COMPUTING GRÖBNER FANS OF TORIC IDEALS

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ABSTRACT. The monomial initial ideals of a graded polynomial ideal are in bijection with the vertices of a convex polytope known as the state polytope of the ideal. The Gröbner fan of the ideal is the normal fan of its state polytope. In this paper we present a software system called TiGERS (Toric Gröbner bases Enumeration by Reverse Search) for computing the Gröbner fan of a toric ideal by enumerating the edge graph of its state polytope. The key contributions are an inexpensive algorithm for local change of Gröbner bases in toric ideals and the identification of a reverse search tree on the vertices of the state polytope. Using these ideas we obtain a combinatorial Gröbner walk procedure for toric ideals. TiGERS has been used to compute state polytopes with over 200,000 vertices.