David M. Cerna

Curriculum Vitae

pod vodárenskou věží 271/2 182 07 Prague,Czechia ⊠ dcerna@cs.cas.cz Born: 16. 05. 1986 ORCID ID: <u>0000-0002-6352-603X</u> Homepage: <u>www.cs.cas.cz/dcerna</u> Languages: English (Native), German (B1,ÖSD,ÖIF)

Education

- Apr. 2015 **PhD in Computer Science**, *TU Wien*, Vienna, Austria. Computational Proof Theory and automated deduction (Supervisor: Alexander Leitsch)
- Aug. 2010 Master of science, Computer Science, Rensselaer Polytechnic Institute (RPI), Troy, New York, USA.

Network security and Cryptography (Supervisor: Bülent Yener)

- May 2010 Bachelor of science, RPI, Troy, New York, USA, Mathematics.
- May 2010 Bachelor of science, RPI, Troy, New York, USA, Computer Science.

Funded Grant Proposals

- July 2022 **22-06414L**, (PANDAFOREST) Proof analysis AND Automated deduction FOr RE-June 2025 cursive STructures, <u>Hosts:</u> CAS ICS, Prague, Czechia, and Kurt Gödel Society, Vienna,
- Austria, Funding provided by FWF and GACR, Bilateral International Project. Funding: 395,000 Euros
- Aug. 2020 LIT-2019-7-YOU-213, (Math_{LP}) Learning to Prove by MATHematical Induction: Feb. 2023 Invariant Discovery Aided by Modern Machine Learning Technology, <u>Host:</u> RISC, JKU, Linz, Austria, Funding provided by Upper Austrian Government. Funding: 160,500 Euros
- Sep. 2021 CAS ICS outgoing Junior Researcher Fellowship, Three Month Research Visit,
- Dec. 2021 <u>Host:</u> University of Innsbruck, Austria, Funding provided by Czech Ministry of Education, Youth and Sports. Funding: 13,000 Euros

Employment History

- Sept. 2020 Scientist, Czech Academy of Science, Institute of Computer Science. Current <u>Details:</u> Tenure-track research position
- Aug. 2020 Principal Investigator, Research Institute for symbolic computation (RISC), Jo Feb. 2023 hannes Kepler University (JKU), Linz, Austria.
 <u>Details:</u> Leading the Math_{LP} project.
- Sept. 2018 Postdoc, Logic Technology for Computer Science Education (LOGTECHEDU).
- Aug. 2020 Institute for Formal Methods and Verification (FMV), JKU, Linz, Austria
- Mar. 2017 **Postdoc**, Generalization ALgorithms and Applications (GALA).
- Aug. 2018 RISC, JKU, Linz, Austria
- Feb. 2015 Postdoc, The Optimized Checking of Time-Quantified Logic Formulas with Applica-
- Mar. 2017 tions in Computer Security (LogicGuard II). RISC, JKU, Linz, Austria

Research Visits

- Nov. 2023 Andrew Cropper, University of Oxford, United Kingdom., 2 week visit funded by $Math_{LP}$.
- Sept.2023 Cezary Kaliszyk, University of Innsbruck, Innsbruck, Austria., 2 week visit funded Oct. 2023 by PANDAFOREST.
- May 2023 Bahareh Afshari, Imperial College London, United Kingdom, 3 week visit Gothenburg, Sweden, 3 week visit funded by PANDAFOREST and university of Gothenburg.
- Oct. 2022 **Daniel Nantes**, Imperial College London, United Kingdom, 1 week visit funded by $Math_{LP}$.
- Sept.2022 Andrew Cropper, University of Oxford, United Kingdom., 2 week visit funded by Oct. 2022 Math_{LP}.
- Sept.2021 Cezary Kaliszyk, University of Innsbruck, Innsbruck, Austria., Funded by the CAS Dec. 2021 ICS outgoing Junior Researcher Fellowship.
- Feb. 2018 Sorin Stratulat, University of Lorraine, Metz, France. Member of Calcul, graphes et logique research team at LITA, Visiting as part of the Erasmus+ HE Staff Mobility Agreement for teaching program.
- Feb. 2014 **Nicolas Peltier**, CNRS CAPP team Laboratory of Informatics of Grenoble, Visit part of the joint ASAP project.

