Assignment: Data reconciliation

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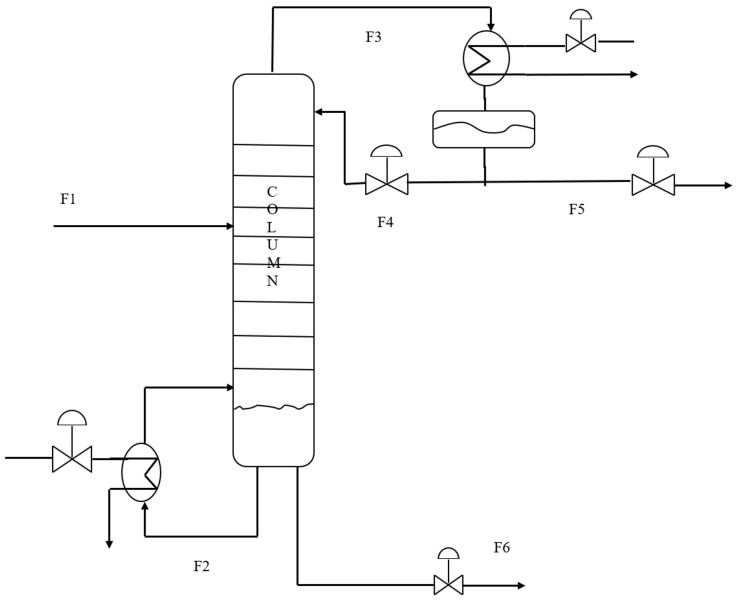

Process stream	Mass flow kg/s	Instrument variance σ^2
F1	120.2	1.2
F2	95.2	0.5
F3	180	5.0
F4	142.8	0.8
F5	35.7	0.5
F6	80.2	0.2

- Find incidenc matrix
- Tank: $F_1 + F_4 - F_3 - F_6 = 0$
- Destidation: $F_3 - F_4 - F_5 = 0$

Minimize $i(\hat{v}) = (y - \hat{v})^T V^{-1} (y - \hat{v})$

Minimize $j(\hat{y}) = (y-\hat{y})^T \cdot V^{-1} (y-\hat{y})$

$$j(\hat{y}) = (y-\hat{y})^T \cdot V^{-1} (y-\hat{y}_n) - 2\lambda^T \cdot A \cdot \hat{y}$$

$$\lambda^T = [\lambda_1, \lambda_2, \lambda_3, \lambda_4]$$

$$\min_{x,\, y^*} \sum_{i=1} \left(\frac{y_i^* - y_i}{\sigma_i} \right)^2$$

$$\hat{Y} = Y - VA^T (AVA^T)^{-1} \cdot AY$$

$$y = \begin{bmatrix} 120,2 \\ 95,2 \\ 180 \\ 142,8 \\ 35,7 \\ 80,2 \end{bmatrix} \qquad V = \begin{bmatrix} 1,2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0,5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0,8 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0,5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0,2 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 0 & -1 & 1 & 0 & -1 \\ 0 & 0 & 1 & -1 & -1 & 0 \end{bmatrix}$$

Reconciled mass flows:

F1	117,5
F2	95,2
F3	179,7
F4	142,8
F5	36,8
F6	80,6