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FirstOrderSolve - A MAPLE Package

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Given a first order autonomous algebraic ordinary differential equation, i.e. an equation of the form F(y, y')=0 with F ∈ K[y, y'],
where K is an computable field such as the rational numbers, we present a method to compute all formal Puiseux series solutions. In fact, all of the solutions are convergent Puiseux series.
By considering y and y' as independent variables, F implicitly defines an affine plane curve where (rational) local parametrizations can be computed via Puiseux expansions. We show a sufficient and necessary condition on such a local parametrization to obtain a formal Puiseux series solution of the original differential equation by substitution. This leads to a complete characterization of initial values with respect to the number of distinct solutions extending them. Moreover, by choosing a particular initial value, we give an algorithm computing the coefficients of all solutions starting with this initial value up to an arbitrary order.
These results have been extended to systems of autonomous ordinary differential equations by using the Thomas decomposition.

The theoretic results have been implemented in Maple in the Software package FirstOrderSolve. In the talk we give an overview on the theoretic results and illustrate them by using this software package.

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