Design Project Part A Solution

i.

$$\frac{d[S]}{dt} = -k_1[E][S] + k_{-1}[ES]$$

$$\frac{d[E]}{dt} = -k_1[E][S] + (k_{-1} + k_3)[ES] - k_2[E][I] + k_{-2}[EI]$$

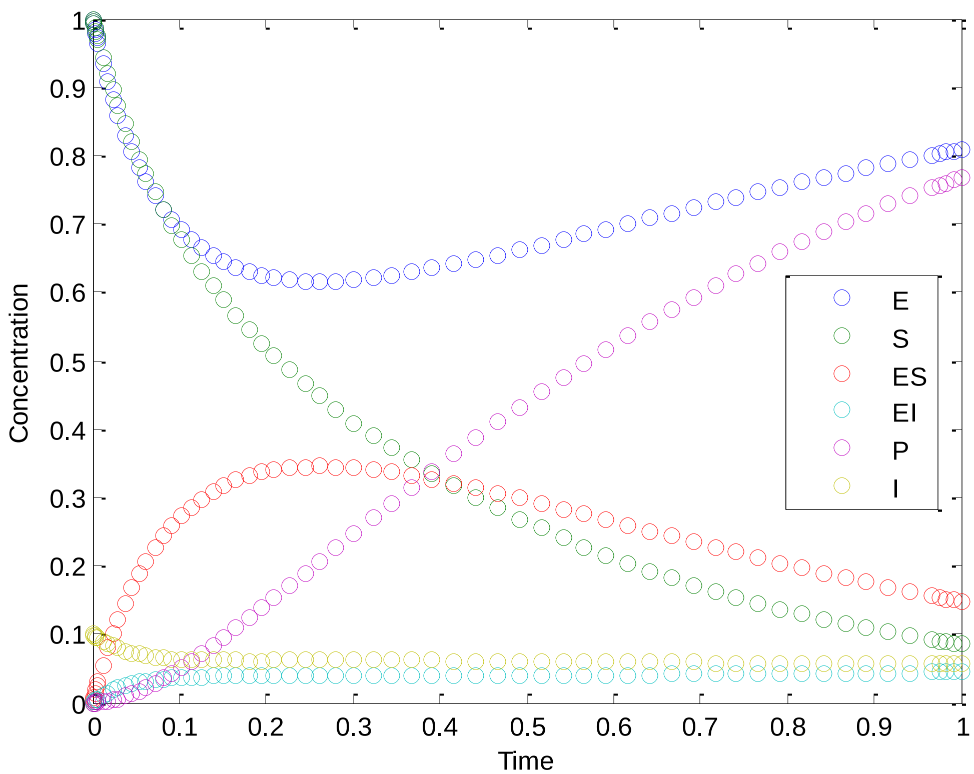
$$\frac{d[I]}{dt} = -k_2[E][I] + k_{-2}[EI]$$

$$\frac{d[P]}{dt} = k_3[ES]$$

$$\frac{d[EI]}{dt} = k_2[E][I] - k_{-2}[EI]$$

$$\frac{d[ES]}{dt} = k_1[E][S] - (k_{-1} + k_3)[ES]$$

ii.



iii. Optimal rate parameters:

$$k_1 = 4.9998, k_{-1} = 1, k_2 = 9.9993, k_{-2} = 9.9975, k_3 = 3.0001$$

For those of you who are curious, the data was generated using the following rate constants:

$$k_1 = 5, k_{-1} = 1, k_2 = 10, k_{-2} = 10, k_3 = 3$$

Clearly, the fitting procedure does a remarkable job of estimating the original rate constants.