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Chipping Away at Functional Safety Flaws in Automotive Electronics

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Chipping Away at Functional Safety Flaws in Automotive Electronics

Today's automobiles are packed with electronics. From autonomous driving support and infotainment systems to mission-critical functions like braking, a car's performance depends on the reliability of these electronics systems. While the semiconductors that lie at the heart of these systems have been not been a focus in the past, today their reliability is coming under closer scrutiny by both the automotive industry and government regulators. A key automotive standard, ISO 26262, is being updated to consider the safe performance of all semiconductor components. How will automotive systems engineers meet this tougher standard — and address functional safety concerns down to the chip level? It's clear that they can no longer rely on manual analysis and consumer software tools like Excel. What's needed is a new solution for mapping semiconductor designs to the key functions they support within the vehicle — and ensuring that semiconductors will perform flawlessly to support consistent vehicle performance and outstanding passenger safety.

/ Semiconductors: Tiny Systems, Huge Impact

Because they are tiny and virtually invisible, it's easy to overlook the central importance of the semiconductors that underlie reliable automotive performance today. But these small systems allow larger electronics networks to control every aspect of a car's performance — from lighting, HVAC and entertainment systems to fail-safe or even fail-operational braking, steering and acceleration.

As consumers demand higher and higher levels of performance from their cars — including, in the near future, autonomous driving — the amount of electronic components and semiconductors will only increase. Recognizing the growing role of semiconductors, as well as their essential contribution to automotive safety, in 2018 a newly revised automotive regulatory standard places semiconductors in the spotlight.

Created in 2011 by the International Standards Organization, ISO 26262 is called "Road Vehicles — Functional Safety." It aims to ensure that electronics in automobiles perform reliably, in order to support the safety and control systems that deliver overall performance. This standard requires automotive systems engineers to identify any relevant hazards or failure modes for their electronic components, and minimize these in order to safeguard the entire vehicle's consistent performance.

Beginning in 2018, ISO 26262 was expanded to explicitly include semiconductor components in the scope of functional safety analysis for road vehicles. The developers of automotive electronics will now have to consider functional safety down to the chip level.

They must also deliver documentation proving that all semiconductors in their technology systems have been analyzed and verified for safe performance.

The Challenge of Functional Mapping

This new requirement presents a significant challenge for automotive engineers, who are already tasked with ensuring functional safety across highly complex electronic systems, with dozens of components and interfaces. For years, functional safety experts have looked at the cohesive system architecture to identify every potential mode of failure, the likelihood of each event and the response of the entire electronics architecture should this occur.

Now they must also look beneath the surface of tiny semiconductors to assess all the things that could go wrong — and determine how a flaw in a single chip, for example, could manifest itself in the car's overall performance.

This process involves mapping each functional area, or "block," within the semiconductor, to some specific aspect of the vehicle's performance, such as braking or airbag deployment. These connections are often subtle and technologically complex. Hundreds or even thousands of scenarios must be studied to identify the consequences of any possible failure mode. In addition, electrical engineers must consider the long-term environmental conditions, such as thermal stress, that can degrade semiconductor performance over time.

This careful analysis must happen in parallel with the larger, more comprehensive functional safety analysis that evaluates and assesses the entire electronics system model. Both the functional safety of semiconductors and the overall electronics architecture must be studied and determined to be fail-safe in detailed documentation submitted to automotive regulators.

