactical mission control in the field of civil protection for several years now. Within the TARGET project, MobiKat modules for the effective planning and control of resources were enhanced to include a training component aiming at the improvement of existing skills.

The objective of the EU-funded TARGET research project (Training Augmented Reality Generalised Environment Toolkit) was to create a pan-European, realistic and flexible simulation solution that supports a large variety of dynamic and sometimes very complex field operation scenarios in hazard prevention. These scenarios are then to be practiced in a highly immersive training environment in order to achieve a significantly more effective training experience for the respective personnel. In addition to police, firefighters, emergency service providers and civil protection services, this also includes counter-terrorism units, border control staff and critical infrastructure operators.

The TARGET platform, which is decentralized and open to third-party systems, offers broad standards-compliant methods that integrate simulators, complex algorithms and technologies for virtual and augmented reality as well as real equipment.

It can be adapted to different languages and the corresponding national concepts, organizational structures, established standards, fixed operational procedures and existing legacy systems. Both the real-time evaluation of the teams in training and trans-organizational, joint large-scale trainings are possible.

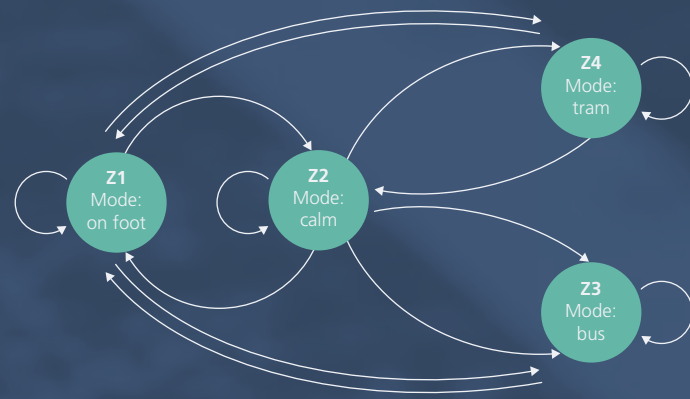
In order to achieve this aim, the institute created a simulator that can run scenarios – including the movement of operatives and crowds of people – according to a previously compiled training script. With the help of the integrated evaluation function, teams can be evaluated in real time. In the case of unplanned events, trainers can intervene and manually adjust the training to suit the current situation.

The training scenarios implemented within the project cover a broad range from the operative to tactical and strategic levels. Scenarios such as property protection, large-scale protest rallies, serious traffic accidents, cyber attacks and hostage takings are included. The task of the Fraunhofer IVI was to create effective training opportunities within the scope of command post exercises in order to reduce the amount of preparation and staff necessary to carry out the trainings.

RANGE OF SERVICES

- ▶ Operational command systems for firefighters, emergency service providers, civil protection services and police
- ▶ Analyses for the planning of fire control requirements and rescue service zones as well as site optimization
- ▶ Evaluation of manufacturing processes with the help of AI methods
- ▶ Big/Smart Data-based data mining and machine learning
- ▶ Integrated cargo space and production planning
- ▶ Predictive analysis / condition-based maintenance planning

TARGET – Flexible Platform for AR/VR Training of Security-Critical Agents



1 Graph for layered movement status model.



JUNIOR RESEARCH

MOTION STATE IDENTIFICATION FOR THE SUPPORT OF NAVIGATION FUNCTIONS IN PUBLIC TRANSPORT

The reliable locating of passengers and vehicles is the foundation for diverse applications in public transport. Acceleration sensors provide additional locating information. Within the scope of this doctoral thesis, methods for the utilization of sensor information as support for navigation functions in public transport were developed.

In order to control vehicles intelligently and to inform passengers reliably in public transport, the correct positioning of all parties involved is essential. Under the given system conditions, radio-based locating has its limitations due to signal propagation phenomena (shadowing effects or multipath propagation). Acceleration sensors of the kind installed in standard mobile phones can be used as an additional source of information.

The focus of this thesis was a detailed comparison of vehicle signals – both theoretically present and practically measurable – with the signals of mobile sensor platforms (e. g., smartphone or other user medium equipped correspondingly) taking into account the influence of their users.

On this basis, a new method was developed for estimating mode of transport (choice of vehicle) and movement status (detailed motion type, e. g., turning maneuver) with the help of a layered movement status model that defines and connects all the different movement statuses to be considered in a public transport environment (Figure 1).

The model was then used as a basis for the movement status detection algorithm developed and applied in this thesis. Using measurement examples of vehicle (Dresden measuring tram, bus of the DVB AG) and person movements, an applicability analysis was carried out.

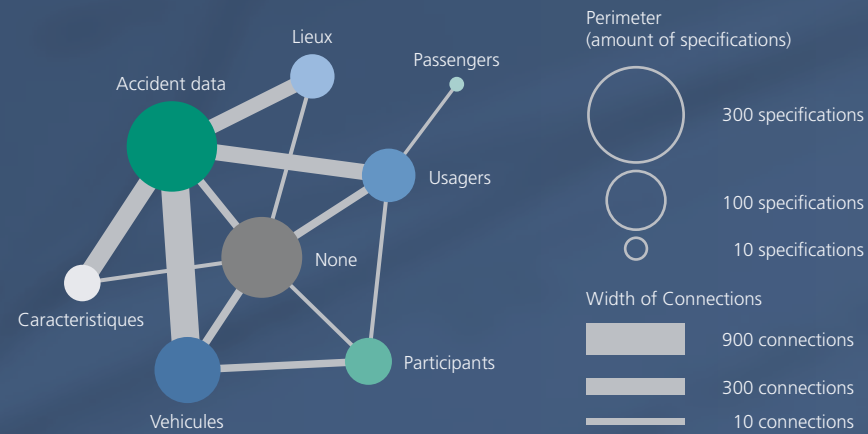
The classifiers derived in the process were evaluated with a probability-based quality barrier approach also developed within this thesis. In addition, the achieved reproduction of acceleration signals was discussed and the use of classifiers demonstrated with the examples of logical vehicle locating as well as locating processes for automatic passenger detection.

