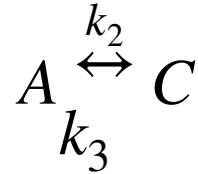
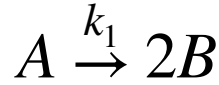


Multivariate Non-linear Algebraic Equations:

**Q1.** The mass balance equations for the following reactions taking place in a CSTR:



is given by:

$$F_1 = -C_A + C_{A0} + \left[ -K_1 C_A - K_2 C_A^{\frac{3}{2}} + K_3 C_C^2 \right] \theta = 0$$

$$F_2 = -C_B + \left[ 2K_1 C_A - K_4 C_B^2 \right] \theta = 0$$

$$F_3 = -C_C + \left[ K_2 C_A^{\frac{3}{2}} - K_3 C_C^2 + K_4 C_B^2 \right] \theta = 0$$

$$F_4 = -C_D + \left[ K_4 C_B^2 \right] \theta = 0$$

Use Newton Raphson Method and find the concentrations  $[C_A \ C_B \ C_C \ C_D]$  for the following situation as a function of iteration

$$K_1 = 1.0 \frac{1}{s}$$

$$K_2 = 0.2 \frac{\text{lit}^{\frac{1}{2}}}{s - \text{mol}^{\frac{1}{2}}} \quad K_3 = 0.05 \frac{\text{lit}}{s - \text{mol}}$$

$$K_4 = 0.4 \frac{\text{lit}}{\text{s} - \text{mol}} \quad \theta = 2s \quad C_{A0} = 1 \text{ mol/lit}$$