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Title: Desarrollo de un simulador para el robot SCARA utilizando SolidWorks y LabView

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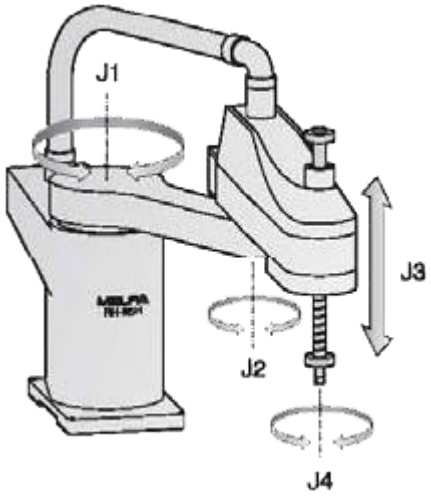
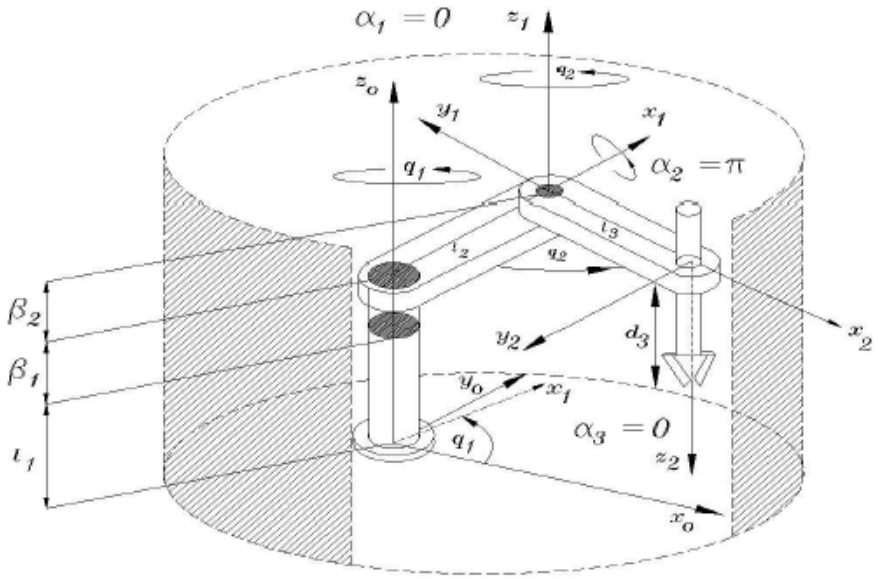
Robot Scara



Cinemática Directa



Eslabón	l_i	α_i	d_i	θ_i
1	0	0	$l_1 + \beta_1$	q_1
2	l_2	π	β_2	q_2
3	l_3	0	d_3	0

Cinemática Directa

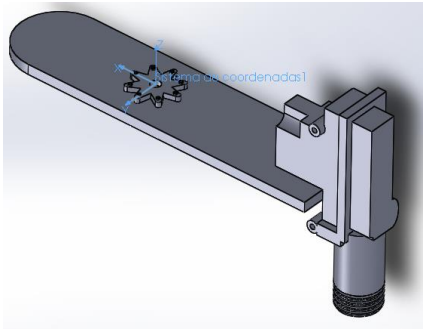
$$
\begin{aligned}
H_0^1 &= H_{Rz_0}(q_1)\,H_{Tz_0}(l_1+\beta_1)\,H_{Tx}(l_2)\,H_{Rx}(0) \\
&= \begin{bmatrix} \cos(q_1) & -\operatorname{sen}(q_1) & 0 & l_2\cos(q_1) \\ \operatorname{sen}(q_1) & \cos(q_1) & 0 & l_2\operatorname{sen}(q_1) \\ 0 & 0 & 1 & l_1+\beta_1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \\
H_1^2 &= H_{Rz_1}(q_2)\,H_{Tz_1}(\beta_2)\,H_{Tx_1}(l_3)\,H_{Rx_1}(\pi) \\
&= \begin{bmatrix} \cos(q_2) & \operatorname{sen}(q_2) & 0 & l_3\cos(q_2) \\ \operatorname{sen}(q_2) & -\cos(q_2) & 0 & l_3\operatorname{sen}(q_2) \\ 0 & 0 & -1 & \beta_2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \\
H_2^3 &= H_{Rz_2}(0)\,H_{Tz_2}(d_3)\,H_{Tx_2}(0)\,H_{Rx_2}(0) \\
&= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \\
H_0^3 &= H_0^1 H_1^2 H_2^3 \\
&\begin{bmatrix} \cos(q_1+q_2) & \operatorname{sen}(q_1+q_2) & 0 & l_2\cos(q_1)+l_3\cos(q_1+q_2) \\ \operatorname{sen}(q_1+q_2) & -\cos(q_1+q_2) & 0 & l_2\operatorname{sen}(q_1)+l_3\operatorname{sen}(q_1+q_2) \\ 0 & 0 & -1 & l_1+\beta_1+\beta_2-d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}
\end{aligned}
$$

