

APPROXIMATION OF FUNCTIONS IN HÖLDER'S CLASS AND SOLUTION OF RICCATI DIFFERENTIAL EQUATION BY VIETA-LUCAS WAVELETS

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Abstract. In this article, an algorithm for solving the Riccati differential equations based on the Vieta-Lucas wavelet series has been introduced. By dilatation and translation of orthogonal Vieta-Lucas polynomials, the Vieta-Lucas wavelets are created. The convergence analysis of the Vieta-Lucas wavelet series is intended for the Hölder's class. The Vieta-Lucas wavelet approximations of solution functions of the Riccati differential equation in Hölder's class are determined by partial sums of their wavelet series. In concisely, two approximations $E_{2^k, M}^{(1)}(f)$ and $E_{2^k, M}^{(2)}(f)$ of solution functions of classes $H_2^\alpha[0, 1)$ and $H_2^\phi[0, 1)$ by $(2^k, M)^{th}$ partial sums of their Vieta-Lucas wavelet expansions have been estimated. There are several applications of linear and non-linear differential equations, which include the quadratic Riccati differential equations. The solution of the Riccati differential equation obtained by the Vieta-Lucas wavelets is compared to its solution by the ODE-45 method. Matlab is used to calculate the solution of the ODE-45 method and algebraic equations. It has been shown that the solutions produced by the Vieta-Lucas wavelets are more accurate than those produced by the ODE-45 approach and almost match their precise solutions. This is a result of the wavelet analysis research article.

1. Introduction

Wavelets are a powerful tool used in pure mathematics and also widely applied in computational mathematics, audio and video signal analysis, and other related areas of numerical analysis. It is also used in the approximation of the solution functions of the differential and integral equations. In wavelet analysis an approximate solution of the differential equation and integral equation, a finite-dimensional space has to be chosen in which the approximate solution is constructed. In its most general form, the

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