$$(x-A_1)^2+(y-B_1)^2+(z-C_1)^2=[c(t_1-d)]^2$$
$$(x-A_2)^2+(y-B_2)^2+(z-C_2)^2=[c(t_2-d)]^2$$
$$(x-A_3)^2+(y-B_3)^2+(z-C_3)^2=[c(t_3-d)]^2$$
$$(x-A_4)^2+(y-B_4)^2+(z-C_4)^2=[c(t_4-d)]^2$$

$$f(x+\Delta x)\cong f(x)+\Delta x f'(x)+\frac{\Delta x^2}{2}f''(x)+...$$

$$f(x+\Delta x)=f(x)+\Delta x f'(x)$$

Assume $f(x+\Delta x)=0$, then

$$f(x)+\Delta f'(x)=0$$

$$f(x)=-\Delta x f'(x)$$

$$\Delta x=\frac{-f(x)}{f'(x)}$$

$$x_{new}=x+\Delta x=x-\frac{f(x)}{f'(x)}$$

$$\overrightarrow{F}(\overrightarrow{x})=\overrightarrow{0}$$

$$\overrightarrow{F}(\overrightarrow{x}+\Delta\overrightarrow{x})=\overrightarrow{F}(\overrightarrow{x})+DF(\overrightarrow{x})\Delta\overrightarrow{x}$$

$$DF(\overrightarrow{x})=\begin{pmatrix}\frac{\partial F_1}{\partial x_1} & \frac{\partial F_1}{\partial x_2} & \cdots & \frac{\partial F_1}{\partial x_n}\\ \frac{\partial F_2}{\partial x_1} & \frac{\partial F_2}{\partial x_2} & \cdots & \frac{\partial F_2}{\partial x_n}\\ \vdots & \vdots & \ddots & \vdots\\ \frac{\partial F_n}{\partial x_1} & \frac{\partial F_n}{\partial x_2} & \cdots & \frac{\partial F_n}{\partial x_n}\end{pmatrix} \tag{1}$$

$$\overrightarrow{x}_{new}=\overrightarrow{x}_{old}+\Delta\overrightarrow{x}=\overrightarrow{x}_{old}-DF(\overrightarrow{x})^{-1}\cdot F(\overrightarrow{x})$$

$$A_i = \rho cos\phi_i cos\theta_i$$
$$B_i = \rho cos\phi_i cos\theta_i$$
$$C_i = \rho sin\theta_i$$

satelite ranges $R_i = \sqrt{A_i^2 + B_i^2 + (C_i - 6370)^2}$ and travel times $t_i = d + R_i/c$

$$\text{error magnification factor} = \frac{||(\Delta x, \Delta y, \Delta z)||_\infty}{c||\Delta t_1, \ldots, \Delta t_m)||_\infty}$$

$$-DF(\overrightarrow{x})\Delta\overrightarrow{x} = F(\overrightarrow{x}) \tag{2}$$
$$-DF^T(\overrightarrow{x})DF(\overrightarrow{x})\Delta\overrightarrow{x} = DF^T(\overrightarrow{x})F(\overrightarrow{x}) \tag{3}$$
$$-(DF^T(\overrightarrow{x})DF(\overrightarrow{x}))^{-1}DF^T(\overrightarrow{x})DF(\overrightarrow{x})\Delta\overrightarrow{x} = (DF^T(\overrightarrow{x})DF(\overrightarrow{x}))^{-1}DF^T(\overrightarrow{x})F(\overrightarrow{x}) \tag{4}$$
$$\Delta\overrightarrow{x} = -(DF^T(\overrightarrow{x})DF(\overrightarrow{x}))^{-1}DF^T(\overrightarrow{x})F(\overrightarrow{x}) \tag{5}$$