

Miloslav Čapek

Curriculum Vitae (October 25, 2024)

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Full Professor at Czech Technical University in Prague

Scientific interests

Electromagnetic field theory, electrically small antennas, fundamental bounds, computational electromagnetics, numerical and optimization techniques, inverse design, HPC in MATLAB.

Education

- Dec. 2023 – **Full professor**, *Optimal Inverse Design in Electromagnetism and Its Effective Implementation*.
now Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
- June 2017 – **Associate professor**, *Source Concept Based Analysis and Synthesis of Small Radiating Structures*.
Nov. 2023 Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
- Nov. 2014 – **Assistant professor**.
May 2017 Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
- Sept. 2009 – **Philosophiæ doctor in Radioelectronics**, *Modal Analysis and Optimization of Radiating Planar Structures*.
July 2014 Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
- Sept. 2007 – **Master of Science in Telecommunication Engineering and Radioelectronics**, *Tools for modal analysis of fractal patch antennas (in Czech)*.
May 2009 Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
graduated summa cum laude
- Sept. 2004 – **Bachelor of Science in Electronics and Telecommunication Engineering**.
June 2007 Dept. of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic

Training

- August 2022 COMSOL Multiphysics course
- June 2017 Rhetoric course
- June 2015 Advanced course on Adobe Illustrator
- April 2012 Course of scientific computing on CUDA
- June 2010 European School of Antennas (ESoA) – Antennas for Mobile Communication
- March 2010 Course of HPC in Matlab

Scientific missions (three weeks and longer)

- Nov. 2021 **Lund University**, *Lund, Sweden*, prof. Gustafsson.
1-month stay on T-matrix extraction and decomposition of scattering dyadics into characteristic modes.
- Jan. 2020 – **Lund University**, *Lund, Sweden*, prof. Gustafsson.
- Feb. 2020 1-month stay on topology optimization and cloaking.

- Aug. 2018 – **Lund University**, *Lund, Sweden*, prof. Gustafsson.
 May 2019 9-months stay on antenna synthesis techniques, 70% workload in Lund, the rest in Prague.
- Jan. 2018 – **Lund University**, *Lund, Sweden*, prof. Gustafsson.
 March 2018 3-months stay on multi-criteria convex optimization in antenna theory.
- Sept. 2016 – **Lund University**, *Lund, Sweden*, prof. Gustafsson.
 Feb. 2017 6-months stay on fundamental bounds in antenna theory and electromagnetism.
- Aug. – Sept. **KU Leuven**, *Leuven, Belgium*, prof. Vandenbosch.
 2015 1-month stay on new procedure to evaluate stored electromagnetic energy in time domain.
- Sept. 2013 **KU Leuven**, *Leuven, Belgium*, prof. Vandenbosch.
 1-month stay on energy stored in electromagnetic field.

Computer skills

- Advanced MATLAB, \LaTeX , Beamer, TikZ, FEKO
 Intermediate Mathematica, CST-MWS, Adobe Illustrator, Camtasia
 Basic COMSOL Multiphysics, AWR Microwave Office, Spice

Languages

- | | | |
|---------|-----------------------|---------------------------|
| Czech | Native Speaker | |
| English | C1 | <i>Proficient speaker</i> |
| Germany | A2 | <i>Basic user</i> |

Pedagogical experience

- 2024 **Organizer & Lecturer**, *European School of Antennas*.
 Optimal Antennas: Performance Limits and Inverse Design (2024, Prague).
- 2024 **Instructor**, *Optimal Antennas: Operators, Limits, and Design*.
 Short course at EuCAP 2024, Glasgow (co-taught with Mats Gustafsson).
- 2023 **Instructor**, *Matrix Formalism for Optimal Computational Design*.
 Short course at IEEE APS/URSI 2023, Portland (co-taught with Mats Gustafsson).
- 2022 – 2023 **Instructor**, *Optimal Inverse Design of Antennas*.
 Short courses at IEEE APS/URSI 2022, Denver and EuCAP 2023, Florence (co-taught with Mats Gustafsson).
- 2022 **PostDoc supervision**, *Enrique Moreno*.
- 2022 – now **Lecturer and guarantor**, *CTU in Prague*, Course on computational algebraic systems (Code: A8B17CAS).
- 2013 – now **Lecturer and guarantor**, *CTU in Prague*, Course on MATLAB programming (Codes: B0B17MTB, BE0B17MTB).
 A course established from 2014+ with approx. 70-80 students every year (taught both semesters both in Czech and English).
- 2021, 2023 **Lecturer**, *European School of Antennas*.
 Characteristic modes: Theory and Applications (2021, Prague; 2023, Hannover).
- 2016 – now **Supervisor of Ph.D. students**, *CTU in Prague*, Six supervisions, two defended.
- 2012 – now **Supervisor of Diploma Theses**, *CTU in Prague*, Three B.Sc. and eight M.Sc. theses supervised.
 Students received two IEEE-MTT prizes for excellent Diploma Thesis, four Dean's prizes for excellent diploma thesis, and Poster Conference Award.
- 2010 – 2013 **Lecturer**, *CTU in Prague*.
 Six semesters of computational seminars in electromagnetic field theory and numerical methods at CTU-FEE.
- 2018 – now **Wiki & YT contributor**, *Science popularization*.
 Creation and maintenance of the Wikipedia web page on characteristic modes (link), extended YouTube talk (link).

