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New Possibilities and Applications of the Method of Collocations and the Least Residuals

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In the numerical method of collocations and the least residuals (CLR), the boundary differential problem using the collocation method is projected into a finite-dimensional linear functional space. To find the solution of the obtained approximate problem, an overdetermined system of linear algebraic equations (SLAE) is written out and it is required that on its solution the minimum of the discrepancy functional of all its equations is attained. From this requirement and the presence of a piecewise analytic solution of the approximate problem, a number of merits of the method follows. In particular, the algorithms of the CLR method are relatively simple to apply in non-canonical regions and on irregular grids. It is relatively simple to build variants of the method of increased accuracy, including those for sufficiently ill-conditioned problems and with singularities in the solution of the initial differential problem. Its algorithms are easily parallelized. In the CLR method, modern algorithms of computational mathematics are effectively used: multigrid complexes, Krylov subspaces, preconditioners, irregular grids. The presented report will give a brief overview of the latest results obtained in the CLR method and demonstrate its indicated properties.

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