

Contents

1	Introduction	2
2	Polynomial and commutative Algebra	3
2.1	Monomials	3
2.2	Monomial Order	3
2.3	Ideals	3
3	Linear Codes	4
4	Software	4
A	Appendix	4

1 Introduction

2 Polynomial and commutative Algebra

In this chapter a mathematical basis is systematically approached to give the reader an understanding to Groebner Bases and obtaining by the Flipping-Algorithm which is needed later.

In the first section monomials are revisited. The second section explains how monomials can be mathematically ordered. After that Ideals are defined over polynomial rings and a summary on Groebner bases and Groebner fans for ideals is presented.

2.1 Monomials

First of all, the basic components of a polynomial ring...

Definition 2.1 (Monomial) A monomial m is a product of variables over a finite field \mathbb{K} , denoted by $\mathbb{K}[X_1, X_2, \dots, X_n]$ of the form $X_1^{u_1} X_2^{u_2} \cdots X_n^{u_n}$, where $u_i, 1 \leq i \leq n$ and $u_i \in \mathbb{N}_0$

The total *degree* of a monomial is $\deg(m) = \sum_{i=1}^n u_i$

Definition 2.2 (Polynomial) A polynomial f is a finite linear combination with coefficients $c_u \in \mathbb{K}$ multiplied with monomials.

$$f = \sum_u c_u X^u$$

If $c_u \neq 0$ then $c_u X^u$ is a term of f

2.2 Monomial Order

It is necessary to arrange the terms of a polynomial in order to compare every pair of polynomials. That is important for instance dividing polynomials in the finite field $\mathbb{K}[X_1, X_2, \dots, X_n]$

Definition 2.3 (Term Ordering)

2.3 Ideals

3 Linear Codes

4 Software

A Appendix