1 Rate of Changes

Assume:

- At the beginning of the reaction, the amount of products produced is so small that the inverse reaction can be disregarded.
- The substrate concentration is much larger than that of the free enzyme, so that the substrate concentration remains essentially constant during the reaction.
- The second step of the reaction is the rate-limiting step of the reaction to ensure that the rate of ES decomposition to P is not sufficient to disrupt the equilibrium between E and ES.

Define the concentrations of the reactants as $[E]$, $[ES]$, $[P]$, $[S]$ he rate of change of reactants with time t:

$$V_E = \frac{d[E]}{dt} = -k_1[E][S] + k_2[ES] + k3[ES]$$

$$V_S = \frac{d[S]}{dt} = -k_1[E][S] + k_2[ES]$$

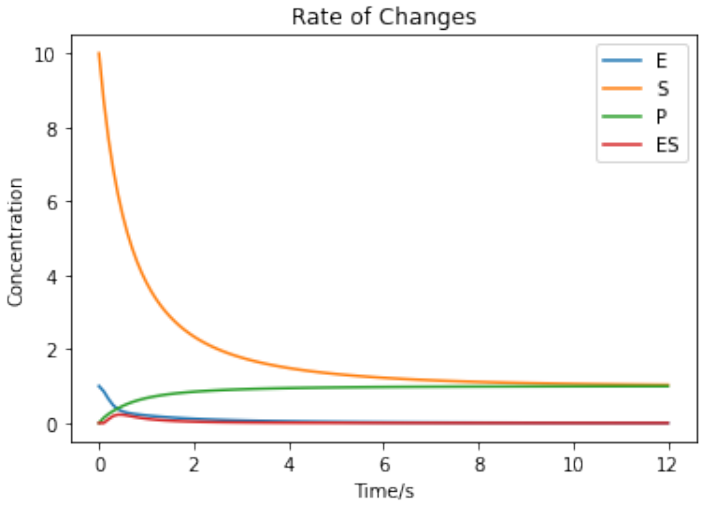
$$V_{ES} = \frac{d[ES]}{dt} = k_1[E][S] - k_2[ES] - k_3[ES]$$

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

2 Fourth-order Runge-Kutta

Given: k1 = 100 μM/min, k2=600 μM/min, k3=150 μM/min; E = 1.0 μM; S = 10μM;

The rate of changes are plotted as below:



3 Velocity

The velocity V as a function of the concentration of the substrate S is defined by the Michaelis-Menten equation:

$$V = \frac{V_{max}[S]}{K_M + [S]}$$

The function is plotted as follows: The maximum velocity is 72.1724322962807