An Implementation of Polynomial System Solving Algorithm

Dingkang WANG Hidetsune Kobayashi
Media Science Lab
College of Science and Technology
Nihon University

Abstract

In this paper, we will discuss how to solve system of the algebraic equations with the following form

$$\begin{cases} P_1(x_1, x_2, \cdots, x_n) = 0 \\ P_2(x_1, x_2, \cdots, x_n) = 0 \\ \vdots \\ P_m(x_1, x_2, \cdots, x_n) = 0 \end{cases} \tag{1}$$

where K is a field of characteristic 0 and $x_1, x_2, \cdots, x_n$ are indeterminates. P_1, P_2, $\cdots$, P_m are polynomials in the ring $K[x_1, x_2, \cdots, x_n]$.

Based on the characteristic set method, we will give a modified algorithm.

For a polynomial set PS, the zero set of PS has the following decomposition.

$$Zero(PS) = \sum_k Zero(AS_k/J_k) \tag{2}$$

in which AS_i is an ascending set. After we get this zero decomposition, we can solve each system AS_k by symbolic or numerical method. Because the polynomials produced in the computation process will be factorized, the amount of computation will be reduced greatly. This algorithm can be used to solve both 0-dimensional system or higher dimensional system.