

FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS  
DESIGN AUTOMATION DIVISION EAS



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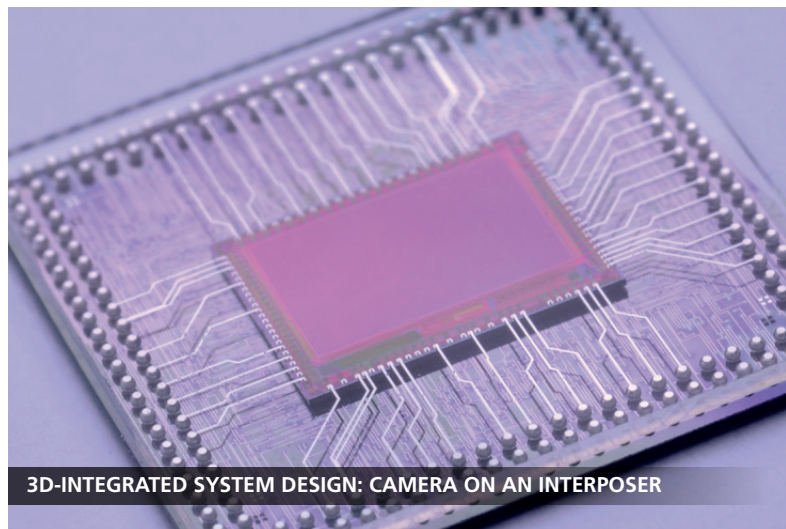
## NANOELECTRONIC DESIGN FOR 3D SYSTEMS

**As the requirements on the functional scope of electronic systems grow, the development of highly integrated systems is expanding. In many areas of application, such 3D microchip systems yield resource and cost savings. However, known development methods and approaches are often not ideally suitable. Researchers at Fraunhofer IIS/EAS have therefore participated in a partner project to develop an optimized design process. With the results achieved, the researchers are now in a position to support companies in finding the best technology variant for their system design.**

In their various forms, three-dimensional integrated chips can be more compact, faster and less energy hungry than typical microchips while also enabling the direct integration of additional components. Because existing tools and design methods are directed toward classic two-dimensional chips, the partners involved in NEEDS developed new design methods. These should make it possible for various integration technologies to be optimized even before production. It was important to take an interdisciplinary approach spanning the individual tasks involved and independent of the field of application.

The partners investigated various work steps and aspects of the circuit design process within this project. These included communication structures, the placement of components in the chip stack (floor planning), test concepts, manufacturing processes and the analysis of thermal effects in the stack. The Fraunhofer

researchers integrated the results of the various disciplines into a hierarchical optimization process. With the help of this design space exploration, they are now capable of reliably assessing variants for the system before manufacturing regardless of the respective application. This allows the architecture of the chip stack to be optimized with regard to production costs and performance. The NEEDS project was financed within the research program "ICT 2020 – Research for Innovation" by the Federal Ministry of Education and Research.



3D-INTEGRATED SYSTEM DESIGN: CAMERA ON AN INTERPOSER

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## OPTIMAL WIRELESS COMMUNICATION IN AUTOMATION TECHNOLOGY

**In the future, industrial companies will be able to more reliably utilize wireless solutions for exchanging data between automated systems and machines. This is made possible by a new measurement and diagnosis system from Fraunhofer IIS/EAS that reliably detects transmission difficulties and possible sources of interference in the radio communication. This allows the causes to be quickly identified and optimal countermeasures to be developed. The system operates with a previously unachieved level of precision and can be used during both the installation and operating phases.**

Industrial systems are currently networked via diverse means in order to ensure communication between machine controllers, sensors and actuators as well as for automated control of entire systems. Today, these data connections usually consist of wired solutions. If it is necessary to include moving or remote system components or to subsequently install new data connections, however, wireless technologies represent a better solution. They are significantly more flexible and often less expensive. Optimal installation of wireless solutions can nevertheless be difficult if various wireless systems mutually influence each other or a variety of metallic objects interfere with transmission. These influences can make it impossible to achieve the often high requirements for the robustness and reliability of a communication system.

