Rizeng Chen

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Education

Peking University Beijing, China
School of Mathematical Sciences Sept. 2021 - Present

- Ph.D. in Mathematics

Beihang University Beijing, China
Hua Loo-keng Honorary Class, School of Mathematics Sciences Sept. 2017 - June 2021

- B.Sc in Mathematics

Teaching

As **Teaching Assistant** in **Peking University**

- **Advanced Algebra II** (**2022 Spring**, **2023 Spring**, **2024 Spring**), School of Mathematical Sciences
  I graded the exercises and exam papers. I also taught lessons about problem solving on advanced algebra.
- **Linear Algebra C** (**2021 Fall**), School of Mathematical Sciences
  I graded the exercises and exam papers.

Research Interests

- **Computational Algebraic Geometry** (Especially Computational Real Algebraic Geometry)
- **Symbolic Computation**
- **Computability** of Mathematical Theory

Publications

- **Chen, R.**, & Xia, B. Reduction of Transcendental Decision Problems over the Reals. *In Proceedings of the 2024 International Symposium on Symbolic and Algebraic Computation* (pp. 56-64).
  This paper shows that reduction can be widely performed in a class of problems called "Trigonometric Extension", which generalizes our previous result. Some new decidability results, including a special kind of reachability problem, are derived from the reduction (conditional on Schanuel's Conjecture).
- **Chen, R.** (2023, November). Geometric Fiber Classification of Morphisms and a Geometric Approach to Cylindrical Algebraic Decomposition. *arXiv preprint arXiv:2311.10515.*
  This paper is about the geometry behind the cylindrical algebraic decomposition (CAD, a classical construction in real algebraic geometry). We show that this construction is related to the geometric fiber cardinality classification in algebraic geometry and present a new algorithm for CAD.
  Slogan: Understanding something $\mathbb{C}$omplex is the beginning of knowing it for $\mathbb{R}$eal (pun intended).
- **Chen, R.**, & Xia, B. (2023, July). Deciding first-order formulas involving univariate mixed trigonometric-polynomials. *In Proceedings of the 2023 International Symposium on Symbolic and Algebraic Computation* (pp. 145-154).
  This paper is about the computability of the first-order theory of univariate mixed trigonometric-polynomials. We prove that this theory is surprisingly unconditionally decidable and a decision algorithm is proposed in the paper.

- **Chen, R.**, Li, H., Xia, B., Zhao, T., & Zheng, T. (2024). Isolating all the real roots of a mixed trigonometric-polynomial. *Journal of Symbolic Computation*, 121, 102250.
  This paper is about a real root isolation algorithm for rational univariate mixed trigonometric-polynomials.

Misc.

- I enjoy coding. The algorithms in my papers are all implemented and the code can be found at my GitHub page.
- I used to participate in competitive programming before entering university, but that was long ago.
- I like cats.