OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

CHAIR OF ELECTROMAGNETIC COMPATIBILITY

Topics for Nontechnical Projects

Here you will find an overview of topics for nontechnical projects.

Solving engineering problems with large language models such as ChatGPT

Background and problem: Large language models and generative pre-trained transformers such as ChatGPT have enjoyed great popularity since the end of 2022. Although these are primarily language models and not knowledge models or logic models, attempts are often made to use them to solve mathematical, scientific or engineering-related questions or problems. The challenge here is the mathematical weakness of the models and the tendency to hallucina i.e. to produce texts that sound good and look correct but are nevertheless incorrect in terms of content.

The aim of this project is to use ChatGPT to solve (exam) problems in engineering subjects, to mark correct and incorrect solution steps, to correct and improve the solution, to present the correct solution in a technically correct way and to discuss alternative solutions. In doing so, it is necessary to use expert knowledge within the domain of the problem and to use "high" levels of competence of the Bloom's taxonomy, e.g. analyze, evaluate, assess and create.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Solving+engineering+problems+with+large+language+models+such+as+Cha PT.html)

EMC in Everyday Life

Background and problem: EMC is nowadays an important issue:

- The radio crackles during a phone call with the mobile phone
- When the air conditioning system is running in the hospital, the resolution of the magnetic resonance tomographs are worse
- The central locking system has been blocked by radio equipment in English patrol cars
- In the case of a mobile phone call (without hands-free system), the automatic transmission switches back a gear
- when the power-saving light (from China) is switched on, the washing machine goes crazy

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/EMC+in+Everyday+Life.html)

Creation of an Online Interface for RoboPicasso using Sphero Mini Robots

Background and problem: The ball-shaped Sphero robot is about the size of a ping-pong ball, but it's full of technology. Two motors, a rechargeable battery, colored LEDs and a remote control module enable the Sphero to be controlled via smartphone and facial expression recognition -- smiling means driving forwards, looking sad means driving backwards and steering is done b tilting the head. Manual control by hand, following a pre-drawn line or programming via a graphical interface are also possible. T idea behind RoboPicasso is to pack the Sphero robots into a waterproof and paintproof shell and use them as a mobile paint roll or brush. The robot first drives through paint, picks it up on the surface, and then releases it back onto a canvas as it moves across it. This creates abstract, colorful and interesting drawings and patterns depending on the color selection and control. Witl this activity, which combines creative design and technology sensitization in an innovative way, we would like to explore the question of how creatively people and robots can paint together. Anyone from 3 to 99 years of age can control the robots via smartphone during the interactive hands-on activities. More information can be found at the following websites:

- https://bit.ly/RoboPicasso
- https://www.facebook.com/robo.picasso
- https://twitter.com/hashtag/RoboPicasso
- https://www.instagram.com/p/CBYVp49gEte/
- https://www.instagram.com/p/CBbSbjFAO8q/

› more ...

(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Creation+of+an+Online+Interface+for+RoboPicasso+using+Sphero+Mini+Ro
s.html)

Preparing a Virtual Laboratory Tour of our Large Reverberation Chamber

Background and problem: Included in the free and open-source content collaboration framework H5P, a › virtual tour (https://h5p.org/virtual-tour-360) content type allows users to add questions, texts and interactions into multiple 360° environments using only a web browser. Lecture and course materials can be more more engaging with H5P, which is based on JavaScript, a can be easily integrated into the learning management system Moodle of the Otto-von-Guericke University in Magdeburg.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Preparing+a+Virtual+Laboratory+Tour+of+our+Large+Reverberation+Chamb
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Analysis of Educational Live Streams on Twitch

Background and problem: Twitch is a large live streaming video platform with millions of daily users worldwide and also millions of active channels. Most of them show computer games, but there are also channels dedicated to science and technology, engineering and educational purposes.

The aim of this project is to analyze some of these channels in the form of a selection of 5 to 10 regularly active accounts. The following questions can be addressed as examples: Who runs the channel and with what motivation? Who is the channel's target group and what characterizes it? What is the typical content of the channel? How is this content produced, with what hardware and software? How often and in
what form does interaction with viewers take place?