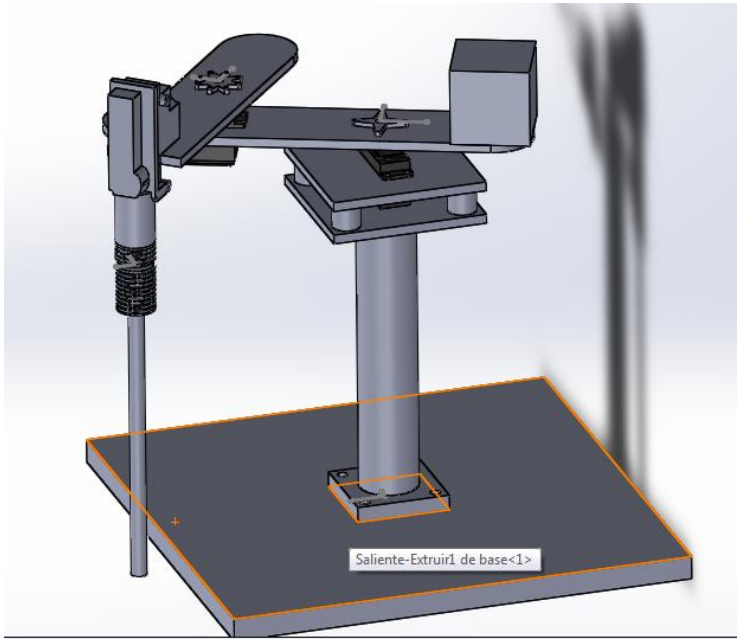
$$
\begin{bmatrix} x_0 \\ y_0 \\ z_0 \end{bmatrix} = \boldsymbol{f}_R(\boldsymbol{q}) = \begin{bmatrix} l_2\cos(q_1)+l_3\cos(q_1+q_2) \\ l_2\operatorname{sen}(q_1)+l_3\operatorname{sen}(q_1+q_2) \\ l_1+\beta_1+\beta_2-d_3 \end{bmatrix}
$$

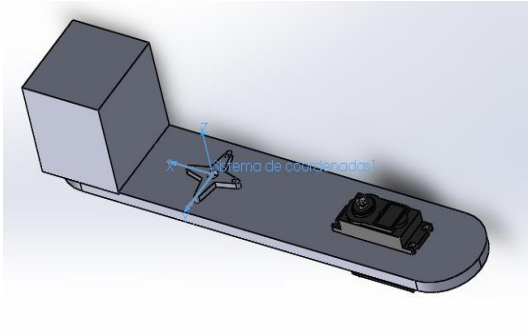
Cinemática Inversa

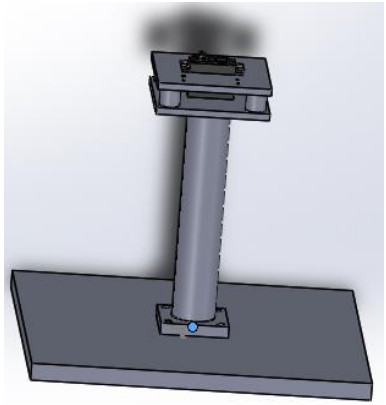
- $q_2 = \cos^{-1}\left(\frac{x_0^2+y_0^2-l_2^2-l_3^2}{2l_2l_3}\right)$
- $q_1 = \tan^{-1}\left(\frac{y_0}{x_0}\right) - \tan^{-1}\left(\frac{l_3 \sin q_2}{l_2+l_3 \cos q_2}\right)$
- $d_3 = l_1 + \beta_1 + \beta_2 - z_0$

