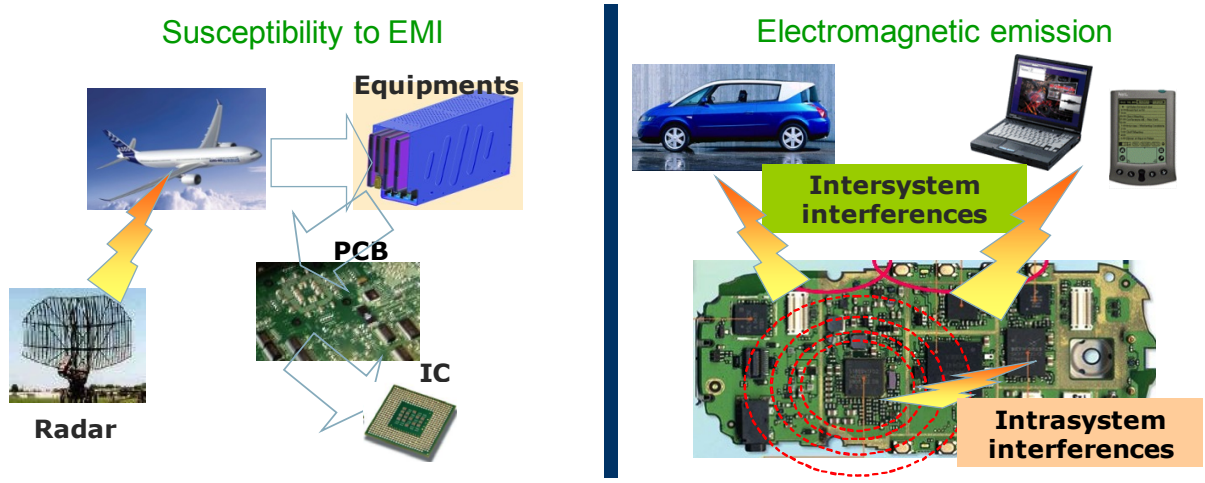
With the increasing integration of various electronic functions within a same miniature system, the concerns about electromagnetic compatibility (EMC) issues are growing. In a context of severe requirements in term of EMC certification, especially for safety critical applications (e.g. aeronautics, space, automotive, health), EMC is an important source of redesign and extra-cost for manufacturers which do not integrate this constraint early in their own design and validation flow. Whatever their purpose (digital processing, sensor, energy management, power actuator, radiofrequency link…), integrated circuits (ICs) are at the origins of both electromagnetic emission (EME) and susceptibility (EMS) issues.



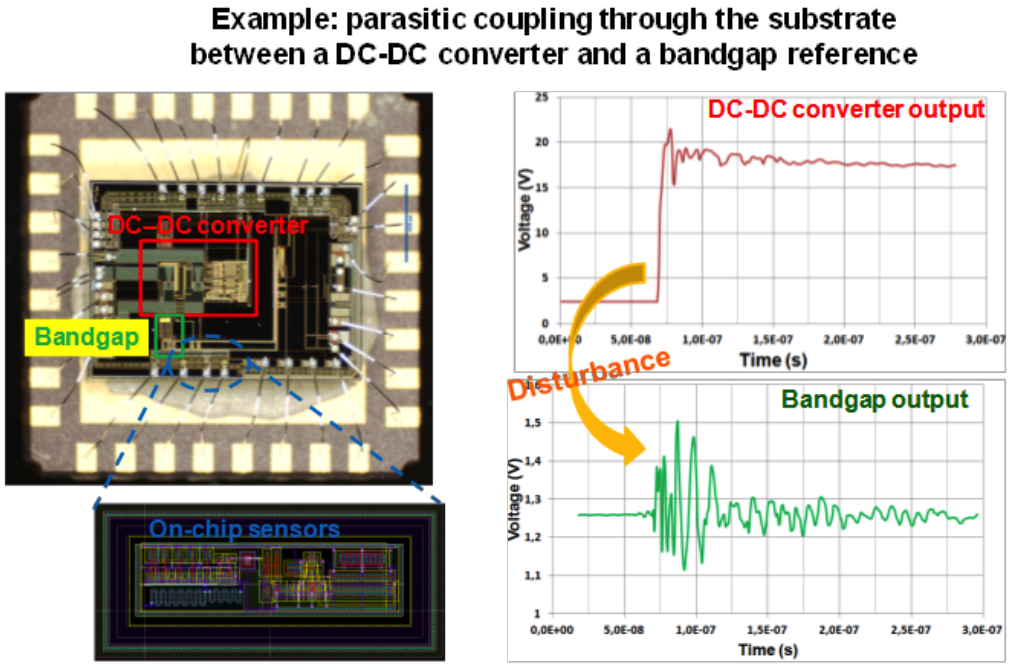
In this context, our research team is one of the few teams in Europe focused on the EMC issues of embedded electronic systems, with a specialization about ICs. Our research objectives are twofold:

- developing measurement methods in order to improve the understanding of EMC related problems and their location within small integrated electronic systems
- proposing modeling and simulation methods to predict EME and EMS, and evaluate the risks of non-compliance of an electronic systems in a given environment (e.g. the influence of harsh environment)

On-going research projects:

- AUTOMICS - Pragmatic approach to parasitic-aware optimization of electronics ICs for automotive