The results of this research have been addressed and further improved within the scope of the internal SmartTicket project at the Fraunhofer IVI.

The findings presented above were submitted as a Doctoral Thesis to the »Friedrich List« Faculty of Transport and Traffic Sciences at the TU Dresden.

With special thanks to my supervisors, Prof. Dr.-Ing. Oliver Michler and Prof. Dr.-Ing. Dr. h.c. Günter Löffler, TU Dresden, and to my subject supervisor, Dr.-Ing. Georg Förster.

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1 Comparison between German and French accident data including detected specifications and connections.



DEVELOPMENT OF A COMPARISON METHOD FOR EUROPEAN ACCIDENT DATA

The aim of this thesis was to develop a method for making comparable accident data from different sources. The greatest challenge in this process was to obtain reliable results from database queries and to use them for research purposes.

In order to improve traffic safety in Europe, it is opportune to collect and evaluate accident data on a transnational level. In addition to language barriers, different procedures for data recording and storage impede data processing. Even the Europe-wide CARE database cannot solve the problem because the entries are usually not filled in completely due to data protection.

Therefore, a tool was developed that analyzes the accident data recorded in different countries with regard to its comparability. The basic data for this was provided by the French national database and the Fraunhofer IVI's database.

First, the structural differences of the databases were analyzed comprehensively in order to develop an approach to which method can be used.

It seemed logical to link each variable of one database with the corresponding variable of the other database, while distinguishing between the following three link types: no correspondence, unique correspondence and multiple correspondence. In order to automatically sort the desired data, a database query was developed simultaneously.

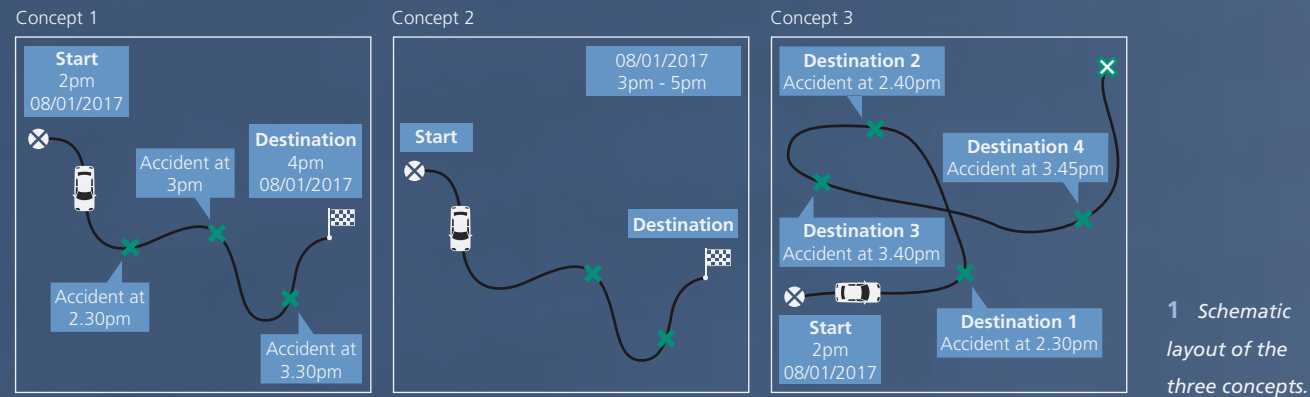
First results were achieved and conclusions drawn with the help of a practical example from the field of two-wheeled vehicles.

Using the method presented above, accident databases of different origins can easily be compared in terms of query and sorting accuracy. However, the method showed weaknesses regarding the data's accessibility for research purposes. Due to different approaches, as well as differences in accuracy, level of detail, and classification, only simple queries yield reliable results. Comprehensive additional adjustments are necessary to guarantee the interpretation of complex relationships within accident research. These issues will be addressed in a subsequent doctoral thesis.

The results above were submitted as a Diploma Thesis to the »Friedrich List« Faculty of Transport and Traffic Sciences at the TU Dresden.

With special thanks to my supervisors Prof. Dr.-Ing. Regine Gerike, TU Dresden, and Dr.-Ing. Christian T. Erbsmehl as well as Dr.-Ing. Tom Landgraf, Fraunhofer IVI.

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CONCEPT DESIGN AND VALIDATION OF A COMBINED MICRO AND MACRO VEHICLE SIMULATION

The findings presented above were submitted as a Diploma Thesis to the Faculty of Mechanical Engineering at the HTW Dresden.

*With special thanks to
Prof. Dr.-Ing. Stephan Zipser and
Prof. Dr. rer. nat. Toralf Trautmann,
HTW Dresden, and
Dr.-Ing. Christian T. Erbsmehl,
Fraunhofer IVI.*

Proof of functional safety is highly important for the development of autonomous driving functions. Due to increasing safety demands, it is plausible to test dangerous situations on the computer first. By combining route data with accident data, virtual test drives can be simulated.