Piezas en SolidWorks

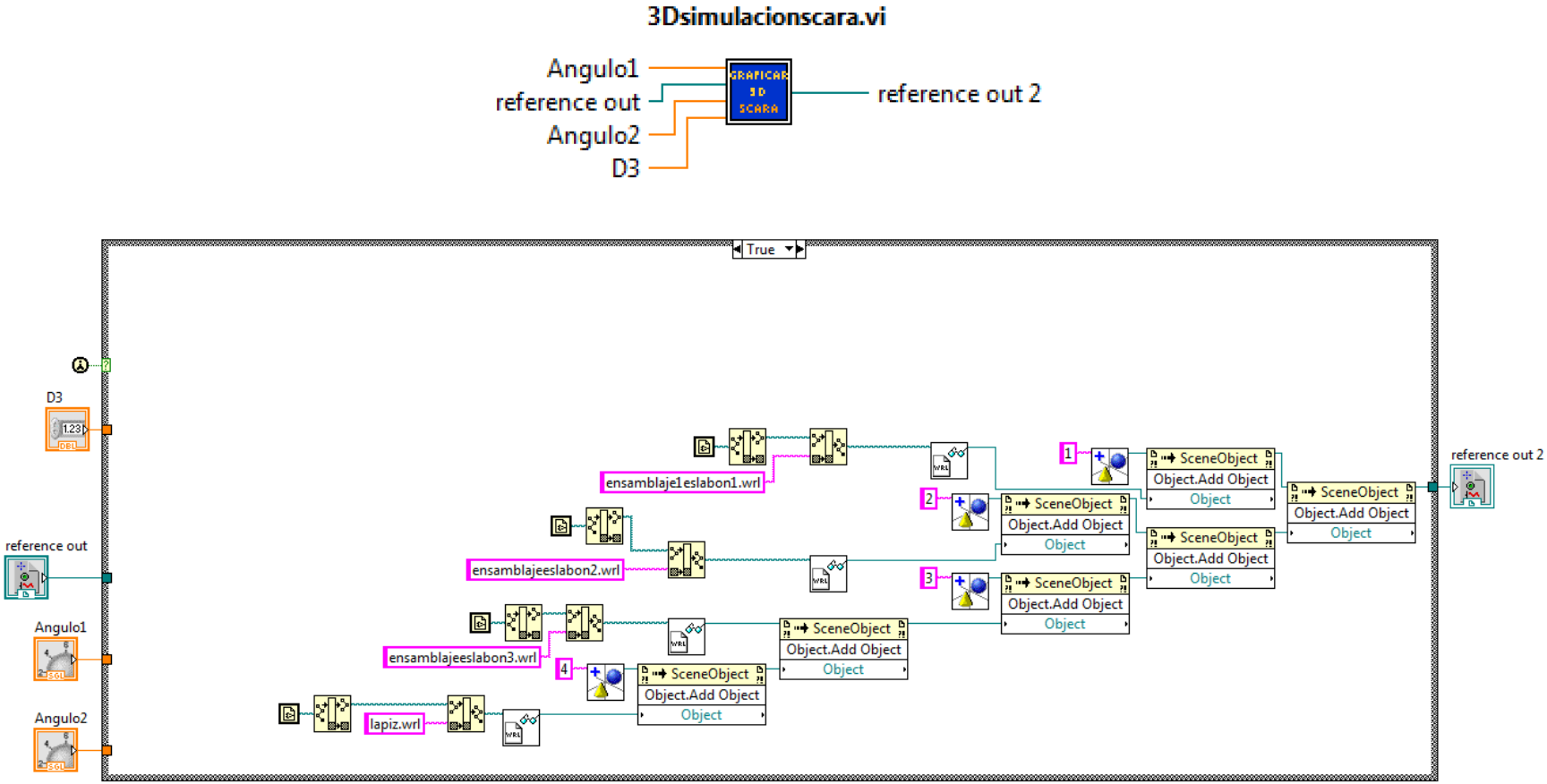




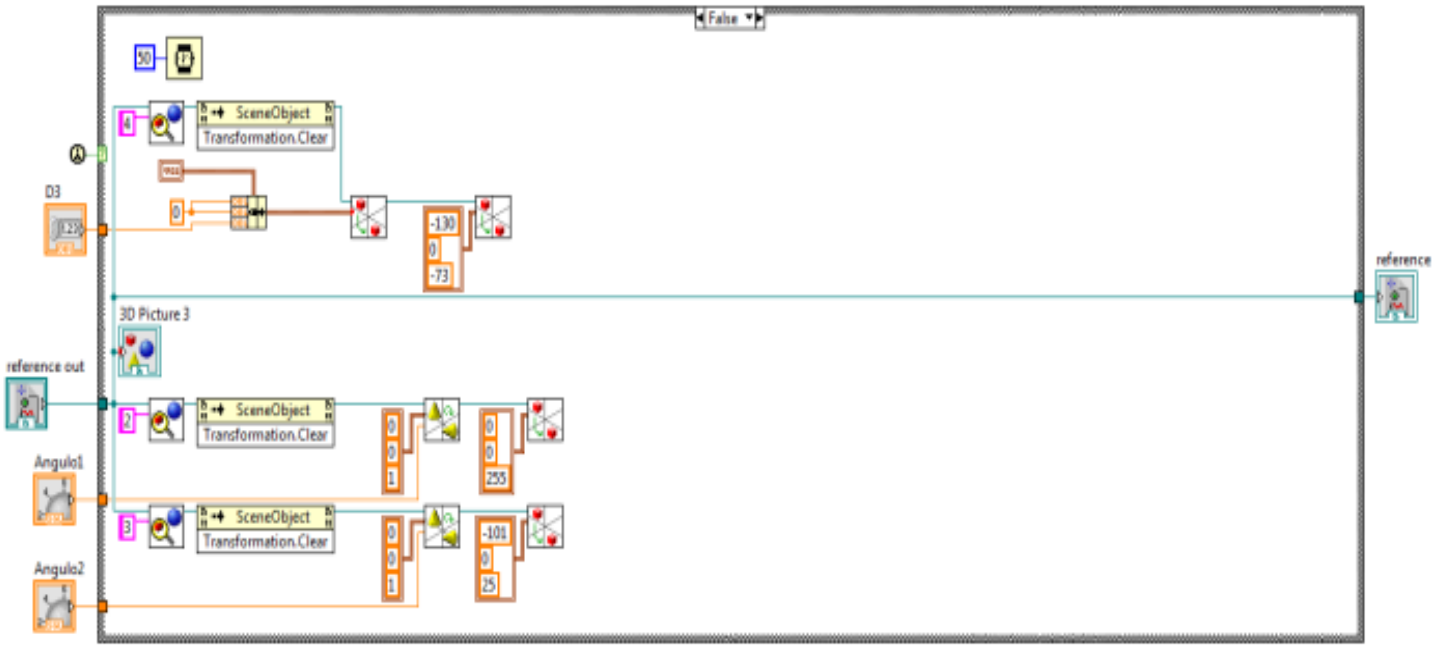




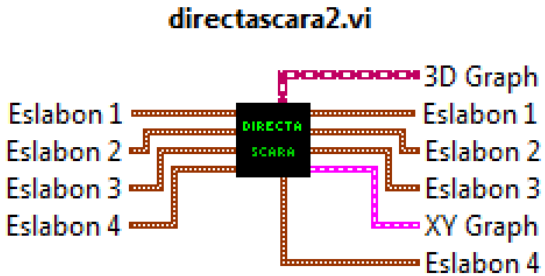
Graficar en Labview el robot en 3D

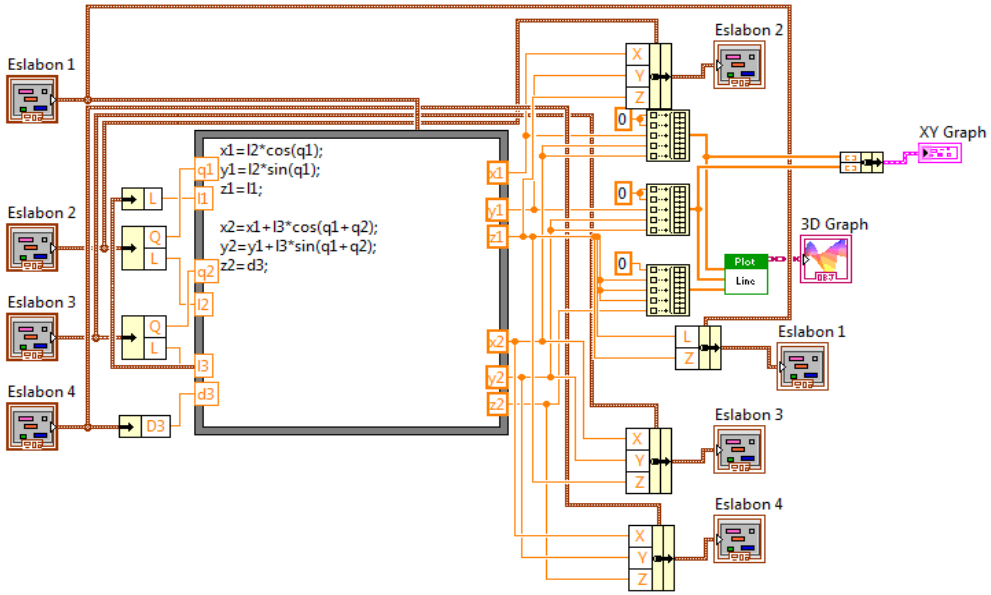


