Fraunhofer
IGD

FRAUNHOFER INSTITUTE FOR COMPUTER GRAPHICS RESEARCH IGD

Annual Report 2010

THE FRAUNHOFER IGD

Preface **1**

Profile of Fraunhofer IGD **2**

The Fraunhofer IGD network 6

The institute in figures 8

Project center Fraunhofer IDM@NTU 10

Competence center "Identification and Biometrics" 11

Leading minds of Fraunhofer IGD 12

Our lines of research **14**

Our research competence centers **30**

Trade fairs & events **52**

Customer & collaborative partners **54**

Publications **56**

Contact **58**

Editorial notes **59**

PREFACE

The past year has been an exciting one. 2010 was the year of economic recovery. Forecasts have transformed us all into optimists, while current economic figures are better than they have been for a long time. The mood is positive. It is now becoming clear without a doubt who acted sensibly during the time of the crisis. We are concentrating fully on our abilities - Fraunhofer designs the future! Research implies discovery. In line with our motto, we once again promoted innovative themes and developments in 2010, which we are delighted to present to you below.

Competence center "Identification and Biometrics"

Biometric systems are becoming ever more commonplace in daily life. Our institute has been engaged in biometrics since as early as the mid-nineties. The competence center "Identification and Biometrics" highlights Fraunhofer IGD's focus on this future technology. In November 2010 our employee ZHOU Xuebing was awarded the research prize of the European Biometrics Forum. This distinction confirms this competence center's great success in applied biometrics research.

Project center Fraunhofer IDM@NTU in Singapore

Fraunhofer is growing. In 2010 we continued to expand our position in the Asian market. We identified new and future-oriented markets in the Far East many years ago and are already looking back on a long period of successful work. Interactive digital media is a technological field with enormous application potential in a variety of industrial sectors. Fraunhofer IGD established the project center Fraunhofer IDM@NTU in conjunction with Nanyang Technological University in Singapore. This is where researchers are developing solutions inter alia for the future of mobile communications. The alliance profits from the international prestige that German and Singaporean research enjoys.

Prizes bestowed on the educational game "Winterfest"

The Rostock site had a most successful year in 2010. The outstanding performance of researchers at Fraunhofer IGD in Rostock was reflected not least in the award for the educational game "Winterfest". Fraunhofer IGD coordinated the Alphabit project, promoted by the BMBF (Federal Ministry of Education and Research) under the auspices of which "Winterfest" was created. The educational game was awarded the well-known LARA Games Award in the education category at the end of June in Cologne. The game encourages functional illiterates to expand their own capabilities in reading, writing and arithmetic.

Fraunhofer spin-off

Fraunhofer IGD is setting new standards in the field of computer aided design. Fraunhofer IGD scientists have created software that can optimally construct all dental prostheses virtually. In March 2010 the institute spun off a new autonomous company. exocad GmbH develops software for the design of dental prostheses, highlighting its outstanding performance in the field of dental CAD processes. Clearly, Fraunhofer IGD is triumphing in the development of market-ready software. This software is now being successfully launched in the market.

Innovation and ability – this is what Fraunhofer IGD, the world`s leading institute for applied research in Visual Computing, stands for. Our customers remain competitive; our annual report will show you how. We hope you enjoy reading it.

Prof. Dieter W. Fellner

Dr. Matthias Unbescheiden

PROFILE OF FRAUNHOFER IGD

For over 20 years, the Fraunhofer Institute for Computer Graphics Research IGD has focused its research activities on people. Researchers see people as users and want to facilitate their work with computers and help them design these computer systems more effectively.

Technical solutions and marketable products are created in close cooperation with partners, since one of the core goals is to utilize newly developed technologies in simple and, above all, efficient ways. The institute's employees play a decisive role by dint of innovative research and development projects conducted in their individual competence centers.

Fraunhofer IGD is a global leader in applied research in Visual Computing. Image and model-based computer science uses, captures and processes images and graphics for every imaginable computer-based application. Researchers generate the interaction of graphic application data with non-graphic data. They enhance images, videos and 3D models with text, sound and voice. To this end they design advanced dialogue techniques.

When a number of different data types are combined in the computer, the resulting findings create numerous potential benefits. Fraunhofer IGD offers technical solutions for innovative products and services due to its many years of competence and experience. It is a decisive factor in the continued international competitiveness of the European economy.

Researchers at Fraunhofer IGD are active in three strategic areas: "semantics in the modeling process", "confluence of computer graphics and computer vision" and "generalized digital documents". Scientists are focusing on new key themes in graphic data processing using selected competences.

Visual Computing is a significant component of the IT infrastructure and an important prerequisite for creating a modern information and knowledge society. Institute employees wish to offer their customers cutting-edge technology in order to ensure their success in the market. Small and medium-sized companies as well as service centers benefit from applied research activity, since it enables industry and business to develop strategically. The future of information technology is in a state of continuous development.

Fraunhofer IGD offers services for all requirements – industrial applications and private use, large projects and standardized solutions for day-to-day application. Its research and development activities are contributing to the establishment of Visual Computing in Germany as a basis for technology, tools and development. In-house products and processes underline how important Visual Computing is as a service. The spectrum of work conducted is as diverse as it is specialized: it ranges from application-specific fundamental research and algorithms to system concepts and prototype implementation. Specific customer wishes are always at the forefront of this process.

Fraunhofer IGD can call on organized research teams in competence centers and scientific excellence in strategic research areas in order to be able to support its customers with the most up-to-date methods of graphic data processing. The institute has both general IT competences and well-developed capabilities in a broad range of different application fields of Visual Computing at its disposal. In November 2009 the institute was certified according to DIN ISO 9001:2008.

In 1987 a working group set up by the Fraunhofer-Gesellschaft started its research work in Darmstadt. Five years later Fraunhofer IGD emerged. It now boasts three locations in addition to the headquarters in Darmstadt – Rostock, Graz and Singapore.

Professor Dieter W. Fellner is the head of Fraunhofer IGD and at the same time holds a chair for graphic-interactive systems at TU Darmstadt (Technische Universität Darmstadt).

A total of twelve research and development competence centers with over 170 employees are spread over sites in three countries. The institute's philosophy is to build on employee satisfaction and motivation, since experience dictates that excellent research, development and continuing education flourish best in a cooperative and trusting atmosphere. Reliable, punctual and customer-oriented work is therefore a matter of course for our scientists. Fraunhofer IGD works closely together with university partners, thus reinforcing its research competences at the various locations both in terms of personnel and expertise. TU Darmstadt (Technische Universität Darmstadt), TU Graz (Graz University of Technology) and the NTU (Nanyang Technological University) of Singapore have been some of the institute's close cooperation partners for years.

Fraunhofer IGD in Darmstadt

The Fraunhofer IGD site in Darmstadt exceeds 8,000 square meters (9,600 square yards). Over 100 permanent staff members work in the institute's offices and laboratories. Approximately 250 scientific assistants help process research jobs. Fraunhofer IGD can be broken down in terms of both themes and organization into seven competence centers and one Service Center. The Service Center takes care of the network, the servers and computer workstations. Thanks to the service team, the scientists can devote themselves to research without the burden of daily routine work. The institute works closely together with the "Graphic-Interactive Systems" (GRIS) department of the Computer Science faculty of TU Darmstadt. This traditional cooperation is mutually complementary, guaranteeing as it does the excellence of the scientific work. It enriches both the fundamental research of the specialist field and the applied research of Fraunhofer IGD. The institute significantly assists industry and business in their strategic development by virtue of its applied research. It is precisely the small and medium-sized firms and service centers that benefit most.

Fraunhofer IGD in Rostock

The Rostock site has been involved in research for almost twenty years. Since its establishment in January 1992, Rostock has consistently expanded and further established its competences in Visual Computing. This encompasses multimedia communication, systematic handling of knowledge, mobile multimedia applications and entertainment, as well as solutions for virtual product development. In order to refine their position in the research market in future, researchers in Rostock are concentrating on a narrower range of themes and key industries of the federal state of Mecklenburg-Vorpommern. These include the maritime industry, machinery and plant construction, information technology and software development.

Fraunhofer Austria Visual Computing in Graz

In 2009 the Fraunhofer family grew. The Fraunhofer IGD project bureau, in existence at TU Graz since 2007, was merged into the business segment of "Visual Computing" of Fraunhofer Austria Research GmbH. The Graz Fraunhofer site is thus a direct affiliate of Fraunhofer IGD and develops effective solutions and new products in the fields of graphic data processing, computer vision and virtual and augmented reality. Research results make it easier for people to deal with computers. The Fraunhofer-Gesellschaft is Europe's largest institution for applied research. Austria is therefore an important cooperation partner in international contract research. Researchers at Fraunhofer Austria work in close cooperation with the "Visual Computing" excellence cluster established at TU Graz.

Technology Labs in Darmstadt and Rostock

Fraunhofer IGD uses its laboratories in Darmstadt and Rostock in order to demonstrate the findings of the competence centers. Furthermore, experiments and studies for project work are performed in these labs.

The following laboratories are available:

- Ambient Intelligence Laboratory
- Biometrics Demonstration Center
- Laboratory for Augmented Engineering
- Laboratory for High Quality Image Acquisition and Output
- Laboratory for Knowledge Engineering Technologies (KET Lab)
- Laboratory for Usability and Assistance Technologies (UAT Lab)
- Maritime Graphics Laboratory
- Visual Analytics Laboratory
- VR Technology Laboratory
- Medical Applications Laboratory
- Media Competence Center

In addition to the laboratory work, Fraunhofer IGD offers service centers on these topics:

- Evaluation Laboratory for Biometric Systems
- Demonstrations Center for Graphic Information Systems
- Showroom/HEyeWall

Board of Trustees

The Fraunhofer Institute's board of trustees is an advisory and control committee. It is composed of a number of renowned representatives from science and business.

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THE FRAUNHOFER IGD NETWORK

The Fraunhofer-Gesellschaft

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 more than 80 research units in Germany, including 60 Fraunhofer Institutes. The majority of the more than 18,000 staff are qualified scientists and engineers, who work with an annual research budget of €1.65 billion. Of this sum, more than €1.40 billion is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Almost 30 percent is contributed by the German federal and Länder 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. Affiliated international research centers and representative offices provide contact with the regions of 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.

The Executive Board of the Fraunhofer-Gesellschaft

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Prof. Dr. Ulrich Buller
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Institute Advisor of Fraunhofer IGD

Christoph Hanno Fischer
Fraunhofer-Gesellschaft

www.fraunhofer.de/en

Fraunhofer Alliances

Institutes or departments of institutes with varied competences cooperate in the Fraunhofer alliances in order to work on and market a business area together. Competence centers in Fraunhofer IGD work closely together with departments in other Fraunhofer Institutes in the Fraunhofer alliances of "Ambient Assisted Living" and "Numerical Simulation of Products, Processes".

www.fraunhofer.de/en/institutes-research-establishments/groups-alliances

Fraunhofer Group Information and Communication Technology

Important business units of the The Fraunhofer ICT Group are:

- *Automotive*
- *Digital Media*
- *Medicine and Life Sciences*
- *E-Business*
- *E-Government*
- *Security*
- *Production*
- *Financial Services*
- *Information and Communication Technology*
- *Energy and Sustainability*

Institutes working in related subject areas cooperate in Fraunhofer Groups and foster a joint presence on the R&D market. The Fraunhofer IGD is member of the Fraunhofer Group Information and Communication Technology (ICT-Group). The institutes of the group work hand in hand, collaborating and pooling different skills in flexible structures when needed. This secures their leading position in the development of system solutions and the implementation of comprehensive innovations.

Employing more than 4,000 people at its 18 institutes and with an annual budget of approximately 180 million euros, the ICT-Group is Europe's largest research association. The business office in Berlin-Mitte works as a one-stop-shop and is the first contact point.

As Europe's largest combined research unit for information and communication technology (ICT), the Fraunhofer ICT-Group is the starting point for clients from industry and the media who are looking for the right contacts. The strengths of our 18 member institutes are combined and marketed jointly. This networking makes well-aimed, integrated solutions possible from application-oriented research for each specific area of industry: tailor-made IT solutions, expert advice on technology, and prospective research for new products and services.

www.iuk.fraunhofer.de/en

THE INSTITUTE IN FIGURES

Budget graphs and personnel figures clearly show the development of Fraunhofer IGD. Fraunhofer IGD was able to expand the job and financial structure of the institute in all four locations slightly during the period under review.

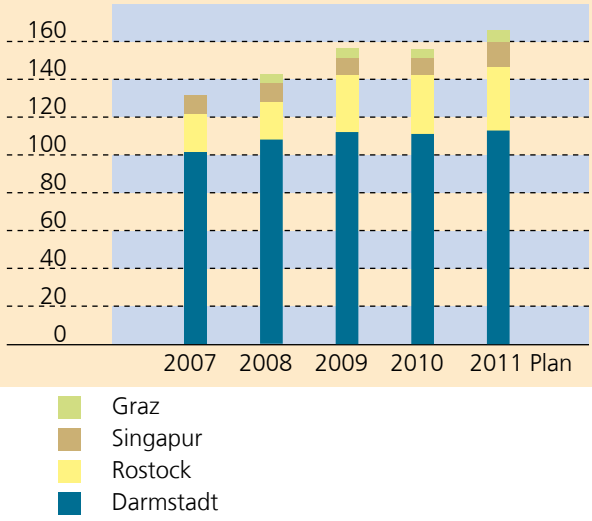
Fraunhofer IGD employed 175 individuals in total in Darmstadt, Rostock, Graz and Singapore. The number of posts results in a capacity of 156 staff years in terms of cost. Posts in the institute are distributed as follows: 71 percent in Darmstadt, 21 percent in Rostock, three percent in Graz and five percent in Singapore. Plans for 2011 project a growth rate of approximately three percent.

In addition, Fraunhofer IGD employed roughly 260 external contractors in its institutions in 2010. This is equivalent to approximately 60 full-time posts. External contractors include scientific and student assistants, visiting scientists and interns.

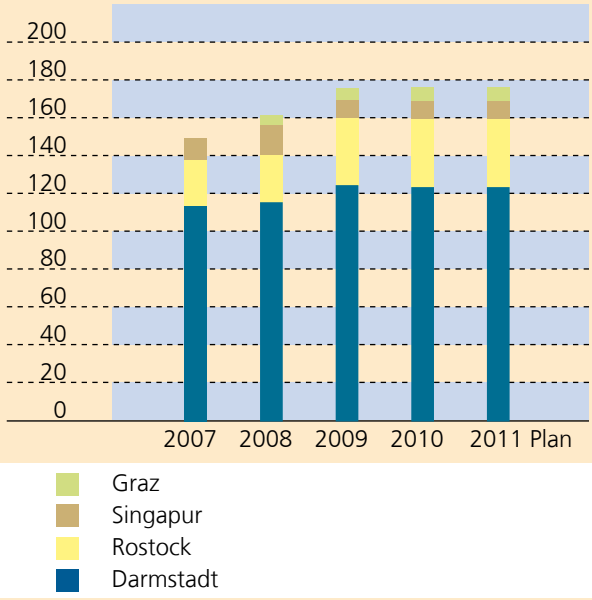
The total operating budget of Fraunhofer IGD was approximately EUR 15.6 million in 2010. Some 74 percent of costs were incurred in Darmstadt, 19 percent in Rostock, three percent in Graz and four percent in Singapore.

