On the Computation of Resolvent Representations

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The notion of a resolvent representation of a prime differential ideal in a ring of differential polynomials was introduced by Ritt as a tool towards an algebraic elimination theory in the realm of differential equations. Roughly speaking, a resolvent representation of a prime differential ideal provides a parametrization of the generic zeros of the ideal by the zeros of a single irreducible differential polynomial.

The talk will deal with the computation of resolvent representations of prime differential ideals associated with a class of ordinary first order multivariate polynomial differential systems. We will present upper bounds on the order and degree of the polynomials involved in a resolvent representation and we will exhibit a probabilistic algorithm which obtains this resolvent representation within time polynomial in the natural syntactic parameters and the degree of a certain algebraic variety related to the input system.

Unlike the previous methods, our algorithm does not require the computation of Gröbner bases or characteristic sets. Based on the computation of algebraic eliminating polynomials, our approach enables us to obtain complexity estimates in terms of a geometric invariant, which are more precise than those depending only on syntactic parameters.