Fraunhofer

Research News

No. 4 – 2010

Fraunhofer Press
Phone: +49 89 1205-1302
presse@zv.fraunhofer.de
www.fraunhofer.de/press

1 Intelligent networking of wind farms

The EU member states have passed a resolution requiring one fifth of their electricity needs to be derived from renewable energy sources by 2020, with wind farms covering a large part of this requirement. Researchers have succeeded in interconnecting large wind farms in clusters.

2 Savvy injection molding

With the help of neural networks, in which complex algorithms are used to monitor critical process steps, engineers are paving the way for zero-defect production in the area of metal powder injection molding. The gain for manufacturers is less waste combined with time savings.

3 A smart way to charge up

Electromobility makes sense only if car batteries are charged using electricity from renewable energy sources. But the supply of green electricity is not always adequate. An intelligent charging station can help, by adapting the recharging times to suit energy supply and network capacity.

4 Tracking down rust

Damage to concrete bridges caused by rust can have fatal consequences, at worst leading to a total collapse. Now, researchers have developed an early-warning system for rust. Sensor-transponders integrated in the concrete allow the extent of corrosion to be measured.

5 Detecting defects with wind and water

Bridges, aircraft and wind turbines are in constant movement. Natural forces and pedestrians all create vibrations. Previously, time-consuming tests were needed to determine how building components would react to vibrations. Now, researchers have developed a simpler method.

6 Multimedia search without detours

Finding a particular song or video is often no easy matter. Manually assigned metadata may be incorrect, and the unpacking of compressed data can slow up the search. DIVAS, a multimedia search engine, uses digital fingerprints to reliably locate what you are looking for.

7 Smart career planning

Who'll be the best fit for the company? While human resources experts often find it difficult to identify suitable candidates or evaluate existing employees' talents and skills, assessment centers undoubtedly provide a useful tool for appraising competences.

© RED Electrica de Espana (REE)

In future, Fraunhofer's Wind Farm Cluster Management System will enable Spanish grid operator REE to steer wind farms from its central control station.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Wind Energy and Energy System Technology IWES
Branch Kassel
Königstor 59
34119 Kassel, Germany
Press contact:
Uwe Krengel
Phone +49 561 7294-345
Fax: +49 561 7294-300
ukrengel@iset.uni-kassel.de
www.iwes.fraunhofer.de

Fraunhofer

Research News
Topic 1

No. 4 – 2010

Intelligent networking of wind farms

The future belongs to renewable energies. Wind energy is one of the main forms of renewable energy experiencing a boom. According to the German Wind Energy Association, 952 new facilities were installed in Germany in 2009. The German Renewable Energy Federation predicts that 47 percent of total electricity consumption in 2020, estimated at 595 terawatt hours, will be covered by renewable energy sources, with wind energy accounting for one quarter.

For further information:
Dr.-Ing. Kurt Rohrig
Phone +49 561 7294-328
krohrig@iset.uni-kassel.de

»Wind on the Grid«, one of the EU's biggest network integration projects, has just been completed. A group of European industrial companies and research organizations teamed up to investigate how wind farms on the Iberian peninsula could be safely integrated in the European electricity grid on a large scale. To assist grid operators in the capture, control and forecasting of wind energy, the Fraunhofer Institute for Wind Energy and Energy System Technology IWES has made available both its Wind Farm Cluster Management System (WCMS) and its Wind Power Management System, adding new functions to both. The researchers used these software packages to integrate five wind farms in Portugal with a total capacity of 204 megawatts and six in Spain with a total capacity of 107 megawatts in the power grid. The integration was achieved in real-time tests under a variety of weather conditions. »We used the WCMS to link the scattered wind farms in a cluster, enabling them to be controlled by the central control station of the Portuguese and Spanish power utilities respectively. While the WCMS keeps both the frequency and the voltage of the electricity grid constant, thus ensuring safe operation, Fraunhofer's Wind Power Management System forecasting software uses artificial neural networks to calculate expected wind energy on the basis of predicted weather patterns,« explains Dr. Kurt Rohrig, department head at the Kassel branch of the IWES. Individual wind farms are subject to wide fluctuations in output The more wind farms that can be interconnected in a cluster, the easier it is to balance out the fluctuations caused by variations in wind force, from gusty winds to totally calm conditions. And the higher the number of installed facilities, the lower the energy price. »The price of electricity produced using wind energy is currently seven cents per kilowatt-hour; by 2025 it should be around four cents,« says Rohrig.