In 2011 the budgets of all locations are to be kept at the previous year's level. Due to the reorientation of the Rostock and Singapore locations, budget increases may occur if project acquisitions are successful. Budget figures for 2011 are based on a calculation dating from October 2010 and are regularly adjusted in line with future developments.

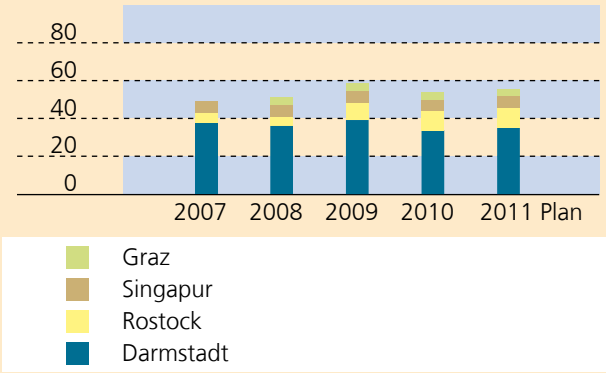
Development of cost-effective capacity at the Fraunhofer IGD locations



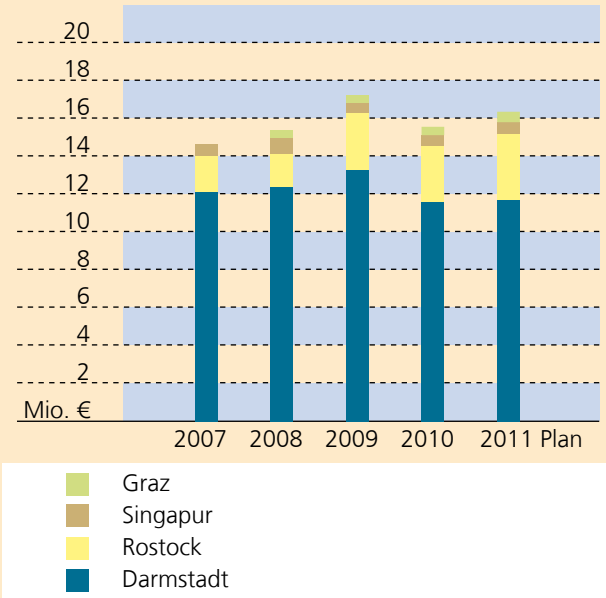
Development of staff contingents at the Fraunhofer IGD locations



Development of part-time staff contingents at the Fraunhofer IGD locations



Total budget development at the Fraunhofer IGD locations



The operating budget of Fraunhofer IGD in Darmstadt is financed with about 64 percent by external revenue and with approximately 36 percent by public funding of the Fraunhofer-Gesellschaft. The share of external financing consisted of funds from industry (about 16 percent), EU projects (about 25 percent) and national public projects (about 22 percent).

In Rostock the operating budget remained the same as for 2009. The share from public funds was around 20 percent. The major share of external financing came with about 60 percent from public projects and with about 17 percent from industry.

The Graz site has become firmly established in Austria. Due to the low budget volume, ongoing development is still subject to sharp fluctuations. Each project can significantly affect available data. No meaningful comparisons are therefore possible with the available figures.

The operating budget of the Singapore site is managed within the NTU Singapore budget. When work in the Fraunhofer project center commences in the first quarter of 2011, comparable figures will be available for the first time, starting next year.

FRAUNHOFER IN ASIA

PROJECT CENTER FRAUNHOFER IDM@NTU IN SINGAPORE

The Fraunhofer family is growing. Since May 31, 2010, Fraunhofer IGD has continued to expand its activities in the Far East. The Asian market shows trend-setting potential – Fraunhofer has responded by establishing the Fraunhofer IDM@NTU project center in Singapore. Potential in Visual Computing and media technology can be better exploited as a result.

As early as 1998, Fraunhofer IGD founded the Centre for Advance Media Technology (CAMTech) with Nanyang Technological University (NTU). It has now been merged into the Fraunhofer IDM@NTU project center, a direct affiliate of Fraunhofer IGD. The research team at Fraunhofer IDM@NTU under the leadership of Professor Wolfgang Müller-Wittig and Professor Yeow Meng Chee is focusing on interactive digital media (IDM).

Cooperation with leading Asian scientists

The project center responds to the requirements of the Asian market with respect to research, development, technology and innovation and pursues the mission of the Fraunhofer-Gesellschaft to promote application directed research on current issues emanating from the business world. The close cooperation with NTU and its top-flight Asian scientists from the IDM field plays a key role in this endeavor. The Asian market is known for its products in this sector, thus the project center has a wide field of activities. Solutions for augmented reality are especially interesting with respect to modern cell phones.

Visual Computing for the Asian market

The project center is working on IDM basic technologies and Visual Computing applications. The research emphasis on real-time rendering and visual analytics should be highlighted. Fraunhofer IDM@NTU can rely on the experience of Fraunhofer IGD in bringing innovations to the Asian market.

International exchange

Fraunhofer IDM@NTU maintains an international network and is a member of renowned research associations. Currently, it contributes to the developments of new doctoral programs between the NTU, the TU Darmstadt and TU Graz. Moreover, scientists in Singapore are contributing their skills in real-time rendering, visualization and virtual and augmented reality to international research initiatives. They are already working successfully together with the Singapore-MIT Alliance for Research & Technology (SMART) CENSAM, Future Urban Mobility and the Future Cities Laboratory of ETH Zurich.

More Information on this competence center and projects:
www.igd.fraunhofer.de/en/Institut/Standorte

FUTURE TECHNOLOGY BIOMETRICS

COMPETENCE CENTER “IDENTIFICATION AND BIOMETRICS”

The competence center “Identification and Biometrics” has been in existence since April 2010, when it was formed from the competence center for “Security Technology”. In this reorientation, Fraunhofer IGD is stressing its focus on the future technology of biometrics. Alexander Nouak and his team are the contact points for solutions and services regarding biometric systems. They work closely together with the Fraunhofer SIT.

Since the mid-nineties, researchers have been developing and working in the field of biometrics. This promising field of technology revolves around the concept of machine recognition of people. It uses certain physical features to be able to identify people again. The best-known biometric processes include fingerprint, iris and facial identification. Additional methods include identifying gaits, vein patterns or signatures.

Interdisciplinary research team

There are not only numerous processes in the field of biometrics, but also many providers. Alexander Nouak and his team assist companies, authorities and individual citizens in maintaining a clear overview. The competence center “Identification and Biometrics” is engaged in implementing biometric projects and evaluating existing biometric systems and processes. It has a demonstration and evaluation laboratory at its disposal for this purpose. As not every system is suitable for every application scenario, the range of tasks is extremely broad. The interdisciplinary team of experts engages in consultation, evaluation and research, thus allowing for a wide-ranging view of the topic of biometrics. Not only people can be identified based on physical features, but multimedia files as well. Files, too, have characteristic properties due to their content. Image and video files can be properly identified with the technology of perceptual hashing without changing the content.

Protection of privacy using template protection

Biometric methods in fact do harbor security risks and risks associated with data protection legislation, but these risks can be minimized using template protection. Template protection can transfer biometric information in a secure, non-invertible form, thus protecting the user’s privacy. The competence center contributes its many years of experience to the research program BioKeyS. Promoted by the Federal Agency for Security in Information Technology (BSI), the project is designed to discover how template protection can enhance security using passwords. Project team members are also developing more efficient identification options.

More Information on this competence center and projects:
www.igd.fraunhofer.de/en/Institut/Abteilungen

LEADING MINDS AT FRAUNHOFER IGD

"It is above all our personnel who shape our institute: Enthusiastic assistant scientists, employees and managers. Taken together they form Fraunhofer IGD's innovation potential. We will introduce you to five selected individuals below."

Professor Wolfgang Müller-Wittig – director of Fraunhofer IDM@NTU

After studying computer science at the Technische Universität Darmstadt, Professor Müller-Wittig received his doctorate in 2000. Since May 2010 he has headed the newly opened project center Fraunhofer IDM@NTU in Singapore. He had already been working in Asia as the director of the Centre for Advanced Media Technology (CAMTech) – the precursor of Fraunhofer IDM@NTU. Furthermore, he has been engaged in both research and teaching at Nanyang Technological University in Singapore. He is the author of over 100 publications on the topics of real-time rendering, virtual and augmented reality, digital heritage and expanded technologies in computer-aided surgery and GPGPU (General Purpose computing on Graphics Processing Units). Professor Wolfgang Müller-Wittig is a member of numerous associations, such as Eurographics, IEEE Computer Society, Singapore Biophysical Society and the German-Singaporean Chamber of Industry and Commerce.

Dr. Wolfgang Müller-Wittig, Assoc. Prof. , +65 6790 6988, wolfgang.mueller-wittig@fraunhofer.sg

Alexander Nouak – manager of the competence center "Identification and Biometrics"

Alexander Nouak completed his studies in information and documentation at the University of Applied Sciences Darmstadt with the focus on media and business information. In 2005 he took over the management of the competence center "Security Technology for Graphics and Communication Systems", which was merged with the competence center "Identification and Biometrics" in the spring of 2010. Before joining Fraunhofer IGD, Alexander Nouak established the company "zeitform Internet Dienste" with two business partners. While working, he pursued studies in international business with the focus on marketing, finishing in 2004.

Alexander Nouak, +49 6151 155-147, alexander.nouak@igd.fraunhofer.de

Images (from the left): Professor Wolfgang Müller-Wittig, Alexander Nouak, Katharina Schmidt, Steffen Malo, Holger Diener

The LARA Games Award is one of the most sought-after prizes in the computer and video game industry. Katharina Schmidt, Steffen Malo and Holger Diener of Fraunhofer IGD in Rostock were awarded this prize. Their educational game "Winterfest" took first prize in the education category in June 2010: the adventure game is designed to encourage illiterates to improve their capabilities.

Katharina Schmidt – the designer

Katharina Schmidt studied communication design and media in Wismar, specializing in the design of graphic user interfaces. She gained initial practical experience in developing games by writing her thesis on game-based learning and the design of an educational game. Initially, Katharina Schmidt was engaged as a student assistant at Fraunhofer IGD in Rostock and since 2007 as in-house designer for the Zentrum für Graphische Datenverarbeitung e. V. (ZGDV) (Center for Graphic Data Processing) in the competence center "Knowledge Engineering Technologies" (KET). Presently she is working on the Alphabit project and has been assisting the "Interactive Document Engineering" competence center since 2008 as communications designer.

Steffen Malo – the educator

Steffen Malo studied education at the University of Rostock. Subsequently he researched the use of technology-assisted learning in a number of different research projects, largely interdisciplinary, at the University of Rostock. Since 2005 Steffen Malo has been conducting research at Fraunhofer IGD in the "Interactive Document Engineering" competence center and is pursuing the use of game-based learning for literacy and basic education for his doctorate. He holds seminars on the topics of game-based learning, didactic lesson design and self-directed learning.

Holger Diener – the mathematician

Holger Diener was born in Berlin. He studied mathematics and computer science at the Technical University of Berlin from 1988 to 1995. He has been employed at Fraunhofer IGD in Rostock since 1996. From 2000 onwards Holger Diener managed the "Entertainment Technologies" competence center, which was merged into the "Interactive Document Engineering" competence center in 2008. His activities include tasks in image processing and technology studies in the production and entertainment industry environment: game-based interfaces, serious games, games engineering and game-based learning constitute the focus of his research.

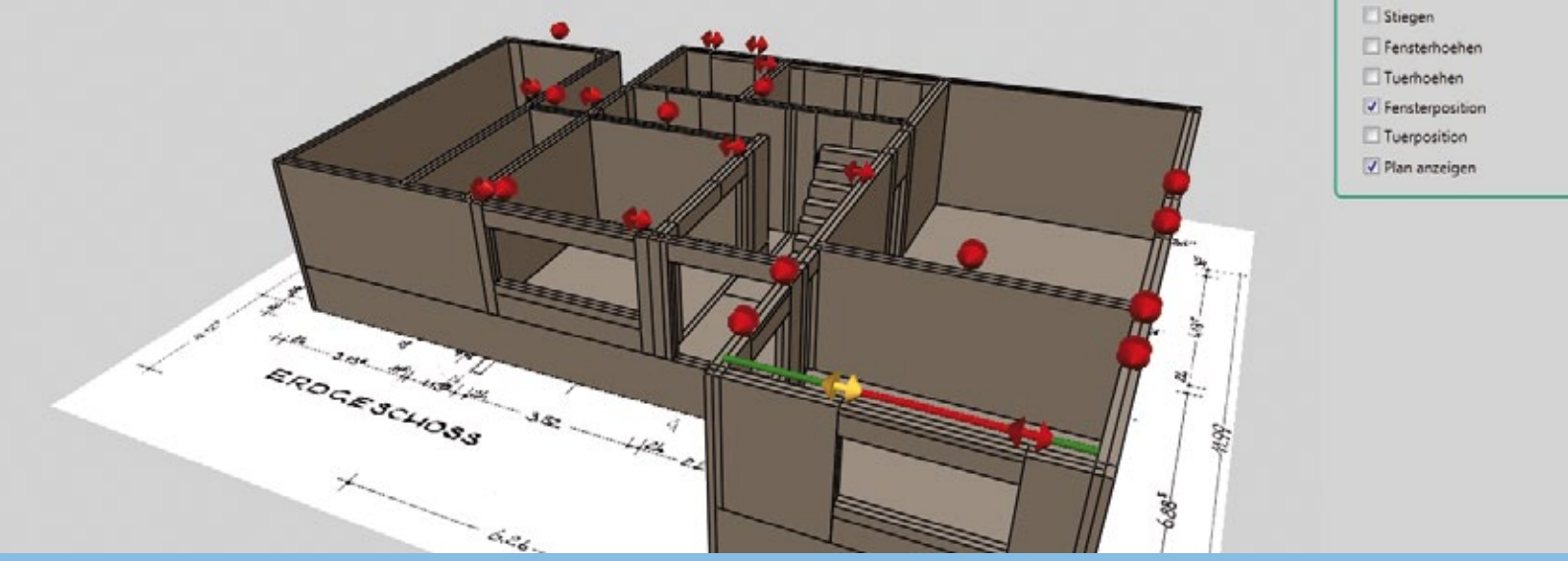
OUR LINES OF RESEARCH

Fraunhofer Institutes are committed to selected competences and future challenges to society, industry and business. At Fraunhofer IGD these general aims are broken down into three lines of research, which are briefly presented below. The institute is pursuing new key themes and is a global leader in these areas. You will also be able to read about examples from our current project work in the pages that follow.

