



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Computer aided power system analysis

State Estimation Technique

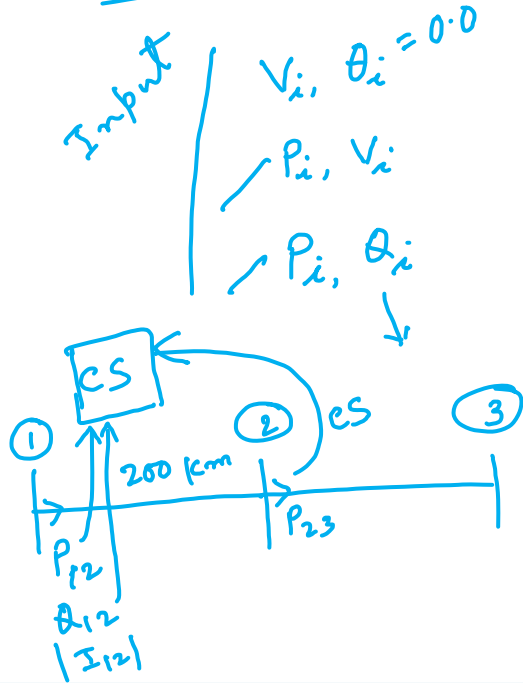
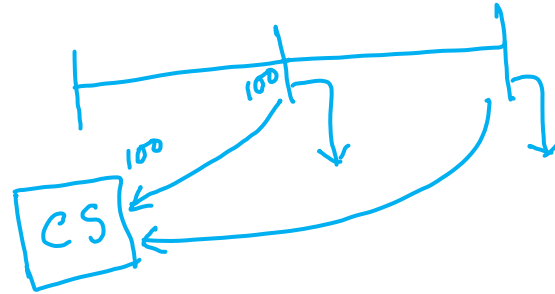
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STATE ESTIMATION TECHNIQUE

Power-flow analysis



100 MW
101 MW
99 MW

10%

90 110

Meters $\rightarrow$ Errors in meters

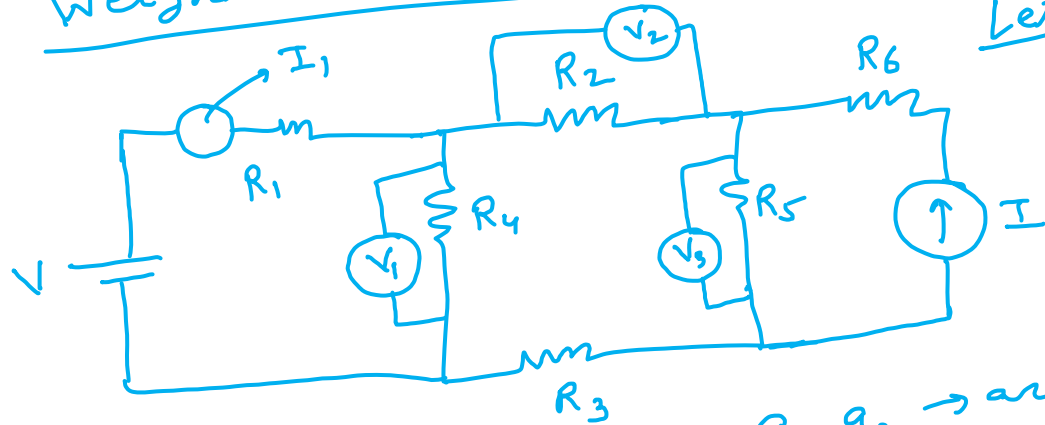
Communication channel $\rightarrow$ error

STATE ESTIMATION (SE)

To estimate the values of the unknown quantities such that the effect or measurement errors is minimized.

Weighted least square (WLS) method

Let the unknowns are V and I



$$I_1 = a_1 V + a_2 I$$

$a_1, a_2 \rightarrow$ are constants
functions of all
 $R_i \forall i=1, \dots, 6$

$$\left. \begin{aligned} m_1 \leftarrow I_1 &= a_1 V + a_2 I \\ m_2 \leftarrow V_1 &= a_3 V + a_4 I \\ m_3 \leftarrow V_2 &= a_5 V + a_6 I \\ m_4 \leftarrow V_3 &= a_7 V + a_8 I \end{aligned} \right\}$$

a_i ; $i=1, \dots, 8$ are all constants and functions of $R_1, R_2, \dots, R_6$.

$$\begin{aligned} a_1 &= h_{11}; & a_2 &= h_{12} \\ a_3 &= h_{21}; & a_4 &= h_{22} \\ a_5 &= h_{31}; & a_6 &= h_{32} \\ a_7 &= h_{41}; & a_8 &= h_{42} \end{aligned}$$

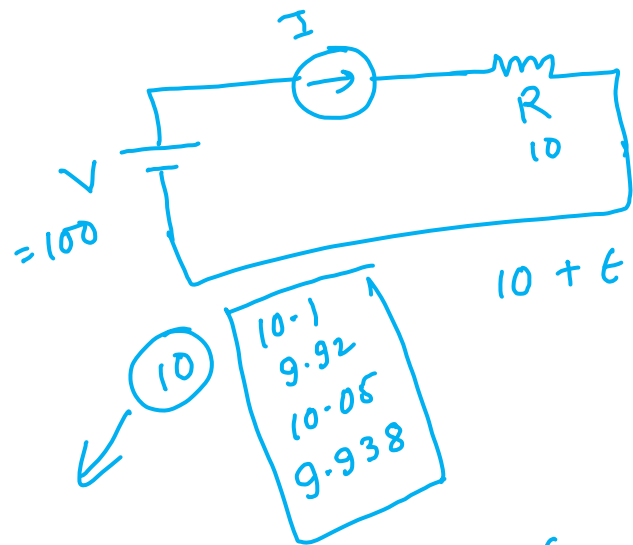
$$\begin{array}{c} V, I \\ \swarrow \quad \searrow \\ x_1 \quad x_2 \end{array}$$

$$\begin{array}{l} V = 10 = x_1 \\ I = 5 = x_2 \\ h_{11} = 5 \\ h_{12} = 2 \end{array}$$

$$\begin{aligned} m_1 &= h_{11} x_1 + h_{12} x_2 + e_1 \\ m_2 &= h_{21} x_1 + h_{22} x_2 + e_2 \\ m_3 &= h_{31} x_1 + h_{32} x_2 + e_3 \\ m_4 &= h_{41} x_1 + h_{42} x_2 + e_4 \end{aligned}$$

Ideal value of $m_1 = 50 + 10 = 60$





$$m = x_{true} + \epsilon$$

