

A Course in Real Algebraic Geometry

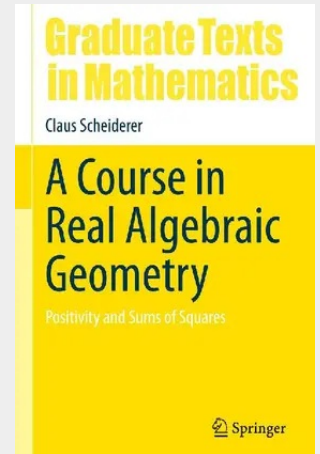
Positivity and Sums of Squares

This textbook is designed for a one-year graduate course in real algebraic geometry, with a particular focus on positivity and sums of squares of polynomials.

The first half of the book features a thorough introduction to ordered fields and real closed fields, including the Tarski–Seidenberg projection theorem and transfer principle. Classical results such as Artin's solution to Hilbert's 17th problem and Hilbert's theorems on sums of squares of polynomials are presented in detail. Other features include careful introductions to the real spectrum and to the geometry of semialgebraic sets. The second part studies Archimedean positivstellensätze in great detail and in various settings, together with important applications. The techniques and results presented here are fundamental to contemporary approaches to polynomial optimization. Important results on sums of squares on projective varieties are covered as well. The last part highlights applications to semidefinite programming and polynomial optimization, including recent research on semidefinite representation of convex sets.

Written by a leading expert and based on courses taught for several years, the book assumes familiarity with the basics of commutative algebra and algebraic varieties, as can be covered in a one-semester first course. Over 350 exercises, of all levels of difficulty, are included in the book.

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