Graficar en Labview el robot en 3D

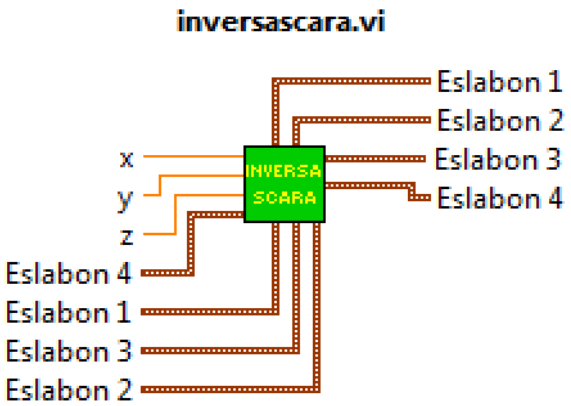


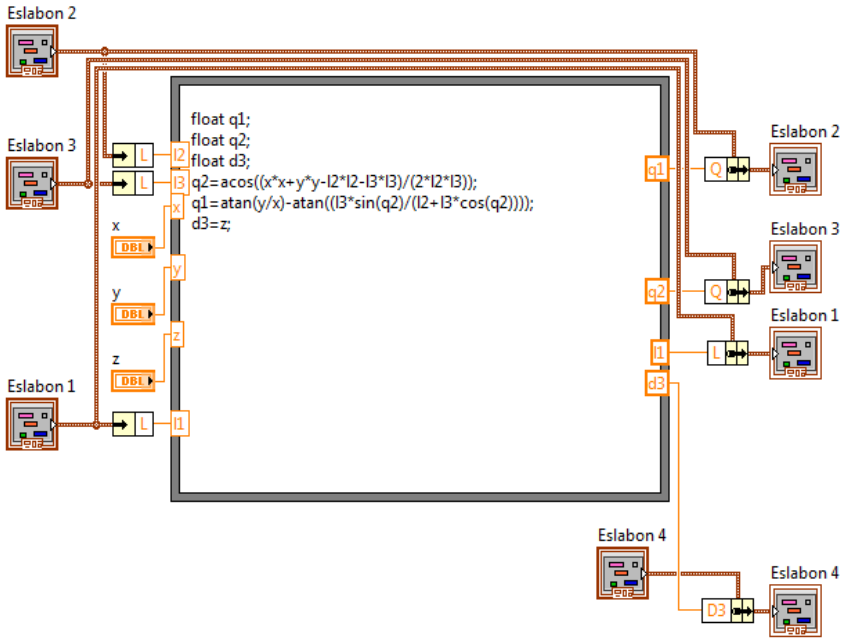
SubVI Cinemateca Directa



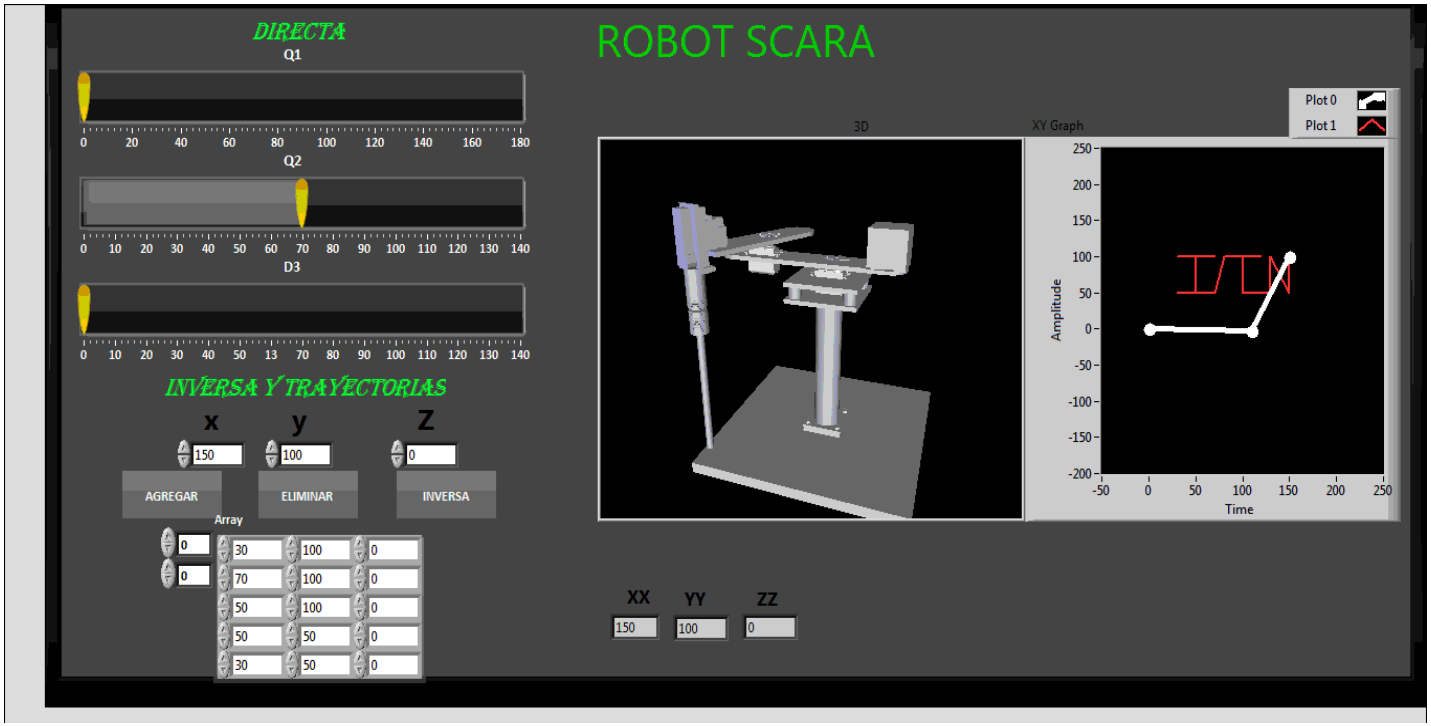


