

Marek Kaluba, PhD

I solve problems other people can't.

Passionate about bridging advanced mathematics, computational techniques, and software engineering to solve complex problems in data science, optimization, and scalable computing.

Experienced in teaching, mentoring, and collaborating with international teams across domain boundaries.

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PROFESSIONAL EXPERIENCE

Research Scientist

APRIL 2021 - MARCH 2024, Karlsruhe Institute of Technology, GERMANY

Project Lead: secured and managed funding for a federal research project. Oversaw research directions, budget allocation, and team coordination.

Demonstrated expertise in software design and development by transforming research software into reusable, high-quality libraries. Published in high-impact journals, demonstrating expertise in problem-solving.

Visiting Professor

APRIL 2022 - SEPTEMBER 2022, Heidelberg University, GERMANY

Designed and taught a specialized course *Computational Group Theory*, focused on algorithms, data structures and practical computational complexity.

Research Software Engineer

JANUARY 2019 - MARCH 2021, Technical University Berlin, GERMANY

Conducted research on approximate convex hulls with applications to AI and machine learning e.g. attacks on auto-encoder networks.

Designed and developed Polymake.jl, an interface to a complex templated C++ library for computational geometry.

Visiting Professor

NOVEMBER 2018 - FEBRUARY 2019, Tokyo University of Science, JAPAN

Designed and taught a course on convex optimization, emphasizing applications in algebra and rigorous computation.

Assistant Professor

OCTOBER 2015 - NOVEMBER 2017, Polish Academy of Science, POLAND

OCTOBER 2014 - MARCH 2021, Adam Mickiewicz University, POLAND

Project Lead: secured and managed a scientific grant focused,

TECHNICAL SKILLS

Convex optimization

Algebraic modeling

Rigorous computation

Julia (expert)

Python (advanced)

C/C++ and Rust (beginner)

Domain knowledge translation

Problem solving

Critical thinking

DevOps (git, CI, advanced)

Linux environment (expert)

Metaprogramming (expert)

Performance tuning (advanced)

GPGPU (beginner)

SOFT SKILLS

Teaching and mentoring

professional writing, lecturing, and leadership – see Supervision of students and Other skills

Teamwork

collaborative research with multiple multicultural parties, stakeholders and contractors

Professional attitude

appreciation of feedback, flexibility, and assertiveness in hierarchical organizations

Work ethic

overseeing research direction, budget allocation, and team collaboration to achieve project milestones. Coordinated research, and software development cycle for internal and external softwares.

The project received the highest possible evaluation marks of the National Science Foundation.

SELECTED SOFTWARE PROJECTS (Author or Main Contributor)

SCS.jl – Main contributor & Maintainer

560 downloads monthly

Developed an interface for SCS conic solver written in modern C, improving accessibility for large-scale optimization.

SymbolicWedderburn.jl – Designer & Main contributor

70 downloads monthly

Created symbolic and matrix-free tools for the simplification of semidefinite optimization, enabling solutions for massive problems.

ArbLib.jl – Designer & Main contributor

160 downloads monthly

Meta-programmed a thin, efficient wrapper around F. Johansson's Arb library for certified computation.

Polymake.jl – Designer

340 downloads monthly

Built a Julia interface to a complex templated C++ library *polymake*, leveraging C++, perl and julia metaprogramming capabilities.

SUPERVISION, TEACHING & ORGANIZATION

- 2 promoted PhD students
- 1 promoted MSc student
- 10+ led seminars at PhD level
- 3 taught courses at PhD level
- 7 taught courses at MSc level
- 20+ taught courses at BSc level
- 5 taught courses for Computer Science students
- 7 taught courses for Biology, Geo-sciences, Cognitive sciences students
- 3 international conferences organized
 - KPA70, 2020 — *The main organizer* (online, 50+ participants from 5 different time-zones)
 - Glances@Manifolds, 2018 — *Organizational committee* (offline, 100+ participants from all of the world)
 - Glances@Manifolds, 2016 — *Organizational committee* (offline, 100+ participants from all of the world)

scientific integrity

Intercultural fluency

professional experience in countries in the EU, India, Japan, and the US

LANGUAGES (CEFR)

English (C2)

German (B2, Telc)

Polish (C2, native)

OTHER SKILLS

Certified Yoga Teacher (300h YA)

Rock Climbing Instructor and Paragliding Pilot (IPPI 4)

Graduated Pianist and Traditional Woodworking Hobbyist

Curious Photographer and Keen Sailor

AWARDS

Frontiers of Science at International Congress for Basic Science

AUGUST 2023, Beijing, CHINA

Recognized for solving a 50-year mathematical problem by bridging mathematical theory and applied optimization.

EDUCATION

Adam Mickiewicz University — Doctor of Mathematics

OCTOBER 2010 - JUNE 2014, Poznań, POLAND

Adam Mickiewicz University — Master of Mathematics

SEPTEMBER 2005 - JUNE 2010, Poznań, POLAND

SELECTED PUBLICATIONS

On Kazhdan's property (T) for $\text{Aut}(F_n)$ and $\text{SL}_n(\mathbb{Z})$

Annals of Mathematics, 193 No. 2, 539-562. doi: 10.4007/annals.2021.193.2.3

Joint with D. Kielak and P.W. Nowak, arXiv:1812.03456

$\text{Aut}(F_5)$ has Kazhdan's property (T)

Math. Annalen, 375 (2019), 1169-1191 doi: 10.1007/s00208-019-01874-9

Joint with P.W. Nowak and N.Ozawa, arXiv:1712.07167

Certifying numerical estimates of spectral gaps

Groups Complexity Cryptology, 10 No. 1 (2018), 33-41 doi: 10.1515/gcc-2018-0004

Joint with P.W. Nowak, arXiv:1703.09680

Polymake.jl: A New Interface to polymake

Mathematical Software – ICMS 2020, 12097, 377 - 385.

doi: 10.1007/978-3-030-52200-1_37

Joint with B. Lorenz and S. Timme, arXiv:2003.11381