New Technologies for Approximate Solution of Ordinary Differential Equations

REVAZ CHIKASHUA, DIMITRI ARABIDZE

E-mail: rezochikashua@gmail.com

Georgian Gas Transportation Company. Department of
Information Technology. Main Specialist. Kakheti
Highway 21, Tbilisi Georgia

We consider the problem of approximate solution of two-point boundary value problem (BVP) for ordinary differential equations (DEs) using multipoint finite-difference method. In this report we will construct and investigate high accuracy schemes for BV problem. Particularly such types of statements are true:

Stmt. 1. The order of arithmetic operations for calculation of approximate solution and its derivative of BVP for nonlinear second order DE of normal form with Sturm–Liouville conditions is $O(n \ln n)$ *Horner unit*. The convergence of the approximate solution and its derivative has $(p-1)$-th order with respect to mesh width $h = 1/n$ if $y(x)$ has $(p+1)$th order continuously differentiable derivative. If the order is less than p, the remainder member of corresponding scheme has best constant in A. Sard's sense.

Stmt. 2. There are created new schemes and corresponding programs by which are possible to calculate the classical Orthogonal Polynomials (Legendre, Laguerre, Hermite, Chebyshev, all other Ultraspherical ones) when the order of degrees is not less than 50.000 and an accuracy about 200 decimal points.