



High Order Compact Cubic B-spline Collocation Method for the Solution of Fisher's Equation

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Accepted: 22 September 2021 / Published online: 11 October 2021
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Abstract

In this article, we formulate a compact fourth order accurate method using the collocation of cubic B-splines to find the numerical solution of the Fisher's equation. To achieve fourth order accuracy in space, the proposed method requires only three spatial grid points as compared to the requirement of five grid points in the literature, using the collocation methods based on splines. This helps us in achieving accurate results with less computation time. The method is unconditionally stable. A detailed analysis is done to show fourth order accuracy of the method. A comprehensive analysis of the method has been done to check the precision and effectiveness of the suggested method with the help of some examples.

Keywords Fourth order collocation technique · Cubic B-spline function · Fisher's reaction-diffusion equation

Mathematics Subject Classification Primary 65N12 · Secondary 35K05

Introduction

For modeling of various physical phenomena, reaction-diffusion equations plays an important role. It is used in many fields such as ecology, plasma physics, chemistry, metallurgy, combustion etc. The Fisher's equation a.k.a. Fisher's reaction-diffusion equation for 1-D is written in the form

$$u_t = \alpha u_{xx} + \beta u(1 - u) + f(x, t) \quad (1)$$

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