Fraunhofer researchers are negotiating with the Portuguese grid operator with the aim of integrating their software in the latter's control system. And Kurt Rohrig is convinced: »In the long term, wind farms will replace traditional power plants.«

IFAM researchers inspecting components produced using metal injection molding.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Manufacturing and Advanced Materials IFAM
Wiener Strasse 12
28359 Bremen, Germany
Press contact:
Martina Ohle
Phone +49 421 5665-404
Fax +49 421 5665-499
martina.ohle@
ifam.fraunhofer.de
www.ifam.fraunhofer.de

Fraunhofer

Research News
Topic 2

No. 4 – 2010

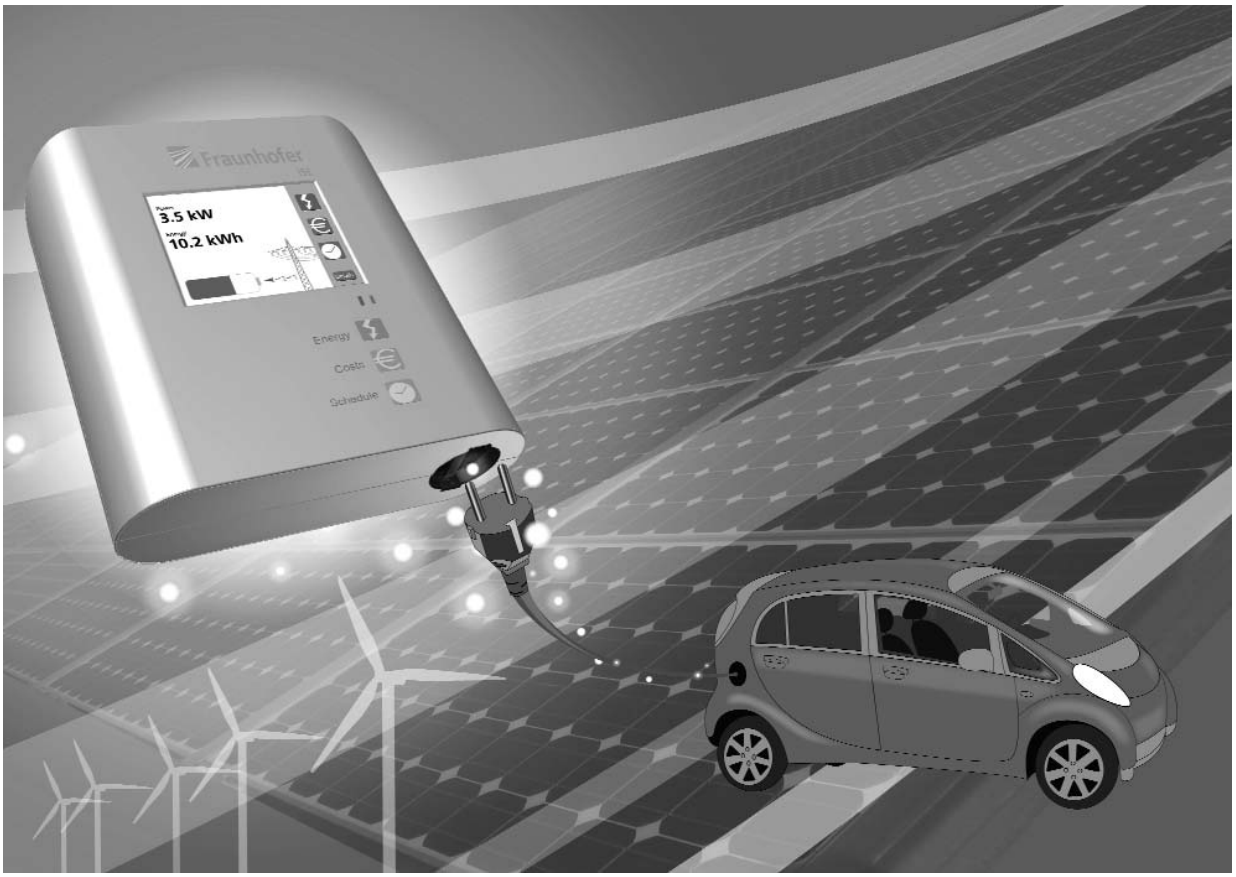
Savvy injection molding

The metal components used in the hinges of spectacle frames, surgical instruments or artificial heart valves are often very small. For some years now, manufacturers of components with complex geometries of this type have relied on a special production process: metal injection molding. Things can occasionally go awry during production, and then it is often impossible to detect defects until after sintering, the final step in the process chain, by which time it is too late to correct the defect.

For further information:
Dr. Thomas Hartwig
Phone +49 421 2246-156
Fax +49 421 2246-300
thomas.hartwig@ifam.fraunhofer.de

Now, researchers at the Fraunhofer Institute for Manufacturing and Advanced Materials IFAM are working towards achieving zero-defect production. Their idea is that, at any time during the molding process, the system should be able to monitor all parameters – such as weight, pressure and temperature – and to deliver a verdict on the quality of the component. »In this way, errors, dimensional inaccuracies and defects such as cracks, warps or cavities can be detected on line,« explains IFAM project manager Dr. Thomas Hartwig. »This will allow the manufacturer to respond immediately by changing the relevant settings.« In the long run the system can, if required, even be programmed to alter the parameters fully automatically. The necessary technical support is provided by a neural network developed for metal injection molding (MIM) in a joint effort by the IFAM engineers and algorithmica technologies, a private company. »The neural network is based on highly complex algorithms,« says Hartwig. »Its advantage over existing solutions is that it is self-learning.« After a mandatory initial training phase it can interpret all the measured data in the system, detecting correlations between them that would be impossible to find without the network. All information of relevance to the manufacturer can be given by the process control system, for instance the final weight of the component if the pressure or temperature is changed at a given step in the process.

