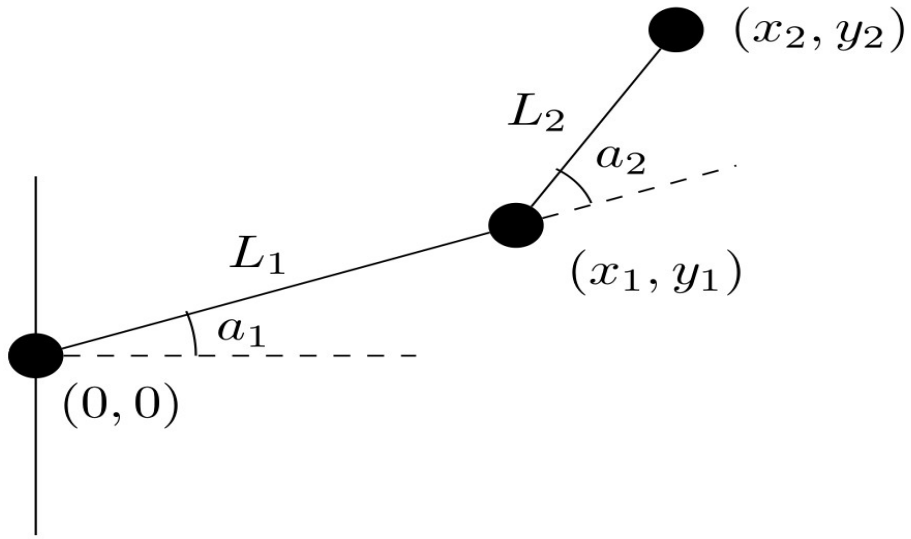
Forward Kinematics Equations



Rotation matrix: $\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$

We represent the location of a point using a 2x1 vector: $\begin{bmatrix} x \\ y \end{bmatrix}$

Example of using rotation matrix: $\begin{bmatrix} \cos(a_1) & -\sin(a_1) \\ \sin(a_1) & \cos(a_1) \end{bmatrix} * \begin{bmatrix} L_1 \\ 0 \end{bmatrix} = \begin{bmatrix} L_1 \cos(a_1) \\ L_1 \sin(a_1) \end{bmatrix}$

Translation (sliding) matrix: $\begin{bmatrix} x_{diff} \\ y_{diff} \end{bmatrix}$

Transformation = Rotation and Translation

Example of changing from reference frame 1 to reference frame 0:

$$\begin{bmatrix} \cos(a_1) & -\sin(a_1) \\ \sin(a_1) & \cos(a_1) \end{bmatrix} * \begin{bmatrix} L_1 \\ 0 \end{bmatrix} + \begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} L_1 \cos(a_1) + x_1 \\ L_1 \sin(a_1) + y_1 \end{bmatrix}$$

We are using one reference frame for each joint in our robotic arm.
You will need to apply the transformation once for each reference frame change.