The Workshop on
Computational Differential Algebra and Related Topics, June 21-25, 2014
School of Mathematics, IPM, Tehran

Doing Algebraic Geometry with the Regular Chains Library

Parisa Alvandi
University of Western Ontario

Canada

Traditionally, Groebner bases and Cylindrical Algebraic Decomposition are the fundamental tools of Computational Algebraic Geometry. Recent progress in the theory of regular chains has exhibited efficient algorithms for doing local analysis in algebraic varieties, In this talk, we present the implementation of these new ideas within the RegularChains Library. We start by the computation of the (non-trivial) limit points of the quasi-component of a regular chain. This type of calculation can be used to compute the Zarisky closure of a constructible set. Next, we show that these latter computations can be used to calculate tangent cones of space curves, thus providing an alternative to the standard basis approach. From there we derive an algorithm which, under genericity assumptions, computes the intersection multiplicity of a zero-dimensional variety at any of its points. This algorithm relies only on regular chain manipulations, that is no Groebner bases or standard bases are involved. This is a joint work with Paul Vrbik.