SEMANTICS IN THE MODELING PROCESS

"Models created with computer graphics – so called digitally borne artifacts – are the basis for new products in modern industry. Developers simulate the new product, thus reducing production costs. In order to be able to simulate and visualize products long before the first real prototype as well and accurately as possible, it is not sufficient to design a detailed 3D model. Rather, the visualization must have its own 'intelligence' and know how it reacts to external influences as the sum of its parts.

The project 3D-COFORM illustrates this very well. Works of art can be recorded, archived and presented three-dimensionally. When the computer shows a vase, it graphically depicts not only the individual parts, but also knows that it is depicting a vase and the function of the vase. Special search processes can, for instance, filter out all vases from the sixth century B.C. with at least two handles. This is made possible by geometric analysis. Fraunhofer IGD researchers include all projects that are pursuing new paths in the generation, visualization and simulation of prototypes under 'semantics in the modeling process'."



BUILDING PLANNING PROJECT

"A new office building is to be constructed. The concept has been developed and the planning process begins. Three months later: the clients arrive to view the designs. The model of the building complex has been created virtually on the computer using a CAD program. But then the windows are not right – they are too narrow and allow too little light into the interior of the building. What can be done?"

Under normal circumstances each window would have to be adjusted post facto in the model. That takes time, but time is essential. Are intelligent 3D models the solution? Geometric models generally consist of basic modules, which may be triangles, Bézier surfaces or partitioning surfaces. Conventional modeling tools store these models by listing the basic modules. A CAD program does in fact allow a description of the flow of the construction, but important information regarding the production process is lost at the time of storage. Generative modeling is an alternative approach to describing three-dimensional forms. The idea behind it is: describe the model and its objects not in terms of their three-dimensional surfaces, but in terms of form and function.

Intelligent 3D models

The modern model builder implements this thought using the generative modeling language GML. This CAD solution is able to take into account complex interdependencies. In our example a window would not be a rigid object that appears several times in the plan, but rather a function of the generative modeling language, GML. In other words, planners do not have to adjust every window that is too small individually; rather, they simply change the function that creates the windows and simplify the development process enormously as a result. Subsequent changes can be made easily. The digital 3D objects contain the factual knowledge what they mean. A window is not a transparent rectangle in digital space, rather it knows how to insulate heat, how to open, how much room it needs, on which wall it is located and which compass point it faces.

New stimuli for the construction industry

While this sounds like a matter of course, it is by no means normal yet to design construction work digitally in this fashion. The architect still has to document a great deal by hand, but this could become increasingly rare thanks to intelligent construction. If something changes in the overall plan, these intelligent building parts can tell; this must, however, have previously been established as one of the basic requirements of the building. Researchers in Graz are also ensuring that the intelligence of the objects is not lost if they are transformed into other forms of representation. Changes in 3D visualization can be directly incorporated in the intelligent plan. Without doubt intelligent construction planning is providing new stimuli for the construction industry.

Project manager Dr. Eva Eggeling
eva.eggeling@fraunhofer.at

MAXIMUS PROJECT

"Good architecture begins at the desk – and at the computer. Architects still fall back on traditional methods, such as paper sketches and model building, in the development process, but subsequent planning and presentation takes place almost exclusively on the computer in this industry as well. This is where virtual product development comes into play."

maximus

The computer is particularly useful when lighting situations have to be planned, as lighting design is one of the most difficult tasks in the design process. Light creates reality, but is as special in its handling as in its effect – lighting complements architecture, stages the buildings and creates interior atmosphere. The use of high-dynamic range imaging in lighting design is extremely handy.

High-dynamic range in research

In reality the ratio of the full illuminating power of the sun to complete darkness is in the range of 2,000,000,000:1. Current presentation technologies can manage to depict a spectrum of 10,000:1, but illumination effects in the automotive design, architectural and industrial design industries can still not be simulated satisfactorily. In recent years, high-dynamic range imaging (HDRI) has developed into a new field of research. HDR images can capture wide differences in brightness and offer the ideal basis to depict materials realistically. What has been missing so far are the interactive visualization systems that allow handling of the HDR material and light information from the time that it is captured through processing to presentation in an integrated fashion.

Researchers are for the first time developing a complete HDR pipeline under the aegis of the MAXIMUS project. It ranges from the capture of light and materials through processing to presentation in a specially developed projector. The interplay of virtual light sources and virtual objects appears more realistic than ever. Users should be able to simply interact with virtual objects and compose virtual light sources. Furthermore, researchers want to be able to evaluate different situations and lighting effects in real time.

Projector Prototype and Demonstrator

In 2010 partial results from the MAXIMUS project were integrated and presented for the first time, using the first prototype of an HDR projector. The employees of the "Industrial Applications" competence center are proud that the system is already being tried as part of the vehicle design project and for architecture.

Project manager Prof. Dr. André Stork
andre.stork@igd.fraunhofer.de

INTERPLAY BETWEEN COMPUTER GRAPHICS AND COMPUTER VISION

"Computer graphics are in a position to technically generate and represent in 2D or 3D anything that the individual can perceive visually. With significantly more effort it is possible to endow the computer with vision. The computer can identify objects and living things with computer vision. The combination of computer graphics and computer vision offers an incredible range of potential applications.

The following development is an illustration: Researchers of the Fraunhofer IGD have developed a system that can identify the individuals in front of the presentation screens and then run a corresponding program. If the person standing in front of the screen is a woman, only film previews specially aimed at a female target group are shown. The interplay of computer graphics and computer vision makes this possible.

One example of this line of research are the activities of Fraunhofer IGD in Augmented Reality - AR. The computer must be able to identify something quickly and accurately in order to overlay it precisely with a previously defined and adjustable graphic in real time. Fraunhofer IGD is one of the very best leaders world-wide in this trend-setting application."

VAALID PROJECT

"To live 100 years in wonderful health – isn't this everybody's dream? Quite a few of us would like to be able to live independently up to a very old age. But our bodies change, our strength gradually diminishes and a few limitations lurk in our daily routines that make life more difficult. It doesn't have to be like this!"

As part of the EU project VAALID, Fraunhofer IGD researchers are creating environments specifically tailored to the needs of the elderly. Researchers are developing new tools and methods to implement and adapt AAL scenarios more easily under the auspices of the current focal project of the competence center "Interactive Multimedia Appliances".

Intelligent assistance systems

To this end they have developed an authoring environment for fast prototyping and a 3D simulation environment: intelligent assistance systems monitor health, record movements and respond to the behavior of individuals. They are particularly beneficial for the elderly or people in need of care.

Directly experience technological innovations

Real test subjects play an important part in the VAALID project. Initially, focus groups determine the wishes of the elderly in the test environment. A target group aged 55-90 years was surveyed in a room for projecting virtual reality (a cave). Fraunhofer IGD also supplies the key core technology for this part of the project, specifically instantReality, i.e. software for advanced mixed reality. This allows technological innovations to be demonstrated in the home environment prior to their implementation. Planners and future residents can experience changes directly by means of virtual reality.

The scientists are also engaged in ascertaining which interfaces the simulation environment must take into account, simulating user interaction and determining requirements for the user-centered design process.

Trend-setting research project

The results of VAALID will be of great significance to developers in all phases of user-centered design. They provide both recognized standards for verification and validation of user interfaces, as well as the requisite technological support. The European Union is supporting this trend-setting research project.

Project manager Dr. Reiner Wichert
reiner.wichert@igd.fraunhofer.de

DIGITAL ADVERTISING AND PRESENTATION SYSTEMS PROJECT

"A company is planning its next appearance at a trade fair. Signs and static advertising have, so far, done their job well. But now it's time for something new – solutions that set the company apart from their competition and appeal to and attract visitors. New interactive advertising and presentation systems are the key to success."

Public entertainment and information systems have changed dramatically due to technological innovation. As part of the Omniwall project, software is being created that enables presentations on large multi-touch screens: images are combined with several projectors on screens of any size, form or resolution. While small multi-touch devices are already well-known and widely in use, there are many additional application fields for the large-format systems. Both flat and convex screens and presentation walls play an important part in this. Exhibitions, museums and television studios, as well as games and simulations can take advantage of the interactively operable curved screens to the same extent as the finance sector for visualizing large data quantities.

Omniwall and Omnitouch technology

The Omniwall technology developed by Fraunhofer IGD is based on the Unified Grabber Architecture (UGA). It supports formats such as DVI, Display Port, HD-SDI and VGA. The use of the system is very flexible, so that both, reflected light projection and rear projection are possible. Omniwall is compatible with current multi-monitor-rendering solutions and is especially suited for use in game applications. Omnitouch technology completes Omniwall's business range. It can incorporate monitors touch-sensitive that integrate several infrared cameras at once.

User identification via ChameleoAd System

The ChameleoAd system developed by Fraunhofer researchers can identify the public in front of digital presentation systems and respond to its particular characteristics, such as age, gender, movement flows and attention. It uses special visual sensors such as digital cameras and time-of-flight sensors, i.e. 3D camera systems, in this endeavor. ChameleoAd builds on Omnisense software, which includes a variety of components. An appropriate analysis tool allows the user to adapt the presentation to the public even more focused. To this end all data from visual sensor processing are integrated into a database via the camera pixels. The system can therefore automatically run and prepare content tailored exactly to the public identified. Presentations, too, can benefit from Omnisense technology, because it enables interaction to take place without contact. In order to move to the next slide, the presenter need only make a wiping motion. Clicking is triggered by a simple typing gesture.

Project manager Volker Hahn MBA
volker.hahn@igd.fraunhofer.de

SKILLS PROJECT

"A technician is standing in front of a machine in a factory. He has to find out why the equipment is not working anymore. He then arranges his tools, pulls a cuff over his wrist and positions his display. Then he starts to work. What's so special about this? The worker has never before performed this activity and will nevertheless do so to everyone's full satisfaction. How does this work? Augmented Reality makes it possible."

SKILLS
Multimodal Interfaces for Capturing and Transfer of Skill

The EU project SKILLS captures, stores and transmits human capabilities with technologies from the fields of multimodal interfaces, robotics and virtual environments. Researchers are, for example, developing augmented reality technologies in order to train service technicians. The service technician is led through complex maintenance scenarios via augmented reality, using his smart phone or AR glasses. The worker sees the working steps to be performed directly in the field of vision of his glasses superimposed over the machine. The cuff that he puts on gives the service technician tactile feedback. It lets him know when he performs an incorrect action or uses the wrong tool.

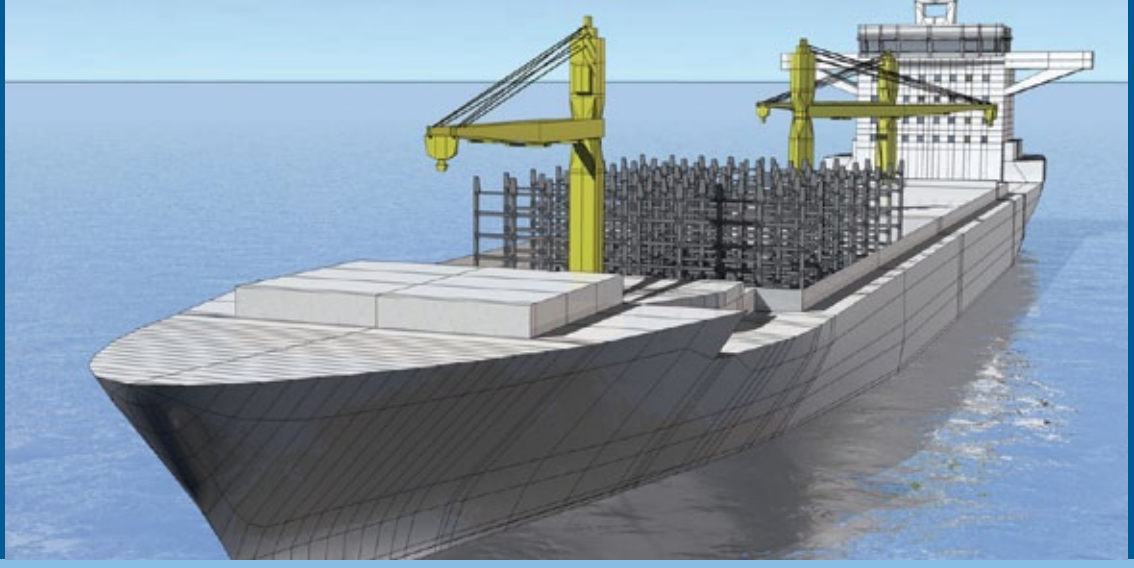
Learning from experts

The SKILLS project is pursuing the idea of capturing the capabilities of experts via multimodal sensory systems and transmitting them to virtual/augmented reality-assisted training simulators. Participating scientists analyze human capabilities, including human perceptions, i.e. cognitive capabilities. They integrate their findings in a digital representation of these skills. In addition, they develop and evaluate appropriate professional techniques to pass on these capabilities. The EU project's aim is to create a system that experts can use to describe sensomotor and cognitive skills. The data generated in this process should assist in deriving the optimal approach to the most varied manual activities. A training simulator then transmits the working steps to be performed. Prototypes are being created at present in the areas of sports and entertainment, surgery and rehabilitation, as well as industry and production.

Visual representation of skills

The tasks of Fraunhofer IGD within the SKILLS project include capturing skills in a variety of application scenarios, as well as transmitting these skills multimodally to the training simulator. The "Virtual and Augmented Reality" competence center evaluates new methods of computer vision-based tracking and multimodal rendering. These technological developments are integrated into the computer vision library VisionLib and are then used in the mixed reality system instantReality. The library and the mixed reality system have been developed by Fraunhofer IGD.

Project manager Dr. Ulrich Bockholt
ulrich.bockholt@igd.fraunhofer.de



POWER-VR PROJECT

"A fire breaks out on a ferry. In the event of an emergency on the high seas, every second counts – passengers and crew all benefit from a well-planned safety strategy. Fraunhofer IGD researchers simulate realistic evacuation measures. They use the deck layouts, a simulation of escape behavior and a 3D model for this purpose."

The Fraunhofer IGD researchers in Rostock evaluate the results intuitively and in depth; they hope to glean information about the additional potential of virtual reality – for ship-building in general and safety in particular. Power-VR investigates a variety of options in order to integrate virtual reality technology as effectively as possible into ship-building product development processes. Experiences from other industries such as automotive construction cannot simply be transferred to ship-building. This is due to the significantly higher data volume in ship design, as well as the development and planning processes, which are especially oriented towards one-of-a-kind designs and small series. In addition, 3D technology is not yet widespread, particularly among suppliers.

