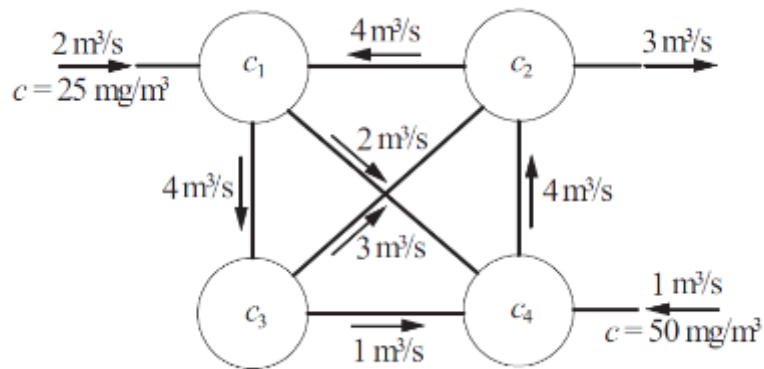


Problem Statement: Determine the steady state concentration of the chemical in the four tanks.



Solution:

Four mixing tanks are connected by pipes.

Applying overall mass balance to the system, we get

$$v_i \frac{dC_i}{dt} = \sum (QC)_{in} - \sum (QC)_{out}$$

Where v_i is volume of the tank i , Q is volumetric flow rate and C is concentration.

Applying this equation to each tank, we get

$$v_1 \frac{dC_1}{dt} = -6C_1 + 4C_2 + 2 \cdot 25$$

$$v_2 \frac{dC_2}{dt} = -7C_2 + 3C_3 + 4C_4$$

$$v_3 \frac{dC_3}{dt} = 4C_1 - 4C_3$$

$$v_4 \frac{dC_4}{dt} = 2C_1 + C_3 - 4C_4 + 1 \cdot 50$$

At steady state $v_i \frac{dC_i}{dt} = 0$; thus, we get

$$-6C_1 + 4C_2 + 50 = 0$$

$$-7C_2 + 3C_3 + 4C_4 = 0$$

$$4C_1 - 4C_3 = 0$$

$$2C_1 + C_3 - 4C_4 + 50 = 0$$

We can solve these four linear equations using Gauss Elimination method.