$$A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B$$

open   closed

Conservation statement

$$A + B = M$$

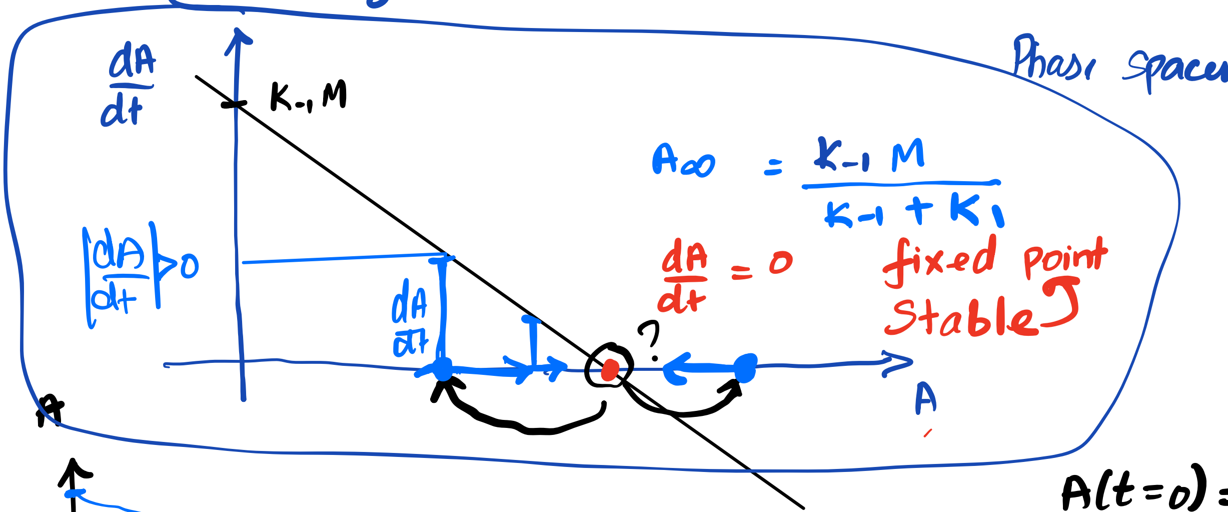
$$B = M - A$$

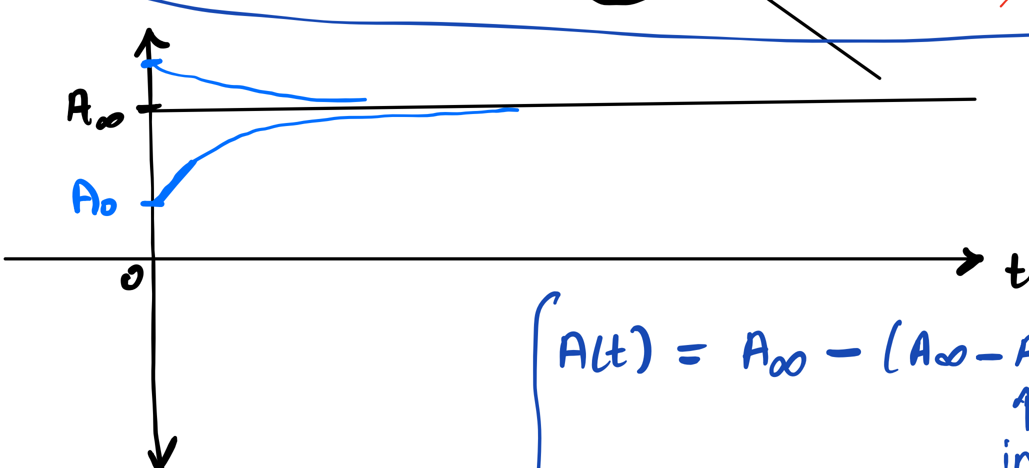
$$\frac{dA}{dt} = -k_1 A + k_{-1} B$$

$$\frac{dB}{dt} = k_1 A - k_{-1} B$$

$$\boxed{\frac{dA}{dt} = -(k_1 + k_{-1})A + k_{-1} M}$$

Linear ordinary differential equation.





$$A(t=0) = A_\infty$$

$$A(t) = A_\infty - (A_\infty - A_0)e^{-(k_1 + k_{-1})t}$$

initial

$$B(t) = M - A(t)$$

$$A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B$$

$$A + B \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} P$$

$[A] \Rightarrow$ Concentration of A

Law of mass action -

$$\frac{\text{moles}}{\text{time}} \quad \boxed{\frac{d[P]}{dt}} = \underline{K_1}[A][B] - \underline{K_{-1}}[P]$$

moles^2

$K_1 \quad \frac{1}{\text{moles time}}$

$$3A \xrightarrow{K} C \qquad A + A + A \rightarrow C$$

$$\frac{d[C]}{dt} = KA^3$$

Stoichiometry.

$$2A + B \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} C$$

Forward

molecules	Stochiometry
A	-2
B	-1
C	+1

Reverse

molecules	Stochiometry
A	+2
B	+1
C	-1

$$\frac{dA}{dt} = \overset{\text{Stochiometry}}{-2}\underbrace{K_1 A^2 B}_{\text{reaction}} + 2K_{-1}C$$

$$\frac{dB}{dt} = -1\,K_1 A^2 B + 1\,K_{-1}C$$

$$\frac{dC}{dt} = K_1 A^2 B - K_{-1}C$$

A(t)
B(t)
C(t)

$$A + A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C$$ Dimerization.

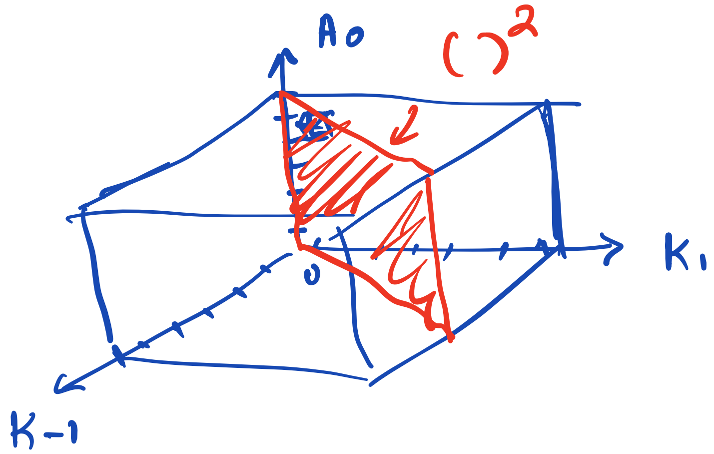
$$\frac{dA}{dt} = -2k_1 A^2 + 2k_{-1} C$$

$$\frac{dC}{dt} = k_1 A^2 - k_{-1} C$$

Conservation statement

$$\frac{dA}{dt} + 2\frac{dC}{dt} = 0 \qquad A + 2C = A_0$$

$A(t)$ $\qquad$ $A_0,\ k_1,\ k_{-1}$



$(\ )^3$

$k_1 \quad f(k_{-1}, \dots)$

'composite' parameter

$k' = f(\underline{k_1, k_{-1}})$

'Non-dimensionalization and scaling'