Understanding, finding, or even deciding on the existence of real solutions to a system of equations is a difficult problem with many applications outside of mathematics. While it is hopeless to expect much in general, we know a surprising amount about these questions for systems which possess additional structure often coming from geometry.

This book focuses on equations from toric varieties and Grassmannians. Not only is much known about these, but such equations are common in applications. There are three main themes: upper bounds on the number of real solutions, lower bounds on the number of real solutions, and geometric problems that can have all solutions be real. The book begins with an overview, giving background on real solutions to univariate polynomials and the geometry of sparse polynomial systems. The first half of the book concludes with fewnomial upper bounds and with lower bounds to sparse polynomial systems. The second half of the book begins by sampling some geometric problems for which all solutions can be real, before devoting the last five chapters to the Shapiro Conjecture, in which the relevant polynomial systems have only real solutions.
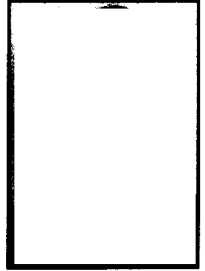
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