»Our goal with neural networks is to reduce reject rates by at least 50 percent,« says Hartwig. »This represents a huge cost saving for manufacturers because the raw materials are so expensive. Until now, companies often had to reject large numbers of components in the first few days before quality requirements could be met again.« Another advantage of neural networks is that they could eventually make quality checks superfluous and could also be deployed in other types of series production such as die-casting in the light-metal industry. Having successfully produced a test component with the aid of neural networks, the researchers are now looking for industrial partners.



Customers can enter their requirements via a touchscreen on the charging station. Costs and energy readings can also be displayed during the recharging process.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Solar Energy Systems ISE
Heidenhofstrasse 2
79110 Freiburg, Germany
Press contact:
Karin Schneider
Phone +49 761 4588-5150
Fax +49 761 4588-9342
info@ise.fraunhofer.de
www.ise.fraunhofer.de

Fraunhofer

Research News
Topic 3

No. 4 – 2010

A smart way to charge up

Germany aims to have one million electric vehicles – powered by energy from renewable sources –on the road by 2020. And, within ten years, the German environment ministry expects »green electricity« to make up 30 percent of all power consumed. Arithmetically speaking, it would be possible to achieve CO_2-neutral electromobility. But, in reality, it is a difficult goal to attain. As more and more solar and wind energy is incorporated in the power grid, the proportion of electricity that cannot be controlled by simply pressing a button is on the increase. In addition, there is a growing risk that the rising number of electric vehicles will trigger extreme surges in demand during rush hour.

»What we need is a smart grid that carries information in addition to power,« says Dominik Noeren of the Fraunhofer Institute for Solar Energy Systems ISE. The structure of the grid has to change from a push system based on energy demand to a pull system based on production output. In Noeren's opinion, »electric cars are best equipped to meet this challenge.« Introduced in large numbers, they have the capacity to store a lot of energy. On average, a car is parked for at least 20 hours out of 24. That is more than enough time to recharge them when the wind picks up or the demand for electricity is low.

