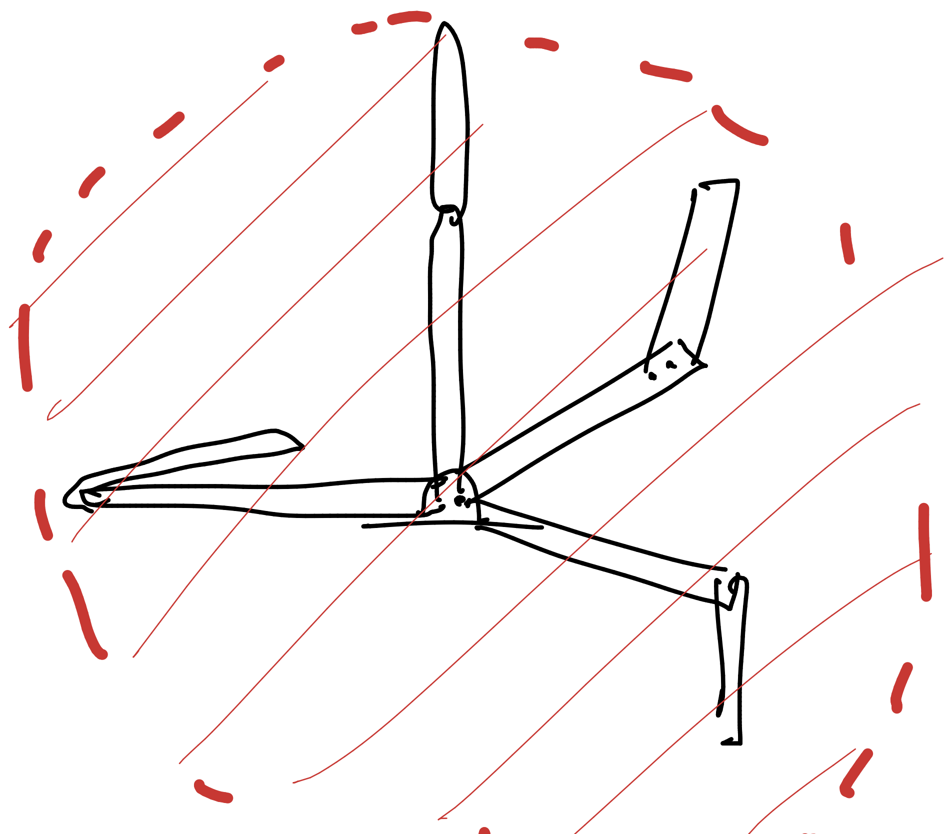
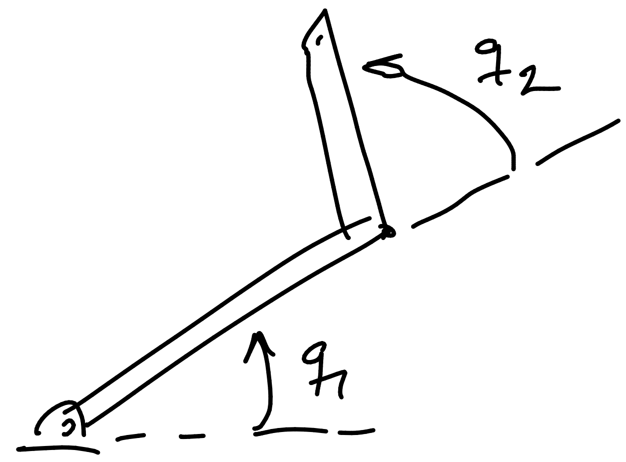
1/15/19

