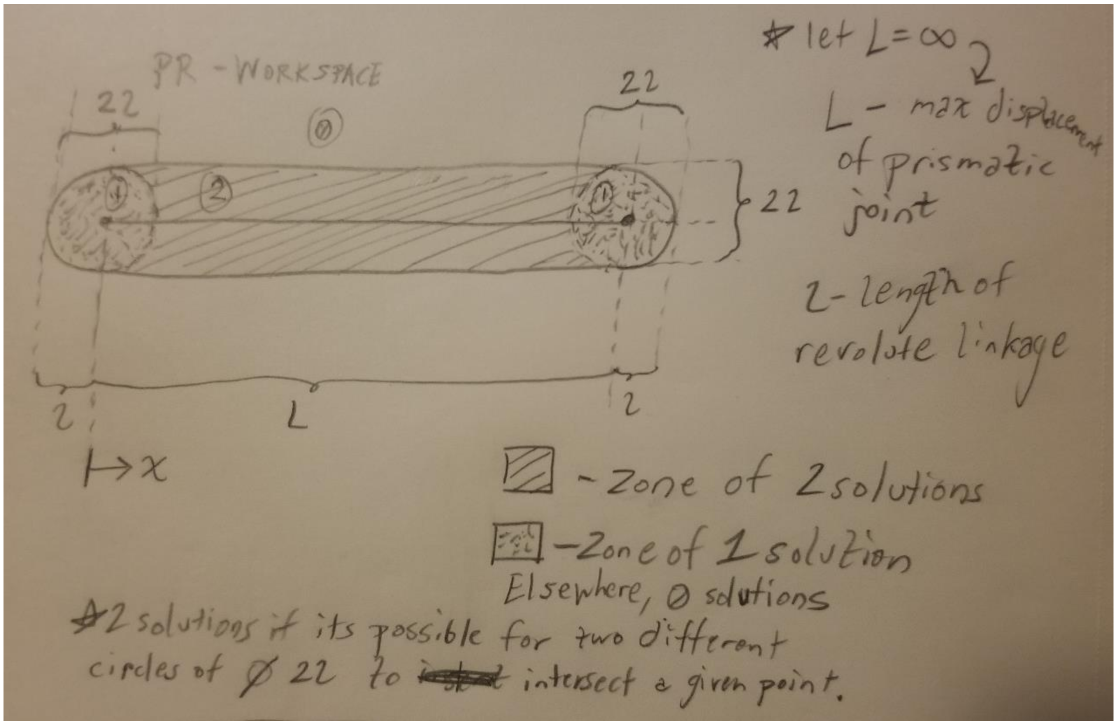
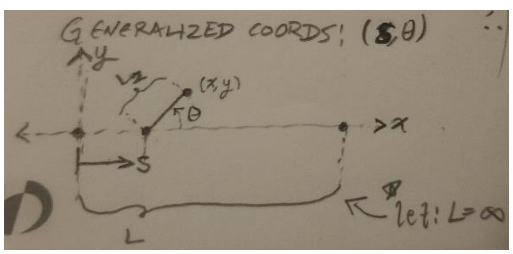
Connor W. Colombo
cwcolomb

2.)



3.)



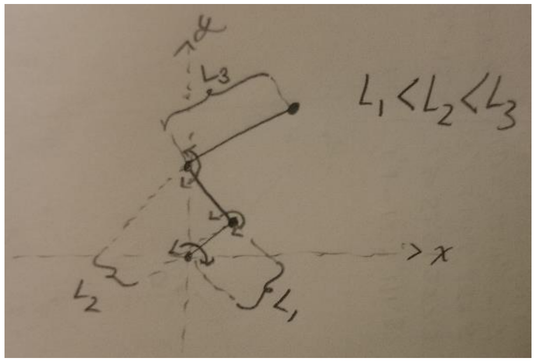
$$y = L_2 \sin(\theta)$$
$$\therefore \theta = \sin^{-1}\left(\frac{y}{L_2}\right)$$
$$\because \sin^{-1}\colon [-1,1] \mapsto \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$$

$$\boldsymbol{\theta} = \begin{cases} \boldsymbol{\sin^{-1}\left(\frac{y}{L_2}\right)}, & \boldsymbol{x > 0} \\ \boldsymbol{\sin^{-1}\left(-\frac{y}{L_2}\right) + \pi}, & \boldsymbol{x < 0} \end{cases}$$

$$x = s + L_2 \cos(\theta)$$
$$\therefore \boldsymbol{s = x - L_2 \cos(\theta)}$$

* Gives one θ for all (x,y), thus producing a singular solution set since s is determined by θ.

