Abstract: there is described a new project of parallel computer algebra; the main two features of this project are a new class structure and a new data structure intend for storage data in external memory; a special attention is paid to the parallel kernel of the system.

Keywords: parallel computer algebra; class structure; data structure; external memory.

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AN ALGORITHM FOR SYMBOLIC SOLVING OF DIFFERENTIAL EQUATIONS AND ESTIMATION OF ACCURACY [1]

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Keywords: systems of differential equations; Laplace transform; preassigned accuracy.

Abstract: An algorithm for solving systems of differential equations, based on Laplace transform method is produced. An algorithm to compute the error of calculations sufficient to obtain the preassigned accuracy of solution of linear differential equations system is included.

An algorithm for solving systems of differential equations, based on Laplace transform method is produced. There considered ordinary linear differential equations with constant coefficients, nonzero initial conditions and right-hand parts as composite functions, reducible to the sums of exponents with the polynomial coefficients.

An algorithm to compute the error of calculations sufficient to obtain the preassigned accuracy of solution of linear differential equations system is included.

Present-day computer systems provide an equipment for solving of differential equations. If they deal with numerical methods, there many algorithms to estimate an error of obtained approximate solutions. If it concerns symbolic algorithms it can hardly be found many attempts to find such estimations as it is customary to presume an exact character of analytic solving. But nearly each symbolic algorithm of solving contains numerical components or is based on approximation of participating functions or other mathematical structures by series, products, sequences, etc. It is necessary to guarantee an adequate accuracy in this case as well.

An algorithm, which is produced in this article, is based on the application of the Laplace transform method for solving differential equations systems. This method provides the symbolic character of computations. However there exists a fragment of numerical calculations. It concerns the computing

[1] Работа выполнена при поддержке программы "Развитие потенциала высшей школы" (проект 2.1.1/1853).

of polynomial roots. This is the operation that requires an estimation of accuracy for calculations. An algorithm for such estimation is presented here.

The Laplace transform has been very useful in various problems of differential equations theory. In this article we consider systems of ordinary linear differential equations with constant coefficients, nonzero initial conditions and right-hand parts as composite functions, reducible to the sums of exponents with the polynomial coefficients. A case of continuous right-hand parts was discussed previously. Here we consider a general case of composite functions and obtain estimations in a general case and of higher exactness. Such systems are very important because of their application for many problems in electronics, electrical or radio engineering, economics, etc. Moreover such systems provide very transparent applying of Laplace method.

Let us describe in some words the main items of the algorithm.

At first a preparation of data functions for the formal Laplace transform is performed. It is achieved with application of Heaviside function and moving the obtained functions into the bounds of smoothness intervals. The next step is solving the algebraic system with polynomial coefficients and the right hand part, obtained after the Laplace transform of the data system. There are algorithms, that are efficient for solving this type of equations, and are different for various types of such systems. Then the obtained solution of algebraic system is prepared to the inverse Laplace transform. It is reduced to the sum of partial fractions with exponential coefficients. Just at this stage it is necessary to calculate the error of the denominator roots, sufficient for the required accuracy of differential equations solutions.

An important part of the algorithm contains the estimation of an error of calculations sufficient to obtain a preassigned accuracy of solution of a differential equations system. We must underscore that it is not necessary to obtain the exact solution of the differential equations system in order to obtain the value of an error sufficient to a required accuracy of approximate solution.

The complexity of the algorithm depends upon the complexity of three main operations: solving the system with polynomial coefficients, solving the system with constant coefficients for a representation in partial fractions, determination of the polynomial roots.

Аннотация: Предлагается алгоритм решения систем дифференциальных уравнений с использованием преобразования Лапласа. Его частью является алгоритм вычисления погрешности численных вычислений, обеспечивающей заданную точность решения системы.

Ключевые слова: системы дифференциальных уравнений; преобразования Лапласа; точность решения.

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