46th Annual Iranian Mathematics Conference
25-28 August 2015
Yazd University
Talk Singular normal forms and computational algebraic geometry pp.: 1–4

Singular normal forms and computational algebraic geometry

Majid Gazor
Department of Mathematical Sciences,
Isfahan University of Technology

Mahsa Kazemi*
Department of Mathematical Sciences,
Isfahan University of Technology

Abstract

In this talk we discuss the possible applications of techniques from computational algebraic geometry in germ computations of smooth local singular normal forms. Due to the algebraic nature of these techniques, we need to address the ideal and module membership problem. Here, as a part of our ongoing project, we briefly describe how we utilize concepts from algebraic geometry like *local rings*, *Mora normal form*, and *standard bases* to obtain an algorithm for computing the normal forms for such bifurcation problems. This work contributes into enhancement of our developed Maple library, called "*Singularity*".

Keywords: Normal form; Standard basis; Singularity theory; Local ring.
Mathematics Subject Classification [2010]: 34C20; 13P10; 14H20.

1 Introduction

The bifurcation theory of singular smooth vector and scalar valued germs is an important subject and has many applications in engineering problems; see [5–9]. The applications include bifurcation control and designing effective controllers for uncontrollable singular systems; see [8]. In order to achieve this, we need to compute certain ideals and modules. Hence, a convenient answer to the ideal and module membership problem is a desirable goal. There are various ways to answer the ideal membership problem: the first method is to find a convenient representation of the ideals or module structures such as the use of intrinsic ideals and module representations. The other approach is by the use of efficient algorithms through a symbolic computer algebra system. Given the local nature of our problem, our rings constitute a local ring and therefore, techniques such as Gröbner basis does not properly work here. Thereby, we shall use Standard basis and Mora remainder instead of the usual Gröbner remainder. Mora normal form is a more common terminology in the literature than Mora remainder, yet we prefer Mora remainder since it does not confuse with the normal form of a singular germ. The results presented in this talk has some contributions in *Singularity*. *Singularity* is an end-user friendly symbolic library for bifurcation analysis of singularities. We hereby announce that the first version of *Singularity* will soon be released for public use and it will be enhanced and updated as our research progresses.

*Speaker