

2x Master's Thesis, 10-20h/week (f/m/d)
R&D Engineer/Researcher Machine Learning (entry level)
Physics-Informed & Bayesian Machine Learning
for Electric Vehicle EMC Optimization
(Physics / Computer Science / Maths / Engineering etc.)

Institute of Theoretical Physics and Computational Physics, Graz University of Technology
 In cooperation with the Institute of Electronics

We are seeking **2** highly motivated Master's students working on Machine Learning to support our multi-national, interdisciplinary team working on the electromagnetics of electrical vehicles. To increase the range and ensure the reliability of electric vehicles without increasing their cost, high-dimensional multi-objective optimization (MOO) tasks must be solved. The underlying electromagnetic models are hard to solve, with each one taking several hours of computation time. Machine-learning techniques reduce this computation time down to milliseconds, enabling MOO, but they must be trained consistently with the physics. It is your task to maximize the accuracy of the trained models by feeding information about the underlying physical process (here: Maxwell's Equations) into the training process. This is known as physics-informed learning. In addition, we will use techniques from Bayesian probability theory to investigate associated uncertainties and find the optimal surrogate model form (Gaussian Processes, Polynomial Chaos), as these machines need be both physically sensible and reliable. Two Master's projects are available focusing on the physical and probabilistic aspects of the learning machine, respectively.

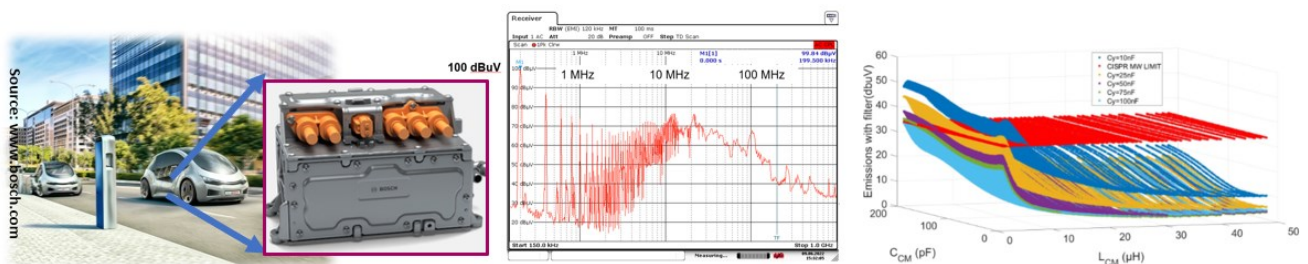


Figure 1: The heart of the electric vehicle is the traction inverter (left). Its electromagnetic emission (center) must be optimized to design reliable, long-range and affordable vehicles. With your contribution, such optimal designs can be selected from Pareto surfaces which are generated using machine-learning models (right, exemplary, simple case).

Tasks:

- Contribute to an interdisciplinary applied research & development project at the intersection of machine learning, computer simulations, electromagnetics, and power electronics
- Coding and implementing machine learning algorithms, testing and real-world application

- Collaborate with simulations engineers, physicists, electrical engineers
- Disseminate results (e.g. contribute to scientific reports, demos and presentation at international conferences etc.)
- Write Master's thesis related to the project

Your profile:

- Background in physics, computer science, maths, engineering or similar (Bachelor's degree)
- Passionate about machine learning and artificial intelligence, with a focus on data analysis and modelling, and its interdisciplinary applications (simulation engineering, probability theory, electromagnetics and electric drives)
- Interest in the engineering and technology of electric vehicles
- Solid programming skills: Python or similar preferred
- Excellent analytical, problem-solving and communication skills, ability to learn quickly
- Ability to work independently and collaboratively in team environment

What we offer:

- The opportunity to complete a Master's thesis on the subject of the work
- A workplace with collegial atmosphere, full inclusion in the research team of several experts
- Extensive, cooperative training on ML and mentoring on an individual basis at eye level
- R&D experience in a young, & interdisciplinary field with highest industrial relevance
- Flexible working hours, options for home office / tele-working
- The minimum salary is 1190 EUR gross based on 20h / week employment

Start date and duration: flexible

This is a unique opportunity to work on an interdisciplinary project that has the potential to make a significant impact on future development of electric vehicles and thus to support the de-carbonization of transport. If you are passionate about machine learning and interdisciplinary applications and looking for an exciting entry-level opportunity, please apply with your CV and possibly cover letter, emphasizing your research/coding experience and interests. Recommendation letters will be considered.

Please send applications and/or inquiries for further information using the subject header [Application EMC ML - YOUR FAMILY NAME] to both Dr. Sascha Ranftl (ranftl@tugraz.at) and Asst.-Prof. Dr. Jan Hansen (jan.hansen@tugraz.at). Applications will be reviewed for interview on a rolling basis starting from 15th October 2023.

Contact:

Dr. Sascha Ranftl

Institute of Theoretical Physics & Computational Physics, TU Graz
Petersgasse 16/II, A-8010-Graz

Dr. Jan Hansen

Institute of Electronics, TU Graz
Inffeldgasse 12/I, A-8010-Graz

Offices:

Graz Center of Computational Engineering
Münzgrabenstraße 36/II, A-8010 Graz