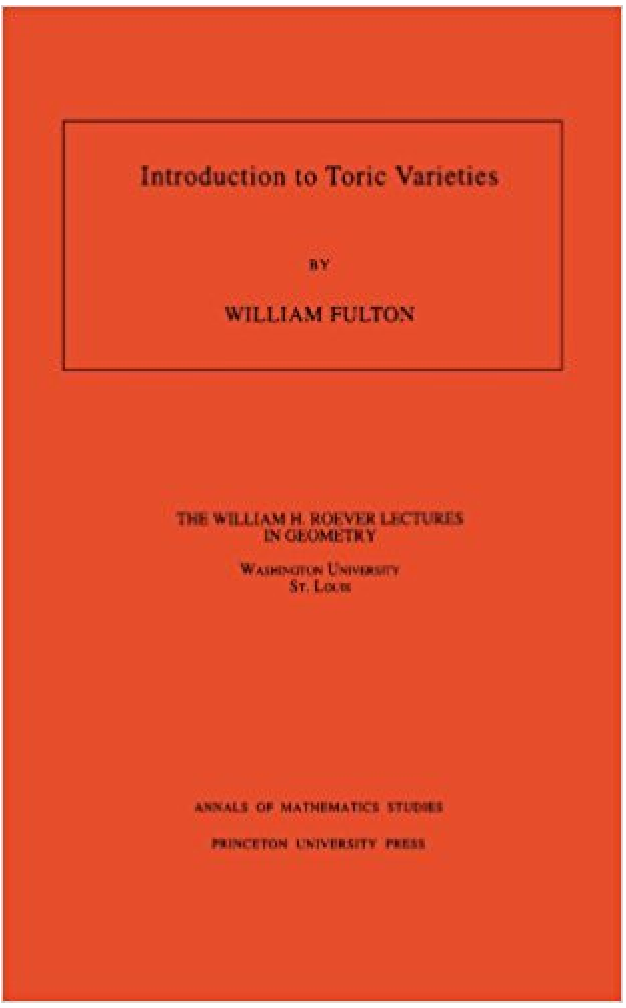
Introduction To Toric Varieties. (AM-131)



Synopsis

Toric varieties are algebraic varieties arising from elementary geometric and combinatorial objects such as convex polytopes in Euclidean space with vertices on lattice points. Since many algebraic geometry notions such as singularities, birational maps, cycles, homology, intersection theory, and Riemann-Roch translate into simple facts about polytopes, toric varieties provide a marvelous source of examples in algebraic geometry. In the other direction, general facts from algebraic geometry have implications for such polytopes, such as to the problem of the number of lattice points they contain. In spite of the fact that toric varieties are very special in the spectrum of all algebraic varieties, they provide a remarkably useful testing ground for general theories. The aim of this mini-course is to develop the foundations of the study of toric varieties, with examples, and describe some of these relations and applications. The text concludes with Stanley's theorem characterizing the numbers of simplicies in each dimension in a convex simplicial polytope. Although some general theorems are quoted without proof, the concrete interpretations via simplicial geometry should make the text accessible to beginners in algebraic geometry.

Book Information

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Customer Reviews

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Anyone who needs a concrete set of examples from the set of general algebraic varieites will find them in toric varieties. The definitions and resulting constructions of toric varieties satisfy the need for an intuitive understanding of varieties. In addition, toric varieties are the easiest collection of varieties to manipulate from the standpoint of computational-geometric algorithms. Toric varieties also have applications to various areas of mathematical physics, such as in mirror symmetry. Indeed, the case of toric varieties is one of the few examples where an explicit mirror can be found.Fulton gives an excellent overview of toric varieties in this short book, and the reading is fairly easy going. He introduces toric varieties in the first chapter as objects originating from compactification studies, with projective n-space the natural example as a compactification of complex n-space. It is their definition in terms of fans in lattices however that permeates chapter one. The author's treatment is very understandable, and he does not hesitate to use many diagrams and figures to illustrate the concepts. This is followed by a consideration of compactness and resolution of singularities. The example given of the resolution of a two-dimensional toric singularity is done, interestingly, via Hirzebruch-Jung continued fractions. A taste of the algebraic topology of toric varieties is given in the next chapter, where the fundamental groups and Euler characteristics are calculated, along with the cohomology of line bundles over toric varieties. More of this follows in the next chapter, where a statement and proof of Serre duality is given, along with a calculation of Bott numbers. The most interesting results are in the last chapter of the book on intersection theory. Because of the intuitive nature of toric varieties, one can see the very abstract constructions of algebraic geometry take on a concrete form. I think one can appreciate the more abstract constructions in algebraic geometry if the more concrete examples are studied first. This is especially true for those seeking to apply these ideas, for example physicists, who must grasp them quickly and efficiently.This book should give readers sufficient insight into the subject to move on to applications or to more advanced treatments of toric varieties or algebraic geometry.

This is the Math book I needed, and in the right condition (like new), and the price is better then in a store

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