Extensive field testing is necessary to prove the safety of autonomous driving functions. Especially in urban environments, complex traffic situations need to be recreated so that sufficient proof of safety can be established for the safety-relevant components. Above all, dangerous situations both inside and outside the vehicle must be detected and independently resolved as quickly as possible. Currently, proof of functional safety is established on the basis of test drives in real traffic. Because this requires thousands of actual kilometers driven, computer simulations can be a genuine alternative. However, existing programs lack the necessary combination of route simulation (macrosimulation) and accident simulation (microsimulation), which is why this new approach was investigated.

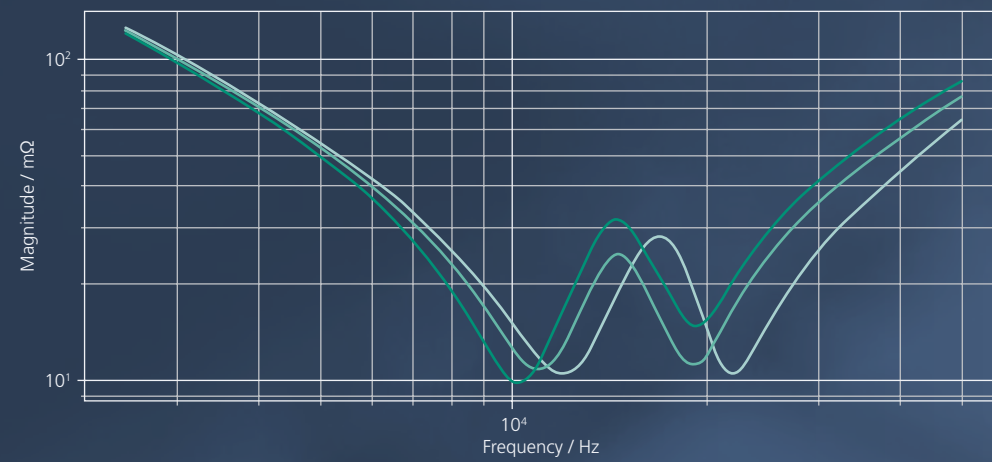
With the help of the OSRM navigation application as macrosimulation system, the test route can be calculated and recreated using a point of origin and a point of destination. In addition, the simulated vehicle becomes involved in several accidents »en route«.

The database of police-recorded accidents in Saxony provides a basis. An integrated selection process ensures that not only accidents relevant in terms of time and location are submitted to the microsimulation, but also accidents that show similarities to the environment of the simulated situation in terms of traffic, weather, lighting and trajectories of the parties involved.

In order to investigate several possible selection processes, three different concepts (Figure 1) were created and compared to each other. After an assessment and evaluation of all concepts, the simulation was implemented.

The microsimulation is carried out using the PC-Crash software and tests within two parallel simulations – one with a driver assistance system and one without it – how and whether a collision can be avoided. This determines the efficiency of the driver assistance system in question. As a result, a program was created that yields the test kilometers driven as well as the number of simulated accidents and the number of accidents avoided by the driver assistance system. With the help of comprehensive accident data, the simulation could be extended to cover all of Germany or even all of Europe.





1 Impedance response of three two-terminal circuits of a pair of three-phase capacitors.

DETERMINATION OF THE INTERNAL RESISTANCE OF FILM CAPACITORS

Internal resistance is an important factor in monitoring the aging process of film capacitors. Within the scope of the present work, a measuring circuit was developed and tested that allows the determination of both internal resistances and complete frequency responses.

Film capacitors have become a significant subsystem of different electronic applications. Failures in these parts result in high losses, downtimes and long maintenance periods, thus causing high costs.

Previous investigations have shown that a capacitor's equivalent series resistance (ESR, also known as internal resistance) may provide insight into its aging process. This calls for a new method that is able to determine the ESR and monitor the capacitors.

The method implemented in this thesis is one of the direct measuring methods that are also applied in electrical impedance spectroscopy (EIS), for example. A source that can generate alternating currents with adjustable frequency excites the capacitors. Both the voltage difference and the current is filtered, amplified and digitized.

After that, the signals are transformed from the time spectrum to the frequency spectrum and the impedance is determined over the excitation frequency.

The measuring method described above was implemented as a prototype and tested under laboratory conditions. The validation of the method was carried out with the help of high-precision laboratory measuring devices.

The method developed within this thesis is distinguished from conventional methods by the option of continuously and autonomously acquiring measurements in real-time and under real operating conditions.

Based on the initial findings, the measuring method was improved within SILKE, a research project funded by the Federal Ministry of Education and Research (BMBF) that deals with the monitoring of film capacitors in active use. A significant improvement in the characterization of film capacitors was achieved, which will lead to more precise lifetime prognoses in the long term.



The findings presented above were submitted as a Diploma Thesis to the Faculty of Electrical and Computer Engineering at TU Dresden.

With special thanks to Dr.-Ing. Andreas Mögel, TU Dresden, and Dipl.-Ing. Malte Keil, Fraunhofer IVI.

HIGHLIGHTS



February 26 - March 2, 2018

The **Fraunhofer IVI Accident Prevention School** raises traffic safety awareness amongst teenagers. In 2018, it was held for the third time.

April 10, 2018

The Fraunhofer IVI introduced itself as an attractive employer with a presentation and an exhibition stand during the **Career Symposium**.



April 12, 2018

The final event of the European **ECOCHAMPS** project took place in Amsterdam. The project aimed to develop economic, compact and cost-efficient hybrid powertrains.

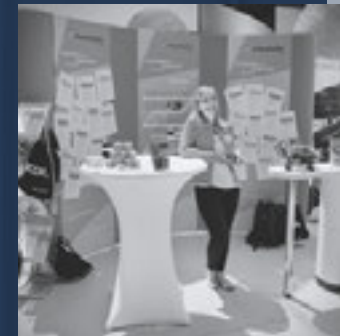
April 26, 2018

As part of the **AutoTruck** project, an electric truck for fully automated operation in automation zones was handed over to the Fraunhofer IVI in Bernkastel-Kues.



