ISSN: 1391-8796
Proceedings of 9th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 19, 2022

A hybrid method for solving the model of human immunodeficiency virus infection of CD4+ T cells

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The present study describes the application of a new method called Laplace Padé Differential Transform Method (LPDTM), which combines Differential Transform Method (DTM) with Laplace-Padé approximation for a system of non-linear ordinary differential equations. A dynamic model of HIV-1 (Human Immunodeficiency Virus - type 1) infection of CD4+ T cells is considered. These CD4+ T cells secrete growth and differentiation factors that are required by other cell population in the immune system, and thus these cells are known as helper T cells. LPDTM is used to prove that the post-treatment power series solution updated by Laplace-Padé re-summation method is a useful strategy to extend the convergence range of the approximate solutions. The main advantage of the proposed method is that it is based on a few simple steps, does not generate secular terms, and does not depend on perturbation parameters. Firstly, the solutions of the model consisting of a system of ordinary differential equations are obtained in the form of convergent series using the DTM. Then, a post-processing combining Laplace transform and Padé approximation is applied in order to expand the convergence range of the truncated power series. Finally, a comparative study between the present method, Differential Transform Method and fourth order Runge-Kutta (RK4) method is also carried out to show the high accuracy of the results using numerical solutions and plots.

Keywords: Differential transform method (DTM), Fourth order Runge-Kutta (RK4) method, HIV-1 CD4+ T cells model, Padé approximation

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