Team Members

May 2023 – Raheleh Jalali, Czech Academy of Science, Institute of Computer Science, Prague,

June. 2025 Czechia, Postdoc funded by PANDAFOREST. Postdoc

May 2022 – **Michal Buran**, Research Institute of Symbolic Computation, JKU, Linz, Austria, Feb. 2023 Postdoc funded by $Math_{LP}$. Postdoc

Participation in Supervision (unofficial)

PhD students, Liao Zhang (2023-current, Advisor: Temur Kutsia & Mauricio Ayala-Rincón), Liao Zhang (2023-current, Advisor: Cezary Kaliszyk & Joseph Urban), Stanislaw J. Purgal (2021-2022, Advisor: Cezary Kaliszyk), Lee Barnett (2019–2020, Advisor: Armin Biere), Anela Lolic (2016–2019, Advisor: Alexander Leitsch).

Master students, Greog Schauberger (2019, Advisor: Martina Seidl), Andrea Condoluci (2016, Advisor: Alexander Leitsch).

Bachelor students, Simone Atzwanger (2020, Advisor: Martina Seidl).

Membership: Professional Organizations

Approaches and Applications of Inductive Programming, Invited to Participate:Oct. 29 - Nov. 03, 2023.

https://www.dagstuhl.de/23442

CLAIRE: Confederation of Laboratories for Artificial Intelligence Research in Europe, *Insitute Representative for CAS ICS within the CLAIRE Network of research laboratories.*

https://claire-ai.org/network/

EUROPROOFNET: European Research Network on Formal Proofs, Management Committee member representing Czechia, Cost action CA20111. https://www.cost.eu/actions/CA20111/

Invited Talks

- July 12th KIU Annual Conference on Math and Computer Science, Anti-unification 2023 and solution set types, Karakoram International University Gilgit-Baltistan, Tbilisi, Georgia.
- July 12^{th} KIU Annual Conference on Math and Computer Science, Inductive Logic 2022 Programming: the Basics, and Modern Approaches to Symbolic Learning, Karakoram International University Gilgit-Baltistan, Tbilisi, Georgia.
- Feb. 8^{th} - 12^{th} XIII Summer Workshop in Mathematics, Session on Theoretical Computer 2021 Science, University of Brasilia, Brasilia, Brazil.

Journal Publications

- June 2021 David M. Cerna, Alexander Leitsch, Anela Lolic, Schematic Refutations of Formula Schemata, Journal of Automated Reasoning volume 65, pages 599–645. DOI: https://doi.org/10.1007/s10817-020-09583-8
- Dec. 2020 David M. Cerna, Journal of Theoretical Computer Science (TCS), Anti-unification and the Theory of Semirings, Volume 848: 133-139. DOI: https://doi.org/10.1016/j.tcs.2020.10.020
- May 2020 David M. Cerna and Temur Kutsia, Mathematical Structures in Computer Science (MSCS), Higher-Order Linear Pattern Generalization with Unit and other theories, Volume 30, issue 6: 627-663. DOI: https://doi.org/10.1017/S0960129520000110
- Nov. 2019 David M. Cerna and Temur Kutsia, ACM Transactions in Computational Logic (TOCL), Idempotent Anti-Unification, Volume 21, issue 2:1-32. DOI: https://doi.org/10.1145/3359060
- Oct. 2017 David M. Cerna, Alexander Leitsch, Giselle Reis, and Simon Wolfsteiner, Annals of Pure and Applied Logic (APAL), Ceres in Intuitionistic Logic, Volume 168, number 10. DOI: https://doi.org/10.1016/j.apal.2017.04.001

Conference Publications

- 19th 25th, David M. Cerna, Temur Kutsia, Anti-unification and Generalization a Survey, August 2023 32st International Joint Conference on Artificial Intelligence, IJCAI-23, Survey Track. DOI: https://doi.org/10.24963/ijcai.2023/736
- 23th 29th, Stanislaw J. Purgal, David M. Cerna, Cezary Kaliszyk, Learning Higher-Order July 2022 Programs From Failures, 31st International Joint Conference on Artificial Intelligence, IJCAI-22. DOI: 10.24963/ijcai.2022/378
- $7^{th} 10^{th}$, David M. Cerna, A Special Case of Schematic Syntactic Unification, 23^{rd} Inter-
- Dec. 2021 national Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC 2021).

DOI: https://doi.org/10.1109/SYNASC54541.2021.00024

- June 29th David M. Cerna and Temur Kutsia, Unital Anti-Unification: Type and Al-July 6th, gorithms, 5th International Conference on Formal Structures for Computation and 2020 Deduction (FSCD 2020). DOI: https://doi.org/10.4230/LIPIcs.FSCD.2020.26
- June 29th Lee P. Barnett, David M. Cerna, Armin Biere, Covered Clauses Are Not July 6th, Propagation Redundant, 10th International Joint Conference Automated Reasoning 2020 (IJCAR 2020).

