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# Mean Square Solutions of Second-Order Random Differential Equations by Using Homotopy Perturbation Method

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**Abstract**

In this paper, the Homotopy perturbation method (HPM) is successfully applied for analytic (approximate) mean square solutions of the second-order random differential equations. Expectation and variance of the approximate solutions are computed. Several numerical examples are presented to show the ability and efficiency of this method .

**Keywords**: Random differential equations, Stochastic differential equation and Homotopy perturbation method

## 1. Introduction

A random ordinary differential equations are an ordinary differential equations which contains random constants or random variables. Most scientific problems, biology , engineering and physical phenomena occur in the form of random differential equations [1-3]. Recently, several first-order random differential models are solved using mean square calculus [4-11]. Many scientific models can be described as a second-order random differential equation in the following form

$$\mathrm{L[X(t)]+N[X(t),A]=g(t),} \tag{1}$$

$$\mathrm{X(0)=Y_0,}\quad \left.\frac{\mathrm{dX(t)}}{\mathrm{dt}}\right|_{\mathrm{t=0}}=\mathrm{Y_{1,}} \tag{2}$$

where $L[X(t)]=\dfrac{d^2X(t)}{dt^2}$ , $\mathrm{N[X(t),A]}$ is a nonlinear operator and $g(t)$ is the