Project profile

Cluster for Application and Technology Research in Europe on NanoElectronics

CA403 | Design for Reliability of Systems on Chip [RELY]

PROJECT CONTRIBUTES TO

Communication	
Automotive and transport	✔
Health and ageing society	✔
Safety and security	
Energy efficiency	
Digital lifestyle	
Design technology	✔
Sensors and actuators	✔
Process development	
Manufacturing science	✔
More than Moore	✔
More Moore	
Technology node	130 nm

Partners:

Atmel
CEA LIST
EADS
Fraunhofer
Infineon
Intrinsic-ID
ITTP
MunEDA
STMicroelectronics
TUM
UHB ITEM
X-FAB

Project leader:

Georg Georgakos
Infineon Technologies

Key project dates:

Start: May 2011
End: April 2014

Countries involved:

France
Germany
Romania
The Netherlands

The primary aim of the CATRENE RELY project is to ensure system reliability by combining design solutions for future complex Systems-on-Chip (SoCs), as required for application in such fields as transportation, medical and industrial automation, etc. SoC complexity is rapidly increasing due to the integration of new functions, devices, sensors/actuators and extended operating conditions. Furthermore, the ever shrinking dimensions of SoCs, make them increasingly prone to failure. Consequently, as SoC component density increases, new failure mechanisms will appear and system breakdowns will rise due to the higher level of device count and the potential for interaction between adjacent elements.

The partners in the RELY project form a solid consortium that has, as its main objective, the intention of addressing the issue of SoC reliability in a straightforward and thorough manner. Starting from the identification of key electronic components that are candidates for the construction of SoCs, the partners will divide them into sub-components that will be incorporated in different technologies in order to cover as many elements as possible during SoC implementation. This includes - but is not be limited to - logic functions in 65nm technologies and below, high temperature functions in 0.35μm technologies and sensor/actuator components. The consortium has been structured to combine broad expertise in the relevant fields. For simplicity and for cost reasons, the proof of concept will be demonstrated on each of the separate functions.

The consortium covers the complete industrial value chain and includes integrated device manufacturers, electronic design automation specialists and integrated circuit producers. Together with several research institutes and universities it features an extraordinary range of skills and standards of excellence to meet the ambitious targets. The complete methodology for designing reliability into SoCs can be developed from the provision of an enhanced design kit and new design rules, through the complete design flow up to application level in order to optimise overall product reliability.

One of the key objectives of the RELY project is to ensure that the reliability issue is addressed as early as possible during the design phase of the product. Consequently, the project will focus on improving design rules to take reliability requirements into account on all design levels from the system and architecture level down to gate and transistor level. Moreover, the consortium will extend its “design-for-reliability” efforts to testing and monitoring of functions and components. RELY will demonstrate that this unique combination of different solutions is necessary to fulfil the reliability requirements in view of the shrinking dimensions and increasing complexity of SoCs.

A lifetime of reliability

Europe has a leading position in the high-tech application domains of transportation, medical and industrial automation. For these domains, the reliability of the products is a key requirement and can only be realised if the SoCs involved are designed to support the required product reliability over its entire lifetime.

At the same time, the electronic content is often the main differentiating factor for such products as cars, hearing aids and computerised numerical control (CNC) machines. Further growing demand for performance together with cost pressure enforces the integration of more functionality on one chip and the use of new silicon (Si-) process-

es. A new design methodology has to take these new effects into account. To design such complex SoCs with predictable high reliability within a short design cycle is a key requirement for maintaining a leading position in these application domains.

Reliability is a prerequisite for aircraft/space applications and for new automotive developments. Reliability is essential for the new medical/healthcare devices for the ageing society, while reliability is also needed in automated production lines that provide minimal interruption of the production process. High reliability will also be needed for new automated applications such as the "Smart Grid".

A new design methodology

The electronic design automation (EDA) world is dominated by US EDA companies and it is therefore left to European companies to take care of European interests. The RELY project will therefore build on existing experience and develop a complete reliability design methodology with enhanced design kits and design rules, providing new design tools, test and monitoring tools, while predicting end-of-life based on real environmental conditions and using cases experienced by the application.

Reliability is a growing concern for semiconductor companies. On one side, customers like the aeronautics community are requesting a high level of reliability. On the other side, the new technology nodes are more and more sensitive to the reliability phenomena. In addition, regarding the ageing mechanism the problem cannot be limited to a part of the design process - all development steps are impacted. As a consequence, the RELY project will cover modelling and verification of all relevant ageing effects.

The overall strategy of the RELY project is to establish collaboration from the end-user specification request through to the proof of concept. All of the mandatory intermediate steps will be addressed - the analysis and characterisation of the ageing effect of devices, their tool-based modelling at gate level and above. Finally, the design at system level will be addressed by developing embedded reliability sensors in the final product. By covering all design steps the project partners will establish a comprehensive reliability-aware strategy.

Broadly reliable applications

The impact of the RELY project will mainly be felt in terms of higher reliability of complex SoCs. It will provide a better understanding of ageing due to radiation, temperature and mechanical stress and will address the special semiconductor requirements of the aeronautical, space and defence industries. In particular, applications in aeronautics need an extremely high level of robustness, reliability and quality. One of the RELY project partners specialises in the challenging requirements of that field of application and will ensure that the results are propagated down to semiconductor level.

The impact will also be felt in other domains where high reliability is a key factor. For example, SoC applications in medical, industrial automation, automotive and telecom infrastructure require uninterrupted operation. In the medical area new high-reliability implantable devices will be enabled under difficult (low power) conditions – a new field of business opportunities. The RELY project is therefore of broad relevance to major European industries, especially as industry experts are concerned about the declining reliability of the silicon substrate due to extreme transistor scaling.

The results of the RELY project will strengthen the established position of the consortium partners in their fields of specialisation while their dissemination of the results will ensure broad distribution of the new methodology.

CATRENE (Σ! 4140), the EUREKA **C**luster for **A**pplication and **T**echnology **R**esearch in **E**urope on **N**ano**E**lectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.

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