STABILITY ANALYSIS AND SEMI-ANALYTIC SOLUTION TO A SEIR-SEI MALARIA TRANSMISSION MODEL USING HE'S VARIATIONAL ITERATION METHOD

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Abstract

We consider a SEIR-SEI Vector-host mathematical model of malaria transmission described and built on 7-dimensional non-linear ordinary differential equations. We compute the basic reproduction number of the model, examine the positivity and boundedness of the model compartments in a region, verify the existence of the Disease-Free (DFE) and Endemic (EDE) equilibrium points. Using the Gaussian elimination method and the Routh-hurwitz criterion, we convey stability analyses at DFE and EDE points which indicates that the DFE (malaria-free) and the EDE (epidemic outbreak) point occurs when the basic reproduction number is less than one and greater than one respectively. We obtain a solution to the model using the Variational iteration method (VIM) (an unprecedented method) and verify the efficiency, reliability and validity of the proposed method by comparing the respective solutions via tables and combined plots with the computer in-built Runge-kutta-Felhberg of fourth-fifths order (RKF-45). We speculate that VIM is efficient to conduct analysis on Malaria models and other epidemiological models.

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THE GRAPH OF SUSCEPTIBLE HUMAN

THE GRAPH OF EXPOSED HUMAN

$Eh(t)$ vs $Time$ $(days)$

RKF-45 ■ ■ VIM

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THE GRAPH OF INFECTED HUMAN

$Ih(t)$

Time (*days*)

