On Multistep Interval Methods for Solving the Initial Value Problem

Andrzej Marciniak

Poznan University of Technology
Institute of Computing Science
Piotrowo 3a, 60-965 Poznan
Poland

anmar@sol.put.poznan.pl

Abstract

Interval methods for solving problems in differential equations and their implementation in floating-point interval arithmetic are interesting due to interval-solutions obtained which contain not only the errors of methods, but also all possible numerical errors. Such methods have been analyzed in a number of papers and monographs (see e.g. [1], [5], [9], and [10]). In our previous papers explicit and implicit interval methods of Runge-Kutta type ([2], [6], [7]), and explicit and implicit multistep methods of Adams type ([3], [4], [8]) have been considered. A similar approach may be applied to well-known conventional explicit multistep methods of Nystrm and implicit ones of Milne-Simpson. For interval methods of these kinds it can be proved that the exact solution of the initial value problem belongs to interval-solutions obtained. From estimations of the widths of interval solutions it follows that for implicit multistep interval methods, like for conventional ones, higher orders of accuracy can be obtained. Furthermore, explicit and implicit multistep interval methods can be combined giving interval predictor-corrector methods.

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