To avoid this and make optimal use of the possibilities offered by wireless communication networks, they must be configured in a way that is ideally adapted to their surrounding conditions and that circumvents transmission problems. In pursuit of this goal, scientists at the EAS division of Fraunhofer IIS in Dresden developed a measurement and diagnosis system with which they can optimally support companies in the planning, commissioning and even operation of wireless networks. This is done by capturing all radio communication within an environment with unparalleled precision.

Other measurement systems can only determine how heavily the

radio frequencies are utilized. However, because many radio standards use the same unlicensed frequency bands, this information alone is generally an insufficient basis for system operators to carry out improvements. The Fraunhofer researchers are additionally able to directly determine the source of the disruption in a radio connection for various typical wireless technologies, even in the presence of complex systems. For instance, if a WLAN data connection is being disrupted by a Bluetooth communication on the neighboring machine, this can be accurately identified.



In addition to such cases of interference between competing wireless technologies, the measurement and analysis system also permits additional conclusions. For example, the radio wave propagation within a specific system area can be detected as well as any reserves that are available with regard to reliability and robustness. Based on all of these results, it is possible to define individual strategies for optimizing existing wireless solutions and eliminating the sources of disruptions.

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## News

### »Long Night of Sciences« on July 4th in Dresden

Thousands of people in Dresden will once again become researchers during the Long Night of Sciences, exploring the diverse scientific institutions of the city starting at 6 pm. Fraunhofer IIS/EAS will also be opening its doors.

<http://www.wissenschaftsnacht-dresden.de> (German)

### »VISION 2014« from November 4th to 6th in Stuttgart

At VISION, Fraunhofer IIS/EAS will be presenting its recent developments on the topic of "presence detection". VISION is the

world's leading trade fair for image processing and a platform for system providers and integrators.

<http://www.messe-stuttgart.de/en/vision/>

### Modelica basics course on November 27th, 2014 in Dresden

Our experts will be teaching the basics of the Modelica modeling language. Applications in modeling, the use of typical simulators and analysis will also be discussed in addition to fundamental concepts. The one-day course is an ideal way to get started with Modelica.

<http://www.eas.iis.fraunhofer.de/modelicakurs> (German)



## DAC 2014: PIONEERING DEVELOPMENTS IN SAN FRANCISCO

Visitors to this year's Design Automation Conference (DAC) in San Francisco from June 1st to 5th, 2014, were able to learn about the most recent research results of Fraunhofer IIS/EAS. The division presented both the COSIDE® software and a new method of designing interposers for innovative 3D integrated circuits at this leading international trade fair.

Fraunhofer IIS/EAS exhibited its current developments at the world's most important conference and trade fair for the automated design of electronic systems. Among other exhibits, the researchers presented the prototype of an interposer to the over 6,700 visitors. In order to achieve high system performance levels, this interposer permits a compact arrangement of a processor and wide I/O memory with high bandwidth within an IC. To develop such a high-performance interposer, Fraunhofer IIS/EAS created a new design flow for the interposer design process and the 3D integration. The researchers also supported interested companies in selecting the 3D technology appropriate for them. With the semi-automated methods of Fraunhofer IIS/EAS, designers can decide already in the early design phases whether an application should best be implemented as a system-in-package, a housing-free chip on silicon interposers or as stacked dies.

Moreover, companies at DAC could witness the high performance of the COSIDE design environment, with which development teams can master the especially high demands of system level design for complex and heterogeneous systems. COSIDE offers the benefits of the free modeling language SystemC as



well as its analog extension AMS. The most important new development presented by Fraunhofer IIS/EAS at DAC was the integration of the UVM implementation, making the most powerful verification method currently available compatible with SystemC and SystemC AMS as well. This makes COSIDE the first software tool in the world that offers integration in this form. In addition, the development environment has extensive other functions for extremely fast simulation of entire systems with SystemC AMS and verification based on behavior models.

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