Developed by Fraunhofer researchers, the »smart« charging station is a device that enables electric vehicles to recharge when the system load is low and the share of energy from renewable resources is high. In this way, load peaks can be avoided and the contribution of solar and wind power fully exploited. »For us, it is important that end consumers are completely free to decide when they want to recharge. We do not want them to suffer any disadvantages from the controlled recharging of their vehicles' batteries,« Noeren emphasizes. That's why he favors electricity rates that adapt to the prevailing situation in the power grid – ones that are more expensive in periods of peak demand and particularly cheap when there is a surfeit of renewable energy. The person using the »smart« charging station could then choose between recharging immediately or opting for a cheaper, possibly longer, recharging time. If they go for the second option, all they need to do is enter the time when their vehicle has to be ready to drive again. The charging station takes care of everything else, calculating the costs and controlling the recharging process. Via the display the user can track the progress of recharging and also see the costs incurred and the amount of energy used. The experts will be presenting their charging device at the Hannover Messe from April 19 through 23 (Hall 27, Stand K55).

For further information:
Dominik Noeren
Phone +49 761 4588-5455
Fax +49 761 4588-9455
dominik.noeren@ise.fraunhofer.de

The passive sensor-transponder continuously monitors the protective coating of concrete bridges, allowing corrosion damage to be detected at an early stage.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Microelectronic Circuits and Systems IMS
Finkenstraße 61
47057 Duisburg, Germany
Press contact:
Dipl.-Ing. Martin van Ackeren
Phone +49 203 3783-130
Fax +49 203 3783-266
martin.vanackeren@
ims.fraunhofer.de
www.ims.fraunhofer.de

Fraunhofer

Research News
Topic 4

No. 4 – 2010

Tracking down rust

Concrete bridges have to be strong enough to cope with a wide variety of different impacts: frost, heavy traffic and emissions all take their toll on these structures. And then there are the various types of road salt used in winter to combat icy roads. The most common of these is sodium chloride, which is deployed in large amounts on Germany's roads. When the ice thaws, these salts break down into their ionic components that penetrate the concrete, destroying its five-centimeter thick protective alkaline layer. Any salt that leaches through to the steel rods used to reinforce the concrete pad will cause them to rust, resulting in structural damage. The result is cracks. In a worst-case scenario the bridge itself could collapse.

Until now there have been no effective tests to determine how deep the ions have penetrated the concrete and what damage they have already caused. Current practice is time-consuming and involves construction workers hammering on the reinforced concrete in search of cavities, which are a sure sign of corrosion damage. But experts at the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in Duisburg have now hit upon a more reliable and cost-effective method for detecting rust corrosion at an early stage. With a new sensor-transponder they can continuously measure and monitor how deep the ions have penetrated the concrete. While the sensor was developed by the building materials testing facility in Braunschweig (MPA Braunschweig), the integrated passive wireless transponder system is the work of IMS researchers. The sensor itself is crisscrossed by very fine iron wires, laid down at even distances. »If the dissolved salts reach the iron wires, these begin to corrode and break. The number of defective iron wires is an indicator of the extent of corrosion and the depth to which the concrete's protective layer has been penetrated. This allows us to determine when the next repair work needs to be carried out,« explains Frederic Meyer, a researcher at the IMS. The transponder transmits the measured data by wireless to the reading device carried by the construction workers. »Our transponder does not get the energy it needs to measure the corrosion from a battery, but from a magnetic field. This means it does not need to be replaced and can remain within the concrete structure permanently,« says Meyer.

The first field tests are already underway, with the sensor-transponder being integrated and put through its paces in a test bridge constructed by the MPA Braunschweig. The researchers will be exhibiting a prototype at the EURO ID trade fair, to be held in Cologne from May 4 through 6.

