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ESTIMATION OF SEMI-ANALYTICAL SOLUTIONS FOR A NONLINEAR OBESITY EPIDEMIC MODEL VIA LAPLACE ADOMIAN DECOMPOSITION METHOD AND VARIATIONAL ITERATION METHOD

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Abstract. Obesity results from the accumulation of excessive body fat, significantly increasing the risk of various health complications. The total adult population is divided into normal, overweight, and obese compartments, with the rates of flow between these compartments governed by a system of nonlinear differential equations. In this paper, we employ the Laplace Adomian decomposition method and the variational iteration method to solve the obesity model. The application of these methods is demonstrated through numerical examples. Sensitivity analysis is performed to identify which parameters have the most significant influence on the behavior of the model. Additionally, the dynamic behavior of the adult population in the model is explored by varying the key parameters such as the transmission rate from normal to overweight and obese population, the rate at which overweight individuals become obese, the rate at which obese individuals become overweight, and the rate at which overweight individuals revert to normal weight. Furthermore, the approximate solutions obtained by these methods match well with the existing solutions obtained from the homotopy analysis method and the Runge Kutta 4th order method with a smaller absolute error of about 10^{-8}. The obtained findings highlight the effectiveness and reliability of these methods in solving nonlinear differential equations.

1. Introduction

Obesity is caused by an intake of excessive food, which causes each adipose tissue to increase abnormally in the body. Recent studies indicate that obesity has emerged as a significant global health burden, with at least 2.8 million deaths occurring annually

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