Second derivative parallel one block two point stabilised Simpson’s method

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Abstract

We construct one block two point second derivative Simpson stabilized method. The method is of order four, and performs efficiently when compared with the method proposed in [11]. Numerical results are presented to show application of the method. The method is A-stable and can be implemented on two parallel processors simultaneously.

Keywords: Simpson’s method, parallel block methods, A- & L-stability.

1. Introduction

We seek a parallel numerical method suitable for stiff initial value problems of the form

\[ y' = f(x, y), \quad y(a) = y_0, \quad x \in [a, b]. \quad (1.1) \]

In [11] a Simpson stabilized block method is constructed, the method is A-stable unlike the sequential Simpson’s method that has empty region of absolute stability [4]. In the spirit of [11] we present a Simpson Block method with second derivative as done in [3]. The method is of order four and yields two solutions simultaneously, see [1-12].

2. Construction of the parallel block method

Simpson’s method is given as

\[ y_{n+2} = y_n + \frac{h}{3} (f_n + 4f_{n+1} + f_{n+2}) \]

and of order four. A parallel one block form is by

\[ y_{n+2} = y_n + \frac{h}{3} (f_n + 4f_{n+1} + f_{n+2}) \]

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