May 22-23, 2018

This spring, the Second General Assembly of the European **AEROFLEX** project was held. Core developments are novel technologies for trucks, such as an increase in energy and cost efficiency.

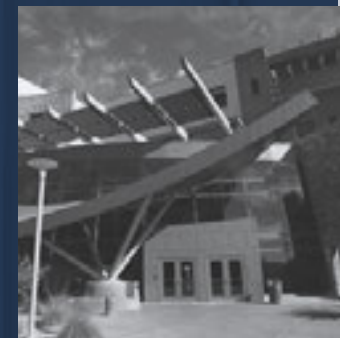


June 14, 2018

A hands-on experience of IT is offered to students by **OUTPUT.DD**. The Fraunhofer IVI presented itself as their future employer in the field of computer sciences.

June 15, 2018

Institute Director Prof. Dr. Matthias Klingner presented his point of view regarding the diesel driving ban during a public hearing at **the German parliament's transport committee**.



July 3, 2018

The collaboration between the **Nevada** Governor's Office of Economic Development, the University of Nevada and the Fraunhofer IVI was made official by signing a **cooperation agreement**.

July 17 and 24, 2018

The **TU Dresden summer university** offers first insights into the STEM subjects and day-to-day life on campus. About 30 teenagers visited the Fraunhofer IVI to gather information.



July 28, 2018

The **alumni of the Deutsche Telekom Stiftung PhD program** were given a comprehensive overview of the Fraunhofer IVI's research areas during their visit at the institute.

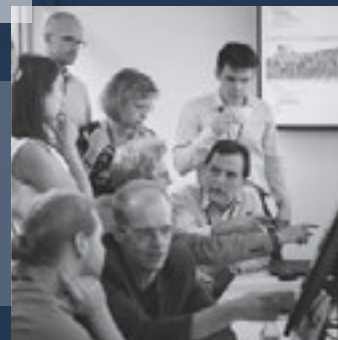


August 21, 2018

This summer, the time had finally come – the floating foundations of the **autartec® house**, consisting of a 50 ton pontoon system, were launched.

August 28-30, 2018

The **EU-CIRCLE workshop** brought together scientists and end users from numerous institutions working in the field of flood and risk modeling.



September 16-22, 2018

A group of 15 students visited the institute during the **European Mobility Week**. They gained insights into the Fraunhofer IVI's research activities, taking a short ride in the plug-in hybrid bus.



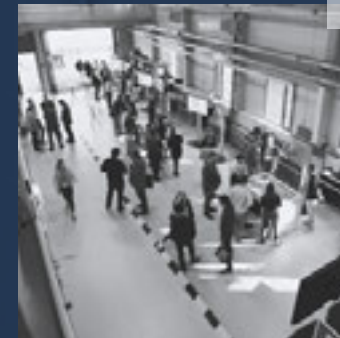
September 25, 2018

Two fully autonomous robots demonstrated research results from the »Synchrone Mobilität 2023« initiative at this year's **IEEE 5G Summit**.



October 1, 2018

The jetty of the **autartec® house** was officially handed over by the LMBV to the local authorities during a festive ceremony with numerous guests, including Minister Kathrin Schneider.



October 17, 2018

Experts and future end users analyzed the first results of the **SePIA project** (Scenario-Based Platform for the Inspection of Automated Driving Functions) during its intermediate presentation.

October 18, 2018

After the structural completion of the **autartec® house**, the topping out ceremony was celebrated, including the traditional address and driving in the last nail.



November 6, 2018

A kickoff meeting was held to launch the **»IOT-COMMS Mobility«** project. It will develop innovative application concepts for traffic safety and efficiency.



November 14, 2018

Within the »Synchrone Mobilität 2023« research initiative, the first **test corridor** for automated and connected driving was launched at the **Dresden airport**.



December 6, 2018

The **simul'InnovationHub** was officially launched at the Kraftwerk Mitte event location. The hub funds the development of electrification and automation in agriculture and forestry.



TRADE FAIRS



GPEC General Police Equipment Exhibition and Conference®, Leipzig

February 20-22, 2018

Presentation of current developments from the EU-funded Target project (Training Augmented Reality Generalised Environment Toolkit) for mission simulation and police training

2nd International VDI Conference, Düsseldorf

»Autonomous Trucks«

April 10-11, 2018

Demonstration of autonomous driving functions using DriveLab

3rd Annual Handelsblatt Conference, Munich **»Trends in Commercial Vehicles Industry 2018«**

April 26-27, 2018

Presentation of the underfloor charging system and autonomous driving functions using DriveLab

International Transport Forum ITF, Leipzig

May 23-25, 2018

Poster exhibition on »Synchrone Mobilität 2023« at the joint booth with the Saxon Energy Agency SAENA

Bundesverband der Energie- und Wasserwirtschaft – Congress, Berlin

June 13-14, 2018

Presentation of the underfloor charging system at the booth of the Fraunhofer ICT Group

InnoTrans, Berlin

September 18-21, 2018

Joint presentation of the »ColumBus« innovator with the »eBus-Cluster« project partners

IAA Commercial Vehicles, Hannover

September 20-27, 2018

Demonstration of the AutoTruck at the Orten Electric Trucks booth and joint presentation of the HeavyGoods web app together with CodeSquare

EXPO REAL, Munich

October 7-9, 2018

Exhibition of the autartec® project at the booth of the Free State of Saxony

FLORIAN, Dresden

October 11-13, 2018

Presentation of the MobiKat technologies including a newly developed solution for tablets