RKF- 45 ■   ■ VIM

THE GRAPH OF RECOVERED HUMAN
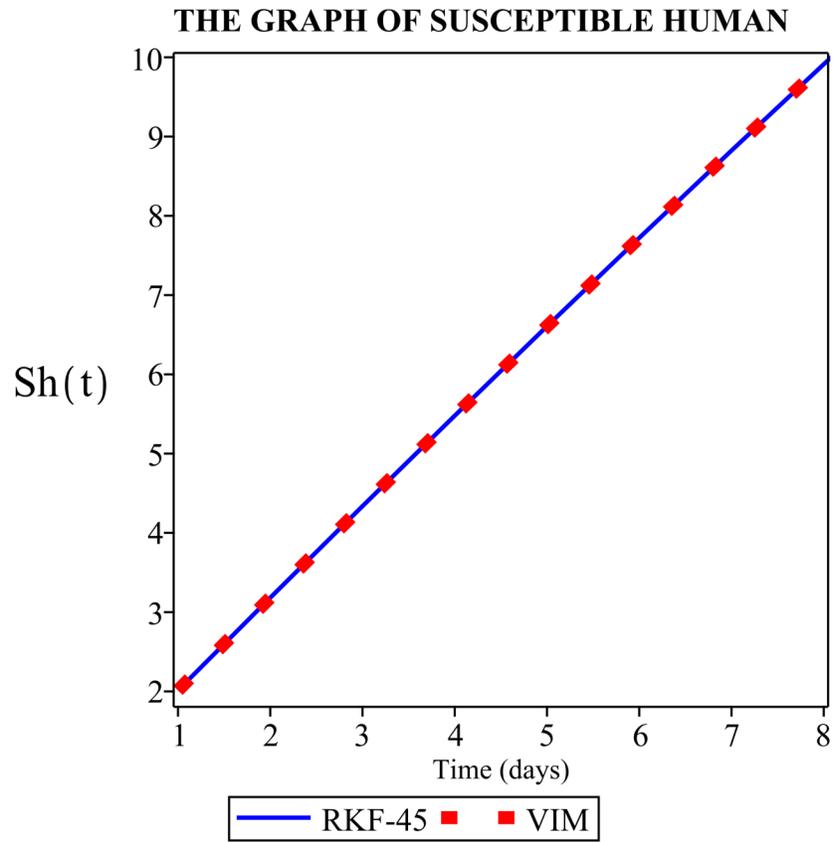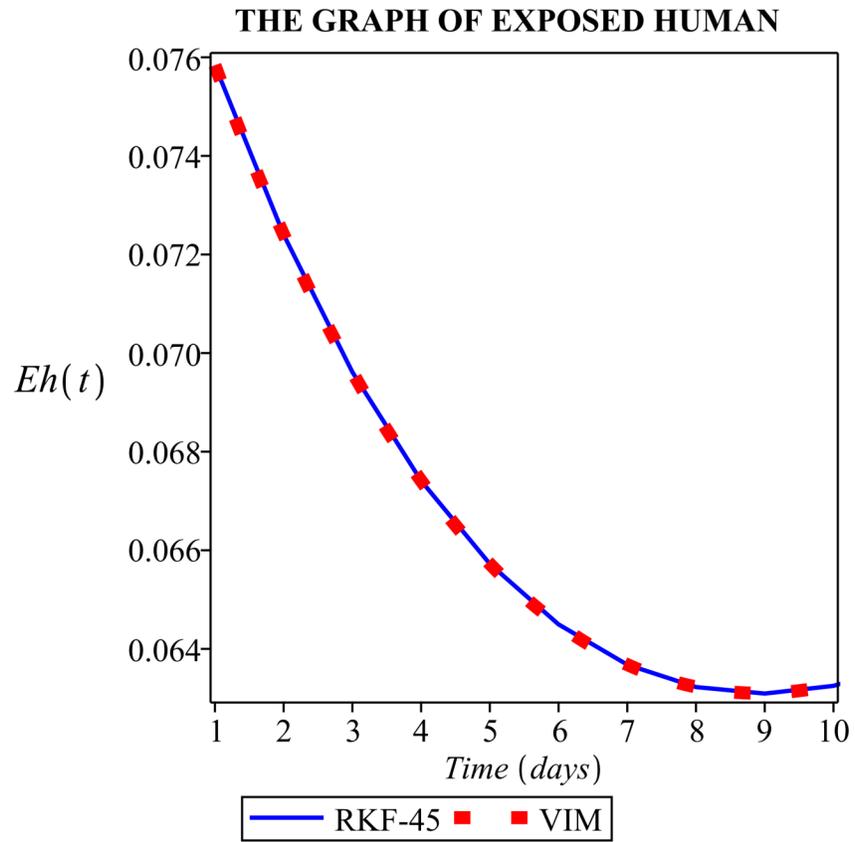