3D models and application scenarios

It is especially important for the scientists to investigate specific application scenarios, regardless of whether this is with the help of a traditional design review or of questions on safety or using VR models for purposes of training and education. Fraunhofer IGD works in close cooperation with well-known shipyards, suppliers, software providers and research institutes and aims at integrating new applications into existing systems landscapes. A ship-builder can, for instance, supplement his data with new information and is not required to convert completely to a new system. Researchers try out the solutions they have developed in the shipyards and with the supplier companies, so that the entire German shipping industry can subsequently use their findings. It is not enough, therefore, that the 3D models are used for the visual exploration of a ship; rather, they must solve complex issues as well. The Federal Ministry for Business and Technology is funding the POWER-VR project to the tune of EUR 5.4 million.

Virtual reality

With the sub-project POWER-VR Rescue, Fraunhofer IGD is creating a bridge to the utilization of Augmented Reality. It uses virtual techniques to simulate equipment, so that the ship-builder can assess the retrofitting of new rescue resources using a prototype and do so directly within the context of the existing ship.

Project manager Prof. Dr. Uwe von Lukas
uwe.von.lukas@igd-r.fraunhofer.de

THESEUS MEDICO PROJECT

"A patient is being treated in hospital because he has a tumor on the lymph node. He has been undergoing chemotherapy. The doctor treating him would like to know whether the therapy has been effective and creates images of the lymph nodes using computer tomography. The physician compares the images from before and after therapy. But assessment is a drawn-out process. Now there is a new option: THESEUS Medico."

Medico is part of the research program THESEUS. The goal is to develop an intelligent, scalable and robust search engine within medical image databases. This automatically allows detailed information to be extracted concerning the type and degree, as well as the position and surroundings of noteworthy changes in medical images.

Help with diagnosis and therapy planning

In our case the treating physician could compare images from before and after therapy using Medico. The system extracts relevant information from the images. The result could be: therapy was succesful, as the lymph nodes have not continued to change anymore. But in addition, new damage to other organs can be noted by the program. For clarification the doctor could use another one of Medico's capabilities if there are no comparable cases in the hospital. He can compare the data from our patient with numerous cases, such as those treated at the University clinic. Thus Medico, in being able to access medical knowledge faster and more efficiently, helps the physician in making diagnostic and therapeutic decisions. Decisions on how the patient's treatment is to progress become easier.

Medical progress

Which organ can be seen on the image detail within the borders? Is there disease? If so, which one? What do similar cases with the same appearance look like? So-called algorithms allow independent knowledge to be filtered from available medical image databases. With the help of semantic technologies, an intelligent search of medical databases is no longer a problem. Fraunhofer IGD is concentrating on developing those algorithms that can segment the most important organs both automatically and manually. If the algorithms are further analyzed, detailed information can be obtained.

THESEUS Medico will help doctors and patients enormously in the future: the program compares, analyzes and interprets important medical image and text information in a rapid and straight-forward manner. The Federal Ministry for Business and Technology (BMWi) is supporting THESEUS Medico.

Project manager Prof. Dr. Georgios Sakas
georgios.sakas@igd.fraunhofer.de

GENERALIZED DIGITAL DOCUMENTS

"Texts, graphics, images, sounds and video are being stored in digital libraries. 3D animation and 3D models are increasingly being stored as well. Frequently such data records are handled separately and processed with different tools. In order to be able to use them more effectively, the user must have tools with which he can use these varied 'digital documents' in a similar and complementary fashion. It is therefore necessary to consistently tie the individual document forms together.

At the moment people are still predominently linking the 3D models stored in the databases with their related texts, images and videos manually. The goal should be that the software automatically recognizes the interconnections in meaning and creates the correct links - so-called semantic references. The term 'three-dimensional documents' is also used in this context.

The research line 'Generalized digital documents' works on library-related issues in the context of three-dimensional models. The development of 3D documents poses several challenges that Fraunhofer IGD has been meeting successfully for many years. The institute is developing the requisite algorithms and tools and generating open standards that enable simple data exchange of the most varied types of digital information to take place.

VISMASTER CA PROJECT

"A Visual Analytics expert has been endeavoring to resolve a certain issue for some time. He already has a few good approaches to solutions, but the crucial concept has not been among them. In a professional periodical, he by chance discovers the article of a colleague who is dealing with similar problems, at which point the expert is finally inspired with the definitive idea. Close cooperation with another researcher could have saved a good deal of time."

VisMaster
Visual Analytics - Mastering the Information Age

To date research on visual analytics in Europe has generally been fragmented and independent. The European Union has recognized that this topic will play a crucial role in the future and has therefore created the VisMaster CA project.

Pan-European visual analytics

This allows researchers and users to improve information exchange. Dr. Jörn Kohlhammer is the coordinator of the project, which brings together academic and industrial research as well as development experts. 26 European partner organizations have developed a visual analytics strategy plan and laid out a roadmap.

Using information volumes as efficiently as possible

This research guideline was published in September 2010. It provides a detailed overview of the subject matter and opens up new fields and strategies for future research. Decision-makers from the public and private sectors have the opportunity of coming into contact with visual analytics via VisMaster CA in the context of a discipline that develops technologies for the most varied applications and that endeavors to use large quantities of information as efficiently as possible. A meaningful link between the computer and people's capabilities is at the forefront of information visualization; it is precisely the combination of statistical methods and human perception and experience that helps people gain new insights and findings. Instead of numeric tables, for instance, the system might show a mosaic of colorful surfaces. A difference in color or structure alerts the user when columns of figures differ from usual data.

VisMaster CA provides a network for specialist fields

VisMaster CA brings together researchers and skills from scientific and industrial research and development fields in a variety of specialised areas, such as data management, data mining, data analysis and human perception. Already a powerful visual analytics research community has been created in this step and partners have been able to attract interested public and private sector parties to this technology, thus preparing the way for future visual analytics research initiatives.

Project manager Dr. Jörn Kohlhammer
joern.kohlhammer@igd.fraunhofer.de

SEMAVIS FRAMEWORK PROJECT

"The human resources manager of a large company is seeking a new employee for a department. How will he find a suitable person quickly and above all in a satisfactory manner, one who is not only a good match with the company but with the position in question? Using THESEUS-CTC-WP5, the human resources manager can conduct his search not only internally, but also externally via databases of other companies or by searching directly by name, specialised area or company."

THESEUS is a research program devised by the Federal Ministry for Business and Technology (BMWi). Research partners from science and business develop new technologies that facilitate access to information, network data with new knowledge and create the foundation for the development of new services for the Internet.

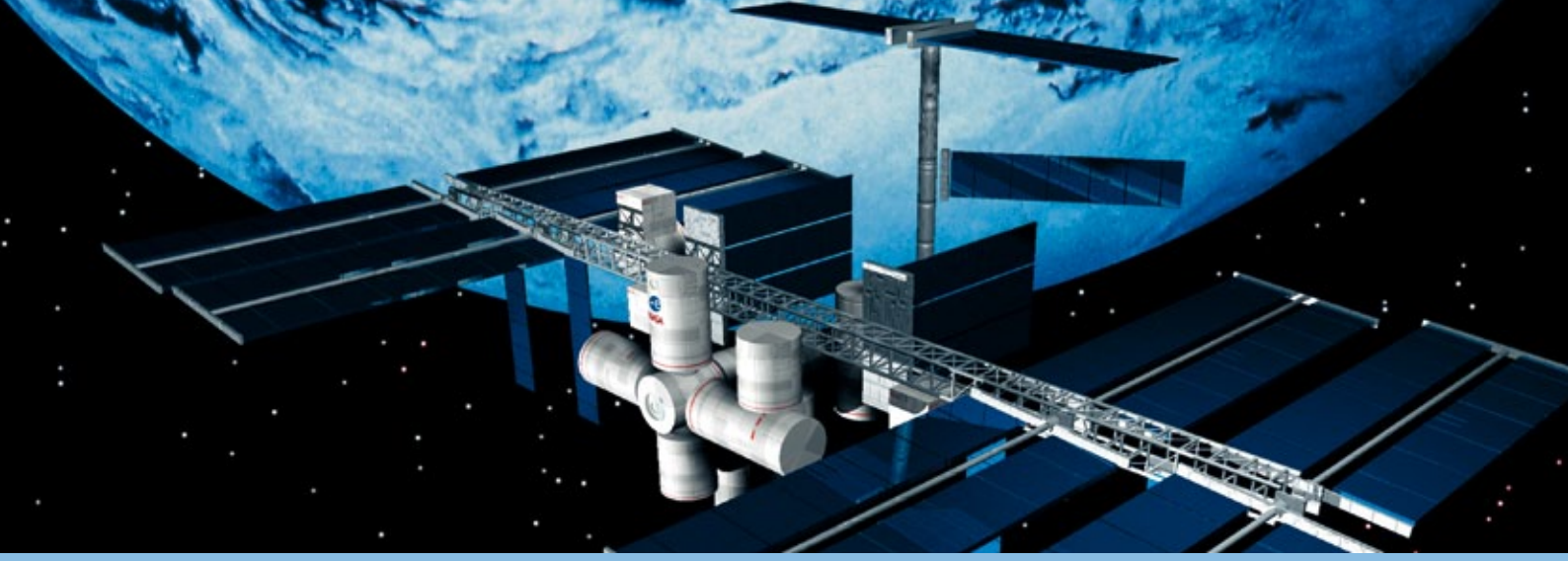
Semantic technologies

Current services on the internet, such as research services, flight bookings and online shopping, are often available separately. A new Internet service can combine and integrate such products. In the future we will be able to simply inform the computer that we would like to fly from Munich to Rome and the program collects and coordinates all information from flight schedules through hotel reservations and transfers to the city tour independently. Semantic technologies that can identify and organize information according to the meaning of its content are the focus of THESEUS. The task of the researchers is to explore how the information, supplemented by content, can be made available as a service, while the industrial partners are testing the technologies in a variety of application scenarios. Fraunhofer IGD is developing core technologies for innovative user interfaces and visualizations within the Core Technology Clusters, CTC. Scientists provide concepts and technologies for interaction with semantics structures and to represent large quantities of raw data. The main output is the SemaVis framework. This system allows the user to interact visually with semantic structures.

Creation of a knowledge cockpit

SemaVis adapts semantic visualization to the user. The system queries and registers the interaction context as defined by the conduct, learning capability and progress of the user. From this it derives a suitable visualization for the relevant user or adapts an existing visualization. Visualizations can be put together in the form of a so-called knowledge cockpit and can thus support various aspects of interaction with semantics. This representation of knowledge dynamically adapts complex semantic structures and information to the user. The design and concept of the different types of user interfaces and visualizations are crucial in achieving higher levels of acceptance and user-friendliness.

Project manager Dr. Jörn Kohlhammer
joern.kohlhammer@igd.fraunhofer.de



TELEIOS PROJECT

"For over 40 years, hundreds of satellites for earth observation have been circling the globe, providing information for the most varied applications - from meteorology to telecommunications. The satellites that exist today emit gigantic quantities of raw data on a daily basis – humans cannot analyze this volume manually. But they can be assisted by intelligent systems."

In 2010 the TELEIOS project started up with the goal of developing an infrastructure for a virtual observatory for earth observation data. Ultimately this earth observation data is to be used in as many applications as possible. But how does such an observation station work?

Development of a virtual observation station

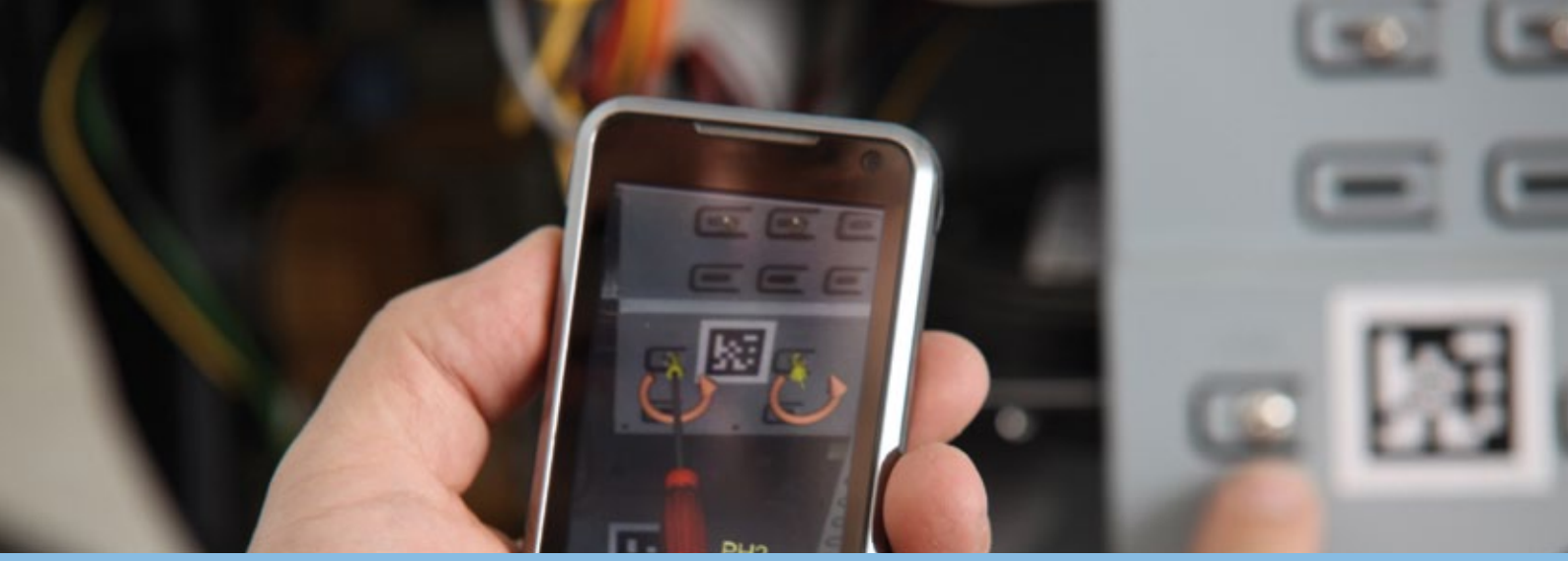
The virtual observatory interprets and combines satellite images with geographical information and will be of great significance in future events of natural disasters, such as floods and fires. These could be identified promptly and then combated. To this end raw data are automatically supplemented with information on the content and the respective quality of the data. This takes place by means of image assessment methods and procedures from the semantic web field, which implies linking information, based on the level of its significance. Another factor is that earth observation data from various sources must be combined. Existing geo-data are used as reference data. Specially developed algorithms permit linking images with earth observation data. Since satellites transmit a continuous stream of data, the scientists' special focus is to analyze this flow of data and use it as optimally as possible. The observatory is being tested for its practical feasibility in two applications: "real-time identification of forest fires" and "integration of TerraSAR-X data". Forest fires generally have a devastating impact on both humans and nature. The TELEIOS project is working on interpreting satellite images. Above all, the identification of clouds, buildings and fields, depending on the type of remote sensing data, is of great significance in this case. If there is really a fire, the station helps the rescue force in decision-making.