DAK

DRESDEN COLLOQUIA ON AUTOMATION TECHNOLOGY

Robot Hands: Design Aspects and Control Problems

January 22, 2018

Prof. Claudio Melchiorri
University of Bologna

Ein einheitliches Verfahren zum einfachen Entwurf von Folgeregelungen für quadratische, unter- und überaktuierte lineare Systeme

May 28, 2018

Sebastian Bernhard, M.Sc.
TU Darmstadt

Intelligent Control Systems: Leveraging Data for Autonomous Control

July 2, 2018

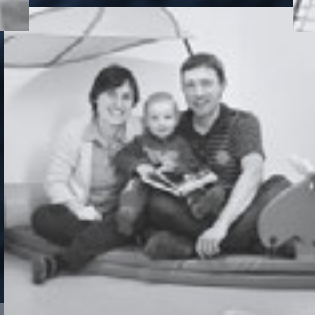
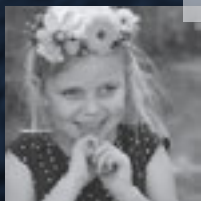
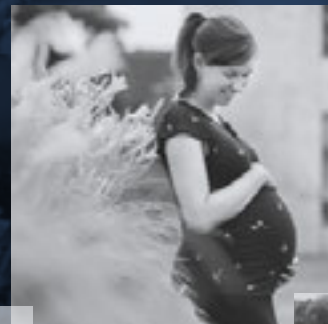
Dr. Sebastian Trimpe
Max Planck Institute for Intelligent Systems

Model-Based Dependability Analysis for Cyber-Physical Systems

December 10, 2018

Dr. Andrey Morozov
TU Dresden

LIFE AT WORK AND BEYOND



The reconciliation of family and work life is of particular concern to the Fraunhofer IVI. Its employees have access to a broad range of offers in this area. In addition to flexible working hours, daycare options for children and a parent-child office help to make families' day-to-day routines easier.

The institute also wants children and parents to have a good time during joint activities and events. At the IVI Midsommar celebration, families were sent to their summer vacations in bright sunshine with typical Scandinavian food and Swedish pop music. A special highlight for the smallest guests was the making of a colorful flower wreath and the decorating of the traditional Midsommar tree.

In the holiday season, the employees' younger children are invited to join their parents at the institute for an afternoon of crafts and games accompanied by hot cocoa and Christmas sweets. At this past year's party, Santa and his elf were very busy handing out gifts to over 30 girls and boys.

The kind of reconciliation of family and work life practiced at the Fraunhofer IVI also made an impression on the Fraunhofer-Gesellschaft at large. In 2018, the institute was awarded the Fraunhofer FamilienLogo (FamilyLogo). Of the 38 Fraunhofer institutes and institutions that had applied for the FamilienLogo, the Fraunhofer IVI won first place. Among the evaluation criteria are aspects such as institute-specific childcare options, organization of the Elternzeit (extended maternity/paternity leave in Germany) and re-entry after the Elternzeit, as well as use of the Fraunhofer support options.

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ACADEMIC OUTPUT



PUBLICATIONS

ARTICLES AND PRESENTATIONS

Adams, P; Nitzsche, G.; Löfstrand, S. et al.: **TRANSFORMERS – Configurable and Adaptable Trucks and Trailers for Optimal Transport.** Transportation Research Arena TRA 2018, Vienna, Austria, April 16-19, 2018, presentation: P. Adams

Alscher, T.; Auerswald, R.; Fritzsche, R.; Jungmann, A.: **»Synchrone Mobilität 2023« – An Initiative of the Free State of Saxony.** International Transport Forum ITF Summit 2018 »Transport Safety and Security«, Leipzig, Germany, May 23-25, 2018, poster presentation

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Nitzsche, G.; Wagner, S.; Baert, R. et al.: **TRANSFORMERS – Test Drive Results of a new Hybridisation Concept for Truck-Semitrailer Combinations**. Transportation Research Arena TRA 2018, Vienna, Austria, April 16-19, 2018, presentation: G. Nitzsche

Pfeiffer, E.; Rauschert, A.: **Unsupervised Dynamic Machine Learning for Tourism Accounting (Projectname Aurebu)**. Big-Data. AI Summit 2018 »Data-driven Business Innovations for the Digital World«, Hanau, Germany, February 28 - March 1, 2018, presentation: E. Pfeiffer; R. Hyka

Pohle, M.: **Fraunhofer IVI Accident Prevention School (FAPS)**. Presentation for the project network »Verkehrssicherheit Brandenburg«, Staffelde, Germany, March 15, 2018

Pohle, M.: **Fraunhofer IVI Accident Prevention School (FAPS)**. 1. PTV Verkehrssicherheitsforum »Unfalldaten verstehen, Sicherheit schaffen«, Karlsruhe, Germany, April 19, 2018

Pohle, M.: **Fraunhofer IVI Accident Prevention School (FAPS)**. Series of lectures »Unfallprävention« Deutsches Hygienemuseum, Dresden, Germany, May 8, 2018

Pohle, M.: **Unfallpräventionsschulung für Jugendliche – Fraunhofer IVI Accident Prevention School (FAPS)**. Deutscher Verkehrssicherheitsrat, board meeting »Kinder und Jugendliche«, Berlin, Germany, April 25, 2018

Pretzsch, S.: **Autonome Kleinbus-Shuttles im ÖPNV – ein Überblick**. breidenbach + frost Fachtagung »Autonomes Fahren im ÖV«, Berlin, Germany, April 24-25, 2018

