

Research Teams

Electromagnetic compatibility - EMC

The department of Electric Power Engineering, Mäsiarska 74, 040 01 Košice

Team members

Prof. Ing. Iraida Kolcunová, PhD. – expert in the area of electromagnetic compatibility with focus on the influence of electromagnetic radiation on the operation of electric power systems and devices, on penetrance, reflection and absorption of electromagnetic waves through building material. Furthermore she focuses on the methods of population protection against the effects of electromagnetic radiation.

Prof. Ing. Roman Cimbala, PhD. – expert for design of measuring system control methods in the field of electromagnetic compatibility by programming development environments. He is also expert for the questions of application and influence of electromagnetic radiation on biological materials and systems.

Doc. Ing. Juraj Kurimský, PhD. - he deals with the interactions of EM fields and biological systems. He carries out the activities aimed to the interdisciplinary networking for the research on the impact of electromagnetic pollution on biological systems.

Doc. Ing. Alexander Mészáros, PhD. – expert for analysis of electric, magnetic and electromagnetic fields every day and work environment and for their reviewing according to valid hygiene standards.

Dr. Ing. Bystrík Dolník – expert for EMC (electromagnetic compatibility) with focus on technical systems in electronics and electric power engineering and with focus on interference source identification, on measures for reciprocal interference elimination in technical systems (including overvoltage). He is also expert for technical system susceptibility against electromagnetic field influence, for interaction of electromagnetic fields with live organisms, expert for physical field modelling, and for describing electro-physical properties of progressive materials for EMC application.

Ing. Dušan Medved', PhD. – expert in the area of computer aided modelling of thermal and electromagnetic fields by numeric methods and in the area of computer aided modelling of electrification system.

Ing. Jaroslav Petráš, PhD. – expert for the area of overvoltage with focus on switching overvoltage and atmospheric overvoltage, furthermore in the field of overvoltage protection of electric and electronic devices, overvoltage protection devices and their coordination.

Ing. Marek Pavlík, PhD. - expert for electromagnetic field propagation trough environment as well as for electric, magnetic and electromagnetic field mapping in environment.

Research Focus

Our research focuses on:

- The ability of technical systems, devices and elements to operate properly during electric, magnetic and electromagnetic field influence and the not to affect by its own operation other systems and devices,
- Overvoltage generation in the network and the protection of electric and electronic devices against overvoltage, the coordination of overvoltage protection devices in the overvoltage protection system,
- Modelling and measuring the distribution of electromagnetic field near object serving for electric power generation and transfer, near transmitting aerials for wireless communication and near other devices,
- The influence of electromagnetic field on biological systems.

Research Significance and Exploits

Currently we can observe an increase of electromagnetic radiation source number in comparison to previous decades. The population pays higher attention to the electromagnetic radiation sources, to their influence and to the term of electromagnetic compatibility. The electromagnetic compatibility means that the device under research does not affect the operation of other devices by its electromagnetic radiation. The measurement of electromagnetic fields recognizes electromagnetic smog that affects the population. For population protection the shielding of electromagnetic field pays an important role. The shielding prevents the penetration of electromagnetic field in determined bandwidth in the dependence on material used for shielding. The selection of proper building material ensures electromagnetic field effect decrease. Research results are useful for correct Wi-Fi transmitter positioning in houses or for correct positioning of mobile network transmitters, as well as other wireless transmitters.

The topic of electromagnetic field interaction with biological systems is worldwide in focus with increasing importance. Experts suggest that electromagnetic radiation is biologically active in its whole extent. Nowadays we cannot say clearly say how such a field affects different biological system types. Therefore research activities are made with different electromagnetic field and biological system interactions.

The research of electric and electronic device protection against overvoltage will yield more accurate coordination of overvoltage protection devices in the overvoltage protection system. Therefore the protection should be more effective. Better protection measures can be provided by the research of switching overvoltage generation process and the process of overvoltage transfer from its source to the protected device.

Currently Solved Topics

The reflection free chamber at our department enables to research the electromagnetic compatibility of electric and electronic instruments and devices. Currently we use it for measurement of electromagnetic wave penetration into building materials. We monitor mainly

frequencies in the bandwidth between 1 GHz and 9 GHz (mobile network transmitters). We measure the reflection, absorption and shielding effectivity coefficients for building materials. The possibilities of electromagnetic wave penetration reduction are researched by the use of proper shielding and paint coat.

Furthermore currently we map the electric, magnetic and electromagnetic fields in environment in comparison with limit values.

The experimental method has been developed for the research of interactions of EM fields and blood samples. The logistics and procedures for sampling and analysis of exposure to biological specimens have been provided. In the research framework the interaction of blood samples with non-ionizing electromagnetic radiation. In cooperation with The Slovak Academy of Sciences the research of the live organism ecology in electromagnetically polluted environments is made.