Cooperation with Scientists and Users

The competence center "Graphic Information Systems" provides its skills when dealing with geo-data harmonization. It shares its experiences in the field of semantic webs with the scientists and works jointly with the user community. Virtual observatory requirements can thus be ascertained directly. The TELEIOS project, launched by the European Union in September of 2010, will continue until 2013 and is supported by the European Space Agency, ESA.

Project manager Thorsten Reitz
thorsten.reitz@igd.fraunhofer.de

"The construction drawing for the current assignment is spread out on the work table. This is not the first job of this type for the worker – he knows exactly which actions he should take in which sequence. Moreover, he has made notes of his knowledge, so that he can accomplish the assignment as quickly and seamlessly as possible. But a week later the following scenario unfolds: the worker has fallen ill. A colleague is to undertake a similar assignment, but this worker is unable to follow the notes and is not sure which information applies to which action. He begins with the usual machine settings and must put up with failed attempts."



IMAP PROJECT

Employees are used for multiple functions, especially in small and medium-sized companies. Depending on the assignment, they operate different machines and process different materials. The know-how that is created from experience is frequently only in the heads of the employees or reflected in personal notes. Colleagues are generally unable to access this individual, hidden knowledge.

Improvements in assembly planning and process

Fraunhofer IGD collaborates with the Fraunhofer application center for large structures in production technology AGP, as well as with software providers and application partners from industry, in the joint project "Intelligent employee-centered assembly process" (IMAP). The goal is to develop solutions for handling knowledge systematically and efficiently in small and medium-sized companies. The project will run until July 31, 2012 and will address the question: how can assembly planning, the assembly process and knowledge engineering be improved in order to preserve the competitiveness of small and medium-sized companies in the global market? Fraunhofer IGD and Fraunhofer AGP are jointly developing a portal system based on the building block principle, using the example of the maritime industry.

Individually tailored help system

The functional scope is adaptable to the relevant factory and can be expanded if necessary. The information available on various systems in the company flows into a common data pool. Machine settings can thus be captured directly via the system and the values input by the respective machine operator can be allocated to different assignments and work processes. Each worker can exchange know-how with his colleagues using the portal system; this know-how will then be readily available for future retrievals. Important information can be exchanged quickly and directly, which motivates and supports the workers. Via the portal system they receive additional information on the complete production process and can trace their own contribution to production and assembly.

Diverse possibilities for use

Fraunhofer IGD is also developing assistance technologies and solutions for the visualization of data and user interfaces for access to the portal system. Each employee will then find the information of importance to him in a manageable and comprehensible fashion on his work-station display. IMAP improves planning of task management and the automation of routine tasks via software. In addition, recommendations for further training of the workers can be derived from work profiles and a basis for decision-making on the costing of customer requests can be derived from the empirical values of completed projects.

Project manager Prof. Dr. Bodo Urban
bodo.urban@igd-r.fraunhofer.de

OUR RESEARCH COMPETENCE CENTERS

FRAUNHOFER IGD COMPETENCE CENTERS

"Our core competences are in the fields of technology and applications. We use a broad range of methods, under continuous development, in our research work. Our comprehensive and interdisciplinary overview allows us to provide a diversity of services, which we have consolidated into eleven specialised departments. Now that you have already gotten to know two competence centers –'Identification and Biometrics' and 'Fraunhofer IDM@NTU project center' – you will be given an overview of the remaining competence centers in our institute."

INTERACTIVE MULTIMEDIA APPLIANCES

INDUSTRIAL APPLICATIONS

REAL-TIME SOLUTIONS FOR SIMULATIONS, VISUAL ANALYTICS AND SEMANTIC VISUALIZATION

VIRTUAL AND AUGMENTED REALITY

GRAPHIC INFORMATION SYSTEMS

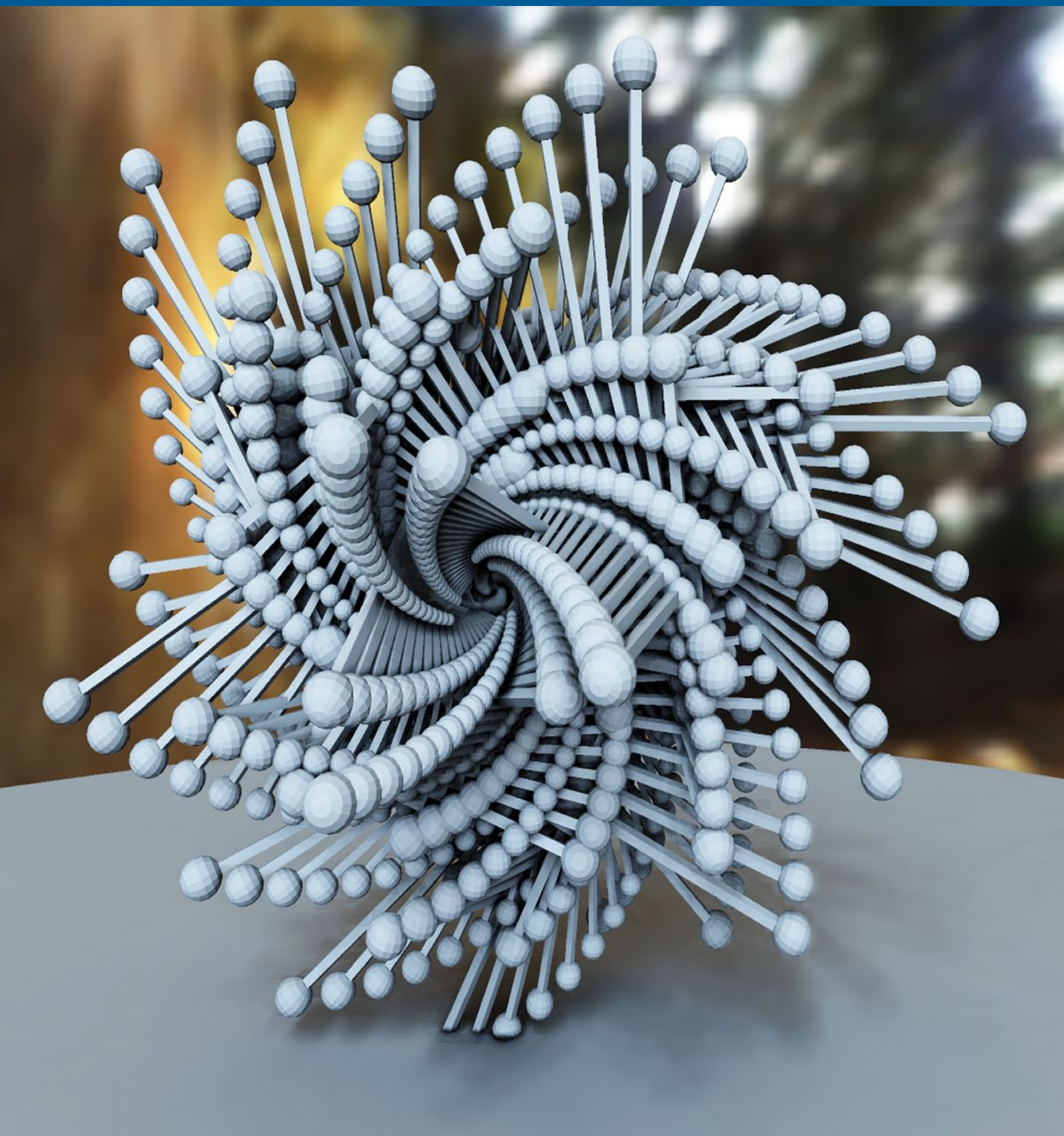
COGNITIVE COMPUTING AND MEDICAL IMAGING

MARITIME GRAPHICS

INTERACTIVE DOCUMENT ENGINEERING

FRAUNHOFER AUSTRIA VISUAL COMPUTING

Photo on the right:
Recursive rotation object:
Dr. Jörn Kohlhammer,
Martin Knuth, Fraunhofer IGD



INTERACTIVE MULTIMEDIA APPLIANCES

"An older married couple is sitting snugly in their living room watching television. The wife gestures in the direction of the television and the channel changes at once. How does this work? The television has learned what the lady wishes to express with this small movement. In the future such intelligent multimedia systems will become commonplace for all of us."

DR. REINER WICHERT
+49 6151 155-574
REINER.WICHERT@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

Future-oriented Ambient Assisted Living solutions constitute the primary research field of the "Interactive Multimedia Appliances" competence center. Under the direction of Dr. Reiner Wichert, solutions are created that facilitate the lives of their users: They respond independently and helpfully to human needs and are invisibly integrated into daily routine. In a variety of projects, scientists create applications that adapt lighting and ventilation to the residents' behavior, monitor their health and use sensors in the floor to identify movements, so that help comes immediately if someone falls.

Proactive day-to-day support

The **PERSONA** project creates semi-automatic systems, which help the elderly cope with daily activities, such as cooking and shopping, or to remember to take medications on a regular basis. Fraunhofer IGD is the technology partner, directs the architectural specification of the project platform and creates intelligent middleware. The **CCE** project primarily wants to improve the quality of life of dementia patients and combines both user groups and experts. A standard technical platform facilitates special information and communications technology software solutions for assisting applications in the health sector. The **V2me** project promotes "Alternative Aging" by linking the real world of senior citizens with elements of virtual social networks. This approach is intended to counteract the increasing isolation of Europe's aging society, to promote joie de vivre and to foster better integration into society.

Wireless sensor networks are the key to success for all projects. The team works on graphic tools that enable sensor connections to be configured and monitored. The lives of the elderly and the handicapped and those in need of care are simplified as a result, as services in their living environment can be controlled. The competence center provides advice and conceptual services and is available as a competence and technological partner in the following fields: user interaction in intelligent environments, Ambient Intelligence and Ambient Assisted Living.

The development of suitable standards and solutions

With the **universAAL** project, Fraunhofer IGD is spearheading the implementation of an expandable open-source platform that is intended to help connect sensors, devices and services in an interoperable fashion. Existing platforms are initially evaluated and can then be integrated. The **Ambient Assisted Living Laboratory** is a small apartment with a kitchen, a living room and a bedroom, equipped with numerous AAL applications that have been unobtrusively integrated. Future users are thus optimally integrated into the development process and can test applications.

As part of the **WASP** project, self-organizing radio sensor networks display and transmit data. Radio sensor networks consist of several distributed elements that communicate with each other independently via a network. The team is researching programming models with which one can implement autonomous aggregates and work on graphic tools so as to configure and monitor sensor connections.

The market potential for AAL developments is great. Potential application areas are emergency and health services, leisure, logistics, production, maintenance, traffic, office or residential premises. All technical objects must be equipped with uniform interfaces in order to create intelligent living environments that function well; the competence center is developing appropriate standards and solutions.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

INDUSTRIAL APPLICATIONS

"A new type of aircraft is to be marketed. The aircraft builders create a computer model for the aircraft. Long before the actual start of construction of the aircraft, the engineers test and assess which requirements are met by the model – load capacity, speed, maneuverability and aerodynamics. Fraunhofer IGD scientists are developing technologies with which builders can improve aircraft construction."

PROF. DR. ANDRÉ STORK
+49 6151 155-469
ANDRE.STORK@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

Virtual product development has significantly increased efficiency in implementing new, increasingly complex product ideas over the past few years. The "Industrial Applications" competence center develops concepts and software to support these virtual product development processes. How can 3D models be created and modified faster? How can simulations be accelerated and linked to one another? To what extent does knowledge of the significance of objects and actions in the 3D model enrich the development process? Professor André Stork devotes himself to these and related issues together with his multidisciplinary team. There are four focal topics: geometric processing, simulated reality, semantic 3D media and rendering.

Geometric processing encompasses efficient handling of CAD data, interactive reverse engineering and sketch-based modeling. Simulated Reality addresses CAE processes, real-time capable simulation of physical effects and interactive visualization of large data quantities from the simulation. The researchers are developing innovative solutions for customers in the automotive, aviation, mechanical engineering and plant construction industries, as well as the software industry. These solutions are without parallel in the commercial environment. The team uses, adapts and further develops the most recent Visual Computing technologies for this purpose.

Trend-setting technologies for industry

The **JTI Clean Sky – Eco-Design for Airframe** project is intended to optimize the entire product life cycle in the aerospace industry in relation to environmental influences. The team develops knowledge models and innovative user interfaces in order to be able to evaluate new, environmentally friendly materials and material-processing approaches. The goal of the sub-initiative **JTI Clean Sky – Green Regional Aircraft – Low Noise Configuration** is to avoid noise and environmental pollution in connection with air traffic. Technologies with which aerodynamic conditions can be rapidly analyzed are useful in this endeavor. Scientists are working on the integration of modeling, visualization and real-time simulation based on graphics cards. As a result, aerodynamic effects can be simulated quickly and the effect of geometric changes assessed interactively. The integrative approach represents a paradigm shift compared to the current approach. Ever higher computer performance enables the simulation of ever more complex models. The user must, however, be able to capture and understand these results. In the **Functional Visualization of Electromagnetic Simulations** project, the competence center is developing a visualization tool that offers a new level of interactivity for large data volumes of simulation results. Programmable graphics cards are preferably used for this purpose. In **XML2JT**, a joint project with VW, Fraunhofer IGD is developing a generic converter, which converts simulation results to the data format JT, in order to make them accessible to a large group of users in the company, using affordable viewers.

Semantic 3D media and rendering

Semantic 3D Media is engaged primarily in researching the embedding of 3D in semantic networks. **3D-COFORM** captures art works in three dimensions and develops software tools in order to supplement them with metadata and make them available to museums, historians and visitors in a pan-European digital archive. Fraunhofer IGD is the technical coordinator of the project. In another project, the production of books is to be designed in a more flexible and efficient manner using semantically defined modules. The research emphasis in rendering is on global lighting simulations and physically-based realistic representations.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

REAL-TIME SOLUTIONS FOR SIMULATIONS, VISUAL ANALYTICS AND SEMANTIC VISUALIZATION

"The CEO of a large corporate group would like to assess the current situation at a specific site, but he has only static data, such as lists and tables, at his disposal, the analysis of which is difficult and time-consuming. He would like to be able to access and clearly identify contents directly and come to a rapid understanding of the situation. A business intelligence program can help."