DOI: https://doi.org/10.1007/978-3-030-51074-9_3

- 15th-20th David M. Cerna, Martina Seidl, Wolfgang Schreiner, Wolfgang Wind-
- June 2020 steiger, Armin Biere, Aiding an Introduction to Formal Reasoning Within a First-Year Logic Course for CS Majors Using a Mobile Self-Study App, 25th Innovation and Technology in Computer Science Education (ITICSE 2020). DOI: https://doi.org/10.1145/3341525.3387409
- 2nd-4th David M. Cerna, Martina Seidl, Wolfgang Schreiner, Wolfgang Wind-
- May 2020 steiger, Armin Biere, Computational Logic in the First Semester of Computer Science: An Experience Report, 12th International Conference on Computer Supported Education (CSEDU 2020). DOI: https://doi.org/10.5220/0009464403740381
- 28th Feb. David M. Cerna and Rafael P.D. Kiesel and Alexandra Dzhiganskaya, 8th
 2020 International Workshop on Theorem proving components for Educational software (ThEdu 2019): Post-Proceedings (EPTCS 313), A Mobile Application for Self-Guided Study of Formal Reasoning. DOI: https://doi.org/10.4204/EPTCS.313.3
- 24th-30th David M. Cerna and Temur Kutsia, A Generic Framework for Higher-Order
- June 2019 Generalizations, 4th International Conference on Formal Structures for Computation and Deduction (FSCD 2019).
 DOI: https://doi.org/10.4230/LIPIcs.FSCD.2019.10
- 9th-12th David M. Cerna and Temur Kutsia, Higher-Order Equational Pattern Anti-
- July 2018 Unification, 3rd International Conference on Formal Structures for Computation and Deduction (FSCD 2018). DOI: https://doi.org/10.4230/LIPIcs.FSCD.2018.12
- 25th-28th **David M. Cerna and Michael Lettmann**, Integrating a Global Induction Mecha-Sep. 2017 nism into a Sequent Calculus, 26th International Conference on Automated Reasoning with Analytic Tableaux and Related Methods (Tableaux 2017). DOI: https://doi.org/10.1007/978-3-319-66902-1_17
- 21th-24th David M. Cerna and Michael Lettmann, Towards a Clausal Analysis of Proof
- Sep. 2017 Schemata, 19^th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC 2017). DOI: https://doi.org/10.1109/SYNASC.2017.00029
- 6th-9th David M. Cerna and Wolfgang Schreiner, Measuring the Gap: Algorithmic
 Apr. 2017 Approximation Bounds for the Space Complexity of Stream Specifications, 8th International Symposium on Symbolic Computation in Software Science (SCSS 2017).
 DOI: https://doi.org/10.29007/t3jg
- 23th-30th David M. Cerna, Wolfgang Schreiner, and Temur Kutsia, Predicting Space
- Sep. 2016 Requirements for a Stream Monitor Specification Language, 16th International Conference on Runtime Verification (RV 2016). DOI: https://doi.org/10.1007/978-3-319-46982-9_9

June 27th– **David M. Cerna and Alexander Leitsch**, Schematic Cut elimination and the July 2th 2016 Ordered Pigeonhole Principle, 8th International Joint Conference Automated Reasoning (IJCAR 2016).

 $\label{eq:doi.org/10.1007/978-3-319-40229-1_17} \text{DOI: https://doi.org/10.1007/978-3-319-40229-1_17}$

28th-30th **David M. Cerna, Wolfgang Schreiner, and Temur Kutsia**, Space Analysis of Mar. 2016 a Predicate Logic Fragment for the Specification of Stream Monitors, 7th International Symposium on Symbolic Computation in Software Science (SCSS 2016). DOI: https://doi.org/10.29007/jnj2

7th-12th **David M. Cerna**, A tableau based decision procedure for multi-parameter proposi-July 2014 tional schemata, Conferences on Intelligent Computer Mathematics (CICM 2014).

DOI: https://doi.org/10.1007/978-3-319-08434-3 6

Preprints

David M. Cerna, Recursive First-order Syntactic Unification Modulo Variable Classes.

DOI: https://doi.org/10.48550/arXiv.2306.09152

David M. Cerna, Andrew Cropper, Generalisation Through Negation and Predicate Invention.

DOI: https://arxiv.org/abs/2301.07629

David M. Cerna, Michal Buran, One or Nothing: Anti-unification over the Simply-Typed Lambda Calculus.

