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Simplified reproducing kernel method for impulsive delay differential equations

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Abstract: In this paper, a new algorithm is presented to solve the impulsive delay initial value problems. This is the first time to proposed the simplified reproducing kernel method(SRKM for short) to solve the impulsive delay differential equations. Then the uniform convergence of the numerical solution is proved, and the time consuming Schmidt orthogonalization process is avoided. The proposed method is proved to be stable and is not less than the second order convergence. The algorithm is employed successfully on some numerical examples.

Keywords: Impulsive delay differential equation; Simplified reproducing kernel method; Convergence order; Numerical algorithm;

1. Introduction

In recent years, the impulsive differential models have been applied to many aspects of life: population dynamics[1], physics, chemistry[2], irregular geometries and interface problems[3-5], signal processing[6]. The investigations have been shown in the papers [7,8] on the existence and numerical solutions for the impulsive differential equations. M.U. Rehman[9] presented a general method for converting an impulsive fractional differential equation to an equivalent integral equation. Some sufficient conditions for the finite-time stability of impulsive fractional differential systems are obtained by using generalized Bellman – Gronwall's inequality[10]. However, limited work has been done in the study on impulsive differential equations. X. Ding[11] solved the impulsive delay differential equations with Euler scheme. G.L. Zhang[12] analysed the stability of Runge – Kutta methods for linear impulsive delay differential equations with piecewise constant arguments. X. Liu[13] presented the linear multistep methods for impulsive delay differential equations. The convergence and exponential stability of linear impulsive delay differential equations is studied by G.L. Zhang[14]. G.L. Zhang[15] used a new numerical methods for a Class of Impulsive Delay Differential Equations based on asymptotic stability.

In this paper, we consider the following impulsive delay differential equations(IDDEs for

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