

# Miloslav Čapek

*Curriculum Vitae* (June 17, 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   | <b>Native Speaker</b> |                           |
| English | <b>C1</b>             | <i>Proficient speaker</i> |
| Germany | <b>A2</b>             | <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 Bounds 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.

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## 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

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## Overall scientific results

- Peer-reviewed journal papers (last 5 years): **31**
- Citations, WOS: **774 (503)**
- Citations, Scopus: **1026 (634)**
- Citations, Google Scholar: **1731 (—)**
- Conference proceedings papers (last 5 years): **50**
- H-index, WOS: **17**
- H-index, Scopus: **18**
- H-index, Google Scholar: **25**

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## Other scientific merits

- 2009 – now Architect and leading developer of the AToM toolbox, see [antennatoolbox.com](http://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; 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).