Project profile

CATRENE
Cluster for Application and Technology Research in Europe on NanoElectronics

CA310 | Resolving key issues of electromagnetic compatibility and reliability will give the electric vehicle and related industries a boost [EM4EM]

PROJECT CONTRIBUTES TO

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

Technology Platform for Process Options

Partners:
AUDI AG
Daimler AG
Infineon Technologies AG
Conti-Temic microelectronic GmbH
Robert Bosch GmbH
NXP-Semiconductors Germany GmbH
ZUKEN GmbH
ELMOS Semiconductor AG
Leibniz Universitaet Hannover
Friedrich Alexander Universitaet Erlangen-Nürnberg
Technische Universität Dortmund
CTU – Czech Technical UniversityInstitut of Microelectronic Applications Ltd.
VTT Technical Research Centre of Finland
Okmetic Oyj
Murata Electronics Oy

Project leader:
Joern Leopold
Audi AG

Key project dates:
Start: July 01, 2013
End: March 31, 2015

Countries involved:
Germany
Czech Rebublic
Finland

Future electrically operated vehicles will encounter huge design challenges with electric and electronic components. Electromagnetic compatibility and electromagnetic reliability of communication units, for example, will require a significant reduction in electromagnetic emission generated by the electric powertrain components. This project aims to tackle these issues in a unique way, developing solutions from the perspective of noise immunity of nanoelectronic components and electronic modules required for future developments in automotive and semiconductor industries.

Issues involving future vehicles with electric drives (EVs) – typically voltage increases and the close vicinity of high field strength from high-power cables and electric motors, as well as, sensitive high-density electronics – will need a holistic approach to ensure electromagnetic compatibility (EMC). What's more, the commonly used shielding effect of the vehicle's metal case will disappear due to lightweight designs (like the use of carbon fibre cabinets), thus aggravating the situation even further. It must therefore be concluded that future EMC behaviour of communication units (like the conventionally used broadcast services DVB-T, FM, AM) in EVs will need a significant reduction of electromagnetic emission generated by the electric powertrain components.

The primary objective of EM4EM is to investigate new design and measurement methods under the EMC conditions of EVs and their integration into the different development flows for full electric vehicles to meet upcoming new technical challenges.

Increased reliability and reduced emissions

The approach taken is to achieve high system-reliability regarding noise immunity of nanoelectronic components (like IC sensors and power devices) and electronic modules required for future developments in automotive and semiconductor industries. Importantly, special attention will be given to electrical propulsion systems. Synergy with other closely related industries also operating in harsh electromagnetic environments will be gained.

Project development – taking into account issues such as time-to-market and cost-efficiency like lightweight and efficient design and packaging – will include new methodologies to reduce electromagnetic noise emission generated by power electronic components, and systems to increase noise immunity of smart sensors. Nanoelectronic systems (including the sensor technologies) and power semiconductors for EVs are targets of this research project, with the focus on technology development for EMC improvements. This calls for significant design flexibility.

The performance of the developed concepts will be validated using several demonstrators along the EM4EM value-chain containing semiconductor, component, system and vehicle levels. This approach is unique and will be managed in close co-operation with all project partners.

Project activities and deliverables will include:

- EMR analysis, modelling and measurement methods for EV components;
- Methodology collection: estimation/assessment of contribution of individual circuits components (also devices) to the electromagnetic interference (EMI) behaviour of the overall circuit and the target system (EV);
- Establishing a continuous EMR RoadMap containing the common understanding of all developers of electro-mobility active in the field of EMC, extending from the OEM (original equipment manufacturer) to the whole EV value-added chain;
- Defining and developing new internationally recognised standards and new 'cascadable' measurement/testing methods, considering components and the full system and providing engine control unit (ECU) modelling parameters.

End-product optimisation

The EM4EM project consortium, comprising participants from industry and academia, will design and develop models, test and measurement methods, simulation tools, simulation methods, and design rules, which will then be passed on to EMC engineers. The consortium will also influence the optimisation of products themselves by influencing key development and the production processes deployed for potential EVs. In addition, co-operation at a European level will accelerate acceptance and implementation.

Higher competiveness, lower costs

EM4EM covers important areas of nanoelectronics development and EMR research, as well as, new methods to improve electrical vehicles and industrial electronic systems. This project not only resolves key technical problems affecting EVs; it will also have some potentially beneficial (commercial) spin-offs. For example, its target to reduce the overall EMR development efforts will increase the competitiveness of the European car and semiconductor industry on the world market. So will reliable operating-equipment integration, optimisation and safety and robustness, main project objectives.

Now, EVs require a huge variety of new electronic functions in propulsion, diagnostics, driver-support, navigation and vehicle-to-grid communications. Taking advantage of these innovative market opportunities requires the special expertise and experience found in semiconductor manufacturers participating in EM4EM. And the trove of project deliverables – including tried-and-tested models, measurement methods and procedures (like 'cascadable' standardised measurement procedures), and simulation tools and methods – can be used by other European businesses to reduce the time-to-market and costs of EMR-optimised components and systems for EVs. The demonstrators along the value chain, for example, will help third parties integrate these results quickly into new products, helping European industry deal with EV components and systems, and related products.

Deliverables will also secure and expand European companies in the automotive industry, as well as, preserve or even increase employment in Europe and ensure a stable R&D. The market for EV-related products and services – including those deploying EM4EM competence and deliverables – will grow. By 2020, there will be a market for more than 13m electric vehicles requiring multiples of electronic components compared to today's combustion engine cars, and providing a huge potential for system and semiconductor manufacturer or supplier. Power semiconductors and modules, in particular, will experience a tremendous economic boost in the upcoming years. The semiconductor market for hybrid-electric and battery-electric vehicles with annual growth rates of 25% is expected to increase to $5.5 billion in 2020, reaching about 15% of the overall automotive semiconductor market.

And the added-value from electronics in cars will continue to grow steadily and their car-value share rise to 32% by 2015, thanks to the electrification of the power train and cost- and energy-efficient car technologies. In addition, time-to-market will get shorter as productivity from these new technologies kicks in much faster. At an annual growth of around 10%, the total automotive-electronics market will stay very attractive in the future.

CATRENE Office
9 Avenue René Coty - F-75014 Paris - France
T. +33 1 40 64 45 60
E. catrene@catrene.org
www.catrene.org

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.