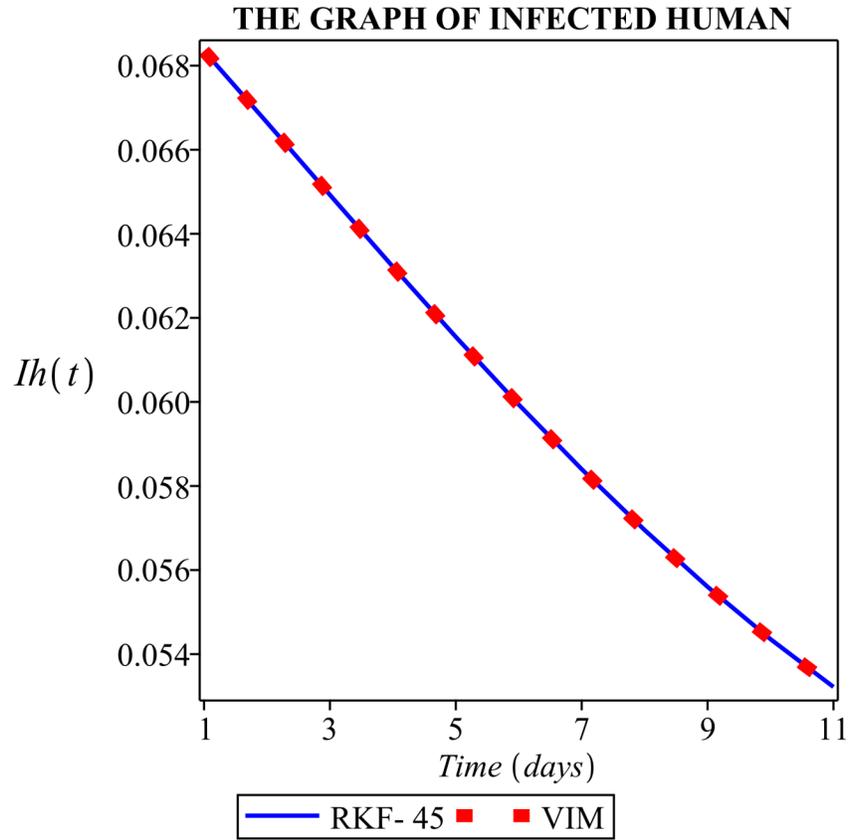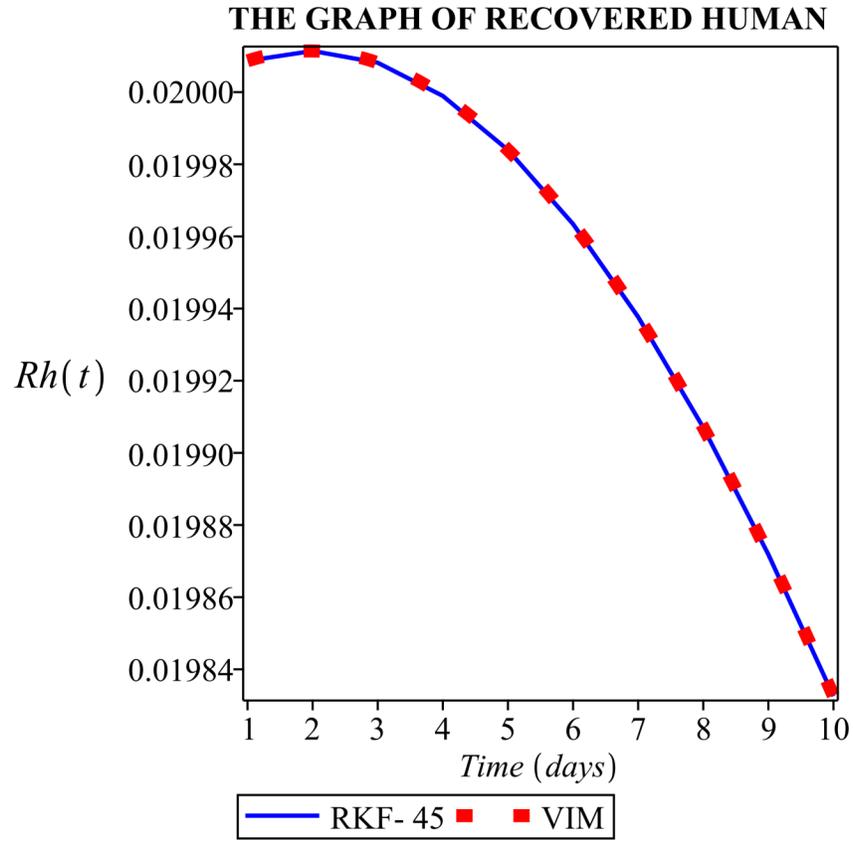
THE GRAPH OF SUSCEPTIBLE MOSQUITO

