APPLICATION OF COMPUTER ALGEBRA SYSTEMS TO CONSTRUCT FORMULAE OF THE COLLOCATION AND LEAST SQUARES METHOD

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Huge analytical work is needed when constructing the formulae of the collocation and least squares (CLS) method for solving the Navier — Stokes equations numerically. To great extent, such work can be carried out by computer algebra systems (CAS) [1, 2]. To construct the formulae one needs to perform analytically the follows: summation of huge expressions in functionals, their differentiation, solving a linear algebraic systems in order to obtain coefficients of approximate solution in polynomial basis. CAS can successfully cope with this work. Computer derivation of the formulae of the method also gives additional advantages. Optimization with respect to rate of computation by obtained formulae, analytical and numerical verification of these formulae by using the same or another CAS, conversion of constructed formulae to arithmetic operators of FORTRAN and C programming languages can be made. All this greatly facilitate the final result obtaining and reduce the time consumption for it. Different modifications of the method are easily available using computer programs in CAS. Modifications related to replacement of basis, collocation nodes, matching conditions and so on, can be made just by changing functions involved in the program. Construction of the formulae of CLS method for Navier — Stokes equations was first performed with the help of the computer program of analytic computations in CAS REDUCE, and then in MAPLE [2, 3, 4].

The CLS method created was verified by solving the different problems numerically. Comparison between obtained and known results was made, good potentialities of the method were shown. This work was partially supported by the Russian Foundation for Basic Research (grants 99–01–00515 and 00–01–00370).

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