Problema matemàtic :

$$\boxed{\Delta x = J \cdot \Delta\Theta}$$

- $\Delta\Theta$ ↳ Espai del sistema : Vector N comp
- J ↳ Matriu (calculable) de Jacobi
- Δx → Dades sobre com volem que es comporti el sistema
- ↳ Representa un conjunt de restriccions o condicions externes

$$\Delta x = J \cdot \Delta\Theta$$

$$\begin{vmatrix} \cdot \\ \cdot \\ \cdot \end{vmatrix} = \begin{vmatrix} \text{—} \\ \text{—} \\ \text{—} \end{vmatrix} \cdot \begin{vmatrix} | \end{vmatrix}$$

⟺ ORIGEN :

$$\boxed{x = x(\Theta)}$$

$$\Delta x = x'(\Theta) \cdot \Delta\Theta \quad \Big\| \quad \Delta x_i = \sum_j \frac{\partial x_i}{\partial \Theta_j} \Delta\Theta_j \ ; \ \Theta$$

Solució algorísmica :

$$\boxed{\Delta\Theta = J^T \underbrace{(\underbrace{J \cdot J^T}_{A(M \times M)})^{-1}}_{B = A^{-1}} \cdot \Delta x}$$

↳ Dades o condicions externes

$\boxed{\text{Exercici}}$ $(\Theta_1, \Theta_2, \Theta_3)$ 3 graus de llibertat $\qquad \boxed{x = x(\Theta)}$

En $t=0 \Rightarrow \Theta_1 = \Theta_2 = \Theta_3 = 1$.

Volem controlar 2 variables externes x_1 i x_2 on ... → $x_1 = \Theta_1 + \Theta_2 + \Theta_3$

Trobar $\Delta\Theta_j$ tals que : → $\Delta x_1 = 1 \cdot 10^{-2}$ ↳ $x_2 = \Theta_2^2 \cdot \Theta_3$

↳ $\Delta x_2 = 0$

⇝ En $t=0$ → $x_1 = 3$ i $x_2 = 1$

↳ En el nostre cas

$$\Delta x = \begin{bmatrix} \cdot \\ \cdot \end{bmatrix} = \begin{array}{c} \begin{array}{ccc} \Theta_1 & \Theta_2 & \Theta_3 \end{array} \\ \begin{bmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{bmatrix} \end{array} \begin{bmatrix} \Delta\Theta_1 \\ \Delta\Theta_2 \\ \Delta\Theta_3 \end{bmatrix} \qquad \Delta x = \begin{vmatrix} \cdot \\ \cdot \end{vmatrix} = \begin{vmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{vmatrix} \cdot \begin{vmatrix} \Delta\Theta_1 \\ \Delta\Theta_2 \\ \Delta\Theta_3 \end{vmatrix} + (\Delta\Theta)^2$$

↳ Negligible

$$\Delta x = \begin{vmatrix} \Delta x_1 \\ \Delta x_2 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \end{vmatrix} \cdot \begin{vmatrix} \Delta\Theta_1 \\ \Delta\Theta_2 \\ \Delta\Theta_3 \end{vmatrix} + (\Delta\Theta)^2$$

derivada x_1

derivada x_2

$$\boxed{\begin{aligned} \Delta x_1 &= \Theta_1 + \Theta_2 + \Theta_3 \\ \Delta x_2 &= 2\Theta_2 + \Theta_3 \end{aligned}}$$

$$\Delta\Theta = J^T (J \cdot J^T)^{-1} \cdot \Delta x$$

$$\Delta\Theta = \begin{pmatrix} 1 & 0 \\ 1 & 2 \\ 1 & 1 \end{pmatrix} \cdot inv\left(\begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 1 & 2 \\ 1 & 1 \end{pmatrix} \right) \cdot \begin{pmatrix} 1 \cdot 10^{-2} \\ 0 \end{pmatrix} = \begin{pmatrix} 5 \\ -1 \\ 2 \end{pmatrix}$$

- $\Delta\Theta_1 = 5/600 = 0.00833$
- $\Delta\Theta_2 = -1/600 = -1/600$
- $\Delta\Theta_3 = 2/600 = 0.00333$

$\Theta_1' = 1.00833$

$\Theta_2' = 0.99833$ i

$\Theta_3' = 1.00333$

$x_1' = 3.0100000$

$x_2' = 0.99999167$

Solució infinita (∞)

$$\Delta\theta' = Q \cdot \Delta\theta$$

↳ diagonal matrix $\begin{bmatrix} q_1 & 0 & 0 & 0 \\ 0 & q_2 & 0 & 0 \\ \vdots & \cdots & \cdots & \vdots \\ 0 & 0 & 0 & q_n \end{bmatrix}$ $\left\{ \begin{array}{l} \theta_1 = q_1 \cdot \Delta\theta_1 \\ \theta_2 = q_2 \cdot \Delta\theta_2 \\ \cdots \\ \theta_n = q_n \cdot \Delta\theta_n \end{array} \right.$

$$\Delta\theta_{prop} = Q^2 \cdot J^T \cdot (J \cdot Q^2 \cdot J^T)^{-1} \cdot \Delta x$$

$$\Delta x = (J \cdot Q^2 \cdot J^T)(J \cdot Q^2 \cdot J^T)^{-1} \cdot \Delta x$$

⇝ les q_i permeten restringir sistemes.