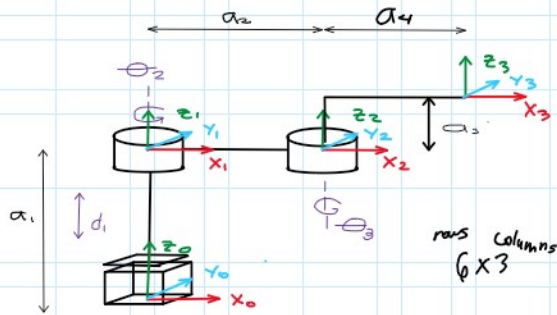


### SCARA - PRR Variant 3



	$n$	$\theta$	$\alpha$	$r$	$d$
${}^0H \rightarrow 1$	1	0	0	0	$a_1+d_1$
${}^1H \rightarrow 2$	2	$\theta_2$	0	$a_2$	0
${}^2H \rightarrow 3$	3	$\theta_3$	0	$a_4$	$a_3$

$a_1 = 55 \text{ mm}$   $d_1 = 100 \text{ mm}$   
 $a_2 = 60 \text{ mm}$   $\theta_2 = 0^\circ$   
 $a_3 = 30 \text{ mm}$   $\theta_3 = 0^\circ$   
 $a_4 = 60 \text{ mm}$

$$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{z} \\ \omega_x \\ \omega_y \\ \omega_z \end{bmatrix} = J \begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \vdots \\ \dot{q}_n \end{bmatrix}$$

$\rightarrow$ 
 $\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{z} \\ \omega_x \\ \omega_y \\ \omega_z \end{bmatrix} = \begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix} \begin{bmatrix} \dot{d}_1 \\ \dot{\theta}_2 \\ \dot{\theta}_3 \end{bmatrix}$

	Prismatic	Revolute
Linear	$R_{i-1}^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$	$R_{i-1}^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \times (a_n^0 - d_{i-1}^0)$
Rotational	$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$	$R_{i-1}^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

$J_1 \quad J_2 \quad J_3 \quad J_4 \quad J_5 \quad J_6$

$$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{z} \\ \omega_x \\ \omega_y \\ \omega_z \end{bmatrix} = \begin{bmatrix} R_0^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \\ R_1^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \\ R_2^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \\ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \\ R_1^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \\ R_2^0 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \end{bmatrix} \begin{bmatrix} \dot{d}_1 \\ \dot{\theta}_2 \\ \dot{\theta}_3 \end{bmatrix}$$

$J_2 \quad J_3 \quad J_4 \quad J_5 \quad J_6$

$$\begin{bmatrix} 0 & 1 & 2 & 3 \\ 0 & 3 \times 3 & 3 \times 1 & d \\ 1 & R & & \\ 2 & & & \\ 3 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Cross Product

$$\begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} \times \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} = \begin{bmatrix} a_2 b_3 - a_3 b_2 \\ a_3 b_1 - a_1 b_3 \\ a_1 b_2 - a_2 b_1 \end{bmatrix}$$

Concatenate  
 ChaA = A  
 ChaB = B

Concatenate(A,B)

$A+B = AB$

A = 4

B = 6

Concatenate(4,6)

AB = 46

A = "Good"

B = " Morning"

Concatenate("Good"," Morning")

AB = Good Morning

A = 5

B = "x"

Concatenate(5,"x")

AB = 5x  $\neq 5*x \neq (5)*(x)$

J1

J2

J3

JM1=Concatenate(J1,J2,J3)

JM1 = J1J2J3

JM2=Concatenate(J4,J5,J6)

JM2 = J4J5J6