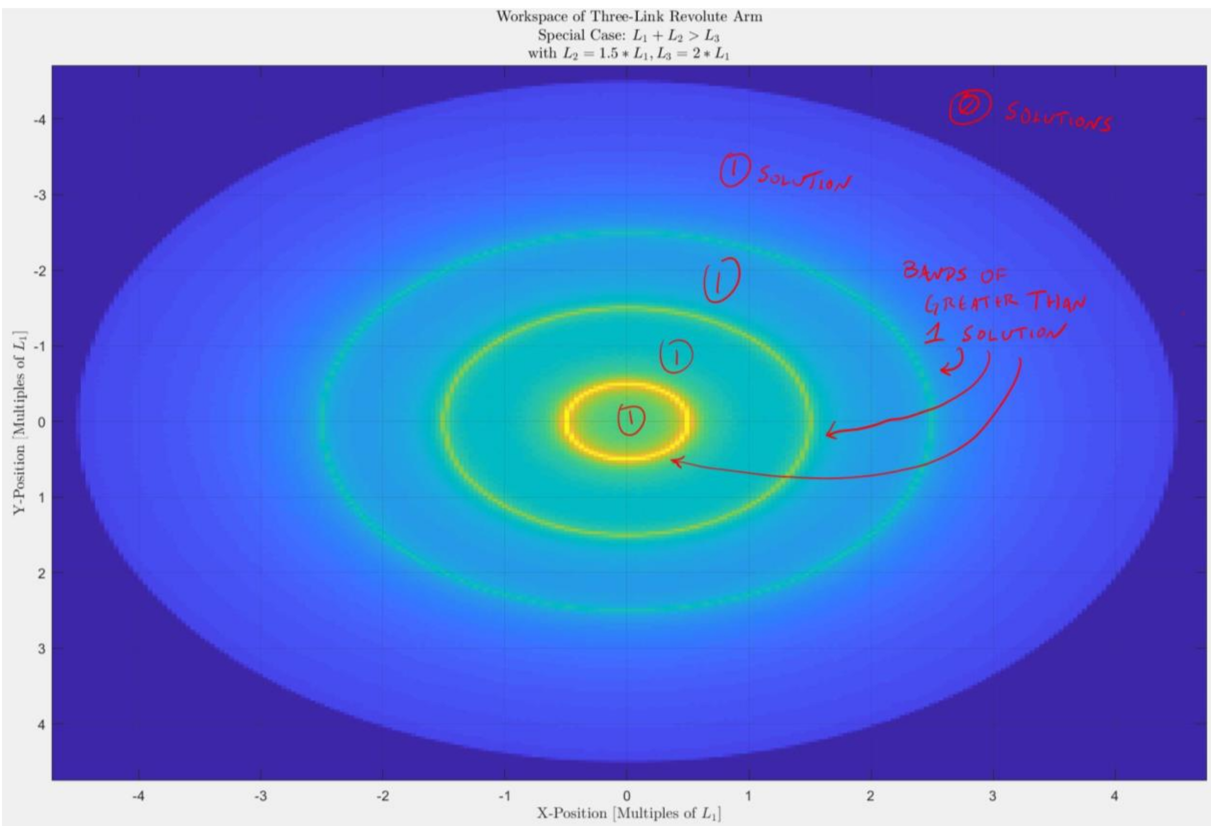
4.)