DR. JÖRN KOHLHAMMER
+49 6151 155-646
JOERN.KOHLHAMMER@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

In order for companies to achieve their corporate goals, they must first filter business-relevant data from the flood of information and then analyze them as effectively as possible. Business intelligence programs are ideal, as they collect, prepare and present key information.

Interactive visualization

Previous analysis processes generally depict information in static lists and reports and obstruct an optical overview, ignoring as they do the human capability of recognizing patterns. The user can quickly identify interrelationships, which often remain undetected, with the help of visualization techniques. The competence center "Real-time solutions for Simulations, Visual Analytics and Semantic Visualization" focuses on topics related to real-time solutions that allow large multi-dimensional data volumes to be visualized interactively. The interdisciplinary team under the guidance of Dr. Jörn Kohlhammer is engaged in visualization, physically-based simulation and rendering of 3D data.

Interdisciplinary research

The central research topic is visual analytics, which is interdisciplinary, combining as it does data mining with information visualization. The **SWINNG** project generated methods for the development of business processes and business models for companies that develop software. Fraunhofer IGD uses a construction kit based on methods designed for this purpose.

In-house architecture is employed in the visual analytics framework in order to link databases with visualization techniques. This serves as the basic framework for current developments. The goal of the **TIB** project is intelligent complexity reduction, facilitating searches in digital libraries in which large data quantities are in turn consolidated. The user gains data access via a visual-interactive system.

Fraunhofer IGD implements visual analytics concepts to this end and links them to a prototype. Researchers also hope that visual analytics will provide new stimuli in order to control Internet criminality: in the **VIS-SENSE** project they are exploring new technologies for the recognition and prediction of behavioral patterns in security scenarios.

Virtual product development

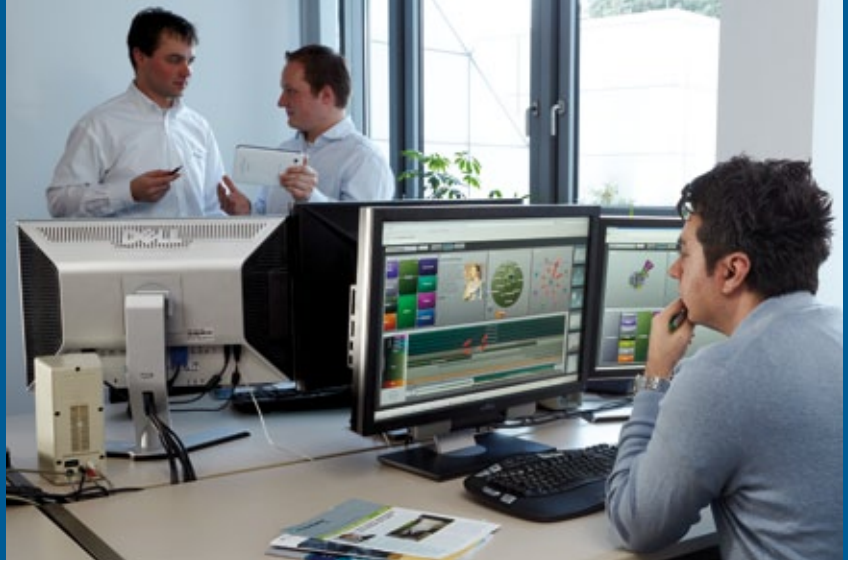
Virtual prototyping is one of the currently most relevant visualization and interaction applications. The competence center concentrates on technologies from textile simulation, which are marketed and further developed together with the garment industry. These methods, for instance, permit real-time simulation of articles of clothing in a virtual fitting room simulation.

The **Enviro-Tex-Design** project incorporates customer requests into the design process and the **ViVoTex** project creates software that allows the virtual visualization of volumetric objects, such as interlining, shoulder pads and stuffed animals. This benefits product development.

Coordination with professional experience

The competence center contributes its professional know-how to the coordination of the **CIP4** consortium. CIP4 is an association of approximately 300 companies from the printing industry and associated branches of business. Fraunhofer IGD not only provides the administration for its members, but operates and develops its website and takes care of the open-source server.

"A company is headquartered abroad. A new branch is to be opened in Germany, but founding a company is expensive and above all time-consuming: market analysis, site selection, entry into the commercial register, recruitment of new employees – all this has to be taken care of. How can this be accelerated? The THESEUS-TEXO project of the "Semantic Visualization" project group is creating a service platform on the Internet for this purpose."



Visualizations are extremely helpful in making complex matters more comprehensible to the user. The "Semantic Visualization" project group is working on presenting knowledge in the form of images and raw data, as well as metadata and semantic concepts, in an integrated fashion.

From the point of view of the user, knowledge visualization is particularly interesting in the case of wide-ranging and complex semantic structures. The processing industry, banks and insurance companies, but also large IT firms, are examples of areas of application.

The project group designs innovative solutions for handling semantics visually. What does this mean? Semantics is concerned with the meaning of words, sentences, grammatical forms and figures of speech. Researchers gain knowledge regarding the meaning of words and sentences. In order to be able to process semantics effectively, not only visualization is required, but also the availability of graphic-interactive tools for navigation, exploration and handling.

Integrated semantics management

This is how integrated semantics management is created. The team's focus is on working with current web technologies in order to develop user-focused solutions. Whether Serious Games, e-learning or knowledge applications are concerned – the "Real-time solutions for Simulations, Visual Analytics and Semantic Visualization" competence center is a skilled partner in research, development and services and promotes innovative projects.

Core competences lie in semantics visualization, visual semantics analysis, visual semantics annotation, visual semantics editing and e-learning. In the e-learning area, a multi-lingual web portal that provides people in rural areas with access to life-long learning and educational options in a simplified way is being created as part of the **RURALeNTER** project.

Semantic visualization and semantic editing

The **VIntEL** project deals with **semantic visualization**. Fraunhofer IGD is creating a system together with the Federal Office for Defense Technology and Procurement (BWB) to simulate battlegrounds. Researchers use the SemaVis Framework to this end. **Semantic editing** has until now only been possible without graphic interaction. The new tools work with intelligent and intuitively operable editing tools – changes at the abstract level are no longer a problem. The **visual semantics annotation framework** supports this process by adding semantic information to multimedia content.

Semantic visualization framework

The team has excellent skills at its disposal in the area of visual management of semantic structures and uses them in cooperation with industry partners in German and European research projects. The portfolio includes web-based semantic visualization frameworks adaptable to a variety of applications and 3D knowledge worlds for very large social networks. This benefits developers of multimedia mining and ontology management, providers of solutions for management and control of time-bound and place-bound data, as well as providers of e-learning solutions and commercial training.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

VIRTUAL AND AUGMENTED REALITY

"A trip through the past – wouldn't it be wonderful to experience the Berlin Reichstag around the turn of the century? A new development by Fraunhofer IGD could soon make this dream a reality for everyone. Tourists could carry their personal history guides with them that illustrate history by means of overlaid, historical image material. Augmented reality makes this possible."

DR. ULRICH BOCKHOLT
+49 6151 155-277
ULRICH.BOCKHOLT@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

Under the leadership of Dr. Ulrich Bockholt, the competence center "Virtual and Augmented Reality" develops software systems based on virtual reality (VR) and augmented reality (AR) technologies. These technologies are used in an increasing number of applications: companies in mechanical engineering and plant construction, the automotive industry and the cultural sector are already using these techniques.

Virtual and augmented reality

VR applications transport the user into a digital 3D world via projection systems and intuitive interaction devices. In contrast, AR applications use mobile and simple systems to the greatest extent possible. The range of research and development work is wide. In high-quality rendering the team analyzes rendering in HTML and scaling from smart phone to PC cluster. In the field of multimodal interaction, scientists are investigating both immersive and haptic interaction and multi-touch systems. They follow developments in VR systems with the sub-projects **tiled display HEyeWall 2.0**, **Cave** and **movable screen**. Marker-free tracking processes involve computer-vision-based tracking and the combination of computer vision with inert sensory systems.

The tracking technology is used in the **Motivotion60+** project: its purpose is to improve the physical and mental fitness of the elderly in order to foster a long, healthy and independent life to the greatest extent possible. A personal fitness-coaching system is being created to this end; it monitors not only activity and vitals, but motivates the user in a hands-on way to stay fit. The system thus indicates early intervention and helps to avoid costly rehabilitation measures.

Tracking on mobile systems

Tracking on mobile devices is a further focus for the "Virtual and Augmented Reality" competence center. Scientists explore AR-based communication strategies together with the Spanish bank, BBVA, in the research project **BBVA**. The communication strategies investigated are based on mobile AR technologies. For instance, cash machines can be shown directly in a smart phone display and the user is guided using video overlays. Researchers are working on solutions that allow AR applications to be divided between server and client in a flexible and unproblematic fashion in the **snapshot AR on smartphones** project.

instantReality

Dr. Ulrich Bockholt and his team on the one hand provide advisory services and conceptualize and develop software and hardware solutions. On the other hand they help to integrate innovative technologies, as well as to create prototypes and products. The research findings in any event are integrated into the **instantReality** VR/AR system used by many in industry and science. InstantReality is a flexible, real-time capable mixed-reality system and unites diverse interfaces under a uniform user interface. This can be utilized by both AR and VR developers. The BMBF project **AVILUS+** researches long-term technologies in the field of virtual and augmented realities and evaluates them with partners from industry. Fraunhofer IGD is involved in the following topical areas in this project: development of novel tracking processes, of processes to register manual skills and dexterity, as well as realistic color rendering.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

GRAPHIC INFORMATION SYSTEMS

"A new street car route is to be implemented in a city. The urban planner needs reliable information in order to plan the routing precisely: is the subsurface suitable for such a project? Are there important conduits and pipes in the ground? The urban planner cannot clarify all these questions, since he does not have access to all databases and valuable time elapses. How can this planning process be changed so that all information is available on time?"

THORSTEN REITZ, M.SC.
+49 6151 155-416
THORSTEN.REITZ@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

Geo-information is an indispensable foundation for the information society. The competence center "Graphic information systems" conducts applications-oriented research and development with digital geographic data. It provides know-how and innovative technologies that foster successful communication and efficient cooperation using geo-information. Customers profit from the greater benefit and value of the geo-information, because it is following new paths in order to integrate, manage and visualize these data comprehensively. The competence center, under the management of Thorsten Reitz, has specialized in the topics of geo-data infrastructures and 3D geo-information systems. What does this mean precisely?

Limitless exchange of geo-data infrastructures

Geo-data infrastructures (GDI) act as a bridge. They allow the exchange and handling of geo-information across various applications fields, organizations and borders.

The research team provides support by conceptualizing and implementing GDI-based solutions. It supervises technical implementation and mediates between users and IT experts. In addition, it assists independently in selecting GI tools that fit the individual requirements profile. The subject of the **HUMBOLDT** project is the pan-European, transnational usability of geo-data. In order to achieve this, separate national geo-information, which is available in various formats, must be standardized. Then the data can be used in combination and users can profit in areas ranging from disaster protection through politics, government and research to industry. Fraunhofer IGD is also a member of the **eSDI-NET+** network supported by the EU. This network is intended to promote international dialogue by raising both regional and national interests and developments to a global level.

3D geo-information systems are useful for the administration, storage and analysis of geo-data. In the development of mechanisms, Thorsten Reitz and his team rely on **CityServer3D** technology in order to integrate 3D geo-data and to develop and prepare them, using standardized interfaces. CityServer 3D technology has been developed in conjunction with partners and customers. It includes a geo-database, a server and client applications. Furthermore, it models and visualizes urban and landscape models and prepares quality assurance services.

Innovative search and visualization tools

The **DeepCity3D** project is developing a 3D visualization tool. The tool integrates above-ground and underground geo-data in a single presentation and offers expanded functions. Complex matters can be grasped intuitively in this manner; this in turn considerably facilitates decisions in urban planning and environmental protection or for construction companies, insurance carriers and architects. The **GeoViQua** project follows on from existing geoportals. This should improve the search for relevant earth observation data. The Fraunhofer IGD competence center develops innovative and quality-based search and visualization tools, which complement the common GEOSS infrastructure. Scientists manage the work packages with respect to the requirements and systems specification of the geo-data and work on being able to analyze geo-data qualitatively both on a manual and an automatic basis.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

COGNITIVE COMPUTING AND MEDICAL IMAGING

"A patient has a severe headache. The treating physician orders an MRI in order to arrive at a diagnosis, but the examination is tedious and the patient moves in the MRI tube. This results in image errors. How can these movements be adjusted for? Fraunhofer IGD researchers are working with optical tracking that can counteract the effects of head movements."

PROF. DR. GEORGIOS SAKAS
+49 6151 155-153
GEORGIOS.SAKAS@IGD.FRAUNHOFER.DE
LOCATION DARMSTADT

New software solutions have significantly altered the practice of medicine in the past few years. Above all, imaging processes have found a solid home in the day-to-day life of the clinic. Researchers in the competence center "Cognitive Computing and Medical Imaging" support doctors in planning, simulation and navigation. Under the leadership of Professor Georgios Sakas, they are developing innovative processes and prototypes that allow the more effective use of data created from imaging processes, in particular with respect to diagnoses, therapy planning and intra-operative navigation. Scientists are building on current digital image-processing technologies. They use as much information as possible from images in the most varied application areas, trying in this way to minimize the effort of interacting with image data while operating.

Maximum support during the operation

Physicians are especially impaired in operating procedures with minimal access, such as endoscopic interventions. In the **integration of computer science, digital image processing and interventional medicine** project, the team is developing a hardware and software system. It helps surgeons to plan the removal of a kidney more easily for instance and to navigate better during the operation. The **registration and navigation for hepatic surgery** project assists in liver operations, as doctors reach liver tumors more easily with the help of ultrasound and tracked instruments. The **Whole'O'Hand** project is developing a navigation system that is combining the most varied approaches in robotics, measurement engineering, computer-assisted diagnosis (CAD) and navigation into a high-performance whole. The surgeon is in a better position to orient himself during an operation and can perform the operation in a more targeted manner.

Medical care from afar

People in rural parts of Latin America, in particular, are benefiting from the team's developments. Doctors can care for them medically from afar via Internet and satellite. ECGs, ultrasound and sampling for blood tests are feasible without a problem. The medical network developed in the **MEDNET** project collects patient data, demographic data and the prescribed treatment in a medical database.

Digital media

In addition to medical and industrial image processing, the researchers are also engaged in transferring the most up-to-date computer vision technologies to digital media applications. Points of emphasis include the content analysis of image and video data, image-based human sensing and 3D vision procedures. In a number of projects, the researchers are concentrating on the currently relevant question of how to implement real-time applications on parallel and distributed systems.

