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Summary: An approximate method for solving the Cauchy problem for nonlinear ordinary differential equations of the first order is considered. The method is based on shifted Chebyshev series and the Markov quadrature formula. The technique of automatically dividing the interval of computing the solution of the Cauchy problem into a number of elementary segments, in each of which the approximate solution of the problem is represented by a partial sum of the shifted Chebyshev series, satisfying a predetermined accuracy, is briefly described. The method is considered in detail on the example of one of the classical problems of celestial mechanics, namely, the restricted plane circular three-body problem. The reliability of the used error estimate and its closeness to the true error are clearly shown. The advantages of the proposed method in comparison with the well-known Gear method for integrating ordinary differential equations are highlighted.

MSC:
65Lxx Numerical methods for ordinary differential equations
65-XX Numerical analysis

Keywords:
ordinary differential equations; approximate analytical methods; numerical methods; orthogonal expansions; shifted Chebyshev series; Markov quadrature formulas; polynomial approximation; precision control; error estimate; automatic step size control

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References:

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