

Rizeng Chen

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EDUCATION

Peking University (PKU)

School of Mathematical Sciences

Beijing, China

Sept. 2021 - Present

- Ph.D. in Mathematics

Beihang University (BUAA)

Hua Loo-keng Honorary Class, School of Mathematics Sciences

Beijing, China

Sept. 2017 - June 2021

- B.Sc in Mathematics

TEACHING

As Teaching Assistant in Peking University

- **Advanced Algebra II (2022 Spring, 2023 Spring, 2024 Spring, 2025 Spring)**, School of Mathematical Sciences
I graded the exercises and exam papers. I also taught the tutoring sessions.
- **Linear Algebra C (2021 Fall)**, School of Mathematical Sciences
I graded the exercises and exam papers.

RESEARCH INTERESTS

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

PUBLICATIONS

Papers are listed in chronological order.

1. **Chen, R.** (2025, February). What Kind of Morphisms Induces Covering Maps over a Real Closed Field? *arXiv preprint arXiv:2502.05834*.
This paper proposes a new family of morphisms between varieties, namely the q -étale morphisms (= flat + locally constant geometric fibers). It is shown in the paper that q -étale morphisms become finite étale after reduction, therefore induce covering maps on the real points for real varieties.
2. **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).

3. **Chen, R.** (2023, November). A Geometric Approach to Cylindrical Algebraic Decomposition. *Mathematics of Computation*, (to appear in print)

This paper is about the geometry behind the cylindrical algebraic decomposition (CAD, a classical construction in real algebraic geometry). We discovered a link between real and complex algebraic geometry: for a finite free morphism of real varieties, the geometric fiber size (geometric property) decides the existence of semi-algebraic continuous sections (semi-algebraic property). From the link, a new algorithm for CAD that can exploit all equations is developed. The new algorithm largely outperforms the existing methods.

Slogan: Understanding something Complex is the beginning of knowing it for \mathbb{R} Real (pun intended).

4. **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.

5. **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 going to university, but that was long ago.
- I like cats.