Why Current Tools and Processes Fall Short

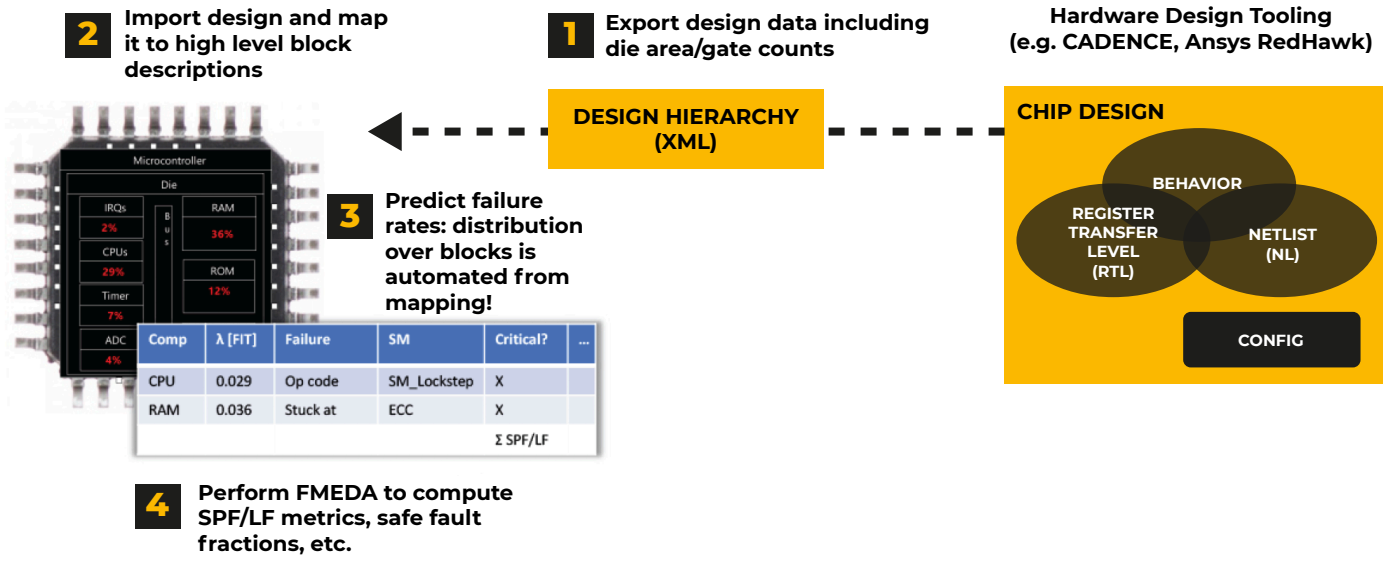
There's no doubt that today's more stringent regulations represent a positive trend. By examining the functional safety of automotive electronics down to the chip level, electrical systems engineers are able to achieve a higher level of confidence in their designs, which should translate to greater safety when vehicles are placed on the highway.

They can also identify opportunities for innovation and improvement. The problem is that many engineering teams are taking on this incredibly sophisticated task with outdated processes that rely heavily on manual labor and human analysis — which is naturally prone to error. They are also relying on consumer-grade software tools, notably Excel™, which were not designed to organize and facilitate the analysis of highly complex electrical systems or large volumes of functional safety analysis data.

Their historic reliance on manually intensive processes and generic software means that these automotive engineering teams are slow to market with new system designs. They are also failing to work in a cost-efficient manner, which erodes profit margins.

A New Solution — from a Trusted Leader in Functional Safety

The good news is that automotive engineering teams now have a comprehensive solution for analyzing, verifying and documenting functional safety across their entire electronics system architecture, including at the chip level. Offered by engineering simulation leader Ansys, the most recent release of medini analyze supports chip-level functional safety analysis for semiconductors.



Via a step-by-step, automated process, medini analyze enables automotive engineers to perform failure modes, effects and diagnostic analysis (FMEDA) for all semiconductor components in a rapid, cost-effective manner.

Across the entire electronics architecture, medini analyze streamlines and automates the process of functional safety analysis — considering hundreds or thousands of operating scenarios, then determining and analyzing potential failure modes that might occur in these scenarios. New capabilities for semiconductors in medina analyze facilitate the process of mapping blocks of the semiconductor design to system functions, such as airbag control, within the overall electronics architecture. Engineers can quickly identify any design weaknesses in semiconductors, whether caused by integration errors or environmental conditions, and address these to mitigate the impact on the car's day-to-day safe performance.

Because Ansys experts understand the regulatory complexities of ISO 26262 and other automotive industry standards, medini analyze is designed to address these systems design requirements. In addition, medini analyze automatically generates the documentation required to verify the functional safety of all electronic systems to automotive regulatory groups. Semiconductor performance is addressed as part of a larger effort to analyze and verify the entire electronics architecture. This analysis occurs in a step-by-step, automated process that eliminates the possibility of human error.

/ Experience These Real-World Benefits

Today, there's no need for automotive systems engineering teams to rely on slow-moving, error-prone manual processes and generic software tools. Instead, medini analyze represents a customized, cost-effective solution to ensuring and documenting functional safety.

