

$$f(x + \Delta x) \approx f(x) + J(x)^T \Delta x$$

$$\Delta x^* = \arg \min_{\Delta x} \frac{1}{2} \| f(x) + J(x)^T \Delta x \|^2$$

$$\begin{aligned} \frac{1}{2} \| f(x) + J(x)^T \Delta x \|^2 &= \frac{1}{2} (f(x) + J(x)^T \Delta x)^T (f(x) + J(x)^T \Delta x) \\ &= \frac{1}{2} (\| f(x) \|_2^2 + 2 f(x)^T J(x)^T \Delta x + \Delta x^T J(x) J(x)^T \Delta x) \end{aligned}$$

$$\frac{\partial F}{\partial \Delta x} = J(x) f(x) + J(x) J(x)^T \Delta x = 0$$

$$J(x) J(x)^T \Delta x = -J(x) f(x)$$