46th Annual Iranian Mathematics Conference
25-28 August 2015
Yazd University

On existence, uniqueness and stability of solutions of a nonlinear integral equation

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Abstract

In this paper we investigate the existence, uniqueness and Hyers-Ulam stability for Volterra type integral equations and extension of this type of integral equations. The result is obtained by using the iterative method in the framework of Banach space $X = C([a, b]; \mathbb{R})$. Finally, we give an example to illustrate the applications of our results.

Keywords: Fixed point; Nonlinear functional-integral equation; Iterative method.
Mathematics Subject Classification [2010]: 45D05, 65R20.

1 Introduction

Integral equations play an important role in characterizing many social, physical, biological, and engineering problems. For example, Volterra [1] was investigating the population growth, focusing his study on the hereditary influences, and several authors, (see [2-4]), discussed the integrodifferential modeled integral equations in the field of heat transfer and diffusion process in general neutron diffusion. Generally, several systems are mostly related to uncertainty and un exactness. The problem of un exactness is considered in general exact science, and that of uncertainty is considered as vagueness or fuzzy and accident.
The solutions of integral equations have a major role in the fields of science and engineering. A physical event can be modeled by the differential equation, an integral equation, an integro-differential equation or a system of these. Investigation on existence theorems for diverse nonlinear functional-integral equations has been presented in other references such as [5].

In this paper we intend to prove existence, uniqueness and Hyers-Ulam stability (HUs) of the solutions of the following nonhomogeneous nonlinear Volterra integral equations.

$$u(x) = f(x) + \psi\Big(\int_a^x F(x, t, u(t))dt\Big) \equiv Tu, \qquad u \in X, \tag{1}$$

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