Industry-Academic Forum on EMC 2023

"Solutions that Look for Applications"

Contributions from Academia (Day 1, 9:00 – 10:30)

Revisiting EMC Design Rules or Risk Analysis Through Machine Learning
(Prof. Philippe Besnier, INSA)

Experimental and numerical investigations in EMC are subject to many uncertain parameters (uncontrolled) and variables (possibly controlled by design). As a result, any appreciation of potentially critical EMC scenarios requires uncertainty analysis and propagation. How machine-learning techniques can be used to reach the goal?

Filling the gap between EMC and Power Quality
(Prof. Flavia Grassi, POLIMI)

The development of modeling and measurement tools to predict the effects of power electronics converters on EMC and power quality is a fundamental step towards increasing the immunity of communication systems, designing suitable EMI filters (passive and active), and assuring coexistence between power and data (e.g., PLC). The talk will provide an overview of available approaches and open issues of a challenge which is straddling the EMC and the power system communities.

Compact Macromodeling for EMC/SI/PI: Recent Advances and Outlook
(Prof. Stefano Grivet-Talocia, POLITO)

PoliTO has established a leadership in algorithm development for complexity reduction of EMC/SI/PI models, even at full system level. Recent research activities led to new fundamental and unexpected results, which have the potential to boost reliability, robustness, and applicability. A showcase and outlook will be provided.

Gaussian Process Regression for Uncertainty Quantification of Electronic Devices
(Prof. Paolo Manfredi, POLITO)

Uncertainty quantification (UQ) recently gained wide popularity to address the impact of component tolerances and process variations on electronic designs. This talk illustrates emerging UQ techniques based on Gaussian process regression, a machine learning method that showed promising results in providing confidence estimates and mitigating the so-called "curse of dimensionality".

The Never-ending EMC Challenge of Complex Wiring Harnesses
(Prof. Sergio Pignari, POLIMI)

Wiring harnesses are of critical importance with respect to EMC compliance and accurate modelling of real wiring structures is still a challenge for EMC engineers. From the computational viewpoint, MTL theory (possibly combined with full-wave simulation) still represents the most efficient tool, but there are well-known limitations. In this presentation we will show examples proving that the boundaries and potential of MTL modeling can be pushed even further!

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Generating a Database for Real-World SI/PI Problems – Two Years Later!
(Prof. Christian Schuster, TUHH)

At TUHH we have been investigating for many years SI/PI problems on printed circuit boards. Based on our own, fast physics-based modeling approach we have been looking lately into collecting our data in an open "database" and made it available to the public. The question is now: How far can we go with this for the real-world?

Can Machine Learning bring a revolution in EMC/SI/PI Design?
(Dr. Domenico Spina, UGHENT & IMEC)

In recent years, machine learning (ML) has become an important tool to facilitate the characterization and design of complex RF and microwave systems. At IDLab (Ghent University - imec), we have extensive expertise on this topic. However, ML has not yet created a revolution like in other fields, such as computer vision and robotics. This talk introduces the state-of-the-art and discussing the potential of ML techniques to innovate the design process of high-speed analog circuits with focus on EMC/SI/PI.

Bridging the Gap Between ANNs and Kernel Regressions for Vector-Valued Problems
(Prof. Riccardo Trinchero, POLITO)

This talk presents a generalized modeling framework for vector-valued functions based on the multi-output kernel Ridge regression (KRR). The proposed formulation aims at bridging the gap between multi-output Artificial Neural Network (ANN) structures and standard scalar kernel-based approaches. The performance and the effectiveness of the proposed modeling approach are investigated on several EM applications.

QM/EM Modeling of (Nano) Devices and Systems for EMC/SI/PI-Aware Design
(Prof. Dries Vande Ginste, UGHENT)

At the Quest Lab of Ghent University/imec we focus on state-of-the-art (nano)electronic devices and systems, which nowadays operate at very high frequencies and are often also extremely miniaturised. Therefore, their behavior is dominated by various electromagnetic (EM) and quantum mechanical (QM) phenomena. Our general goal is to model this QM/EM behavior of novel (nano)devices and systems including the development EMC/SI/PI-aware modelling and design strategies.

3D Modeling of Miniaturized RF Discretes: Making a Big Fuss over a Small Issue?
(Dr. Cheng Yang, TUHH)

From electric discharge protection of ICs and to signal interconnects on printed circuit boards to advanced wireless communication systems, mm and sub-mm sized RF discretes are experiencing a wonderful "high-frequency time" more than ever. The question is: Why and how will 3D modeling of RF discretes advance your designs in critical application?