Tomas Monopoli

Location: Milano, Italy

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Electrical Engineer - phD

Focus on **Machine Learning** and **Statistical Analysis** for **Electromagnetic Modeling**.

Experience

PhD Candidate, Joint program by Politecnico di Milano and European Space Agency (ESA - ESTEC), Nov 2020 – Present
Italy, Milano – Netherlands, Noordwijk

- **Research Project**: Development of Innovative EMC Testing Techniques for CubeSats
- **Research Objective**:

  Standardize EMC specifications for CubeSat components using near-field measurements and specialized testing setups. Utilize machine learning and statistical techniques to generate numerical models of CubeSat PCB components for defining standardized testing procedures.

  Main Activities:

  Onsite at European Space Agency (ESA/ESTEC) : In 2021, I was onsite as a Research Fellow focusing on acquiring complex measurement data using ESA's facilities and laboratories.

  Collaboration with Technical University of Hamburg (TUHH) : Initiated a collaboration with the Institut für Theoretische Elektrotechnik of TUHH leading to multiple joint publications. Also, an overall period of 4 weeks was spent in Hamburg running measurement campaigns. This involved utilizing a robotic arm as an automatic near-field scanner over different test electronic devices.

  Adaptive Sampling Strategies and Surrogate Model Extraction : Compared traditional Kriging and modern Gaussian Process Regression approaches for near-field surrogate model extraction. I proposed a novel approach combining prior knowledge-guided Gaussian Process Regression (GPR) with Bayesian Optimization for efficient adaptive sampling.

  Radiation Emission and Susceptibility Modeling : Constructed equivalent radiation and susceptibility models of electronic boards using an array of infinitesimal dipoles. Different approaches were implemented to optimize the dipole array, such as deep learning (physically informed patch-based CNNs), machine learning (Genetic Algorithm) and other image processing methods (morphological binary erosion).

Edison S.p.a. R&D, Internship Nov 2019 – May 2020
Italy, Milano

- Defined specifications and tested new product prototypes, applications, and services. Managed projects on Technological Innovation and Development, collaborating with Divisions, Business Units, and Management Boards.
- Conducted Technology Scouting for innovative products from companies and promising startups.

CERN, Summer Internship Jul 2019 – Aug 2019
Switzerland, Geneva

- Participated in the CERN Student Program CESP. 14 master students from all over the world for 5 weeks of high-tech venture creation training and feasibility studies of CERN technology. I focused on studying the application of the Structured Laser Beam technology in spectroscopy methods such as: OFI, RAMAN and FTIR.

Publications

[1] Tomas Monopoli, Xinglong Wu, Sergio A. Pignari, Johannes Wolf, and Flavia Grassi. *Wideband Modeling and Simulation of Multiple PCB Components in CubeSat Environments*. Submitted to the 2025 ESA Workshop on Aerospace EMC. Under review. Seville, Spain, May 2025.

[2] Tomas Monopoli, Xinglong Wu, Cheng Yang, Christian Schuster, Sergio A. Pignari, Johannes Wolf, and Flavia Grassi. "Morphological Search for Near-Field Equivalent Infinitesimal Dipole Models". In: *IEEE Transactions on Electromagnetic Compatibility* (2024). preprint. DOI: 10.1109/TEMC.2024.3492701.

[3] Tomas Monopoli, Xinglong Wu, Sergio Pignari, Johannes Wolf, and Flavia Grassi. "Inspection tools for Gaussian Process Regression Modeling of Electromagnetic Fields of Electronic Boards and Chips". In: Oct. 2024, pp. 56–59. DOI: 10.1109/EMCCompo61192.2024.10742047.

[4] Tomas Monopoli, Xinglong Wu, Cheng Yang, Sergio A. Pignari, Johannes Wolf, and Flavia Grassi. "Partial Image Expansion Applied to Real Near-Field Measurement Data Modeling". In: *2024 IEEE Joint International Symposium on Electromagnetic Compatibility, Signal Power Integrity: EMC Japan / Asia-Pacific International Symposium on Electromagnetic Compatibility (EMC Japan/APEMC Okinawa)*. 2024, pp. 138–141. DOI: 10.23919/EMCJapan/APEMCOkinaw58965.2024.10585137.

[5] Tomas Monopoli, Xinglong Wu, Flavia Grassi, Sergio Amedeo Pignari, and Johannes Wolf. “A New Method Exploiting Partial Image Expansion to Include Substrate and Ground in Dipole-Based Near-Field Models”. In: *IEEE Transactions on Electromagnetic Compatibility* 65.6 (2023), pp. 1878–1887. DOI: 10.1109/TEMC.2023.3325242.