Also experiments focusing on the overvoltage generation and transmission are currently made in our laboratories with the identification of possible transfer ways from source to protected device.

Current Projects

1. Protection of population in Slovak republic against electromagnetic field influences (Ochrana obyvateľstva SR pred účinkami elektromagnetických polí), Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic for the Structural Funds of EU, No. 26220220145, duration: 2011 – 2015)
2. Research of the penetrating of high frequency electromagnetic waves through ecological building materials. Scientific grant agency project (S.G.A.) No. 1/0312/15, duration: 2015-2018, co-ordinator: Kolcunová, I.
3. EMC laboratory establishing for electronic devices and biological systems - Centre of excellence for integrated research and exploitation of progressive materials and technologies in automobile electronics (Centrum excelentnosti integrovaného výskumu a využitia progresívnych materiálov a technológií v oblasti automobilovej elektroniky), Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic for the Structural Funds of EU, No. 26220120055, duration: 2010 – 2013
4. The development of unique low energy static power source for electric systems

Cooperation with Academic Institutions and Industry

We cooperate on research project tasks with organization such as:

- Institute Experimental Physics Slovak Academy of Science, Košice
- Geophysical Institute Slovak Academy of Science, Košice
- Parasitology Institute Slovak Academy of Science, Košice
- Clinic of ruminant University of Vets Medicine and Pharmacy of Košice
- Science Faculty University Pavol Jozef Šafárik of Košice
- Research Institute of Nuclear Power Plants Trnava

Most Significant References

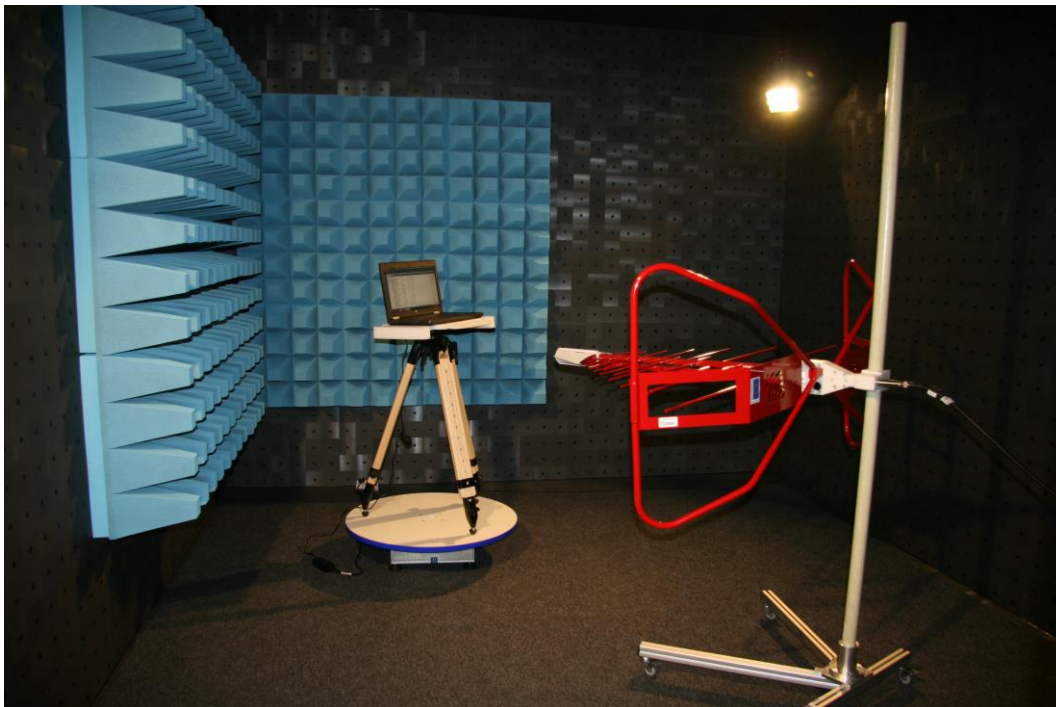
The research team published the results of research in scientific and expert journals, in proceedings of scientific conferences and scientific monographies. Below is the list of most significant ones:

1. Electromagnetic Compatibility / Bystrík Dolník - 1. vyd. - Košice : elfa - 2013. - 240 s. - ISBN 978-80-8086-221-3.
2. Pavlík, M.: Research of electromagnetic waves transfer, reflection and absorption in laminated materials, doctoral work, Košice, 2015.
3. Kostelec, M., Kurimský, J., Fol'ta, M., Bucko, S., Čonka, Z. Investigation of effects of non-ionizing electromagnetic fields interacting with biological systems (2015) Proceedings of the 8th International Scientific Symposium on Electrical Power Engineering, ELEKTROENERGETIKA 2015, pp. 544-547.
4. Rajnak, M., Kopcansky, P., Gdovinova, V., Zavisova, V., Antal, I., Kurimsky, J., Dolnik, B., Jadzyn, J., Tomasovicova, N., Koneracka, M., Timko, M. Dielectric spectroscopy of ferronematics based on 6CHBT liquid crystal (2015) Molecular Crystals and Liquid Crystals, 611 (1), pp. 40-48.
5. Pavlík, M., Kolcunová, I., Zbojovský, J., Medved', D. Measuring of shielding effectiveness of electromagnetic field of polystyrene in the frequency range from 1 GHz to 9 GHz. In: Power and Electrical Engineering, Vol. 32 (2014), p. 46-50, ISSN 2256-0238
6. Pavlík, M., Kolcunová, I., Lisoň, L. Measuring the shielding effectiveness and reflection of electromagnetic field of building material .In: Electric Power Engineering (EPE). - Ostrava : VŠB-TU, 2015 P. 56-59, ISBN 978-1-4673-6787-5
7. Džmura, J., Petráš, J., Balogh, J. Surge arresters in low voltage network In: Electrical Engineering and Informatics 6, proceedings of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, 2015, s. 270-275, ISBN 978-80-553-2178-3
8. Zbojovský, J., Mészáros, A., Medved', D. Simulation of electromagnetic fields propagation through the various materials. In: EPE 2014, proceedings of the 2014 15th International Scientific Conference on Electric Power Engineering, 12. - 14.5.2014, Brno, University of Technology, P. 257-260, ISBN 978-1-4799-3806-3
9. Zbojovský, J., Mészáros, A., Kurimský, P. Modelling the high frequency electromagnetic field propagation through the polystyrene. In: Proceedings of the 8th International Scientific Symposium on Electrical Power Engineering, ELEKTROENERGETIKA 2015, Košice TU, 2015, s. 556-559, ISBN 978-80-553-2187-5