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Analysis+of+Educational+Live+Streams+on+Twitch.html)

Evaluation of the per-unit-length parameters and characteristic impedance for multiconductor transmission line structures

Background and problem: Transmission lines are important coupling paths of external radiated electromagnetic disturbances into connected devices and systems. Often, there is not only just one single line acting as antenna, rather a collection of several wirers forming a multiconductor transmission line. The electrical characteristics of a transmission line include, in addition to the characteristic impedance, the so-called per-unit-length parameters. For EMC-modelling it is important to know these parameters

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Evaluation+of+the+per_unit_length+parameters+and+characteristic+impedan
+for+multiconductor+transmission+line+structures-p-542.html)

From Waste to Energy

Background and problem: The idea of burning garbage is as old as humanity. But the art is to conserve the environment and resources and to produce usable energy. The waste-fueled power station (MHKW) in Magdeburg generates about 370,000 MWh of electrical energy and 350,000 MWh of district heating annually from around 650,000 t of household waste. How does the MHWK in Rothensee work? What are the opportunities and risks of such power stations? Can we talk about green electricity in t case?

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/From+Waste+to+Energy.html)

Overview of control systems for three-phase voltage source inverters

Background and problem: Three-Phase voltage source inverters are the most popular rectifiers used in power engineering. Mo photovoltaic converters, active front ends for motor and generator- or active Filter for power quality applications use such inverte topologies and have a lot of control strategies for their semiconductor devices. In general, three-phase voltage source inverters consists of three IGBT bridges and a large capacitor as an energy storage. In order to get desired gating signals for the IGBTs, there are many possibilities to operate the input voltages and currents.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Overview+of+control+systems+for+three_phase+voltage+source+inverters-p-

538.html)

Economic efficiency of LED lamps

Background and problem: Due to the ban of conventional incandescent lamps LED lamps are increasingly used for lighting. They consume much less energy than the old light bulbs; producers offer a huge variety of colours and promise a long lifetime. However, the investment costs are comparatively high. Moreover, the efficient operation of LEDs directly on the network requires voltage rectifiers, which are in turn the cause of undesired harmonics.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Economic+efficiency+of+LED+lamps.html)

Power Quality Measurement with smart meters

Background and problem: Smart Meters are increasing measuring devices for power consumption measurements in households, public buildings and industries. To know exactly the power flow of every consumer in a distribution grid, gives the chance to compute the state of the grid. Voltage and Currents have a nominal frequency of 50 Hz/ 60 Hz in Power Grids. Power Quality phenomena such as harmonics are often in a higher frequency level. To compute these phenomena a higher precision o measurement devices is necessary.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Power+Quality+Measurement+with+smart+meters.html)

Overview of E-Learning Software for the Development of Interactive Learning Materials

Background and problem: In recent years, there is a growing trend to digitalize the learning material of lectures and of the corresponding exercises and seminars. Such materials can be easily copied in high quality and can be widely distributed via the internet. Lecture materials are very similar to books and can be saved in a quite static format. However, exercise sheets and tas usually require are more interactive format. To develop such interactive learning material, a wide range of software programs are already available, as LearningApps, iSpring, Xerte or Qedoc.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Overview+of+E_Learning+Software+for+the+Development+of+Interactive+Le ning+Materials-p-438.html)

Comparison of different emission standards

Background and problem: The emissions of electronic devices have been divided into two major categories, conducted emission (CE) and radiated emission (RE). In order to minimize the potential interference with nearby electronic devices, differer standards have set limits to regulate the emission levels of equipment under test (EUT).

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Comparison+of+different+emission+standards.html)

EMC emission measurement methods for electric motors

Background and problem: The conducted emission (CE) of the connecting wires and the mains cord as well as the radiated emission (RE) of the electric motor can be measured by different methods. The measured radiation level could be compare with different standards.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/EMC+emission+measurement+methods+for+electric+motors.html

Mode-Stirred Chambers Around The World

Background and problem: A mode-stirred chamber or reverberation chamber is an alternative test environment that is mainly used for radiated tests in the scope of electromagnetic compatibility. Such chambers are also used for testing communication devices, to simulate wireless channels, to investigate the influence of electromagnetic fields onto living cells and so on. A mode-stirred chamber consists of a shielded resonant enclosure, a device to change the electromagnetic boundary conditions (usually rotating stirrer) and some antennas and probes to excite and measure the field.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Mode_Stirred+Chambers+Around+The+World-p-228.html)

Solutions of the Biot-Savart Law for Straight Wires with a Nonuniform Current Distribution

Background and problem: The Biot-Savart law can be used to calculate the magnetic field the surrounds a current-carrying wir The general solution which can be found in the literature assumes that the wire is straight, that the current only flows in the cente of the wire and that the current distribution along the wire is uniform. For some applications it is necessary to deal with a nonuniform current distribution, for example if the current along the wire decreases continuously due to stray currents. A typical workaround is to approximate a long wire carrying a nonuniform current distribution with shorter wire section carrying a uniform current distribution. This is of course inefficient and inaccurate.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Solutions+of+the+Biot_Savart+Law+for+Straight+Wires+with+a+Nonuniform+urrent+Distribution-p-232.html)

