Practice 3

Consider the model of the tumor cell proliferation in the absence of effector cells:

$$\frac{dT}{dt} = \lambda T\left(1 - \frac{T}{T_0}\right), \tag{3.1}$$

where T is the number density of tumor cells, λ is the tumor growth rate, T_0 is the capacity of tissue for sustaining the tumor population.

Also, consider the model of the tumor cell proliferation taking into account the immune response:

$$\frac{dT}{dt} = \lambda T\left(1 - \frac{T}{T_0}\right) - \frac{(k_1 k_2 e_0)T}{k_2 + k_1 T}, \tag{3.2}$$

where e_0 is the total population of effector cells with rate coefficients k_1 and k_2.

The initial condition is given by

$$T(t)\big|_{t=0} = 10^3. \tag{3.3}$$

Tasks

1. Solve model (3.1) with initial condition (3.3) analytically, i.e. find its general and particular solutions.
2. Solve model (3.1) with initial condition (3.3) numerically using the finite difference method. Select the appropriate values for coefficients. Draw a graph of $T(t)$.
3. Solve model (3.2) with initial condition (3.3) numerically by the finite difference method. Plot the results. Compare them with the solution of model (3.1).

(6 points)