Computational Electromagnetics Group

cem.elmag.org

Department of Electromagnetic Field
Faculty of Electrical Engineering
Czech Technical University in Prague
Czech Republic

Prague
February 23, 2024
CEM Group is a part of Department of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague.

Address:
Block B2, the 6th floor
CTU in Prague
Technicka 2
166 27 Prague
Czech Technical University in Prague

Established in 1707 as the first non-military technical university in Europe.

- From 12 students in 1707 to more than 20,000 students in 2018.

Left: Prague seen from the Old town bridge tower; right: Faculty of Electrical Engineering (one of the eight faculties of CTU in Prague).

You are welcome to visit us in Prague!
CEM Group was established around 2015 and consists of the following members:

- Miloslav Čapek (full professor)
- Lukáš Jelínek (assoc. professor)
- Vít Losenický (doctoral student)
- Jonáš Tuček (doctoral student)
- Jakub Liška (doctoral student)
- Vojtěch Neuman (doctoral student)
- Štěpán Bosák (doctoral student)
**Fundamental Bounds in Electromagnetism (EM)**

- Maximal focusing eff., bandwidth, etc.
- Various, trade-offs, ...

**Inverse Design Based on Topology Optimization**

- Optimal shapes, regularity constrains.
- Big-data and HPC.

**Modal Decomposition, Symmetries**

- Characteristic modes.
- Point group theory.
Electrically Small (Multiport) Antennas

- Capacity, MIMO, decoupling,
- Optimal excitation.

Degrees of Freedom in Electromagnetism

- Multi-functional devices.
- Model-order reduction.

Computational EM and Machine Learning

- EM code development.
- Advanced algorithms.
AToM — Antenna Toolbox for MATLAB

MATLAB toolbox developed and maintained by CEM Group.

- free licences (> 700)
- purchased licences (10)
- add-on ordered

www.antennatoolbox.com
CEM Group has an access to licenses of powerful commercial packages:

- Dassault CST Studio Suite
- AWR
- Comsol Multiphysics
- Altair FEKO
- Altium Designer
- Mathworks MATLAB
Collaboration

► With academia:

- Lund University
- Santa Clara University
- KU Leuven
- EPFL
- KTH
- Université Nice Sophia Antipolis
- Aalto University
- DTU
- Universidad de Sevilla

► With industry:

- RF Spin
- EXCEM
- Amazon
- ESI
Final Theses

Feel free to contact us if you are interested in writing a thesis in the field of:

- electromagnetic field theory,
- computational electromagnetics, code implementation,
- antennas, antenna arrays,
- optimization, numerical modeling,
- modal techniques, integral equations.

Theses are usually written in English, with foreign opponent, typeset in \LaTeX\.

Contact us at miloslav.capek@fel.cvut.cz or lukas.jelinek@fel.cvut.cz.

Postgraduate Studies

- CEM group has open Ph.D. positions, see here.
- A great chance to become a part of international team, participate on scientific projects, and collaborate with technological companies.

Two submitted doctoral theses published by the members of the CEM (click on the cover to get the full access).
Visiting Prague

Accommodation in the Vicinity of the University

Masaryk Dormitory operated by CTU in Prague

- Hotel and student dormitory.
- Great price to quality option.
- Applications for accommodation.

Hotel Diplomat

- A regular hotel for short-term visits.
- $\approx 160 \, €/night$, reservation system.
Visiting Prague

- Faculty building
- Student restaurants
- Restaurants
- Grocery shop
- Underground exits
- Accommodation

1. Entrance
2. Student restaurants
3. Restaurants
4. Grocery shop
5. Underground exits
6. Accommodation
Computational Electromagnetics (CEM)

About Us

CEM group concentrates on theoretical research in classical electromagnetic theory with an emphasis on the computational aspects. Currently developed topics include radiation properties of electrically small antennas and metamaterials, fundamental bioscience, and microwave design. Members of the group have for many years been also involved in classical antenna theory and field propagation in artificial materials.

Current research activities are strongly related to a “source coupling” paradigm, in which field observations operate over electromagnetic sources, which are then modelled at various levels in full-dimensional theories. The emphasis is placed on the development of rigorous computational codes based on this paradigm.

CEM group members often voice various topics for final projects and actively contribute to the library of tools related to classical and quantum electromagnetics, artiﬁcial materials, and numerical methods. The team frequently participates in workshops. We are users of MATLAB, LSTO, Beamet, and IN2.

Team Members

Miloš Drábek
Full professor
- Antenna theory
- Numerical methods
- Optimization
- MATLAB, LSTO, IN2

Lukáš Pelín
Associate professor
- Electromagnetic field theory
- Antenna theory
- Artificial electromagnetic materials

Vít Štěpánek
Ph.D. Student
- Electromagnetic field decomposition
- Method of moments

Jan Štěpán
Ph.D. Student
- Electromagnetic problems
- Convergent optimisation

Vojtěch Neuman
Ph.D. Student
- Method of moments

Jan Štěpán
Ph.D. Student
- Topology optimisation

Štěpán Štěpánek
Ph.D. Student
- Machine learning methods

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