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SOLVING BESSEL EQUATION OF ZERO ORDER USING WILSON WAVELETS

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Abstract. A new computational method based on Wilson wavelets is proposed for solving Bessel equation of zero order. To do this an operational matrix of integration for Wilson wavelets is obtained. Using approximation method of Wilson wavelets, Bessel equation are reduced to algebraic equations which can be solved simply to obtain an approximate solution for the problem. Several examples are presented below to demonstrate the applicability and accuracy of this method.

1. Introduction

Bessel equation is a second-order differential equation with two linearly independent solutions. The linear second-order ordinary differential equation of type

$$x^2y''(x) + xy'(x) + (x^2 - n^2)y = 0$$

is called Bessel equation where number n is the order of the Bessel equation. The given differential equation is named after the German mathematician and astronomer Friedrich Wilhelm Bessel who studied this equation in details and showed that its solutions can be expressed in terms of a special class of functions called cylinder functions or Besel functions [4, 5]. Due to space and time constraints the interest of studying the applications of the Bessel functions will be represented as series of solution [2, 6, 7, 8, 9]. Bessel functions are series of solution to a second order differential equation that arise in diverse situations. The Bessel functions appear in many diverse scenarios, particularly the situations involving cylindrical symmetry [1, 3]. The most difficult aspect of working with the Bessel functions is determining whether it can be applied through reduction of the system of equations to Bessel differential or modified equation and then manipulating boundary conditions with appropriate application of zeroes and the coefficient values on the argument of the Bessel functions [10, 11, 12].

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