Visualization and Plotting of Large Datasets

Background and problem: At wide band measurement of systems with sharp resonances like microwave cavities a very large number of values is accumulated. It the subsequent analysis of the data it is often difficult and time-consuming to visualize and p the data. Commercial plotting tools usually do not offer much help in visualizing these large data sets.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Visualization+and+Plotting+of+Large+Datasets.html)

Overview of Freeware/OpenSource Electromagnetic Field Solvers

Background and problem: Electromagnetic field solvers are used in research and industry to calculate and simulation field problems. There exists a wide range of commercial programs that often require a very expensive licence. Also some open-sourc projects exist, which have the goal to develop electromagnetic field solvers that can be used freely. Such solvers can be extreme useful but yet difficult to find, because such projects are often pushed by universities that don't have a large budget for promotion

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Overview+of+Freeware_OpenSource+Electromagnetic+Field+Solvers-p-266.html)

The Millennium Bug -- Just a Hype or a Serious Problem That Was Solved on Time?

Background and problem: The millennium bug is also known as the year 2000 problem (or just Y2K). It resulted from the practice of of abbreviating a four-digit year to only two digits. Shortly before the year 2000 it was assumed that many computer programs would become problems with logical errors arising upon the rollover from 99 to 00. Without corrections it was suggeste that long-working computer systems would break down and stop to work. People thought that it would take weeks and month to the computer run again and that industrial processes would be strongly disturbed. Many companies worldwide checked, fixed, a upgraded their computer systems.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/The+Millennium+Bug+__+Just+a+Hype+or+a+Serious+Problem+That+Was+lved+on+Time_-p-268.html)

What Was Your Motivation to Study Electrical Engineering in Magdeburg?

Background and problem: 'The Otto-von-Guericke-University Magdeburg was founded in 1993 and is one of the youngest German universities. It was formed in a merger of the existing Technical University, the Teacher Training College and the Medic School. The University now comprises 9 faculties and almost 13800 students and is becoming increasingly important as a centre of education and research. It plays an important role in the regional capital Magdeburg which is developing into a centre of business, scholarship and culture.' says the university's › website (http://www.ovgu.de) .

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/What+Was+Your+Motivation+to+Study+Electrical+Engineering+in+Magdebu -p-274.html)

Ethical Dilemmas in Engineering

Background and problem: Consider the following problem (from “Ethical Problems in Engineering”, John Wiley & Sons, New York, 1965): An engineer is employed on a part-time basis by a small city which cannot afford a full- time engineer. The city

commissioners know the engineer also works for clients who are land developers. The engineer, in his private consultant's role, prepares plans for a client. The client then presents these plans to the city officials, who turn them over for approval to their engineer, who has now changed to his city engineer's hat.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Ethical+Dilemmas+in+Engineering.html)

Survey of Electric Vehicles

Background and problem: Electric vehicles are emerging from a niche product to a mass-produced article. Almost every large car manufacturer has launched a model series of fully battery-powered cars, ofter with a very different driving and usage philosophy in mind.

› more ... (https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Survey+of+Electric+Vehicles.html)

How is the Educational System in your Home Country Organized?

Background and problem: Each country of the world has its own educational system. For sure there are a lot of similarities but also lots of small differences. In some countries children are graded with numbers, in other countries letters are used, in some countries must schools are operated by the government, other countries rely on private schools and so on.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/How+is+the+Educational+System+in+your+Home+Country+Organized_-p-280.html)

Converting Azimuth, Polar and Polarization Angles Between Different Definitions of Spherical Coordinate Systems

Background and problem: The spherical coordinate system is an appropriate way to define the direction of the wave vector an the polarization of plane waves for field calculation. The main problem that different authors and different manufacturers of field computation software use different definitions of the spherical coordinate system. That makes it difficult to compare calculation o simulation results between different authors or programs. Numerous examples of different definitions can be found in the literature. Example field computation programs are the Numerical Electromagnetic Code (NEC) or CONCEPT.

› more ...
(https://www.emv.ovgu.de/emv/en/Study/Topics+for+Nontechnical+Projects/Converting+Azimuth_+Polar+and+Polarization+Angles+Between+Different+D nitions+of+Spherical+Coordinate+Systems-p-226.html)

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