[6] Tomas Monopoli, Xinglong Wu, Flavia Grassi, Sergio A. Pignari, and Karl-Friedrich Johannes Wolf. “Positioning Uncertainty of Near-Field Probes”. In: *2023 IEEE 7th Global Electromagnetic Compatibility Conference (GEMCCON)*. 2023, pp. 57–57. DOI: 10.1109/GEMCCON57842.2023.10078196.

[7] Tomas Monopoli, Antonino Borgese, Xiaokang Liu, Flavia Grassi, and Sergio A. Pignari. “Modal Analysis of a Typical Power over Ethernet Configuration”. In: *2020 6th Global Electromagnetic Compatibility Conference (GEMCCON)*. 2020, pp. 1–4. DOI: 10.1109/GEMCCON50979.2020.9456742.

Other Projects

Advanced Optical Character Recognition System for Academic Papers Dec 2023
Project Repository

Developed an Optical Character Recognition (OCR) system tailored for scientific papers using the NOUGAT transformer model by Facebook, enhanced by pyTesseract for cross-checking skipped or missing chunks. Output is structured with metadata and integrated with Language Models and RAG models. Automatic creation of Notion pages with reference databases, detailed summaries, and cross-referenced information.

- **Input:** Academic paper/article in PDF format.
- **Output:** Markdown files or Notion pages enriched with LaTeX expressions, tables, and formatted text. Accurate transcription of complex elements such as mathematical formulas and varied text styles.

Waste Sorting Smart-Bin June 2018 - June 2019
Startup & Entrepreneurship School Program

Part of a multidisciplinary team in a 12-month entrepreneurship program. Developed a smart-bin that automatically sorts waste into categories using a Raspberry Pi, camera module, step motors, and sensors. Implemented a CNN using the pre-trained VGG16 net fine-tuned with a custom database. Presented the prototype at a technology and innovation fair held in Turin (OGR Torino).

Education

Politecnico di Milano and Politecnico di Torino (Double Degree) Sept 2017 - May 2020
Msc. in Electrical Engineering *110 cum Laude*

Thesis: ***Analysis of a Typical PoE Circuit Configuration with coupled Transmission Lines***

Abstract:

Comprehensive examination of a PoE configuration optimized for high-performance automotive and aerospace applications. Various disturbance parameters and non-ideal properties are considered, and the model is validated in MATLAB and compared with Spice simulation

Politecnico di Milano and Torino, Alta Scuola Politecnica (ASP) Feb 2018 - Feb 2020

ASP is a merit-based program made up of 150 students from the two largest Polytechnic schools in Italy. The activities focus one multidisciplinary team work, impact of technological innovation in the market, creative design thinking and multi-criteria decision making.

Politecnico di Milano Sept 2014 - May 2017
Bsc. in Electrical Engineering *110/110*

Thesis: Stability of Synchronous Machines in Dynamic Conditions

Technical Skills

Coding Languages
Python, MATLAB, R, SCPI, JavaScript, Dart
Libraries
PyTorch, TensorFlow, scikit-learn, pandas
Lab Instrumentation
Oscilloscopes, Spectrum Analyzers, VNAs, Near Field Probes
Dev Tools
Visual Studio Code, Git, Docker
Solvers
HFSS, Q3D, LTSpice
Languages
Italian: Mother-tongue; English: Mother-tongue;

Relevant Courses Attended

- **Artificial Neural Networks and Deep Learning**, Prof. Giacomo Boracchi & Matteo Matteucci;
  Computer Science Msc. Course
- **Advanced Deep Learning Models and Methods**, Prof. Giacomo Boracchi;
  Computer Science PhD School course
- **Introduction to Computational Methods for Electromagnetic Fields**, Professor Luca di Rienzo;

Other Activities

- **Reviewer** for IEEE Transactions on Electromagnetic Compatibility (**TEMC**), IEEE Letters on Electromagnetic Compatibility Practice and Applications (**LECPA**) and **IEEE Access**
- **Session Chair**, International Conference on Power Systems and Electrical Technology (PSET 2023), Milan, Italy, during August 25-27, 2023.
- Participation in test campaigns in the EMC lab of Politecnico di Milano with senior researcher of the EMC group. In particular radiated susceptibility of small electronic devices was tested using non-conventional waveforms.

References

Flavia Grassi
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Information and Bioengineering (DEIB),
Politecnico di Milano
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Johannes Wolf
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