The **ANSWER** project is pursuing a new approach in the creative process of film and game production. Tools are being created that support the production and post-production of audio-visual media. Directors can easily present storyboards and determine tracking shots with these tools. In the **GUIDE** project, researchers are working on new multimodal technologies for man-machine interaction. TV applications can be controlled by gestures and voice. The elderly, especially, will be able to benefit from these new technologies in the future.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

MARITIME GRAPHICS

"A company in the maritime industry develops hovercraft – a combination of an airplane and a speedboat. Due to this special combination, the vehicle operator is subject to particular challenges, since not only he, but also the machine is exposed to a high level of risk. Education and training are demanding and cannot be conducted in the customary manner. How can vehicle operators nevertheless be trained in handling hovercraft? Fraunhofer IGD is developing a training simulator for hovercraft in the MARSPEED project – future operators step into a virtual cockpit and can gather expierence with this novel vehicle."

PROF. DR. UWE FREIHERR VON LUKAS
+49 381 4024-150
UWE.VON.LUKAS@IGD-R.FRAUNHOFER.DE
LOCATION ROSTOCK

The "Maritime Graphics" competence center develops solutions for the maritime industry: customers from the ship-building, ship-operating and maritime technology/maritime research sectors benefit from these trend-setting developments. Researchers under the professional guidance of Professor Uwe von Lukas assist in the design and application of interactive computer graphics for all segments of the maritime industry. Changes in future production processes of a dockyard will be effected easily, as the **ALBATROS** project is developing a platform that efficiently implements such changes and significantly improves both quality and execution. Fraunhofer IGD scientists in Rostock rely on well-equipped laboratories in their daily work. In the **KonKav** project, researchers explore the effect of cavitation on a ship's propellers in the flow channel at the University of Rostock. A special camera system analyzes the experiments, so that bubble formation can be reconstructed three-dimensionally and its dimensions can be researched. Whether virtual reality in ship-building, virtual training worlds, mixed reality for maintenance or visual data mining for the analysis of multi-dimensional measurement data – Professor Uwe von Lukas and his team are working flat out on additional effective solutions. Their findings with respect to virtual reality help the dockyards in particular to adapt to the new conditions of the global market. In order to be able to secure a competitive advantage in difficult times, the German ship-building industry must strike out on new paths together with the shipping companies, the dockyards and the suppliers.

Virtual and augmented reality in ship-building

Virtual reality techniques, for instance, allow safety training on ships to be conducted virtually. Just as with a PC game, the team can practice on a regular basis and, above all, inexpensively for an emergency. In addition, the use of augmented reality assists considerably in the maintenance process: the technician receives the required support by putting on special AR glasses. Information regarding the relevant maintenance and repair processes with precise positioning is overlaid in his field of vision via the glasses. Augmented reality is also involved in positioning and using life-saving appliances. Fire extinguishers and life-vests can be adapted and updated for new purposes and the availability of life-boats can be better planned and integrated.

New paths in the maritime industry

The logistical process of ports and seaports is the focus of research in the **IMOTRIS** project. Better information flows and data processing should optimize the transport chain. Fraunhofer IGD would like to adjust the routes in the best possible manner, taking into account different means of transport, such as trains, ships and trucks. In the **Facade Reconstruction** project, the Rostock group, together with GTA Geoinformatik GmbH, is developing a way to enhance the quality of photo textures in the 3D segment; this can be done with image-processing algorithms. Scientists are developing a course of studies in conjunction with the University of Rostock designed for continued education of technical editors. The **Qualification of Technical Documentation** project provides companies the possibility to qualify their employees for this demanding activity. The team is designing an input device for presentations in the **REMUS** project, conducted jointly with the Rostock firm FORTech Software GmbH. The VisionMouse will be able to recognize the line of sight and manual gestures of the person presenting.

The "Maritime Graphics" competence center of Fraunhofer IGD in Rostock not only cooperates with universities and other research institutions. A lively exchange also takes place via the **3D maritime** network between the most varied partners and institutions – from extrovert users to innovative technology providers.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

INTERACTIVE DOCUMENT ENGINEERING

"A maintenance engineer would like to examine a machine to ensure that it is functioning impeccably. To this end he creates a concept that helps him plan and coordinate future maintenance work. Which motions must be performed? Which tools are required? The worker in turn receives supporting information on a display with the help of a digital maintenance log."

PROF. DR. BODO URBAN
+49 381 4024-110
BODO.URBAN@IGD-R.FRAUNHOFER.DE
LOCATION ROSTOCK

The "Interactive Document Engineering" competence center is focused on preparing digital documents, depending on needs and context, and interacting with them. Scientists, under the guidance of Professor Bodo Urban, wish to help people in selected work, learning and living processes. This help consists in having the correct digital document available when it is needed.

The individual in focus

Researchers explore and develop new procedures that initially determine the user's requirements, then select the right documents and adapt them appropriately. The issue is to optimally support the user's work with digital documents. The competence center's research work is classified under the topical focus of Visual Computing: the foundation is constituted by the life cycle of digital documents and tools based on this life cycle. Furthermore, the competence center contributes its findings both in the area of practical applications and in computer science, electro-technological, pedagogical, didactic and psychological work that spans all specialties. In order to ensure that the solutions they develop will be useful, the scientists employ usability engineering. In June 2010 they won the LARA Games Award in the education category for "Winterfest". The competence center conceptualized, developed, tested and disseminated this educational game for illiterates under the auspices of the project **Alphabit**.

Interactive electronic documents

Current research topics include electronic job performance support, workplace learning, user profiling, user behavior analysis, assistance systems and semantics analysis. The **AFoRS** project funded by the Federal Ministry for Education and Research in the field of electronic job performance support is of particular note. It assists the forestry industry by providing software that can analyze cords of wood directly on location. A photo taken with a cell phone suffices to determine the number and class of logs, as well as the stacked and solid cubic meters of a cord. This speeds up logistics processes and reduces fuel and personnel costs. The **AVILUS+** project on the other hand researches basic technologies for virtual and augmented reality and evaluates the results in cooperation with partners from industry. The task is to supplement the process of creating technical documents with new methods. The intention is to be able to combine traditional training and maintenance instructions with interactive electronic documents. **APOSDLE** is a work-place learning project. The competence center includes technologies that support learning at the work-place in this project. For this purpose a prototype has been developed that combines knowledge, learning and work processes, using context information. The prototype provides supporting information adapted to the current work assignment. APOSDLE software helps the user during a normal work day.

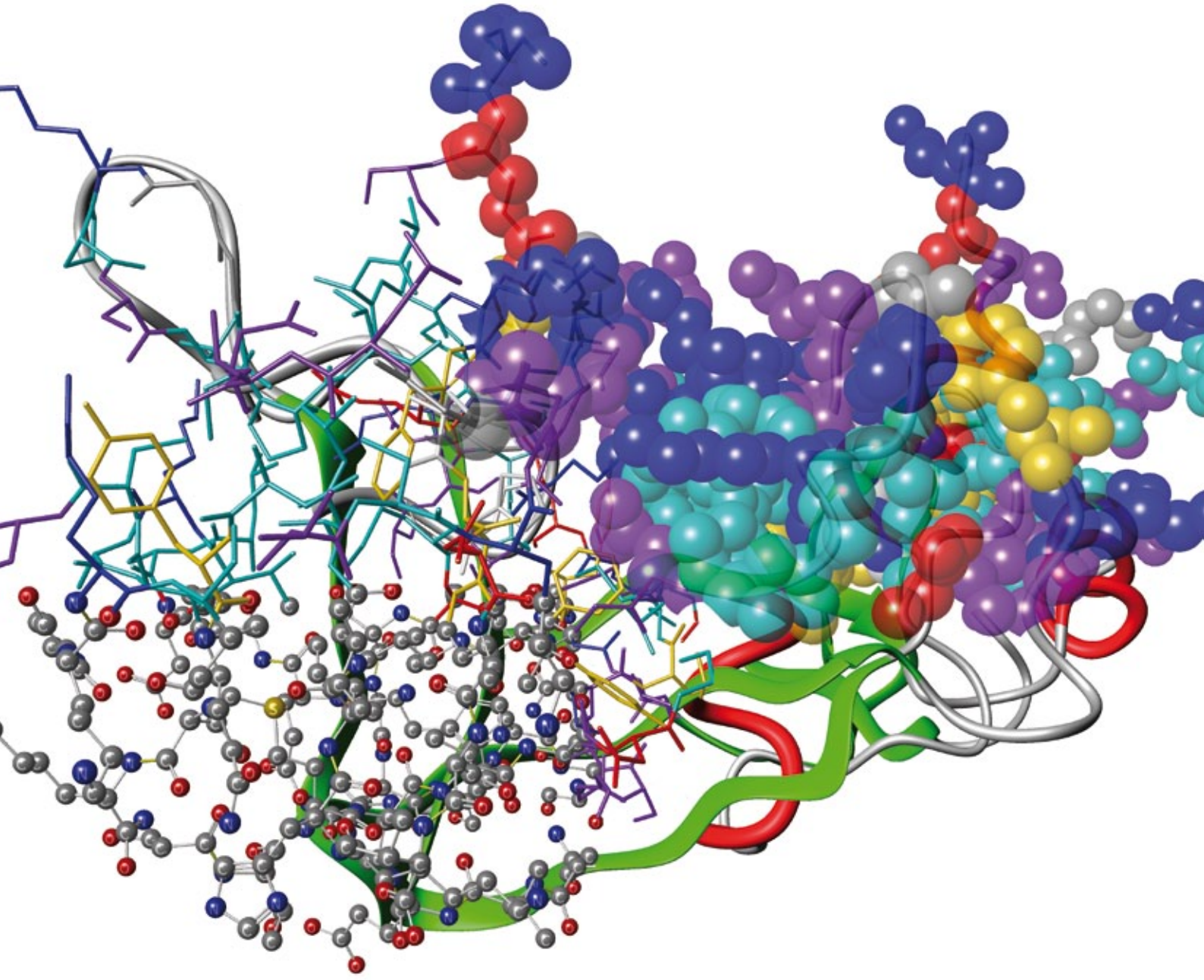
User-centered and needs-oriented documents

New technologies in the field of electro-mobility and rapid technological change call for support for processes in automotive workmanship and the fire department with respect to knowledge transfer, alliances and qualifications. Completely new know-how is required for the maintenance of electrical vehicles or when rescues take place in the event of an accident. The researchers in the **MEMO** project are actively seeking to create user-centered, flexible and needs-oriented products for the target groups mentioned. They are generating a 'cloud' of user-oriented, media-supported learning and collaborative services and are testing them for the electro-mobility field. The current user focus also includes the areas of mechanical engineering and plant construction, the medical sector, banks, insurance carriers and services, as well as ship-building.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

FRAUNHOFER AUSTRIA VISUAL COMPUTING

"A scientist requires image material of a certain molecule group for a pharmaceutical convention. He would like to incorporate this image material into his presentation, so that his audience is better able to follow his lecture. But how is the scientist to locate suitable material to substantiate his theses? The solution is BioSG. This software can allow appealing visualization of even the most complicated molecule groups. It was developed by Fraunhofer Austria and based on findings of a DFG project. DFG is Germany's largest research funding organisation."



DR. EVA EGGELING
+43 316 873-5417
EVA.EGGELING@FRAUNHOFER.AT
LOCATION GRAZ

"Fraunhofer Austria Research GmbH" is a non-profit charitable research organization. Dr. Eva Eggeling manages the business segment of "Visual Computing" in Graz. The researchers working with her cooperate closely with research groups at the Graz University of Technology. They are specialized in graphic data processing and virtual reality and concentrate on visualization, modeling and simulation. The business segment of "Visual Computing" utilizes the human capability of being able to comprehend complex matters visually very quickly. By means of their developments, scientists ensure that people can work quickly, effectively and in a results-oriented manner all at once. In order to be financially successful, it is essential to be able to rapidly convert new ideas into marketable products.

Newest projection and user interfaces

The range of technology in this business segment is extremely diverse and at the same time highly specialized. The Graz contingent combines high-quality visualizations for a variety of practical applications. In order to do so, they use the latest projection techniques and user interfaces as their basis – **HEyeWall**, the four-sided projection room **DAVE** and the Fraunhofer Bene **Multi-touch table**, in particular, reflect the team's skills.

HEyeWall, DAVE and multi-touch table

The Graz HeyeWall allows observers to experience virtual reality first-hand. In the four-sided projection room, DAVE users can splendidly implement product presentations, architectural visualizations and infotainment applications, as they can enter the room completely. The full 3D impression is created by using a special tracking system in combination with two video projectors. The multi-touch table has been developed in conjunction with the furniture manufacturer BENE AG. It can display customized software applications for customers from industry, administration and research. The applications areas range from presentations on architecture programs, data analysis and educational software to molecule visualization.

Simulation of pedestrian flows

The **mPed+** project, classified under the core topic of simulation, is developing a tool for various pedestrian simulations, as well as the visualization of results. Researchers simulate pedestrian flows in public traffic nodes, such as subway stations and airports. They are developing modern simulation tools in order to enable planning for highly frequented locations in future. Furthermore, Fraunhofer Austria is working on a process that is able to convert the sampling data of a laser scanner into spatial characteristics. This new approach divides a model into individual surfaces, using a semi-automatic procedure working according to the principle of reverse engineering. The modeling effort is considerably reduced as a result. The developers hope to support the automotive industry to a greater extent by means of the project **semi-automatic reverse engineering in automobile construction**.

Model creation and simulation must work together to permit high-quality visualizations. Dr. Eva Eggeling and her team are combining these two demanding disciplines, thus enabling new insights into the most varied fields of application. Research for practical applications by means of visualization – this is the motto of the researchers in Austria.

For additional information on the competence center and projects: www.igd.fraunhofer.de/en/Institut/Abteilungen

TRADE FAIRS AND EVENTS

Fraunhofer IGD is developing applications-oriented solutions for industry and society. Because we enjoy presenting our applications to the public, we once again arranged or participated in the organization of numerous events in 2010. A small sample follows.

VisMaster Industrial Day

The 5th Analytics Day 2010 took place as a Europe-wide event under the name of VisMaster Industrial Day 2010 under the aegis of the VismasterCA project. The event showed how people can obtain an overview of huge data quantities with the use of Visual Analytics under the slogan "Science meets Business". From January 20 to 21, 2010, well-known experts from research and industry demonstrated new approaches to solutions for effective data analysis. They showed how they can visualize wide-ranging information and complex matters simply and in an easily comprehensible manner.