SubVI Cinemática Inversa

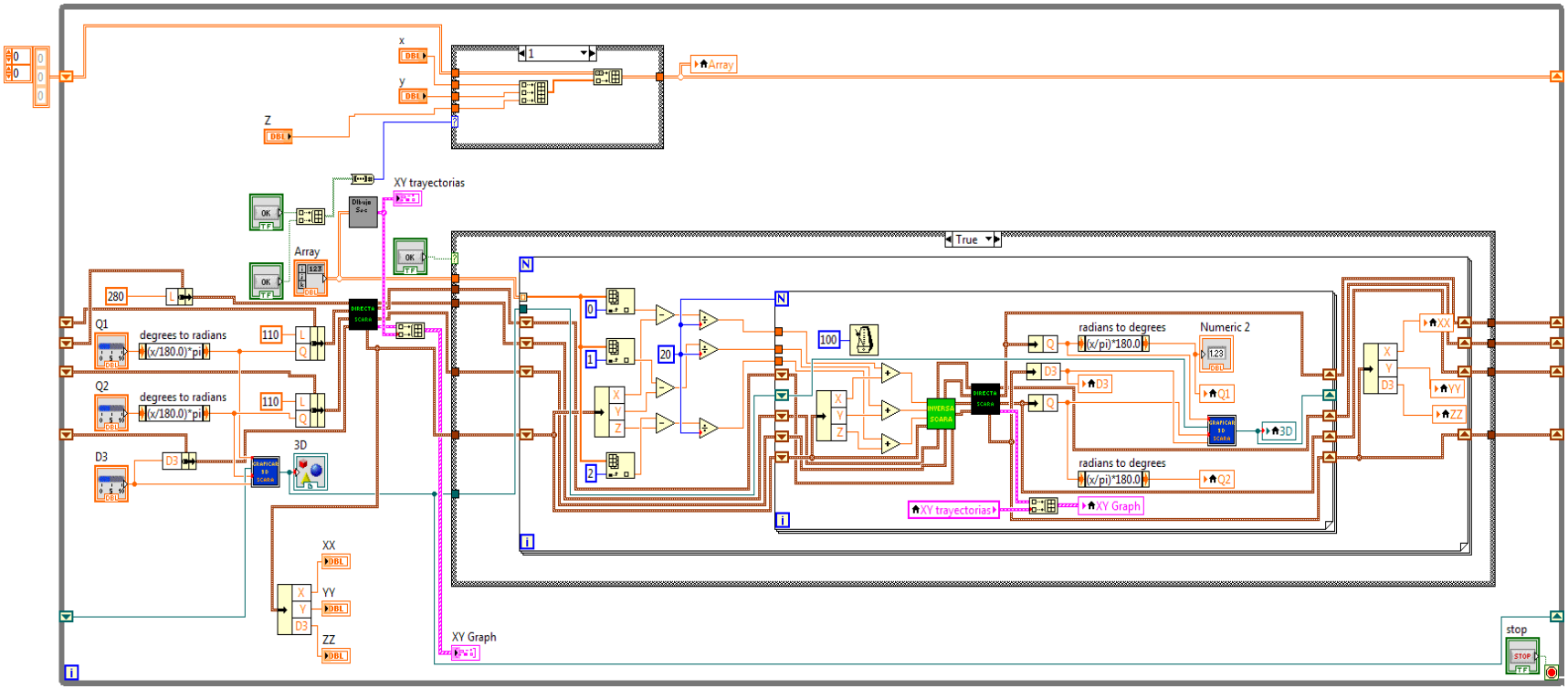




Resultados


DIRECTA
Q1
0 20 40 60 80 100 120 140 160 180
Q2
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
D3
0 10 20 30 40 50 13 70 80 90 100 110 120 130 140
INVERSA Y TRAYECTORIAS
x
y
Z
150
100
0
AGREGAR
ELIMINAR
INVERSA
Array
0
0
30 100 0
70 100 0
50 100 0
50 50 0
30 50 0
ROBOT SCARA
3D
XY Graph
Plot 0
Plot 1
Amplitude
Time
XX
YY
ZZ
150
100
0

Resultados


x
y
Z
Array
XY trayectorias
True
280
Q1
Q2
D3
degrees to radians
(x/180.0)*pi
110
3D
XX
YY
ZZ
XY Graph
radians to degrees
(x/pi)*180.0
Numeric 2
100
20
stop

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