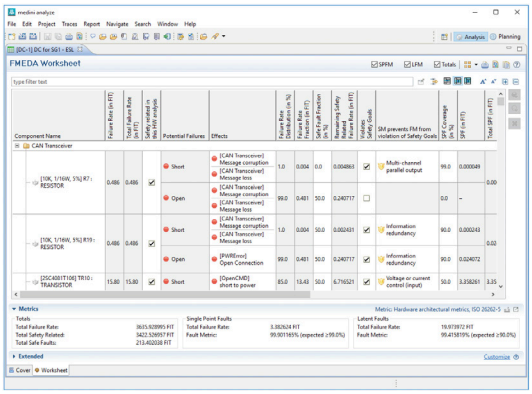
By enabling automotive systems engineers to assess functional safety down to the semiconductor level, the newest release of medini analyze offers these practical benefits:

- **Semiconductor analysis integrated with overall systems analysis.** With the new functional safety requirement for semiconductors in ISO 26262 in 2018, electronics engineering teams may think they need a new dedicated process and toolkit to meet this challenge. However, medini analyze is a trusted solution for assessing functional safety at the system level — which now also addresses the critical role of semiconductors in supporting functional safety.

- **Increased speed and efficiency for functional safety compliance.** Manually ensuring full compliance with complex functional safety standards — via consumer-grade software tools — is a tedious, labor-intensive effort that's prone to error. Instead, medini analyze automates this process at every level of the system architecture, ensuring compliance at every step. Engineering teams can work faster, more efficiently and with a higher degree of confidence — resulting in time and cost benefits, as well as more innovative system designs.

- **Automatic document generation.** Proving compliance with standards such as ISO 26262 is not an easy task. Comprehensive documentation is needed to demonstrate that all relevant analysis has been performed and all functional safety requirements have been met. Manual generation of this documentation requires large amounts of time, money and other scarce resources. To reduce the time required, medini analyze automatically produces the reports needed to demonstrate comprehensive system analysis and verification of safe performance.

- **Synchronization with other leading solutions in the Ansys software suite.** The seamless integration of medini software for functional safety analysis with other leading technology solutions for electronic systems design, including Ansys SCADE Architect, ensures fast, robust solutions. The entire engineering team benefits from a common technology platform and shared interfaces that enable diverse tasks to be completed rapidly, and with a high level of transparency and visibility.



Leading automotive companies use medini analyze to support best-practice workflows that graphically link specific areas of the semiconductor design to key functions within the electronics architecture. This allows engineers to analyze and address potential failure modes as they verify the functional safety of semiconductor components.

/ Driving Toward a Competitive Advantage

Few industries are as driven by innovation as the global automotive industry. From autonomous driving capabilities to cameras and infotainment systems, consumers are demanding richer functionality and higher levels of performance. It falls on the shoulders of electrical engineering teams to deliver this innovation, quickly and cost-effectively.

At the same time, regulatory standards for cars have never been tougher. And they're becoming more stringent all the time, as evidenced by the new requirement for semiconductor functional safety in ISO 26262.

The solution is medini analyze, already used by the world's leading electrical engineering teams to automate the complicated process of functional safety analysis. With its new capabilities for semiconductor analysis and verification, medini analyze delivers the global automotive industry's most comprehensive toolkit for functional safety analysis.

By reducing development costs and time to market, while maximizing innovation and product confidence, medini analyze can help companies achieve a significant competitive advantage in an increasingly crowded marketplace.

/ Summary

As regulatory guidelines and requirements change, it's essential for automotive engineering teams to have best practices and leading-edge technology tools in place to manage the growing challenge of compliance. In response to changes in ISO 26262 that shine a spotlight on the functional safety of semiconductors, medina analyze is ready with new capabilities to facilitate and automate this analysis. Companies that cling to outdated manual processes and consumer-grade tools that weren't designed for functional safety analysis will be challenged to remain competitive as regulations become more and more stringent. In contrast, engineering teams that embrace best-in-class software solutions from Ansys — and the power of automated analysis and documentation — will be much faster to market with more innovative, more profitable electronic systems designs that meet both consumer demands and new regulatory guidelines.

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