For further information:
Frederic Meyer
Phone +49 203 3783-193
Fax +49 203 3783-277
frederic.meyer@ims.fraunhofer.de

© Fraunhofer LBF

Will the support of the wind turbine withstand wind and weather? LBF researchers are using environmental impacts to determine the structural health of building components.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Structural Durability and System Reliability LBF
Bartningstrasse 47
64289 Darmstadt, Germany
Press contact:
Anke Zeidler-Finsel
Phone +49 6151 705-268
Fax +49 6151 705-214
presse@lbf.fraunhofer.de
www.lbf.fraunhofer.de

Fraunhofer

Research News
Topic 5

No. 4 – 2010

Detecting defects with wind and water

A narrow iron bridge is perched high above the river. A pedestrian on it can feel quite clearly how it vibrates the moment another person sets foot on the bridge or rides onto it on a bicycle. To ensure that people can cross the bridge in safety, time-consuming methods are employed to determine what condition the structure is in and whether it is liable to collapse. »The vibration response of bridges is often tested using gigantic drop hammers,« says Dr. Dirk Mayer of the Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt. Dirk Mayer and his team are currently investigating means of employing natural phenomena such as wind and water to carry out an automatic analysis of a structure's vibrational behavior. Thanks to Output Only Modal Analysis, time-consuming and expensive tests with drop hammers could soon be a thing of the past.

For further information:
Dr.-Ing. Dirk Mayer
Phone +49 6151 705-261
dirk.mayer@lbf.fraunhofer.de

»Continuous vibration monitoring is important not only for bridges, but also for ships, wind turbines or airplanes,« explains the Fraunhofer expert. »In the case of aircraft, electrodynamic shakers integrated under the wing surfaces are used to detect defects.« In contrast to conventional testing methods, the scientists are using neither hammers nor shakers – instead, their only tools are environmental impacts. In order to deploy the wind's capacity to cause vibrations, the experts attached two acceleration sensors to a model wind turbine. Two computers were used to process the data measured. »It was necessary to have two because of the huge amount of data that quickly accumulates at sampling rates as low as 100 per second,« explains Dirk Mayer. »While one computer preprocesses the signals and compresses the data, the second carries out another evaluation and determines the resonant frequency. If the frequency diminishes over time, it means that the stiffness of the structure is decreasing. Testers know what the rigidity or damping readings signify for their particular components or machines. »In our test we can determine whether the support of the model wind turbine is defective. In the case of bridges this method makes it possible to determine the condition of structural components by evaluating the vibrations caused by pedestrians over a period of several weeks.«

Going forward, the researchers would like to offer this procedure as a service. They are also considering how unwanted vibrations could be actively dampened. The Fraunhofer experts will be presenting this new method of analysis using a model aircraft at the joint Adaptronics stand at the Hannover Messe (Hall 2, Stand D26). The eventual aim is to monitor airliners during operation.

Fraunhofer Institute for Digital Media Technology IDMT
Ehrenbergstr. 31
98693 Ilmenau, Germany
Press contact:
Julia Edling
Phone +49 3677 467-310
Fax +49 3677 467-4310
julia.edling@idmt.fraunhofer.de
www.idmt.fraunhofer.de

Fraunhofer

Research News
Topic 6

No. 4 – 2010

Multimedia search without detours

Fingerprints at the scene of a crime can betray the perpetrator. And digital fingerprints can help to locate video and audio files – a party video on the Internet, an advertising spot in a television program, or the original version of a film extract in the broadcaster's archive. Fingerprints in music files can provide information on its tempo, genre or the proportion of rhythmic instruments. Those used in videos may contain information on scene changes, camera movements and the brightness of the image. In contrast to manually captured metadata, automatically generated fingerprints are never ambiguous. In many archives – for example those of television broadcasters – they are generated when the file is initially stored. This differs from the Internet, where fingerprints have to be recreated with every search. For this purpose, it was previously necessary to decompress compressed files. But that is no longer the case with the multimedia search engine DIVAS, short for direct video & audio content search engine. DIVAS finds the file you are looking for without needing to first unpack the entire media archive.

