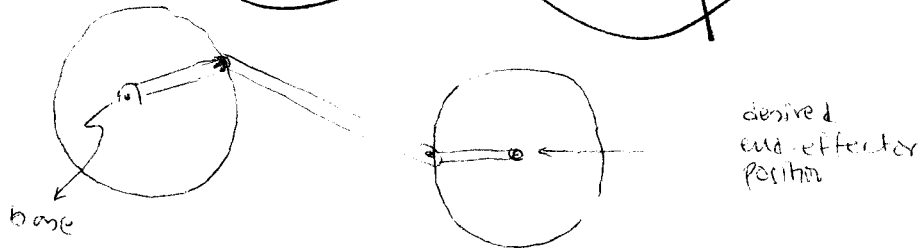


Review  
Klein

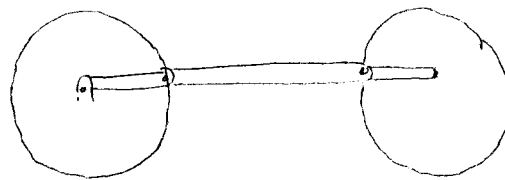
75/100

(4-1)



Given a fixed base and the desired position for the end-effector, there are infinite number of solutions

Worst case scenario:



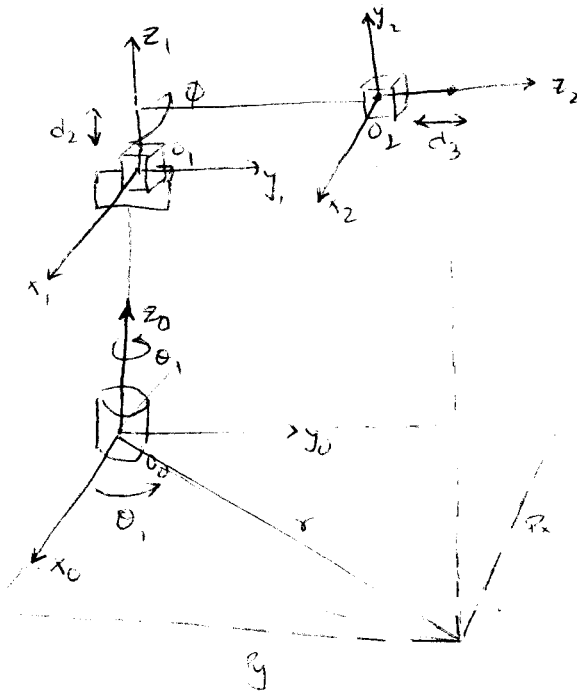
In this case, only one solution is possible.

1P end effector is fixed  
3 2 solutions only

4-2?

25

(4-3)



$$\theta_1 = \tan^{-1} P_x / P_y \quad \text{provided } P_x, P_y \neq 0$$

~~Since~~

Since  $\phi$  is always a right angle, the projection length  $r$  is equal to  $(d_3 + 1)m$ .

$$(d_3 + 1)^2 = P_x^2 + P_y^2$$

$$\therefore d_3 = \sqrt{P_x^2 + P_y^2} - 1$$

$m$  = distance between  $O_1$  and wrist center

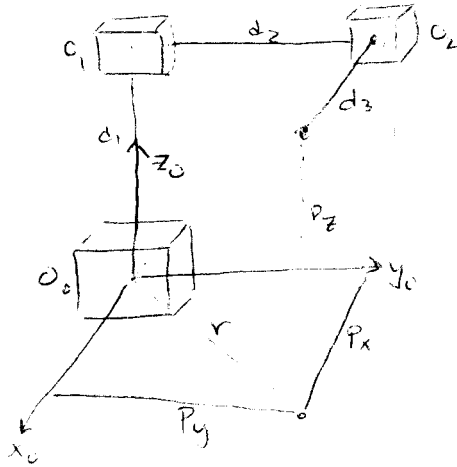
$$d_3^2 = m^2 - (d_3 + 1)^2$$

$$d_3 = \sqrt{m^2 - (d_3 + 1)^2} = \sqrt{m^2 - P_x^2 - P_y^2}$$

for

$$d_3 = P_z - 1$$

(4-4)



$$d_3 = P_x$$

$$d_2 = P_y$$

$$r^2 = P_x^2 + P_y^2$$

$$d_1 = P_z$$

==

} Assuming that the three links are fixed at right angles to each other.