DOI: arxiv.org/abs/2207.08918

Stanislaw J. Purgal, David M. Cerna, Cezary Kaliszyk, Differentiable Inductive Logic Programming in High-Dimensional Space. DOI: arxiv.org/abs/2208.06652

Teaching Experience

Spring Assistant Lecturer, Formal Methods and Specification, Czech Technical University 2021–2023 Prague, Leading Exercise session, Lectures on Inductive Logic Programming.

- Oct. 2021 **Guest Lecturer**, Introduction to Answer Set Programming, University of Innsbruck, Special lecture on Answer Set Programming.
- Dec. 2020 **Guest Lecturer**, *Introduction to Mathematical Logic*, Czech Technical University Prague, Special lecture on automated deduction and formalization of mathematics.
- Winter 2019 Assistant Lecturer, Introduction to Logic, Johannes Kepler University, Linz, Austria, First semester course on formal reasoning, and problem encoding using SAT and SMT. Approximately 300 students.
- Spring 2019 Lecturer, Mathematical Logic II, Johannes Kepler University, Linz, Austria, Selected topics in Mathematical logic such as consistency of Arithmetic as proven by Gentzen.
- Spring 2019 Lecturer, Arithmetic, Recursion, and Types, Johannes Kepler University, Linz, Austria, Introduction to fundamental logical calculi, formal arithmetic, basic recursion theorem, Curry-Howard Isomorphisms for simple and polymorphic types.

Spring Lecturer, Practical software technology, Johannes Kepler University, Linz, Austria,

2016–2017 Course topics include the Java programming language, object oriented programming and data structures.

- Spring 2010 **Teaching Assistant**, *Data Structures and Algorithms*, R.P.I, Troy, New York, USA, Core computer science course on Data Structures and Algorithms. Programming assignments in C++.
- Winter 2009 **Teaching Assistant**, Introduction to Artificial Intelligence, R.P.I, Troy, New York, USA, Elective course introducing artificial intelligence and machine learning.
- Winter 2008 **Teaching Assistant**, *Network Security I*, R.P.I, Troy, New York, USA, Elective course introducing cryptography and network security.

Professional service

Journal Reviewer, Journal of Logic and Computation, Journal of Symbolic Computation, Mathematical Structures in Computer Science, Information Processing Letters, Annals of Mathematics and Artificial Intelligence, Data Mining and Knowledge Discovery, Journal of Automated Reasoning, Journal of Artificial Intelligence Research, Archive of Mathematical Logic.

- Aug 2024 **PC**, 10th International Symposium on Symbolic Computation in Software Science, Tokyo, Japan.
- Apr 2024 Artifact Evaluation Committee, 30th International Conference on Tools and Algorithms for the Construction and Analysis of Systems, Luxembourg City, Luxembourg.
- Oct 2023 **PC**, 3rd International Workshop on Explainable and Interpretable Machine Learning, Krakow, Poland, Joint with ECAI 2023.
- Sept 2023 **PC**, 3rd International Workshop on Automated Reasoning with Connection Calculi, Prague, Czechia, Joint with Tableaux 2023.
- Apr 2023 **Chair**, Workshop on Datasets Generation for Data-Deficient Domains $(DG4D^3)$, Prague, Czechia, EUROPROOFNET Workshop.
- July 2023 Co-organization Chair, Workshop on Logical and Semantic Frameworks, with Applications (LSFA), Rome, Italy.
- July 2023 **PC**, International Workshop on Theorem Prover Components for Educational Software (ThEdu'21), Rome, Italy.
- July 2023 PC, International Workshop on Unification (UNIF 23), Rome, Italy.
- Oct. 2023 PC, European Conference on Artificial Intelligence (ECAI), Krakow, Poland.
- 2022–2026 **Steering Committee**, International Workshop on Unification theory, https://www.irif.fr/ treinen/unif/.
- July 2023 **PC**, International Workshop on Theorem Prover Components for Educational Software (ThEdu'22), Rome, Italy.
- Aug. 2022 Co-Chair, 36th International Workshop on Unification (UNIF 22), Haifa, Israel. https://www.cs.cas.cz/unif-2022/
- Aug. 2022 PC, International Workshop on Theorem Prover Components for Educational Software (ThEdu'22), Haifa, Israel.
- Sept. 2022 PC, 15th Conference on Intelligent Computer Mathematics (CICM 22), Tibilisi, Georgia.
- Sept. 2021 PC, International Symposium on Symbolic Computation in Software Science (SCSS 21), Linz, Austria.
- july 2021 PC, International Workshop on Unification (UNIF 21), Buenos Aires, Argentina.

