Homework #2

Due: Apr 19, 23:59

Construct a program using Excel spreadsheet, python, or any computer software to predict the substrate and biomass concentration (S and X_a) at time t for a batch-type bioreactor by numerical approach .

Use the following initial conditions and growth parameters:

$$S^0 = 500 \ mg \ COD/L \qquad X_a^0 = 100 \ mg \ VSS/L \qquad \hat{q} = 20 \ g \ VSS/g \ COD-d$$

$$K = 100 \ mg \ COD/L \qquad Y = 0.4 \ g \ VSS/g \ COD \quad b = 0.1/d$$

1) What are the substrate and biomass concentrations at $t = 0.1 \ d$ calculated by setting the following values as Δt?

   i. $\Delta t = 0.0001 \ d$;   ii. $\Delta t = 0.001 \ d$;   iii. $\Delta t = 0.05 \ d$

2) Compare the results for the numerical solution with different Δt values. Which one do you think will be the most accurate? Why? For $\Delta t = 0.05 \ d$, obtain the solutions for substrate and biomass concentrations at $t = 0.5 \ d$. What do you get? How would you describe the reason for getting that result?

Submit the Excel spreadsheet (or computer language code + figures) you have constructed. Also do not forget to provide written descriptions that answer the questions above. You can use any format for these descriptions (e.g., writing on the spreadsheet, figure, separate paper, etc.) Grading will be given based on the correctness of your employment of the numerical approach, the correctness of your numerical solution, and the reasonableness of your written answers.

(100 points)