Projects

Czech Science Foundation.

GA 24-11678S, GA 21-19025M (PI, 700k€+ budget), GA 19-06049S, GA 15-10280Y, GAP 102/12/2223, GD 102/08/H018

Technology Agency of the Czech Republic.

TH 04010373, TA 04010457 (PI, 600k€+ budget)

Ministry of Education Youth and Sports.

LTAİN 19047 (PI, 70k€+ budget), MSM 6840770014, OC 08018, LD 12055, FRVS G1/2470 (PI)

Czech Technical University in Prague.

SGS 10/170/OHK3/2T/13 (PI), SGS 11/065/OHK3/1T/13, SGS 12/142/OKH3/2T/13, RPAPS 2015 (PI), RPAPS 2020

European Cooperation in Science and Technology.

COST IC 0603 ASSIST, COST IC 1102 VISTA

Industry cooperation.

RF SPIN, Near-field scanning system (PI, 2022–2023),

Amazon US, AToM add-on evaluating fundamental bounds (PI, 2024, 40kUSD budget).

Invited talks and presentations

1. Capek, M.: "Upper Bound on Antenna Gain and Its Reachability," **Plenary talk**, *MRW 2024: 11th Microwave & Radar Week*, Wroclaw, Poland, July 2024.
2. Capek, M., Jelinek, L.: "Fundamental Bound on Maximum Antenna Gain as a Sum of Characteristic Modes," *The 17th European Conference on Antennas and Propagation*, Florence, Italy, March 2023.
3. Capek, M.: "Characteristic Modes for Antenna Analysis and Synthesis," **Plenary talk**, *The 15th European Conference on Antennas and Propagation*, Düsseldorf, Germany, March 2021.
4. Capek, M., Neuman, V., Tucek, J., Jelinek, L., Gustafsson, M.: "Topology Optimization of Electrically Small Antennas With Shape Regularity Constraints," *The 15th European Conference on Antennas and Propagation*, Düsseldorf, Germany, March 2021.
5. Capek, M., Jelinek, L., Masek, M.: "Fundamental Bounds for Multi-Port Antennas," *The 15th European Conference on Antennas and Propagation*, Düsseldorf, Germany, March 2021.
6. Capek, M., Jelinek, L., Gustafsson, M., Schab, K.: "Fundamental Bounds For Volumetric Structures and Their Feasibility," *The 14th European Conference on Antennas and Propagation*, Copenhagen, Denmark, April 2020.
7. Capek, M., Jelinek, L., Gustafsson, M., Losenicky, V.: "Fundamental Bounds on Dissipation Factor for Wearable and Implantable Antennas," *ICECOM 2019*, Dubrovnik, Croatia, 2019
8. Capek, M., Jelinek, L., Gustafsson, M., Losenicky, V.: "Topology Sensitivity in Method of Moments," *The 13th European Conference on Antennas and Propagation*, Krakow, Poland, April 2019.
9. Capek, M., Hazdra, P., Adler, V., Kadlec, V., Sedenka, V., Marek, M., Masek, M., Losenicky, V., Strambach, M., Mazanek, M., Rymus, J.: "AToM: A Versatile MATLAB Tool for Antenna Synthesis," *The 12th European Conference on Antennas and Propagation*, London, UK, April 2018.
10. Capek, M., Tayli, D., Akrou, L., Losenicky, V., Jelinek, L., Gustafsson, M.: "Accurate Evaluation of Characteristic Modes," *The 12th European Conference on Antennas and Propagation*, London, UK, April 2018.
11. Capek, M., Jelinek, L., Kadlec, P., Strambach, M.: "Excitation of Optimal and Suboptimal Currents," *The 11th European Conference on Antennas and Propagation*, Paris, France, 2017.
12. Capek, M., Masek, M., Hazdra, P.: "Some Numerical Aspects of Characteristic Mode Decomposition," *The 10th European Conference on Antennas and Propagation*, Davos, Switzerland, 2016.
13. Capek, M., Jelinek, L.: "On the Properties of Stored Electromagnetic Energy," *Progress in Electromagnetics Research Symposium*, Prague, Czech Republic, 2015.
14. Capek, M., Hazdra, P., Mazanek, M., Raida, Z., Rymus, J.: "The Antenna Toolbox for Matlab (AToM)," *The 9th European Conference on Antennas and Propagation*, Lisbon, Portugal, 2015.

