

Ordinary Differential Equations (ODEs) in Reaction Engineering

(It is essential to have a good command on solving the ODEs in this set to follow CP303 with ease.)

(1) Solve the following ODEs for the given initial conditions:

(i) $\frac{dx}{dt} = ax$ with $x = x_o$ at $t = 0$.

(ii) $\frac{dx}{dt} = a(1 + \epsilon x)$ with $x = 0$ at $t = 0$.

(2) Solve the following ODEs for a non-zero value of ϵ and give the solutions in terms of integrating constants:

(i) $\frac{dx}{dt} = a \frac{(1-x)}{(1+\epsilon x)}$

(ii) $\frac{dx}{dt} = a \frac{(1-x)^2}{(1+\epsilon x)}$

(iii) $\frac{dx}{dt} = a \frac{(1-x)^2}{(1+\epsilon x)^2}$

(3) Solve the following ODE for the two different cases, (i) $p \neq q$ and (ii) $p = q$, and give the solutions in terms of integrating constants:

$$\frac{dx}{dt} = a(x-p)(x-q)$$

(4) Solve the following ODE for the initial condition $x = 0$ at $t = 0$:

$$\frac{dx}{dt} = \frac{(c+gx)}{(a+bx)}$$

(5) Solve the following set of ODEs for the following two cases, (i) $k_1 \neq k_2$ and (ii) $k_1 = k_2$, with the initial condition of $C_A = C_{A_o}$ and $C_B = 0$ at $t = 0$:

$$\begin{aligned}\frac{dC_A}{dt} &= -k_1 C_A \\ \frac{dC_B}{dt} &= -k_2 C_B + k_1 C_A\end{aligned}$$