Since the sum of linkage lengths is unknown, two workspace classifications emerge: one where $L_1 + L_2 < L_3$ and one where $L_1 + L_2 > L_3$:

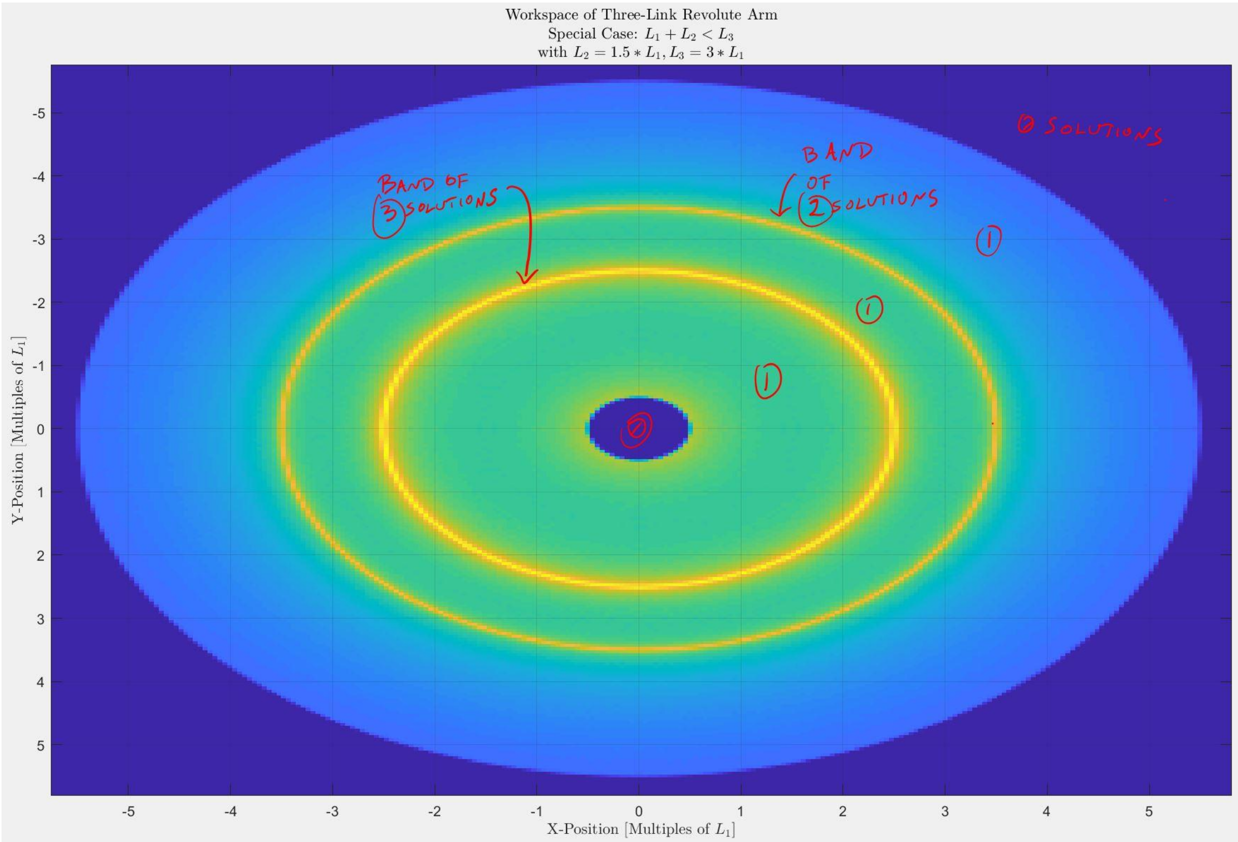
Case 1: $L_1 + L_2 < L_3$

Example configuration: $[L_1, L_2, L_3] = [1, 1.5, 2]L_1$



Case 2: $L_1 + L_2 > L_3$

Example configuration: $[L_1, L_2, L_3] = [1, 1.5, 3]L_1$



Region of no solutions is created in center because linkage 3 is not long enough to reach in any configuration.

NOTE:

** Ignore gradients around bands. This is an artifact of the quick and dirty way theta space was converted to XY-space. The gradients are not indicative of regions of greater than 1 solution, only the bands themselves are.*