

High Order Block Implicit Multi-Step (Hobim) Methods for the Solution of Stiff Ordinary Differential Equations

Authors : J. P. Chollom, G. M. Kumleng, S. Longwap

Abstract : The search for higher order A-stable linear multi-step methods has been the interest of many numerical analysts and has been realized through either higher derivatives of the solution or by inserting additional off step points, super future points and the likes. These methods are suitable for the solution of stiff differential equations which exhibit characteristics that place a severe restriction on the choice of step size. It becomes necessary that only methods with large regions of absolute stability remain suitable for such equations. In this paper, high order block implicit multi-step methods of the hybrid form up to order twelve have been constructed using the multi-step collocation approach by inserting one or more off step points in the multi-step method. The accuracy and stability properties of the new methods are investigated and are shown to yield A-stable methods, a property desirable of methods suitable for the solution of stiff ODE's. The new High Order Block Implicit Multistep methods used as block integrators are tested on stiff differential systems and the results reveal that the new methods are efficient and compete favourably with the state of the art Matlab ode23 code.

Keywords : block linear multistep methods, high order, implicit, stiff differential equations

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020