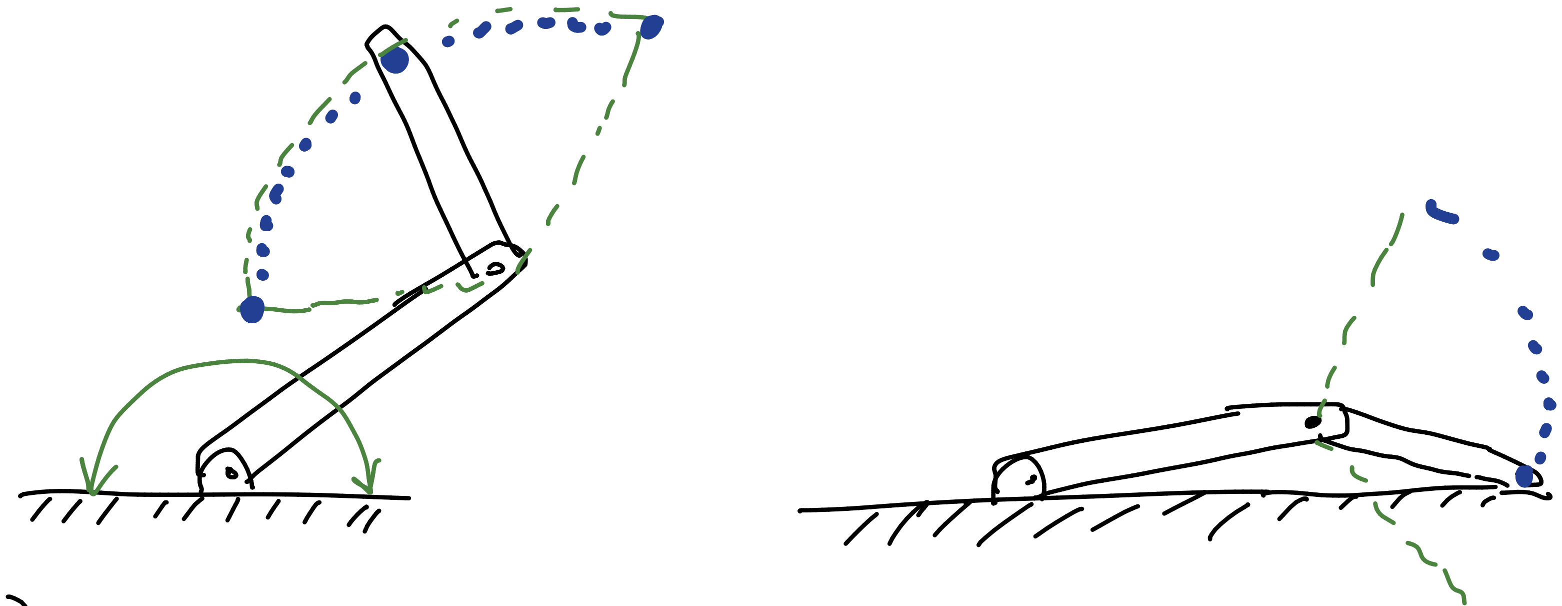


configuration space
(mathematical concept)

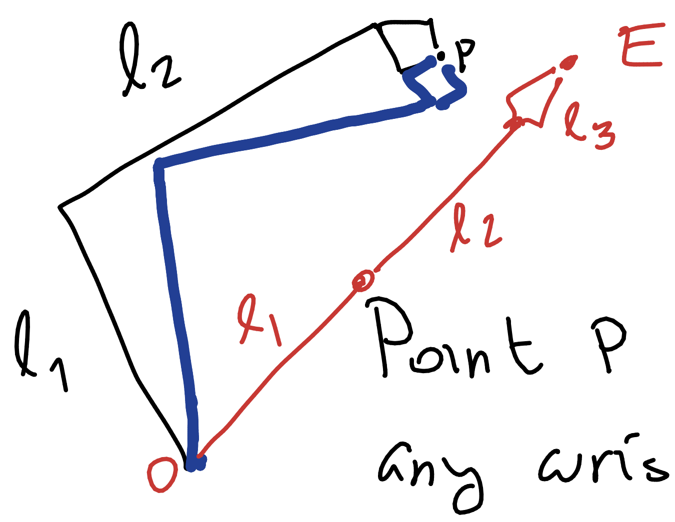


state : $\begin{bmatrix} q \\ \dot{q} \end{bmatrix}$ .... (where) .. --- (where next)

$q = \begin{bmatrix} q_1 \\ q_2 \end{bmatrix}$



(Reachable)
Workspace



Point P can be reached using any wrist angle (within a range) : point P belongs to the dexterous workspace

Point E is $l_1 + l_2 + l_3$ away from O. It can only be reached with zero wrist angle (an isolated value of wrist angle) : not a dexterous point

Linearity f is linear if $\begin{cases} f(x+y) = f(x)+f(y) \\ f(\alpha x) = \alpha f(x) \end{cases}$

(superposition & scaling)

$f(x) = 3 + 2x$ (scaling doesn't hold — f is not linear)

- Vector space (or linear space): set of vectors and 2 operations: $\begin{cases} + & \text{(between vectors)} \\ \cdot & \text{multiplication btw. scalar and a vector} \end{cases}$

Example: functions on $[a,b]$: vectors

Operations: $\begin{cases} (f_1+f_2)(x) = f_1(x) + f_2(x) \\ (\alpha f)(x) = \alpha f(x) \end{cases}$

Also: all $n \times m$ matrices ✓

- Subspace: A linear space V is a subspace if

$x \in V,\ y \in V \implies x+y \in V$

$x \in V \implies \alpha x \in V$

Example: a plane in $\mathbb{R}^3$

- Span of a set of vectors: set of all linear combinations of the vectors:

$V = \{ v_1, v_2, v_3 \dots v_n \}$

$\text{span}(V) = \{ \alpha_1 v_1 + \alpha_2 v_2 + \dots \alpha_n v_n,\ v_i \in V,\ \alpha_i \text{ scalars} \}$

Example: $\text{span}\left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \right\}$ = a plane in $\mathbb{R}^3$

-