SK5201 Pengantar Sains Komputasi 2022/2023

Project

Deadline: October 31st 2022, 23.59

Report's format: PDF file

Answer these questions in the form of a report.

You must submit your report and your codes in the assignment.

In Chapter 2.2 "Unconstrained Growth and Decay", we have studied that a radioactive substance decays at a rate proportional to the mass of the substance. Thus, for positive decay constant r and radioactive's mass at times t, $Q(t)$, we have the following differential equation:

$$\frac{dQ}{dt} = -rQ(t)$$

One radioactive substance can decay into another radioactive substance, forming a chain of such substances. For example, radioactive bismuth-210 decays to radioactive polonium-210, which in turn decays to lead-206.

Develop a model for a radioactive chain of three elements, from substance A to substance B to substance C. Answer the following questions using this model.

a. Draw the model diagram for this system.
b. Write all the differential equation in the systems.
c. Write the algorithm to model this system
d. Write a program to model the system. Allow the user to designate constants. You can use any programming language (except Excel).
e. Use 4th order Runge-Kutta method (you cannot use pre-existing function/subroutine for the simulation techniques).
f. Run your program with this constant values. The decay rate of A is 0.0137/day, the decay rate of B is 0.051/day, and the initial mass of A is $S \times 10^{-8}$g, where S is the last 2 digits of your NIM.
g. Generate a graph and a table for the amounts of substance A, substance B, and substance C versus time. Explains the graph.
h. Find, approximately, the maximum mass of B and when the maximum occurs.
i. Using your model, observe what will happen in cases where:
    1. The decay rate of A is less than the decay rate of B
    2. The decay rate of A is bigger than the decay rate of B.