Pretzsch, S.: **Architektur von Data Spaces für Mobilitätsdaten**. 62. Kontiki-Konferenz, Münster, Germany, June 7-8, 2018

Pretzsch, S.: **Mobility Data Space**. MDM-Konferenz 2018, Berlin, Germany, June 18-19, 2018

Pretzsch, S.: **Architektur des Mobility Data Space**. Workshop »Datenbanken-Architekturen der mFUND-Projekte«, Berlin, Germany, June 20, 2018

Pretzsch, S.: **Vorstudie zur Verknüpfung des MDM mit dem Mobility Data Space**. mFUND-Konferenz »Daten als Motor für die Mobilität 4.0.«, Berlin, Germany, October 16-17, 2018

Pretzsch, S.: **Alles rund um Daten – Auf dem Weg zu einem Mobility Data Space**. Fachkonferenz »Fraunhofer Mobility Infusion«, HYPERMOTION, Frankfurt/Main, Germany, November 21, 2018

Protzmann, R.; Radusch, I.; Festag, A.; Fritzsche, R.; Rehme, M.: **IV2X – Integrierte Betrachtung Fahrzeugkommunikation**. Studie, 2018, Online unter: <https://www.testfeld-berlin.de/pdfs/IV2X%20Dokumentation%201.5.pdf>

Rauschert, A.: **iTESA – Echtzeitfähiges Erkennen von Reisewarnungen**. Smart Data Forum, Berlin, Germany, January 23, 2018

Rauschert, A.: **Machine Learning in der intelligenten Maschine**. Verband Deutscher Maschinen- und Anlagenbau, »Arbeitskreis Machine Learning«, Frankfurt/Main, Germany, February 6, 2018

Rauschert, A.: **Hauni Maschinenbau – Best-Practice-Beispiel für Zusammenarbeit in der Allianz**. Jahrestagung Fraunhofer-Allianz Big Data, St. Augustin, Germany, April 10, 2018

Rauschert, A.: **Maschinelles Lernen im Maschinenbau**. Konferenzpanel VDMA-Gemeinschaftsstand »Software und Digitalisierung auf der Digital Factory«, Hannover Messe, Hannover, Germany, April 24, 2018

Rauschert, A.: **Deep Risk Analytics – Versicherungsrisiken extrahieren aus weltweiten Datenströmen in Echtzeit**. 2. Fachtagung der Versicherungsforen Leipzig »Big Data und Data Analytics – Auf dem Weg zum datengetriebenen Versicherer«, Leipzig, Germany, October 9-10, 2018

Rauschert, A.: **Sonderstellung Maschinenbau und Maschinelles Lernen – Wer sich immer alle Türen offen hält, wird sein Leben auf dem Flur verbringen**. Deutscher Maschinenbaupfidel des Verbands Deutscher Maschinen- und Anlagenbau VDMA, Berlin, Germany, October 16-17, 2018

Rauschert, A.: **Jeder sieht den Garten, aber niemand den Spaten. Wie man erfolgreich wertschöpfende Machine Learning Projekte realisiert**. Erfa »Machine Learning«, Dortmund, Germany, November 29, 2018

Schulze, E.-E.: **Das autartec® FreilichtHaus am Bergheider See**. 11. Regional-konferenz »Das Lausitzer Seenland als Motor für den regionalen Strukturwandel«, Großräschen, Germany, November 14, 2018

Schulze, E.-E.: **Das autartec® FreilichtHaus am Bergheider See**. Tagung »Schwimmende Bauten« der BTU Cottbus, Großräschen, Germany, November 23, 2018

Hofstädter, R.; Klausner, S.: **GUW+ Integrierte Energieversorgung von Elektrobussen und Gleichstrombahnen**. IZBE/VDE-Symposium »Elektrische Fahrzeugantriebe und -ausrüstungen«, Dresden, Germany, November 29-30, 2018, presentation: S. Klausner

Uridia, L.; Walther, D.: **Completeness by Modal Definitions**. 16th Ibero-American Conference on Artificial Intelligence IBERAMIA 2018, Trujillo, Perú, November 13-16, 2018, presentation: L. Uridia
In: Advances in Artificial Intelligence – IBERAMIA 2018 Proceedings, Simari, G.R.; Ferré, E.; Gutiérrez Segura, F. et al. (eds.), Lecture Notes in Artificial Intelligence, vol. 11238, Springer International Publishing, 2018, pp. 67-79, ISBN: 978-3-030-03928-8, DOI (article): 10.007/978-3-030-03928-8_6

Wagner, H.: **Einfach fahren – mit einem Ticket durch ganz Mitteldeutschland**. breidenbach + frost Fachtagung »Moderne Vertriebssysteme im ÖPNV«, Leipzig, January 25-26, 2018

Wagner, H.: **Standardisierte, geräteunabhängige und systemneutrale Digitalisierung von Tarifen**. breidenbach + frost Fachtagung »Digitalisierung im ÖPNV – Überblick mit praktischen Beispielen«, Frankfurt/Main, Germany, June 28-29, 2018

Wagner, S.: **Autonomous Driving for Commercial Vehicles – Gated Areas First**. Podiumsdiskussion, VDI-Fachkonferenz »International VDI Conference – Autonomous Trucks«, Düsseldorf, Germany, April 10-11, 2018

Wagner, S.: **AutoTruck – Autonomes Fahren auf Betriebshöfen, Logistikzentren und Häfen**. 2. VDI-Fachkonferenz »Sensoren für mobile Maschinen 2018. Systeme und Lösungen für automatisiertes Fahren und Arbeitsprozesse«, Frankenthal, Germany, October 10-11, 2018

