

# Abstract

The theory of standard bases in polynomial rings with coefficients in a ring  $A$  with respect to local orderings is developed.  $A$  is a commutative Noetherian ring with 1 and we assume that linear equations are solvable in  $A$ .

Then the generalization of Faugère F4-algorithm for polynomial rings with coefficients in Euclidean rings is given. This algorithm computes successively a Gröbner basis replacing the reduction of one single s-polynomial in Buchberger's algorithm by the simultaneous reduction of several polynomials.

And finally we present an algorithm to compute a primary decomposition of an ideal in a polynomial ring over the integers. For this purpose we use algorithms for primary decomposition in polynomial rings over the rationals resp. over finite fields, and the idea of Shimoyama–Yokoyama resp. Eisenbud–Hunecke–Vasconcelos to extract primary ideals from pseudo-primary ideals. A parallelized version of the algorithm is implemented in SINGULAR.