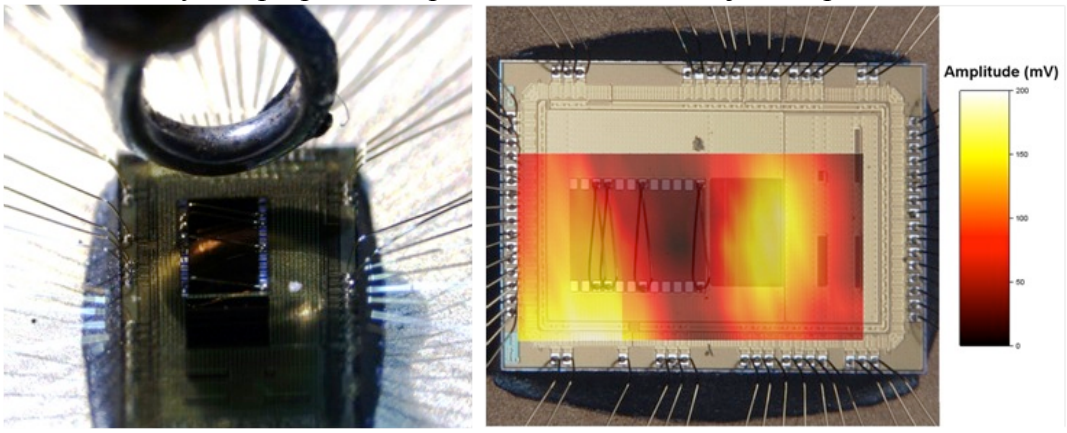
Launched in 2013, this project supported by the European Union within the FP7 Framework aims at improving the modeling and the simulation of substrate coupling issues in Smart Power circuits. They constitute a major part of the electronic devices embedded in automotive and electrical vehicles. Substrate coupling is the source of numerous problems which may be destructive (e.g. latch-up), induce failure (disturbances of sensitive function such as analog blocks) or lead to non compliance to ESD and EMC requirements. In this project, we propose an on-chip voltage sensor to acquire the waveform of transient signals induced during noise injection in the substrate. The measurement results provided by the sensor will provide validation cases for substrate coupling models.



Contact : Sonia Ben Dhia
PhD thesis : V. Tomasevic

- E-Mata-Hari – ElectroMAgneTic Analysis, decipHering and Reverse engineering of Integrated Circuits

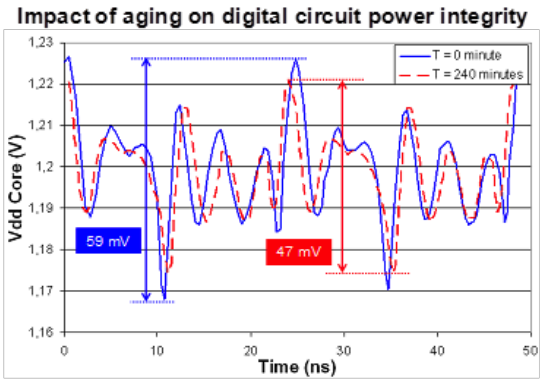
Launched in 2013, this project is supported by the National Research Agency (ANR (program Ingénierie Numérique et Sécurité). It aims at evaluate and quantify the threats due to electromagnetic attacks on secured integrated circuits, especially the methods based on near-field injection. Our research team develop on-chip voltage sensor and test circuits in order to test the near-field injection method to produce local disturbances able to disturb the operation of digital circuits. Another task consists in clarifying the nature of the coupling between the injection probe and the attacked circuit and proposing prediction models of the induced faults in the circuit. Finally, we propose new patterns of miniature injection probe.

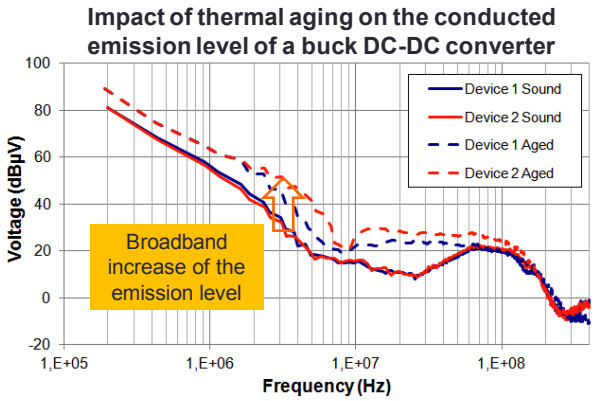


Contact : Alexandre Boyer

- Electromagnetic robustness

Since 2009, our research team has launched an original research topic called Electromagnetic Robustness (EMR) or long-term electromagnetic compatibility. It aims at predicting if an electronic circuit, equipment or system will comply electromagnetic emission and susceptibility requirements during all its lifetime according to its mission profile (exposition to high temperature, moisture, vibration, electrical transients…).
The previous and on-going research have several objectives: clarifying the impact of aging on EMC of electronic devices, studying the physical mechanisms due to aging that alter the "electromagnetic" behavior of circuits, propose qualification methods and develop predictive methods for long-term EMC.
This topic was initially supported by CNES, regional council of Midi-Pyrénées, and an ANR - Jeunes Chercheurs project (EMRIC) and led to three PhD theses and several international publications. The next work will be supported by the IRT Saint-Exupéry within its program Electronic Robustness. The primary objective of this new project is the extension of standard models for prediction of EMC at IC level (ICEM, ICIM) in order to integrate the effect of aging.





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PhD thesis: He Huang