Wagner, S.: **Autonomous Driving – Technologies for Gated Areas**. 4th International Conference on Future Mobility, Abu Dhabi, UAE, November 7-8, 2018

Winkle, T.; Erbsmehl, C.; Bengler, K.: **Area-Wide Real-World Test Scenarios of Poor Visibility for Safe Development of Automated Vehicles**. *In: European Transport Research Review, vol. 10, issue 32, 2018, 15 pp, ISSN: 1866-8887, DOI: 10.1186/s12544-018-0304-x*

TEACHING ENGAGEMENTS

Bartholomäus, Ralf

Optimale Steuerung kontinuierlicher Prozesse. TU Dresden, Faculty of Electrical and Computer Engineering, Institute of Control Theory, SS 2018

Robuste Regelung. TU Dresden, Faculty of Electrical and Computer Engineering, Institute of Control Theory, SS 2018

Festag, Andreas

Einführung in die Car2X Kommunikation. TH Ingolstadt, Faculty of Electrical Engineering and Computer Science, SS 2018

Automotive Telematics. TH Ingolstadt, Faculty of Electrical Engineering and Computer Science, SS 2018

Digitaltechnik. TH Ingolstadt, Faculty of Electrical Engineering and Computer Science, SS 2018

Car2X Kommunikation. TH Ingolstadt, Faculty of Electrical Engineering and Computer Science, WS 2018/19

Software-Entwicklung für sicherheitskritische Systeme. TH Ingolstadt, Faculty of Electrical Engineering and Computer Science, WS 2018/19

Fichtl, Holger

Propulsion Technology and Alternative Propulsion Systems. Dresden International University, Certificate course: Vehicle Safety and Traffic Accident Research, Academic year 2017

Kertzsch, Jana

Berechnung elektrischer Maschinen. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, SS 2018

Einführung in die Elektrotechnik. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Elektrische Energiewandler. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, SS 2018

Elektrische Maschinen und Antriebe. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Energiespeicher. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Energietechnik (lecture series). TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Grundlagen der Elektrotechnik. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, SS 2018

Hybrid- und Elektroantriebe. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Regelung elektrischer Antriebe I. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, SS 2018

Regelung elektrischer Antriebe II. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Theorie elektrischer Maschinen. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Klingner, Matthias

Elektroenergiesysteme. TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, SS 2018

Systemtheorie in der Anwendung (compact seminar). TU Bergakademie Freiberg, Faculty of Mechanical, Process and Energy Engineering, Institute of Electrical Engineering, WS 2017/18, WS 2018/19

Knote, Thoralf

Straßenverkehrstechnik. TU Dresden, »Friedrich List« Faculty of Transport and Traffic Sciences, Institute of Transport Planning and Road Traffic, WS 2017/18, SS 2018, WS 2018/19

Potthoff, Ulrich

Modellierung und Simulation in der Verkehrstelematik. TU Dresden, »Friedrich List« Faculty of Transport and Traffic Sciences, Institute of Traffic Telematics, WS 2017/18, WS 2018/19

Modellierung und Simulation 2. TU Dresden, »Friedrich List« Faculty of Transport and Traffic Sciences, Institute of Traffic Telematics, SS 2018

Rauschert, André

Ideen-, Innovations- und Change Management. Gründungsmanagement. Mittweida University of Applied Sciences, Faculty Industrial Engineering, Faculty Media Sciences, WS 2017/18, SS 2018, WS 2018/19

Steinert, Frank

Automatisierung in der Landtechnik. TU Dresden, Faculty of Mechanical Science and Engineering, Institute of Natural Materials Technology, SS 2018

FINAL THESES

PHD STUDENTS

Engelbrecht, Julia Maria

Ein Beitrag zur funkgestützten Indoor-Positionierung auf der Basis von Leckwellenleitern in Fahrgastzellen. TU Dresden

DIPLOMA STUDENTS

Bosdorf, Christian

In-situ-Alterungsdiagnose von Lithium-Ionen-Akkumulatoren mittels künstlicher neuronaler Netze. TU Dresden

Ebert, Paul

Entwicklung eines Simulationsmodells für Feldarbeitsmaschinen. HTW Dresden

Krause, Nils

Streuungsanalyse von Lithium-Ionen-Zellen in Batteriesystemen. TU Dresden

Lotze, Martin

Verifizierung von Infrarotkamarasystemen zur Verkehrsüberwachung. TU Dresden

Pfitzner, Pascal

Konzeption und Validierung einer kombinierten Mikro- und Makrosimulation von Fahrzeugen. HTW Dresden

Rohrbach, Matthias

Überprüfung von Zusammenhängen zwischen Verkehrszuständen und Unfallschwere auf Autobahnen. TU Dresden

Scholz, Daniel

Phänomenologische Abbildung eines Latentwärmespeichers und modellgestützter Entwurf einer bedarfsgerechten Heizungsregelung. TU Dresden

Strohhäcker, Johannes

Validierung und Optimierung einer SoC-Schätzung für Lithium-Ionen-Batterien. HTW Dresden

Wang, He

Entwicklung eines verbesserten Messverfahrens zur Bestimmung des Innenwiderstandes von Folienkondensatoren. TU Dresden

Wolf, Matthias

Systemdesign für das Energieversorgungskonzept GUW+. TU Dresden

MASTER STUDENTS

Alam, Saif

Real-time Continuous Clustering for Moving Objects and their Visualization. TU Dresden

Hauck, Willy

Elektromobile Geschäftsmodelle. Bedeutung der Batteriediagnose zur Restwertbestimmung elektrischer Nutzfahrzeuge. Westsächsische Hochschule Zwickau