"Jugend forscht" – Competition for Young Scientists

Fraunhofer IGD and the next generation: For the third time in a row it sponsored "Jugend forscht", Germany's best known competition for upcoming researchers in natural sciences, technology, mathematics and computer science. Fraunhofer IGD, together with Fraunhofer LBF and Fraunhofer SIT, addressed the young researchers of tomorrow under the slogan "Discover new worlds". On February 11, 2011 they all gathered and applied to participate in the competition for the South Hessen region. Three projects managed the leap to the national competition, which took place in Essen from May 13 to16, 2010. Theodor Edmund Peez developed a simple acidity test that chemically determines the capsaicin content in food. Comparing a color solution against a color scale, for instance, indicates: green. Careful, very spicy! Noah Strobel and Vladislav Vasilenko developed an optically homogeneous wall surface on the basis of a dye solar cell. Klara Keutel, Tina Ebert and Lothar Klammer won in the mathematics and computer science category after getting involved with the El Farol bar problem, exploring the question of whether a visit to an overcrowded bar is worth it. This was a purely mathematical question from the point of view of the three young researchers. The result: visitors who decide to enter the bar without being influenced by their environment feel best there. These findings can be transferred to many other decision-making processes, such as stock-trading.

The future of the digital age at CeBIT

Fraunhofer IGD and its four locations were represented for the first time at the CeBIT in Hanover, Germany, from March 2 to 6, 2010. Visitors responded enthusiastically to exhibits from Darmstadt, Graz, Rostock and Singapore. The research team around Dr. Reiner Wichert demonstrated its most recent developments in Ambient Assisted Living solutions, which provide assistance especially in the daily routines of the elderly according to their needs, at the world's largest IT fair. These include technologies for controlling gestures and identifying motions and emotions intelligently. The most recent solutions for visualization techniques in business intelligence applications were displayed by the team led by Dr. Jörn Kohlhammer. The methods of Visual Analytics allow users to glean findings from unmanageable data quantities. Furthermore, visitors were able to visually experience 3D molecules by enlarging, rotating and dragging, using Fraunhofer IGD's multi-touch table. ConWeaver GmbH introduced its eponymous intelligent search engine.

SMM – trade fair for the maritime industry

SMM is the leading international trade fair for the maritime industry. From September 7 to 10, 2010, participants from

around the world met at the Hamburg, Germany, fairgrounds to exchange information on the most recent innovations related to ship-building. Scientists from the "Maritime Graphics" competence center presented new options for the effective use of Visual Computing in the maritime industry. Visitors to the Fraunhofer IGD stand were able to directly experience 3D computer graphics technologies. They showed particular interest in the Fraunhofer combined multi-touch technology applications.

IIH-MSP 2010

Multimedia technologies nowadays are distinguished by the fact that they are especially intelligent and create the conditions for a global information infrastructure. Fraunhofer IGD, together with the Technische Universität Darmstadt, organized the 6th International Conference on "Intelligence Information Hiding and Multimedia Signal Processing" (IIH-MSP) from October 15 to 17, 2010 in Darmstadt, Germany. It enabled participants from all over the world to exchange experiences and ideas on information hiding, multimedia signal processing and biometrics.

E12 Summit – Germany´s conference for e-business

Experiencing, touching and trying out the future live – numerous representatives from the fields of business and science discussed the transformation from "Internet to Outernet" at the E12 summit in Seeheim, Germany, from November 29 to 30, 2010. Conference participants experienced the most recent developments in e-business and digital communication first-hand in an interactive environment and tested them independently. Exhibitors displayed their most up-to-date developments on the topics of augmented reality, social media", enterprise 2.0, smart innovation and 3D in the exhibition park. Researchers from Fraunhofer IGD presented three exhibits. Visitors were able to get to know the multi-touch table of Fraunhofer IGD researchers from Graz. In addition, Dr. Ulrich Bockholt and his team showed augmented reality on cell phones. Dr. Reiner Wichert was the specialized contact person for gesture control and additional ambient assisted living applications. The E12 summit takes place once a year and deals with topics from the digital environment. Users and producers can exchange information with a variety of companies and industries on this occasion. The conference was held for the twelfth time this year.

Trade fairs and conferences

Once again Fraunhofer IGD participated in a number of trade fairs and conferences in 2010. Here is a small sample:

AAL-Kongress, Berlin, Germany, January 26-27, 2010
Baltic Future, Rostock, Germany, May 4-6, 2010
BIOSIG, Darmstadt, Germany, October 9-10, 2010
Carnot-Messe, Lyon, France, May 5-6, 2010
CeBIT, Hanover, Germany, March 2-6, 2010
E12-Gipfel, Seeheim, Germany, November 29-30, 2010
Eurographics Exhibition, Norrköping, Sweden, May 3-7, 2010
Euromold, Frankfurt am Main, Germany, December 1-4, 2010
Go-3D, Rostock, Germany, August 31, 2010
Hannover Messe, Hanover, Germany, April 19-23, 2010
I-KNOW, Graz, Austria, September 1-3, 2010
Intergeo, Cologne, Germany, October 5-7, 2010
Internationale Luftfahrtausstellung, Berlin, Germany, June 8-13, 2010
ISMAR, Seoul, South Korea, October 13-16, 2010
Siggraph Exhibition, Los Angeles, USA, July 27-29, 2010
SMM, Hamburg, Germany, September 7-10, 2010
Zuse 2.0, Wiesbaden, Germany, May 26,2010

CUSTOMERS AND COOPERATION PARTNERS

Fraunhofer IGD works together with strong partners, thus continuing to stay on the road to success. The institute collaborates with research institutions and leading businesses throughout the world. A sample of current customers and cooperation partners is attached.

- 1Spatial Holdings PLC, Cambridge, England
- Accenture GmbH, Kronberg, Germany
- AED-SICAD AG, Bonn, Germany
- Aida Cruises - German Branch of Costa Crociere S.p.A., Rostock, Germany
- Airbus, Toulouse, France
- AIT - Austrian Institute of Technology GmbH, Vienna, Austria
- arivis – Multiple Image Tools GmbH, Rostock, Germany
- Assyst GmbH, Aschheim-Dornach, Germany
- Attensity Europe GmbH, Kaiserslautern, Germany
- Bene Office Furniture, Austria
- Bilfinger Berger AG, Mannheim, Germany
- BK Medical L.t.d., Denmark
- BMW Group, Munich, Germany
- Centre for Science, Society and Citizenship, Rome, Italy
- CIP4 Organisation, Zurich, Switzerland
- City of Mainz, Germany
- CNR-ISTI Consiglio Nazionale Delle Ricerche, Pisa, Italy
- Conweaver GmbH, Darmstadt, Germany
- Coperion GmbH, Weingarten, Germany
- Cornelsen Verlag GmbH, Berlin, Germany
- CST AG, Darmstadt, Germany
- Daimler AG, Manching, Germany
- Dassault Aviation, Paris, France
- Deutsche Thomson OHG, Hanover, Germany
- Dolmar GmbH, Hamburg, Germany
- EADS, Germany, France
- Eindhoven University of Technology, Netherlands
- ENT Ericsson, Zagreb, Croatia
- Esaote s.p.a., Italy
- eSZett GmbH & Co. KG, Duisburg, Germany
- European Biometrics Forum EBF, Dublin, Ireland
- EvoLogics GmbH, Berlin, Germany
- Exocad GmbH, Darmstadt, Germany
- Federal Office for Information Security, Bonn, Germany
- Flensburger Schiffbau Gesellschaft mbH & Co. KG, Flensburg, Germany
- FORTecH GmbH, Rostock, Germany
- Fraunhofer IFF, Magdeburg, Germany
- Fraunhofer IOSB, Karlsruhe, Germany
- Fraunhofer ISST, Berlin, Dortmund, Germany
- FutureCamp GmbH, Munich, Germany
- FZI - Forschungszentrum für Informatik, Karlsruhe, Germany
- German Aerospace Center (DLR), Oberpfaffenhofen/ Weßling, Germany
- German Research Center for Artificial Intelligence (DFKI), Karlsruhe, Saarbrücken, Germany
- Graz University of Technology, Austria
- GTA Geoinformatik GmbH, Neubrandenburg, Germany
- Hamburg University of Technology, Germany
- Heinz Nixdorf Forum, Paderborn, Germany
- Hereschwerke GmbH, Austria
- Hessian Ministry of Higher Education, Research and Arts, Wiesbaden, Germany
- Hitachi-Omron Terminal Solutions, Corp., Tokyo, Japan
- Howaldtswerke-Deutsche Werft GmbH, Kiel, Germany
- HSK-Klinik, Wiesbaden, Germany
- IBM, Haifa, Israel
- ibmv, Rostock, Germany
- IFTH, Ecully, France

- imc information multimedia communication AG, Saarbrücken, Germany
- IMG – Ingenieurtechnik und Maschinenbau GmbH, Rostock, Germany
- INRIA, Le Chesnay, France
- Institut Geographique Francais, Paris, France
- International Biometrics Group, Washington DC, USA
- ITACA - Institute for the Application of Advanced Information and Communication Technologies, Valencia, Spain
- itCampus Software- und Systemhaus GmbH, Leipzig, Germany
- Joanneum Research Forschungsgesellschaft mbH, Graz, Austria
- Johns Hopkins University, Baltimore, USA
- KLH Kältetechnik GmbH, Bad Doberan, Germany
- KLH Montage GmbH, Bad Doberan, Germany
- Klinikum und Fachbereich Medizin, Johann Wolfgang Goethe-Universität, Frankfurt am Main, Germany
- KUKA - Roboter GmbH, Augsburg, Germany
- Logica Deutschland GmbH & Co. KG, Darmstadt, Germany
- MAN Diesel und Turbo SE, Augsburg, Germany
- Marinesoft GmbH, Rostock, Germany
- MedCom GmbH, Darmstadt, Germany
- Messe Frankfurt GmbH, Frankfurt am Main, Germany
- MEYER Werft Gmbh, Papenburg, Germany
- Microsoft
- Mister Spex GmbH, Berlin, Germany
- Nanyang Technological University (NTU), Singapore
- National Kaohsiung University of Applied Sciences, Taiwan
- Neofonie GmbH, Berlin, Germany
- O.I.P.C. – INTERPOL, Lyon, France
- ÖBB-Personenverkehr AG, Vienna, Austria
- OFFIS Institut für Informatik, Oldenburg, Germany
- Ontoprise GmbH, Karlsruhe, Germany
- Philips Research Laboratories, Eindhoven, Netherlands
- PI-VR GmbH, Darmstadt, Germany
- Planet Internet Commerce GmbH, Schwerin, Germany
- ProSTEP iViP e.V., Darmstadt, Germany
- Radiologie, Universitätsklinik Erlangen, Germany
- Rittal GmbH & Co. KG, Herborn, Germany
- Safran Morpho, Montrouge, France
- SAP AG, Walldorf, Germany
- SAP Research CEC, Darmstadt, Germany
- Scheller Systemtechnik GmbH, Wismar, Germany
- Siemens AG, Munich, Germany
- Siemens Industry Software GmbH & Co. KG, Germany
- SINTEF, Norway
- Symantec Ltd., Sophia Antipolis, France
- Szenaris GmbH, Bremen, Germany
- Technical University Delft, Netherlands
- Technische Informationsbibliothek, Hanover, Germany
- Technische Universität Darmstadt, Germany
- Technische Universität München, Germany
- Telemed Ltd, Lithuania
- Thyssen Krupp Marine Systems, Kiel, Germany
- TST Biometrics GmbH, Munich, Germany
- Unitec Informationssysteme GmbH, Hanau, Germany
- Universidad Carlos III de Madrid, Madrid, Spain
- University of Applied Sciences, Technology, Business and Design Wismar, Germany
- University of Bremen, Germany
- University of Konstanz, Germany
- University of Münster, Germany
- University of Rostock, Germany
- User Interface Design GmbH, Ludwigsburg, Mannheim, Munich, Germany
- Vienna University of Technology, Austria
- Vodafone Omnitel, Milan, Italy
- Volkswagen AG, Wolfsburg, Germany
- Wiener Linien GmbH & Co. KG, Vienna, Austria

PUBLICATIONS

Those who wish to maintain a dialogue with other researchers and benefit from mutual inspiration must publish their new findings. As science and research rely on an exchange of information, researchers have published their knowledge in different formats in 2010. The following list shows a small sample of Fraunhofer IGD's scientific publications.

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Oyarzun Laura, Cristina; Drechsler, Klaus: *Efficient Globally Optimal Matching of Anatomical Trees of the Liver*. In: Eurographics Workshop on Visual Computing for Biology and Medicine: EG VCBM 2010, pp. 75-82.

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CONTACT

Needless to say, our annual report does not provide exhaustive information concerning Fraunhofer IGD's research activities and opportunities. Our employees would be delighted to answer any further questions you might have - please make an appointment for more detailed discussions. Our contact information is attached.

Fraunhofer Institute for Computer Graphics Research IGD

Fraunhoferstraße 5
64283 Darmstadt, Germany

Phone +49 6151 155-0
Fax +49 6151 155-199
info@igd.fraunhofer.de
www.igd.fraunhofer.de

Director
Prof. Dr. Dieter W. Fellner
+49 6151 155-100
institutsleitung@igd.fraunhofer.de

Deputy Director
Dr. Matthias Unbescheiden
+49 6151 155-155
matthias.unbescheiden@igd.fraunhofer.de

Operations Office
Barbara Merten
+49 6151 155-101
barbara.merten@igd.fraunhofer.de

Library
Ingrid Bechtold
+49 6151 155-219
ingrid.bechtold@igd.fraunhofer.de

LOCATION ROSTOCK

Joachim-Jungius-Straße 11
18059 Rostock, Germany

Phone +49 381 4024-110
Fax +49 381 4024-199
info@igd-r.fraunhofer.de
www.igd.fraunhofer.de/rostock

LOCATION GRAZ

Fraunhofer Austria Research GmbH
Business Area Visual Computing
Inffeldgasse 16c/II
A-8010 Graz, Austria

Phone +43 316 873-5417
Fax +43 316 873-105410
office.graz@fraunhofer.at
www.vc.fraunhofer.at

LOCATION SINGAPUR

Fraunhofer Project Center IDM@NTU
50 Nanyang Avenue
Singapore 639798

Phone +65 6790 6989
Fax +65 6792 8123
info@fraunhofer.sg
www.fraunhofer.sg

Editorial Notes

Editor
Fraunhofer Institute for Computer Graphics Research IGD
Dieter W. Fellner, Professor

Editorial Team
Dr. Konrad Baier (Head)
Melanie Klingelmeyer
Heidrun Bornemann
Katrin Mentel

Translation
Optimus Übersetzungen, Munich, Germany

Production
Melanie Klingelmeyer
Detlef Wehner

Type and Layout
Melanie Klingelmeyer
Carina Bumke

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Further information about the projects, technologies and competencies as well as contact addresses of our institute you can find in German and English on the Internet:
www.igd.fraunhofer.de

For generically requests please send an e-mail to:
info@igd.fraunhofer.de

Editorial Address
Fraunhofer Institute for Computer Graphics Research IGD
Corporate Communication
Fraunhoferstraße 5
64283 Darmstadt, Germany

Phone: +49 6151 155-437
uk@igd.fraunhofer.de

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