Photos



Measuring equipment with un-echoing chamber

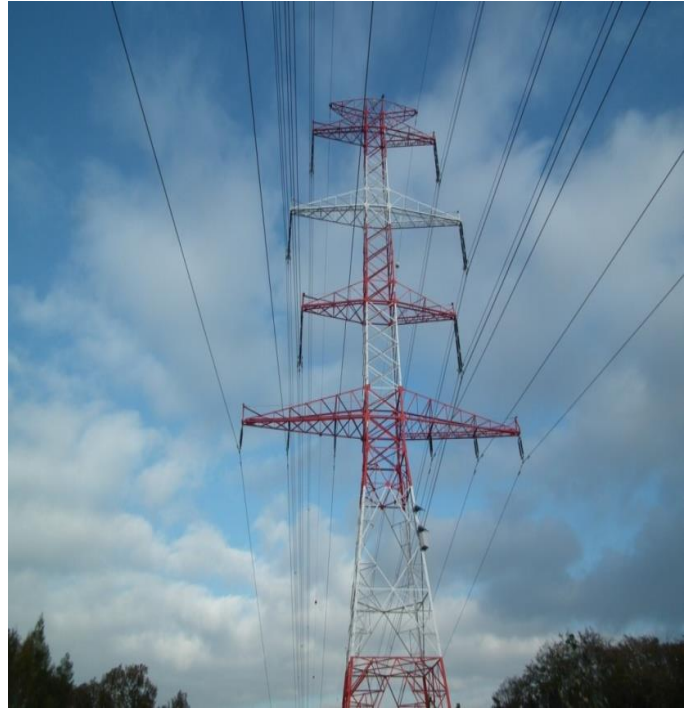


EMC measurement of electronic devices in un-echoing chamber



Biological sample measurement chamber

EM field measurement near multi system outer transmission line

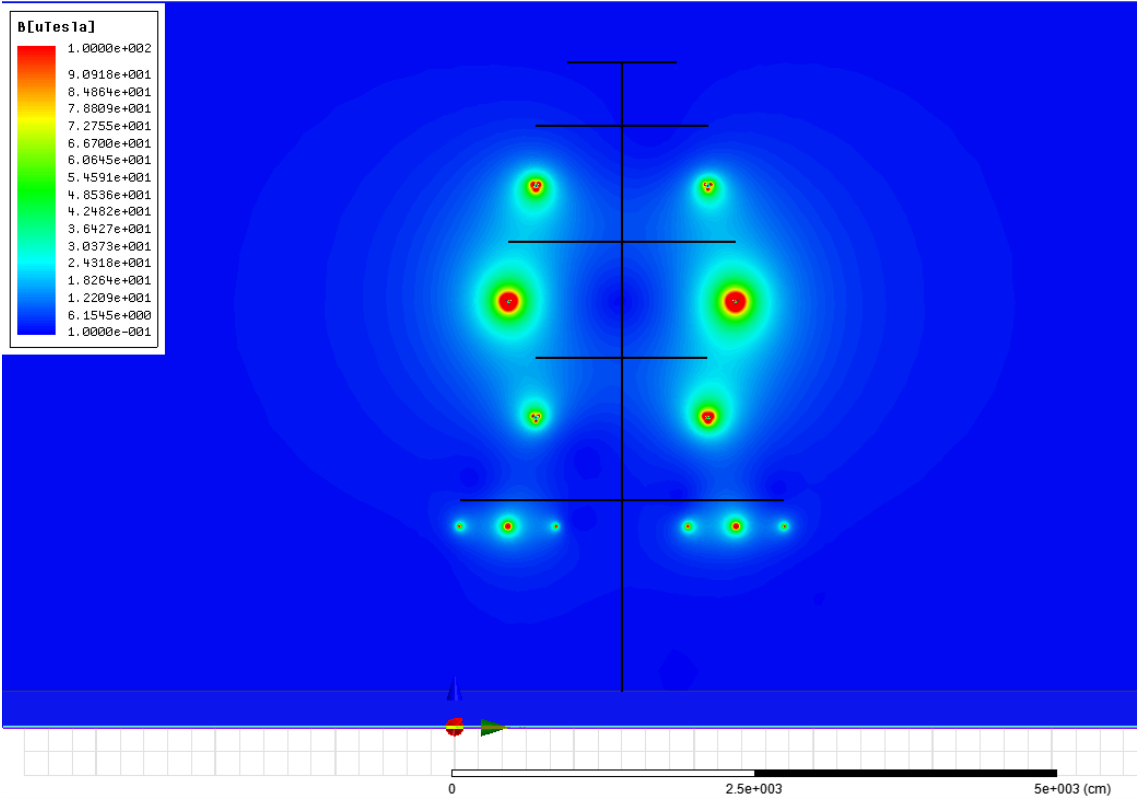


Outdoor measurement

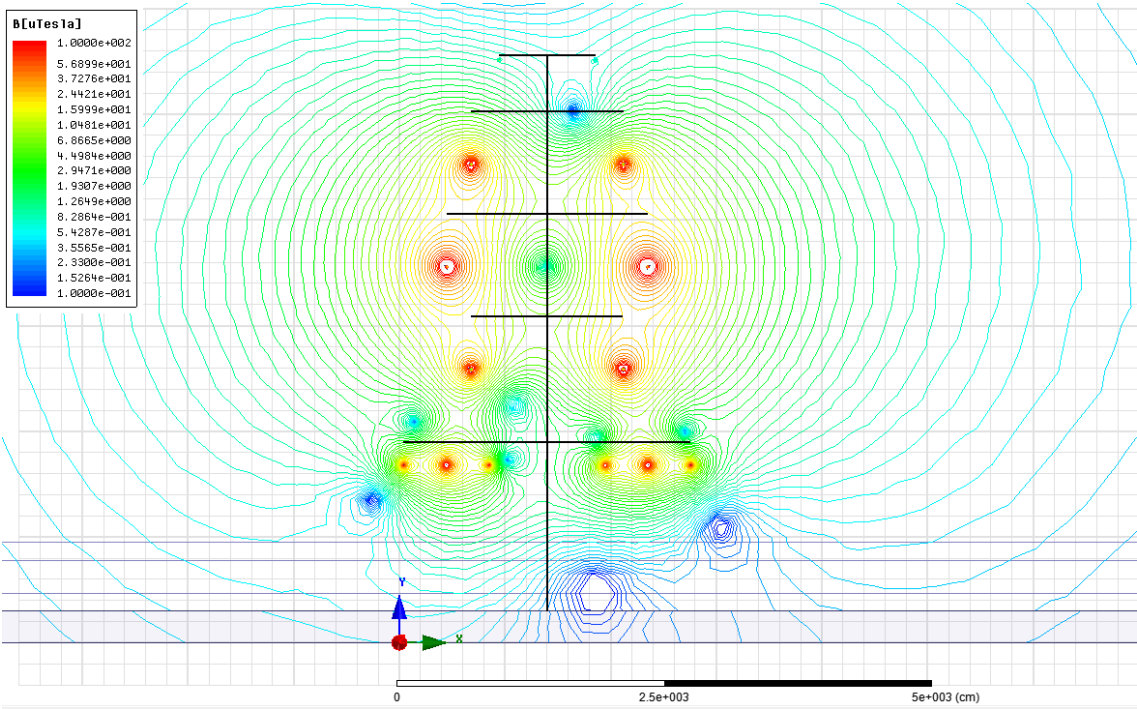


Gauss/Teslameter Model 8030 (on the left) with external sensor (on the right)

EM field modelling near multi system outer transmission line



Graphical display of magnetic induction near multi system outer transmission line



Induction force line distribution near multi system outer transmission line