Langer EMV-Technik-GmbH
Nöthnitzer Hang 31
DE-01728 Bannewitz
GERMANY

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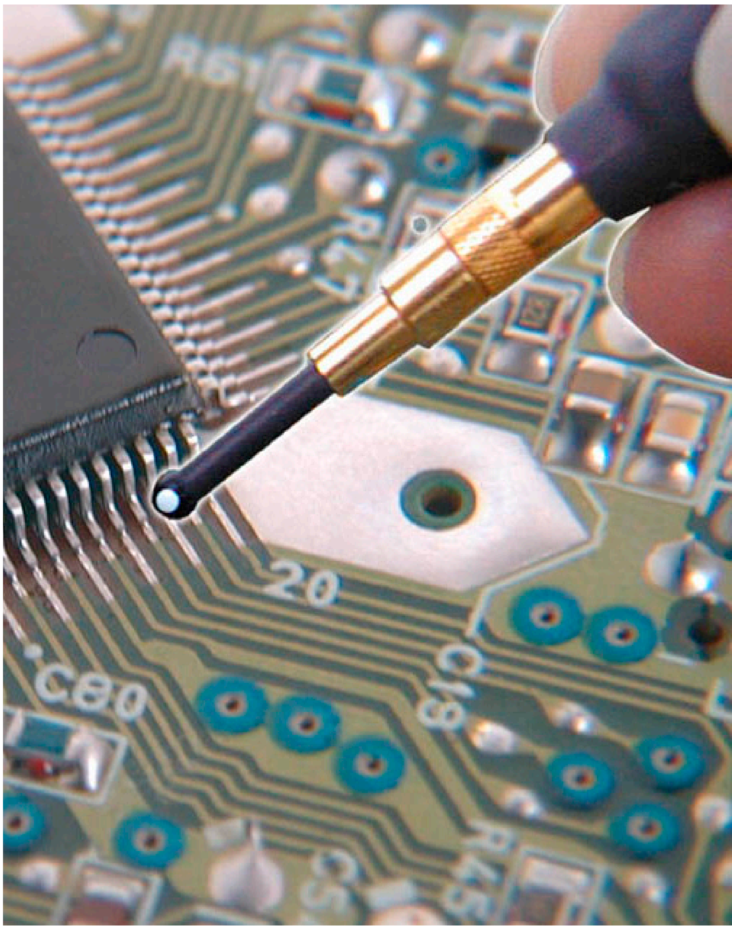
INTERNSHIP

IC Measurement Technology

Modern integrated circuits (ICs) are highly complex and require precise characterization of their electromagnetic behavior. To improve efficiency and reproducibility, a 4-axis robot will be commissioned at Langer EMV-Technik to perform automated EMC-related measurements. The goal is to establish a routine for both near-field and pin-based probing, providing detailed insight into IC emission characteristics.

The tasks include setting up communication between robot and PC, programming automated sequences, and integrating mechanical components for the test setup. Measurements will first be carried out with Langer near-field probes, followed by pin-based tests. Results will be analyzed, visualized, and prepared for publication. A subsequent thesis may extend this work with a full EMC characterization and comparison to standardized methods and manufacturer specifications.



Planed Tasks

- Establish communication between the robot and a PC using Python or a similar programming language
- Program the measurement routine (Python or similar tool)
- Design required mechanical components in collaboration with the mechanical engineering department
- Perform non-contact near-field measurements using Langer near-field probes (LF, RF) or microprobes (ICR)
- Analyze and visually present the measurement results
- Adapt the routine for pin-based measurements and carry them out (e.g., P202/302, P501)
- Compare results with standardized EMC measurements and manufacturer specifications
- Prepare results for publication

www.langer-emv.com
Recruiting@langer-emv.de

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INTERNSHIP

Point Source Transformation

Modern ICs contain many functional modules operating in parallel, all of which contribute to electromagnetic emissions. Current flow generates magnetic fields, while switched voltages create electric fields. The emissions from all functional areas combine to form the overall device emission, which is difficult to assess individually in complex ICs.
With the measurement systems from Langer EMV-Technik (P1602 and P1702), the total emission of electric and magnetic fields can be measured in various operating modes. From this, the emission behavior can be reduced to a simplified model using a substitute electrode (E-field) and a substitute loop (H-field).

Unlike conventional near-field to far-field transformations based on scans of real PCBs, this approach avoids the need for a prototype solely for scanning—provided a database of substitute elements for common ICs is available. Thus, far-field simulation can be integrated directly into the PCB design process instead of relying on prototype measurements.

Planed Tasks

- Literature review on near-field to far-field transformation techniques
- Near-field IC emission measurements using P1602 and P1702
- Development of an algorithm to calculate far-field emission from substitute elements on a PCB (superposition of substitute elements and equipotential surfaces in their vicinity)
- Comparison of the transformation results with a near-field scan of the PCB
- Comparison of the transformation results with a far-field emission measure-ment of the PCB