Ji, Guanghui

Analysis and Evaluation of Visual Data Exploration Algorithms for Big Data. TU Dresden

Meinert, Axel

Implementierung einer Java-Anwendung für die Simulation von Menschenmengen im urbanen Umfeld für GIS-Anwendungen. HTW Dresden

Preuße, Florian

Autonome Kleinbusse im öffentlichen Personennahverkehr – Perspektiven des Einsatzes am Beispiel eines Gewerbegebietes. Karlsruher Institut für Technologie KIT

Reiner, Normen

Java-Implementierung eines Schriftplatzierungsalgorithmus für Geographische Informationssysteme in Echtzeit. HTW Dresden

BACHELOR STUDENTS

Adam, Nadja

Entwicklung einer kundenspezifischen, externen Schnittstelle für den Zugriff auf ausgewählte Projektdaten des Batterieferndiagnosesystems IVImon. Staatliche Studienakademie Dresden (BA)

Vogt, Johanna

Verfügbarkeit von Traktionsbatterien aus verunfallten Elektro- und Hybridfahrzeugen: Prädiktion vor dem Hintergrund des aktuellen Unfallgeschehens. TH Ingolstadt

PUBLIC BODY MEMBERSHIP AND PATENTS

PUBLIC BODY MEMBERSHIP

Brausewetter, Patrick

– JUG Saxony e. V.

Danowski, Kamen

– Section »Civil Protection«, Euroregion Elbe/Labe

Engelbrecht, Julia Maria

– IEEE Intelligent Transportation Systems Society
– IEEE Region 8: Europe, Middle East and Africa
– IEEE Vehicular Technology Society
– VDE District Dresden e. V.

Erbsmehl, Christian T.

– EVU European Association for Accident Research and Analysis e. V.
– SafeTRANS e. V.

Festag, Andreas

– 5G Automotive Associaton e. V.
– Acatech National Academy of Science and Engineering »New autoMobility«
– ETSI European Telecommunications Standards Institute

Grimm, Jan

– BASt Federal Highway Research Institute, Supervisor Group »Impact of Errors on Traffic Management Systems«
– COST Action TU1305 Social Networks and Travel Behaviour
– FGSV German Road and Transportation Research Association, Working Groups AG 3.2.9 »Video Detection in TMS (Traffic Management Systems)« and AG 3.2.10, »Quality Management of TMS«

Gründel, Torsten

– Kontiki Working Group in Contactless Smart Card Systems for Electronic Ticketing e. V.
– CNA Center for Transportation & Logistics Neuer Adler e. V.
– ECTRI European Conference of Transport Research Institutes
– Fraunhofer Traffic and Transportation Alliance
– Network »SatNav Saxony«
– Silicon Saxony e. V., Applications Division, Working Group Cyber-Physical Systems
– UITP International Association of Public Transport

Hedel, Ralf

– Moderator of the ECTRI Thematic Group »Security and Risk Analysis«

Jehle, Claudius

– Fraunhofer Battery Alliance
– Fraunhofer Energy Alliance

Kertzscher, Jana

– VDE Association for Electrical, Electronic & Information Technologies e. V.

Knote, Thoralf

– FGSV German Road and Transportation Research Association, Working Group AG 3.10 »Theoretical Basics of Road Traffic«

Klingner, Matthias

– Agronym e. V.
– agrarVERT – Initiative for Cooperation, Digitization and Sustainability of agriculture and forestry in Saxony e. V.
– Dresden-concept e. V.
– Förderverein HYPOS – Hydrogen Power Storage & Solutions East Germany e. V.
– Fraunhofer Network »Wissenschaft, Kunst und Design«
– Fraunhofer ICT Group
– Fraunhofer-Alumni e. V.
– Steering Group of the Fraunhofer Traffic and Transportation Alliance
– Network »Dresden – Stadt der Wissenschaften«
– Verein Forum Elektromobilität e. V.

Rauschert, André

– Fraunhofer Big Data and Artificial Intelligence Alliance

PATENTS

Jehle, C.; Klausner, S.: **Netzdienliches Gleichspannungsunterwerk.**
Patent no.: DE10 2017 105 728 A1, Publication 2018

Jehle, C.; Klausner S.: **Vorrichtung zur Energieversorgung eines elektrischen Betriebsnetzes.**
PCT application: WO2018/167286, Publication 2018

Klausner, S.; Gamsizlar, Ö.: **Elektrische Kontaktanordnung.**
Patent no.: DE 10 2009 023 072, 2012

Klausner, S.; Vorwerk, T.; Seiler, C.: **Unterflur-Kontaktsystem.**
Application no.: DE 10 2017 218 226.1, 2017
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Klingner, M.: **Leistungssteuereinrichtung und Verfahren zum Lastausgleich eines Netzes.** Application no.: DE 10 2011 114 344, 2011

Wagner, S.; Zipser, S.: **Verfahren zur automatischen oder teilautomatischen spurtreuen Mehrachslenkung eines Straßenfahrzeugs und Vorrichtung zur Durchführung des Verfahrens.** Patent no.: DE 10 2006 037 588 B4, 2011

CERTIFICATES

Städel, Christian: **Expert for energy-efficiency in buildings.**
Registration no.: 1191-16-2016

TRADEMARKS

AutoTram®
DE 304 17 949.3, 2004

autartec®
DE 30 2012 021 316.2/42, 2012

Feldschwarm®
DE 30 2013 013 880, 2013

HORUS®
DE 30 2013 006 673.1, 2014

TruckTrix®
DE 30 2014 003 169.8, 2014