Reproducing kernel method for solving a class of Fredholm integro-differential equations

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Abstract

In this paper, we present a new algorithm in the reproducing kernel Hilbert space (RKHS) to solve integro-differential equations. The approximation solution is expressed by n-term summation of reproducing kernel functions. Some examples are displayed to illustrate the effectiveness and stability of the present method. Results obtained by the proposed method imply that it can be considered as a simple and accurate method for solving such integro-differential equation.

Keywords: Reproducing kernel, Integro-differential, Exact solution.
Mathematics Subject Classification [2010]: 47G20, 33F05, 41A10.

1 Introduction

Numerical modeling of integral and integro-differential equations have been paid attention by many scholars. Several numerical methods have been developed for the solution of the integro-differential equations. Particularly, in [1-5]. We study a class of Fredholm integro-differential equations in the reproducing kernel Hilbert space

$$u^{(n)}(x) = f(x) + \int_a^b k(x,t)(Nu(t))\,dt, \qquad u^{(k)}(x) = \alpha_k, \qquad 0 \le k \le n-1, n \ge 0, \quad (1)$$

where $u^{(n)}(x)$ is the nth derivative of the unknown function $u(x)$ that will be determined, $k(x,t)$ is the kernel of the integral equation, $f(x)$ is an analytic function, $N(u)$ is a linear function of u. Our aim in this paper is to obtain the analytical solutions by using the reproducing kernel method.

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