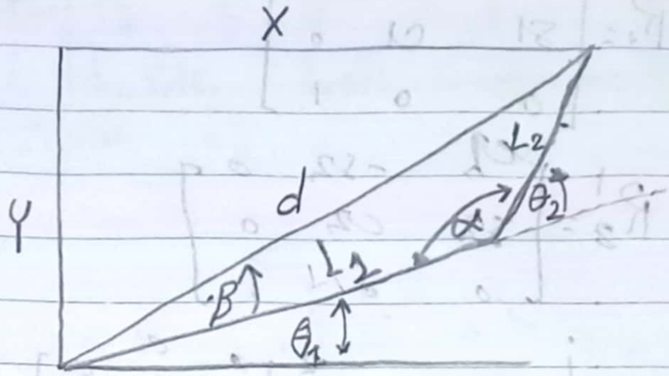
التاريخ: / /   الموضوع:

method scara Robot inverse kinematics:



$d = \sqrt{X^2 + Y^2}$

$d^2 = X^2 + Y^2 \longrightarrow \boxed{1}$

$d^2 = L_1^2 + L_2^2 - 2 L_1 L_2 \cos\alpha$

$\cos\alpha = \dfrac{d^2 - L_1^2 - L_2^2}{-2 L_1 L_2}$ $\boxed{2}$

* From Figure :-

$\theta_2 = 180 - \alpha$ or $\pi - \alpha$

$\cos\theta_2 = \cos(\pi - \alpha) = \cancel{\cos\pi}^{-1} \cos\alpha + \cancel{\sin\pi}^{0} \sin\alpha$

$\cos\theta_2 = \dfrac{d^2 - L_1^2 - L_2^2}{2 L_1 L_2}$

$\therefore \theta_2 = \pm \cos^{-1}\left(\dfrac{X^2 + Y^2 - L_1^2 - L_2^2}{2 L_1 L_2}\right)$ $\boxed{3}$

From Figure:

$\tan(\beta + \theta_1) = \dfrac{Y}{X}$

$\therefore \theta_1 = \tan^{-1}\left(\dfrac{Y}{X}\right) - \beta$ $\boxed{4}$

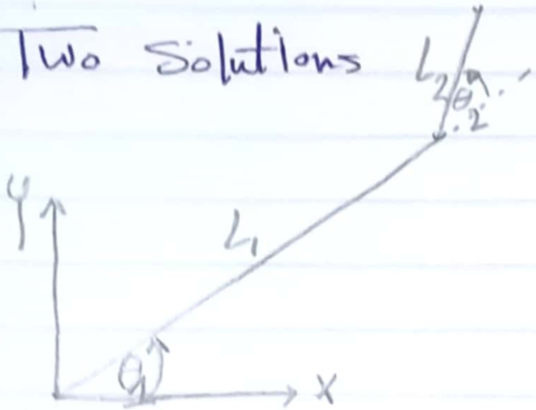
التاريخ: / / الموضوع:

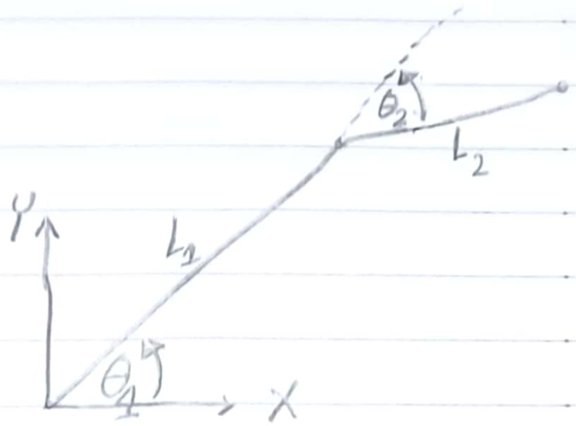
$$\tan\beta = \frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}$$

$$\therefore \beta = \tan^{-1}\left(\frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}\right) \quad \boxed{5}$$

$$\therefore \theta_1 = \tan^{-1}\left(\frac{y}{x}\right) \pm \tan^{-1}\left(\frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}\right)$$

Two Solutions





$$\therefore \theta_2 = +\cos^{-1}\left(\frac{x^2+y^2-L_1^2-L_2^2}{2L_1L_2}\right) \qquad \therefore \theta_2 = -\cos^{-1}\left(\frac{x^2+y^2-L_1^2-L_2^2}{2L_1L_2}\right)$$

$$\therefore \theta_1 = \tan^{-1}\left(\frac{y}{x}\right) - \tan^{-1}\left(\frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}\right) \qquad \therefore \theta_1 = \tan^{-1}\left(\frac{y}{x}\right) + \tan^{-1}\left(\frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}\right)$$

$$\therefore \theta_2 = \pm \cos\left(\frac{x^2+y^2-L_1^2-L_2^2}{2L_1L_2}\right)$$

$$\therefore \theta_1 = \tan^{-1}\left(\frac{y}{x}\right) \pm \tan^{-1}\left(\frac{L_2 \sin\theta_2}{L_1 + L_2\cos\theta_2}\right)$$