The search engine is suitable not only for searches on the Internet and in archives, but also for monitoring TV programs, for example to check whether a contractually agreed advertisement has been broadcast. As the software can take »fingerprints« of compressed files, it is faster than comparable search engines. »Our series of tests with MP3 files showed that search times can be halved,« reports Prof. Gerald Schuller of the Fraunhofer Institute for Digital Media Technology IDMT in Ilmenau. Together with Matthias Gruhne he was responsible for developing the audio component of DIVAS, which covers the extraction of fingerprints and the subsequent search. Both of these function even with music files that are recorded from a loudspeaker using a cell phone. »Even if the sound has been severely distorted, our methods make it possible to clearly identify and classify the song,« explains Schuller.

The fingerprints are stored in MPEG-7 format, the ISO standard for multimedia data. DIVAS can be used to detect similarities between different video or audio contents as well as for topic-related data searches, for instance to find songs of a certain genre. The software can handle audio and video formats such as MP3, AAC, H.264 and MPEG-2. DIVAS was the brainchild of an EU-wide joint project in which seven partners from seven different countries took part. They included Belgian television broadcaster BETV, which plans to use the multimedia search engine in its own archive.

For further information:
Prof. Dr.-Ing. Gerald Schuller
Phone +49 3677 467-355
Fax +49 3677 467-467
gerald.schuller@idmt.fraunhofer.de

Matthias Gruhne
Phone +49 3677 467-203
Fax +49 3677 467-467
matthias.gruhne@
idmt.fraunhofer.de

© Fraunhofer IDMT

The EDMedia digital platform facilitates interactive professional training to ensure effective human resource development.

Picture in color and printing quality: www.fraunhofer.de/press

Fraunhofer Institute for Digital Media Technology IDMT
Ehrenbergstr. 31
98693 Ilmenau, Germany
Press contact:
Julia Edling
Phone +49 3677 467-310
Fax +49 3677 467-4310
julia.edling@idmt.fraunhofer.de
www.idmt.fraunhofer.de

Fraunhofer

Research News
Topic 7

No. 4 – 2010

Smart career planning

However, assessment centers are only useful if they are tailored to the individual needs of a specific company. A one-size-fits-all approach is inappropriate, since standardized tests simply cannot reflect the precise structures and working practices of a particular firm. Researchers from the Fraunhofer Institute for Digital Media Technology IDMT in Ilmenau have now released a program that equips companies with a time-saving and cost-effective tool for carrying out objective assessments of their workforce.

The EDMedia Assessment Center is a new addition to the IDMT's Educational Media (EDMedia) functional learning environment – a learning content management system for intuitive, individual computer-based learning in which users can search for content in accordance with their personal abilities and learning preferences, and choose whether to work alone or in virtual study groups as they exploit the multimedia learning tool. The EDMedia Assessment Center works in a similar way: Multi-level, individualized and standards-based tests completed online at the interactive user interface allow human resources experts to divide their employees into groups according to competency profiles and direct their subsequent professional development in keeping with their respective needs.

Dr.-Ing. Fanny Klett, head of the Data Representation and Interfaces business unit in the IDMT, says: »The EDMedia Assessment Center serves as an infrastructure for competency management within a company and helps devise personal career paths for individual employees.« The standardized software makes it possible for companies to pool resources to develop tests – not only across different locations, but also across company boundaries – and allows the system to connect with other EDMedia functions or external programs. The Assessment Center is also eminently suitable for multinational firms, as it takes into account country-specific data protection regulations.

Klett continues: »Competency Management systems are already the norm in all U.S. firms.« Since October 2009, she and her team at the IDMT have been supporting the U.S. Advanced Distributed Learning (ADL) Initiative in an effort to advance and standardize educational and competency technologies on the international scene as well. She is firmly convinced of the benefits of ADL technologies and predicts: »These new, technologically-advanced competency management tools will soon prove their worth and become indispensable aids to human resources planning in German companies too.«

For further information:
Dr.-Ing. Fanny Bastianova-Klett
Phone +49 3677 467-360
Fax +49 3677 467-4360
fanny.bastianova-klett@
idmt.fraunhofer.de