$\underline{M=\phi}$ MODEL $\quad \underline{\phi}^T(x_n) = [1] \quad \underline{w} = [w_0] \quad \underline{\underline{\Phi}} = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix}$

$$\underline{\underline{\Phi}}^T \underline{\underline{\Phi}} = N \qquad \underline{w}_{LS}^{(0)} = \frac{1}{N}\sum_{n=1}^{N} t_n$$

$\underline{M=1}$ MODEL $\quad \underline{\phi}^T(x_n) = [1 \ \ x_n] \quad \underline{\underline{\Phi}} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \cdots & \cdots \\ 1 & x_n \end{bmatrix}$

$$\underline{\underline{\Phi}}^T \underline{\underline{\Phi}} = \begin{bmatrix} N & \Sigma x_n \\ \Sigma x_n & \Sigma x_n^2 \end{bmatrix}$$

LET $\mu = \frac{1}{N}\Sigma x_n$, $m = \frac{1}{N}\Sigma x_n^2$, $r = \frac{1}{N}\Sigma t_n x_n$

$\bar{t} = \frac{1}{N}\Sigma t_n$

$$\underline{\underline{\Phi}}^T \underline{t} = \begin{bmatrix} \Sigma t_n \\ \Sigma t_n x_n \end{bmatrix} \qquad \underline{w}_{LS}^{(1)} = \frac{1}{m-\mu^2}\begin{bmatrix} m\bar{t} - \mu r \\ -\mu\bar{t} + r \end{bmatrix}$$

IF DATA SOURCE : $\quad t_n = a + e_n \quad (= a\cdot x^0 + e_n = w_0 \cdot x^0 + e_n)$

$$\underline{w}_{LS}^{(0)} = \frac{1}{N}\Sigma t_n = a + \frac{1}{N}\Sigma e_n \simeq a$$

$\bar{t} \to a$

$r \to a\mu$

$$\underline{w}_{LS}^{(1)} \cong \frac{1}{m-\mu^2}\begin{bmatrix} a(m-\mu^2) \\ -a\mu + a\mu \end{bmatrix} = \begin{bmatrix} a \\ \phi \end{bmatrix}$$

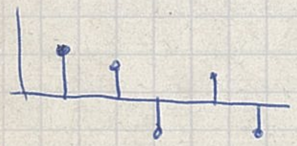
IF DATA SOURCE : $\quad t_n = a \cdot x_n + e_n \quad (= \cancel{\ldots}\ w_0 \cdot x_n^0 + a \cdot x_n^1 + \ldots)$

$w_0 = \phi, \ w_1 = a$

$$\left.\begin{matrix} \bar{t} \to a\mu \\ r \to am \end{matrix}\right\} \qquad \underline{w}_{LS}^{(0)} \simeq a \cdot \frac{1}{N}\Sigma x_n \quad \text{(MODEL ERROR)}$$

$$\underline{w}_{LS}^{(1)} \simeq \frac{1}{m-\mu^2}\begin{bmatrix} ma\mu - \mu am \\ -\mu^2 a + am \end{bmatrix} = \begin{bmatrix} \phi \\ a \end{bmatrix}$$

(BISHOP)



$M=0$

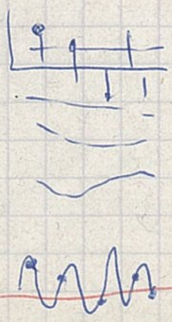
$M=1$

$M=2$

$M=3$

$\vdots$

$M=9$



$\underline{\text{MODEL}}$ $\underline{\text{ERROR}}$

$E(\underline{w}^*) = \min E(\underline{w})$