Mathematical and Computer Modeling of Biological Processes

Practice 6

Consider the HIV model:

$$\begin{aligned} \frac{dT}{dt} &= A - \beta TV - \mu T, \\ \frac{dT^*}{dt} &= \beta TV - \mu^* T^*, \\ \frac{dV}{dt} &= \gamma T^* - \nu V, \end{aligned} \tag{6.1}$$

where T is the number density of the $CD4^+$ T cells, T^* is the number density of the infected $CD4^+$ T cells, and V denotes the number density of the HIV viruses.

Tasks

1. Solve model (6.1) with corresponding initial conditions by the Runge-Kutta method. Draw the graphs for $T(t), T^*(t)$ and $V(t)$.
2. Solve model (6.1) with corresponding initial conditions using the Euler method. Compare the results with those obtained by the Runge-Kutta method. Plot the results.
3. Estimate the basic reproduction number R_0. Show that the disease-free equilibrium (DFE) of (6.1) is asymptotically stable.

Note: all the model coefficients have been described in Lecture 6. Select the appropriate values for the given coefficients.

(4 points)