$Sv(t)$

Time ($days$)

RKF- 45   ■   ■   VIM

THE GRAPH OF EXPOSED MOSQUITO
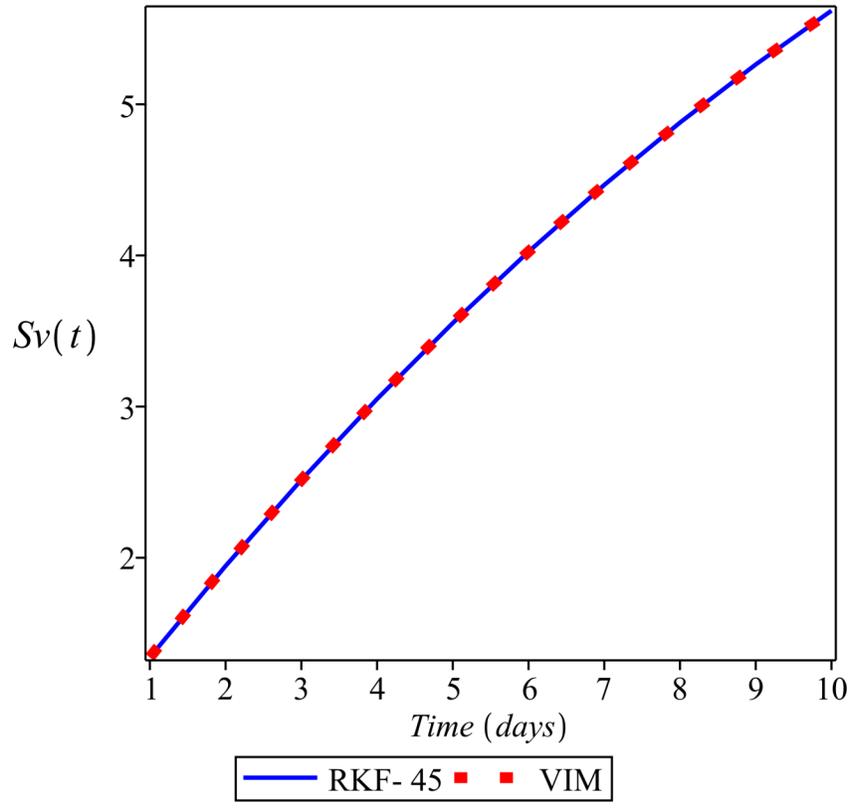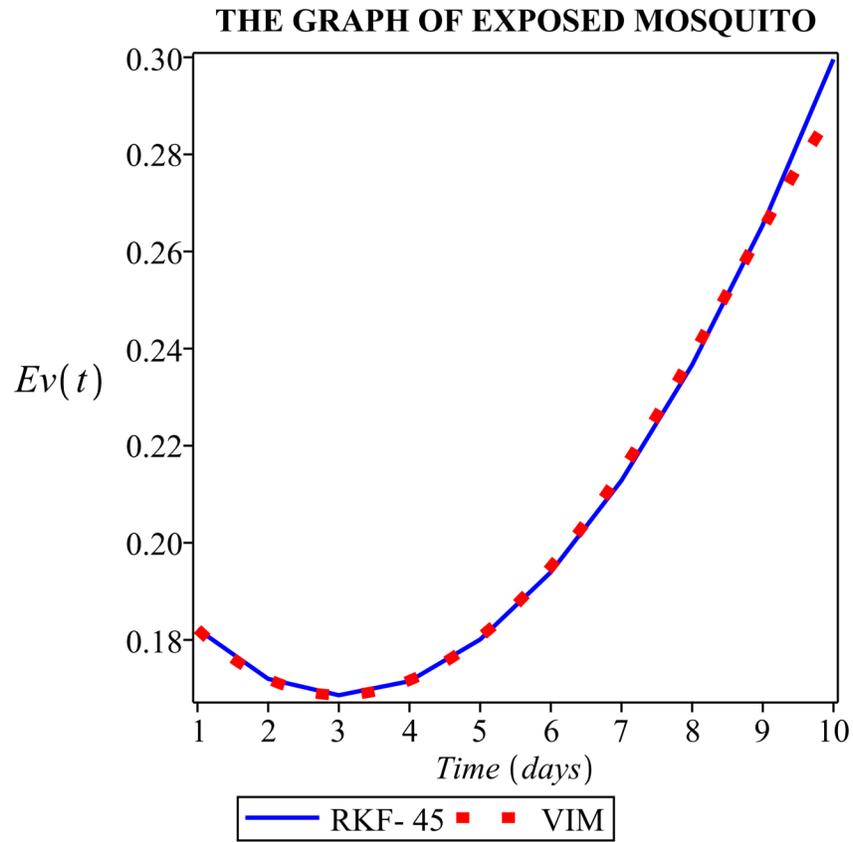
THE GRAPH OF INFECTED MOSQUITO

$Iv(t)$

$Time\ (days)$

RKF- 45   VIM