

FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS  
DIVISION ENGINEERING OF ADAPTIVE SYSTEMS EAS

## PRESS RELEASE

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PRESS RELEASE

May 15, 2018 || Page 1 | 5

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*Joint press release by the German partners of the "RESIST" research project (Airbus Innovations, Fraunhofer IIS/EAS, Reutlingen University, Infineon Technologies, MunEDA, Nexperia Germany, Robert Bosch, Munich University of Technology, University of Bremen, Volkswagen)*

### **Successful Research: Trailblazer for Especially Robust Vehicle Electronics**

**The partners in the research project "RESIST" have spent the last three years working on new approaches to the development of resilient electronic systems. Their results contribute to the next generation of especially fail-safe vehicle electronics to meet the highest quality, safety and performance standards. The work therefore strengthens the competitiveness of German manufacturers and suppliers in the automotive and aviation sectors.**

Electronic systems in cars and airplanes are increasingly sophisticated and complex. They are performing an ever-increasing number of functions while becoming smaller and lighter. This increases the performance of the components and allows energy consumption to be reduced. On the other hand, many of the technologies used in the miniaturization contribute to increased sensitivity of electronic components with respect to external influences. This is even more true of the harsh environmental and operating conditions that vehicle components are subjected to. In order to nevertheless satisfy the highest demands on the reliability of electronics in this environment, it is essential to develop new design methods and solutions. Especially for modern, highly integrated systems, an approach focusing purely on robustness alone is no longer sufficient. The objective for safety-critical electronics in particular is rather to enable an early warning system for detection of the "health condition" in order that failures can be identified before failure and corrected, if possible.

In order to achieve this, the RESIST project partners at the German and European level have researched concepts for designing extremely high-performance micro- and nano-

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DIVISION ENGINEERING OF ADAPTIVE SYSTEMS EAS**

electronic components to be very reliable and robust. The division Engineering of Adaptive Systems EAS of Fraunhofer IIS coordinated the research work into new methods, chip designs and systems in Germany. The RESIST project team consisted of Airbus Innovations, Infineon Technologies AG, MunEDA GmbH, Nexperia Germany GmbH, Robert Bosch GmbH and Volkswagen AG. Reutlingen University, the Munich University of Technology and the University of Bremen are participating as university partners.

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**PRESS RELEASE**May 15, 2018 || Page 2 | 5

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**Methods and chip architectures for realization of a zero-failure target for vehicle operator**

The project work should contribute to extending the lifespan and failure safety of electronic components in future automotive and aviation applications from the current 10 to 15 years to a period of 25 to 35 years. "In order to take all sub-areas of development into account here, the consortium reflects the entire value creation chain," explains Dr. Christoph Sohrmann, project manager at Fraunhofer IIS/EAS. The RESIST partners have developed new types of approaches that permit forecasting of the behavior in subsequent operation already during the design phase of a microchip or a system. For example, this includes new processes that very accurately depict the aging of an electronic circuit to enable a very precise prediction of the long-term behavior. These results can then be taken into account already during the system design. "We not only worked on methodology; we also developed special chip components for further optimization of the results," continues Sohrmann. "For example, the project produced a kind of 'early warning system' in which a sensor continuously monitors the functioning of a circuit. Pending failure due to wear can then be identified early and reported to the vehicle operator or maintenance service." In addition, new types of robust components provide circuits with significant protection against electrostatic discharges that can lead to a reduced lifespan of the electronics. With all measures taken together, components are better able than before to tolerate the operational loads in the vehicle and can therefore function in a fail-safe manner for much longer.

To evaluate the new methods and chip architectures, the RESIST partners tested them in various demonstration projects. Among other projects, a fail-safe direct current converter was created that remained functional even after critical sub-components of its circuit had failed. This ensures uninterruptible continued operation of all electronics

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**DIVISION ENGINEERING OF ADAPTIVE SYSTEMS EAS**

and electrically operated safety systems. For the aviation sector, the results were tested in a system for optimized flow control. Distributed actuators enable a highly fail-safe and efficient response by wing surfaces to the prevailing flow conditions.

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**PRESS RELEASE**May 15, 2018 || Page 3 | 5

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The work of the German RESIST partners was funded with approximately five million euros by the German Ministry of Education and Research (BMBF) within the framework of the European initiative EUREKA-CATRENE. Their research was embedded within an EU project of the same name, in which additional companies and research institutions from the Netherlands and France also participated. NXP Semiconductors Netherlands was responsible for overall coordination of the work.

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**The EAS Division of Fraunhofer IIS**

The Fraunhofer Institute for Integrated Circuits IIS is one of Germany's most important industrial applied research facilities for the development of microelectronic systems. The scientists in the Division Engineering of Adaptive Systems EAS, located in Dresden, develop key technologies for the connected world of tomorrow. Major aspects of their work are the design of reliable microchips and complex electronic systems in leading-edge semiconductor technologies as well as the corresponding design methods. Furthermore, they focus on the development of intelligent sensor systems, the analysis of large amounts of data as well as on new approaches for distributed control systems. Tailored to current industrial needs and future challenges, the researchers work on adaptive and robust technological solutions in a broad range of applications such as mobility and industrial automation.

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**PRESS RELEASE**

May 15, 2018 || Page 4 | 5  
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**PRESS RELEASE**

May 15, 2018 || Page 5 | 5

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