

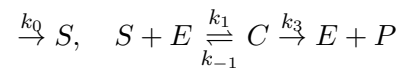
BMTH311: Assignment #2

Required Reading.

- Read §3.1-3.3

To be turned in January 8th, at the start of class.

1. Problem 3.2.2, page 68
2. Problem 3.3.1, page 73
3. Problem 3.7.3, page 82
4. Problem 3.7.4, page 82
5. Consider the case of an enzyme/substrate system where substrate is supplied according to a known rate.



$$S(0) = 0, \quad E(0) = 1, \quad C(0) = 0, \quad P(0) = 0$$

$$k_0 = 1, \quad k_1 = 100, \quad k_{-1} = 100, \quad k_3 = 1.$$

- (a) Use Matlab's ode45 to simulate this for $t \in [0, 1]$. Repeat with ode15s. Be sure to set the option 'Refine' to 1. Plot the results, side-by-side. Do you observe any differences?
- (b) Look at the output t values from both simulations (something like plot(t,0*t) or length(t) will help). What differences do you observe? If you change k_1 and k_{-1} to 1, do you still observe this effect?
- (c) For both cases ($k_1 = k_{-1} = 1$ and $k_1 = k_{-1} = 100$) write down some time scales. By looking at your results from part b, Which solver do you think is more efficient (takes fewer steps) for solving problems with vastly different time scales?