15. Capek, M., Jelinek, L., Vandenbosch, G.A.E., Hazdra, P.: "A Novel Scheme for Stored Energy Evaluation," *The 9th European Conference on Antennas and Propagation*, Lisbon, Portugal, 2015.

Awards

- 2024 ESoA (European School of Antennas and Propagation) Best Teacher Award 2023
- 2023 IEEE Antennas and Propagation 2022 Edward E. Altshuler Prize Paper Award
- 2016 Dean's award for best teachers
- 2015 Josef Hlavka Award
- 2014 Werner von Siemens Excellence Award
- 2014 Dean's prize for excellent doctoral thesis
- 2014 COST VISTA best ER presentation
- 2013 Dean's award for best teachers
- 2009 IEEE-MTT/AP/ED/EMC prize for excellent diploma thesis
- 2009 Dean's prize for excellent diploma thesis

Overall scientific results

- Peer-reviewed journal papers (last 5 years): **31**
- Citations, WOS: **877 (586)**
- Citations, Scopus: **1072 (670)**
- Citations, Google Scholar: **1877 (—)**
- Conference proceedings papers (last 5 years): **50**
- H-index, WOS: **18**
- H-index, Scopus: **18**
- H-index, Google Scholar: **27**

Other scientific merits

- 2009 – now Architect and leading developer of the AToM toolbox, see antennatoolbox.com.
- 2015 – 2019 Associate Editor of Radioengineering.
- 2019 – now Associate Editor of IET Microwaves, Antennas & Propagation.
- 2023 – 2024 Guest editor of IEEE Open Journal of Antennas and Propagation (Small and Multiband Antennas for Wireless Communications), Special issue: *Modeling, analysis, and design methods for embedded antennas in IoT wireless devices*.
- 2015 – 2020 Delegate of EurAAP Association (Group 8).
- 2018 – 2020 Vice-chair of IEEE MTT/AP/ED/EMC joint-chapter (IEEE Czechoslovakia Section).
- 2019 – now Vice-chair of EurAPP Working group on Software and Modeling.
- 2012, 2016 Member of the organizing committee/TPC of European Conference on Antennas and Propagation.
- 2016 Member of Super Technical Program Committee of IEEE AP-S/URSI.
- 2015 – now Member of Technical Program Committee of student conference Poster.
- Affiliations Senior member of IEEE; member of IEEE-AP Soc., EurAPP, Radioengineering Soc.
Member of Special Interest Group on the Theory of Characteristic Modes (SIG).
- Referee work IEEE Transactions on Antennas and Propagation; IEEE Antennas and Wireless Propagation Letters; IEEE Antennas and Propagation Magazine; IEEE Access; IEEE Open Journal of Antennas and Propagation; IEEE Journal on Multiscale and Multiphysics Computational Techniques; Radioengineering; IEEE Transactions on Microwave Theory and Techniques; IEEE Journal on Selected Areas in Information Theory; IET Microwaves, Antennas, and Propagation; IET Science, Measurement and Technology; IET Electronics Letters; IET Signal Processing; Progress in Electromagnetic Research; FERMAT; Chinese Journal of Electronics, Radio Science; Wireless Communications and Mobile Computing; Scientific Reports; Communications Engineering. Reviewer of IEEE URSI/APS, EuCAP, iWAT, and MAREW conferences.
- Chairing Session organizer/chair/co-chair at PIERS2015, IEEE URSI/APS2017, EuCAP2017, EuCAP2018, EuCAP2019, EuCAP2020, EuCAP2021, EuCAP2022, EuCAP2023, IEEE URSI/APS2023, EuCAP2024.

2020 – now Member of Ph.D. Committees/Opponent (T. Michalek, CTU, 2020; N. Peitzmeier, Hannover Uni., 2021; M. Mirzaei, CTU, 2021; V. Grim, CTU, 2023; A. Tornese, CEA Leti).