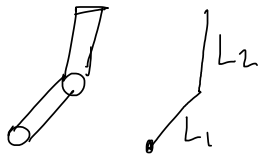
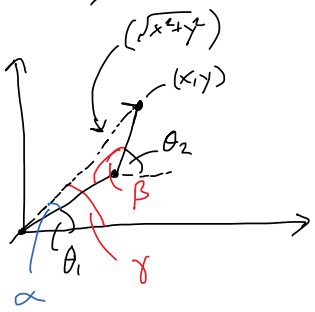
Analytic Inverse Kinematics Example

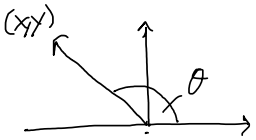
Wednesday, 3 November 2021 2:48 PM

2R Example (Planar)



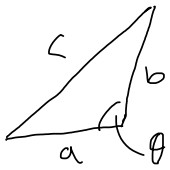


$\text{atan2}(x,y)$



$\theta_1 = \gamma - \alpha$

$\theta_2 = \pi - \beta$



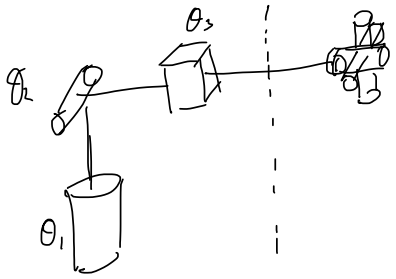
$$c^2 = a^2 + b^2 - 2ab\cos(\theta)$$

$$L_1^2 + L_2^2 - 2L_1L_2\cos(\beta) = x^2 + y^2$$

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

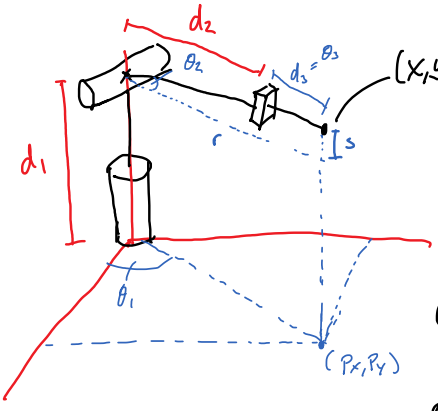
$$\alpha = \cos^{-1}\left(\frac{x^2 + y^2 + L_1^2 - L_2^2}{2L_1\sqrt{x^2+y^2}}\right)$$

Stanford Arm Example



RRP

Given (x, y, z) need to find $(\theta_1, \theta_2, \theta_3)$



$a\tan 2(p_x, p_y)$

$r^2 = p_x^2 + p_y^2$

$s = p_z - d_1$

$\theta_2 = a\tan 2(s, r)$

$(\theta_3 + d_2)^2 = r^2 + s^2$

$\theta_3 = \sqrt{r^2+s^2} - d_2$

$\theta_3 = \sqrt{p_x^2 + p_y^2 + (p_z - d_1)^2} - d_2$