

Lecture 12

INVERSE KINEMATICS

Given ${}^0_T N$, compute $\begin{pmatrix} q_1 \\ \vdots \\ q_N \end{pmatrix} = \underline{q}_N$, the joint vector

- 1) Eqns. relating ${}^0_T N$ & $\begin{pmatrix} q_1 \\ \vdots \\ q_N \end{pmatrix}$ are
- a) non-linear
 - b) coupled

Soln? What can we say

1) Existence of soln. : Soln. may

not always exist. Robots

have finite workspace. (pos. + orient.)

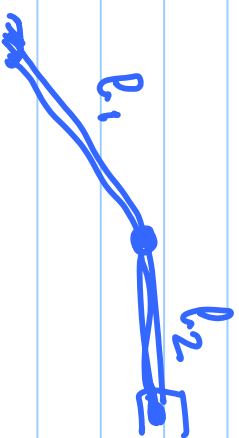
a) reachable workspace (Cart. space)
(position only)

b) free from workspace : in all possible orientations

Simple example: two-link planar arm

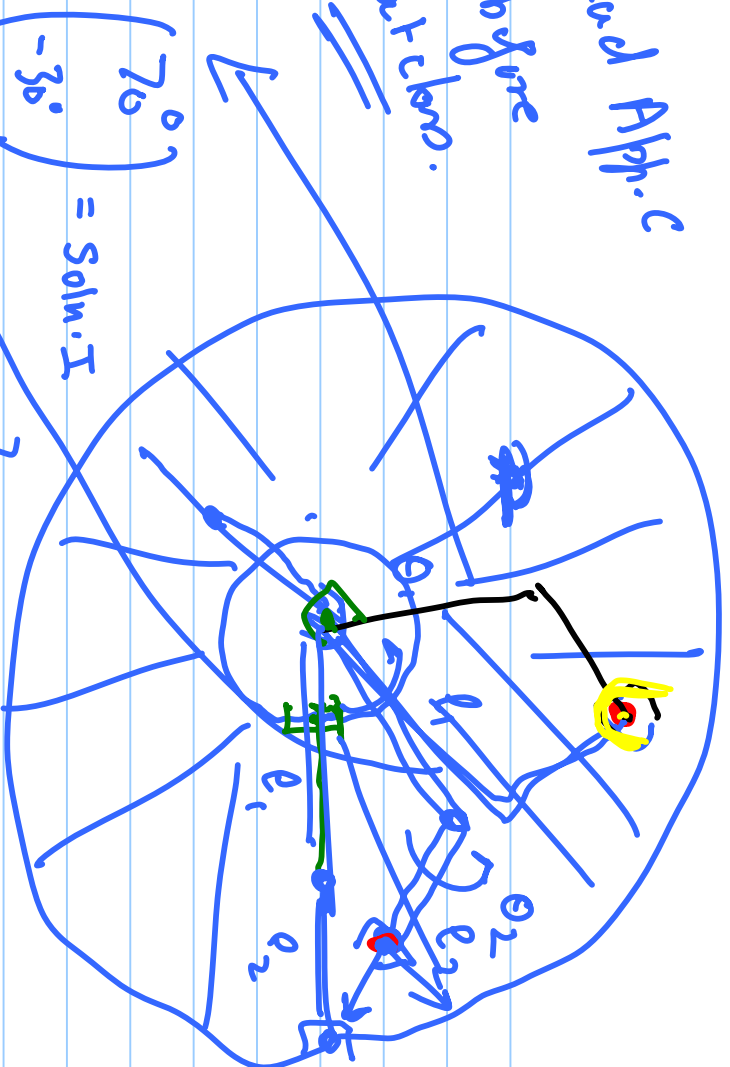
Reachable workspace = annulus

outer rad. = $l_1 + l_2$
inner " = $l_1 - l_2$



Read App. C

before
particles.



$$\begin{pmatrix} 70^\circ \\ -30^\circ \end{pmatrix} = \text{Soln. I}$$

$$\begin{pmatrix} 40^\circ \\ 30^\circ \end{pmatrix} = \text{Soln. II}$$

to reach the same pt. in workspace.
of joint limits.

Destrow workspace
is Null set.

when, $\theta_1 = \theta_2$: Dest. worksp
= single pt. at

→ sketch the origin
reachable workspace

2) Multiplicity: multiple soln possible

(infinite # of soln)