- july 2021 **PC**, International Workshop on Theorem Prover Components for Educational Software (ThEdu'21), Pittsburgh, USA.
- June 2020 **PC**, International Workshop on Theorem Prover Components for Educational Software (ThEdu'20), Paris, France.
- March 2020 **PC**, ACM Special Interest Group on Computer Science Education Technical Symposium (SIGCSE), paper track: CS-Education Research, Portland, USA.
 - Jan 2020 PC, 11th International Conference on Applied Informatics (ICAI), Eger, Hungary.
 - June 2019 PC, International Workshop on Structures and Deduction, Dortmund, Germany.

Contributed Talks

- July 2 2023 Andrés Felipe González Barragán, David Cerna, Mauricio Ayala-Rincón and Temur Kutsia, 37th International Workshop on Unification, Abstract, On Antiunification in Absorption Theories. Rome, Italy
- Nov. 12 2022 David Cerna, Alexander Leitsch, Anela Lolic, Workshop of the Proof Society, Abstract, PANDAFOREST: Proof analysis and automated deduction for recursive structures.

Utrecht, The Netherlands

- Sept. 30 David Cerna, Cezary Kaliszyk and Stanislaw Purgal, 2nd International Joint
 2022 Conference on Learning & Reasoning (IJCLR), Recently Published Track, Learning
 higher-order logic programs from failures..
 Cumberland Lodge, United Kingdom
- Sept. 8 2022 **David Cerna, Cezary Kaliszyk and Stanislaw Purgal**, 7th Conference on Artificial Intelligence and Theorem Proving, Abstract, Sifting through a large hypothesis space: Revisiting differentiable learning through satisfiability. Aussois, France
 - August 12 Chad Brown, David M. Cerna, 36th International Workshop on Unification, Ab 2022 stract, Higher-Order Unification with Definition by Cases.
 Haifa, Israel
- july 18 2021 **David M. Cerna**, 35th International Workshop on Unification, Abstract, When First-order Unification Calls itself. Buenos Aires, Argentina
 - Oct. David M. Cerna, Proof Theory for Automated Deduction, Automated Deduction
 - 23th-25th for Proof Theory, Abstract, An ordering for flexible and finite representation of infinite
 2019 sequences of proofs.
 - University of Vienna, Vienna, Austria
 - July **David M. Cerna & Anela Lolic**, Kurt Gödel's Legacy: Does Future lie in the $25^{th}-27^{th}$ Past?, Abstract, On Herbrand's Theorem.
 - 2019 University of Vienna, Vienna, Austria
 - Apr. David M. Cerna, Artificial Intelligence and Theorem Proving (AITP) 2019, Abstract,
 - $7^{th}\text{-}12^{th}$ Towards A New Type of Prover: On the Benefits of Discovering Sequences of "Related" 2019 Proofs .
 - University of Innsbruck, Obergurgl, Austria
 - Sept. David M. Cerna, First Workshop of the Proof Society, Abstract, A Formalism for
 - 6^{th} - 7^{th} Proof Transformation in the Presence of Induction.
 - 2018 University of Ghent, Ghent, Belgium

- July **David M. Cerna**, Workshop on Proof, Computation, Complexity, Extended Ab-19th-20th stract, Proof Schema and the Refutational Complexity of their Cut Structure.
- 2018 Hausdorff institute mathematics Bonn, Germany
 - July David M. Cerna and Michael Lettmann, Programming And Reasoning on Infi-
 - $7^{th}-8^{th}$ nite Structures, Extended Abstract, Towards the Automatic Construction of Schematic 2018 Proofs.
 - FLOC 2018, Oxford England
 - July David M. Cerna and Temur Kutsia, 32nd International Workshop on Unification,
 - 7th Extended Abstract, Towards Generalization Methods for Purely Idempotent Equational2018 Theories.

FLOC 2018, Oxford England

- June David M. Cerna and Temur Kutsia, Arbeitstagung Allgemeine Algebra (AAA)
- 1^{st} - 3^{rd} 96, Presentation, Term Generalization for Idempotent Equational Theories.
 - 2018 Darmstadt, Germany
 - Oct. Conference on Challenges of Identifying Integer Sequences, Poster, Integer
 - 9^{th} Sequences, Recursive Cut Elimination and Combinatorics.
 - 2014

Media Presence

Nov. 4th Interview for Radiokolleg Ö1 ORF, Logic Puzzles: History and use in Education,
 2019 Journalist: Mariann Unterluggauer.