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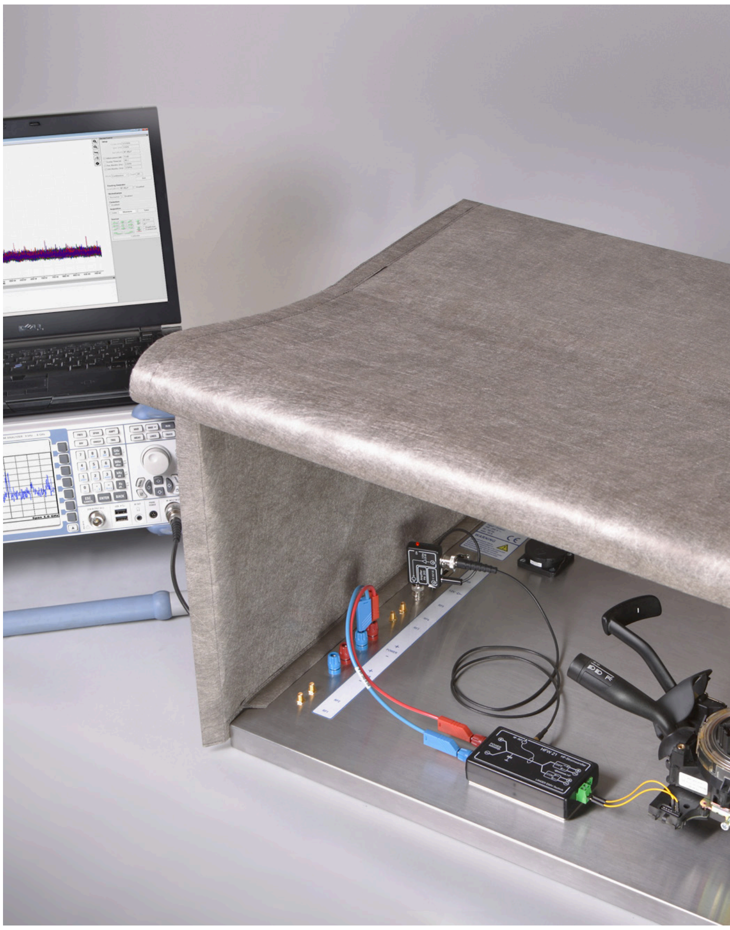
Shielding Effectiveness Measurement

Shielding effectiveness is a key parameter in many areas of electromagnetic com-patibility (EMC), as it helps assess the performance of shielding materials and their connections. However, typical measurement methods only reflect the current state and do not allow conclusions to be drawn about the material properties of the shield-ing itself.

As part of an internship, the shielding effectiveness test setup at Langer EMV-Technik shall be optimized and used to characterize a wide range of shielding mate-rials. The applied measurement approach will be compared to established methods to validate its accuracy and reliability.



INTERNSHIP

Planed Tasks

- Optimize the current test setup as needed (mechanical improvements)
- Conduct research on shielding effectiveness measurement methods for ma-terials in the low-frequency range
- Perform shielding effectiveness measurements on a variety of materials
- Where possible, implement partial automation of the measurement process (e.g., using Python or similar tools)
- Prepare a detailed analysis of the measurement results
- Prepare the results for publication

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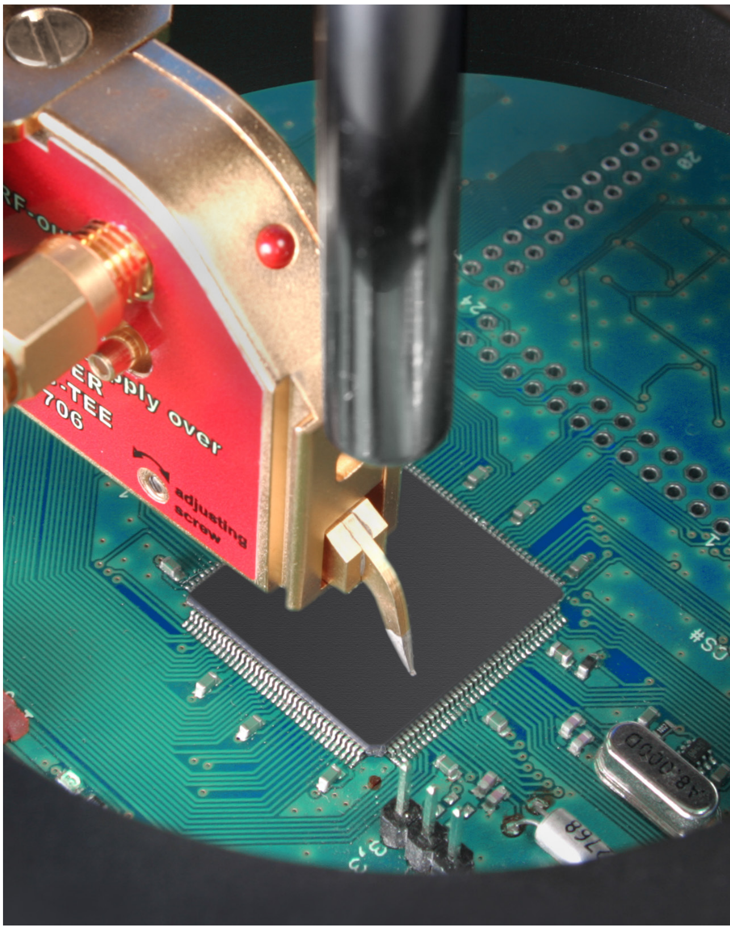
Side-Channel Attack (SCA)

A side-channel attack is a type of cyberattack in which an attacker attempts to extract confidential information (such as cryptographic keys) not by breaking the algorithm itself, but by analyzing physical side effects of the system—such as electromagnetic emissions.

As part of an internship, a (classical) electromagnetic side-channel analysis will be prepared and conducted on a real IC using Langer EMV's micro near-field probes (ICR).



Planed Tasks

- Literature review on (current) EM-based side-channel analysis techniques
- Practical setup of the measurement system (equipment available)
- Extension of existing Python scripts for signal analysis
- Preparation of the test IC (Device Under Test, DUT)
- Analysis and visual presentation of the measurement results
- Preparation of results for publication
- Use of near-field probes (in dB) to derive conclusions regarding the field strength

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