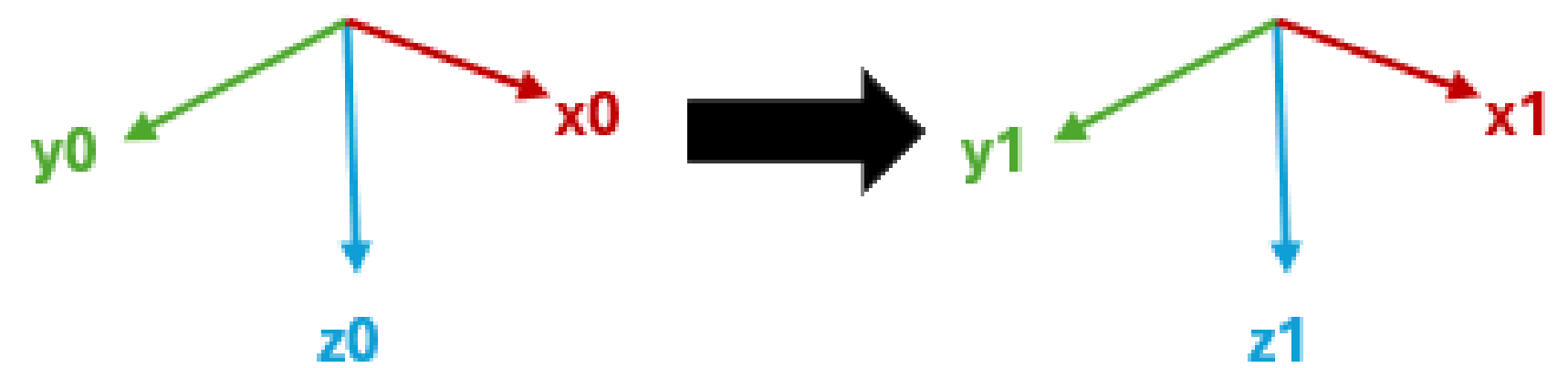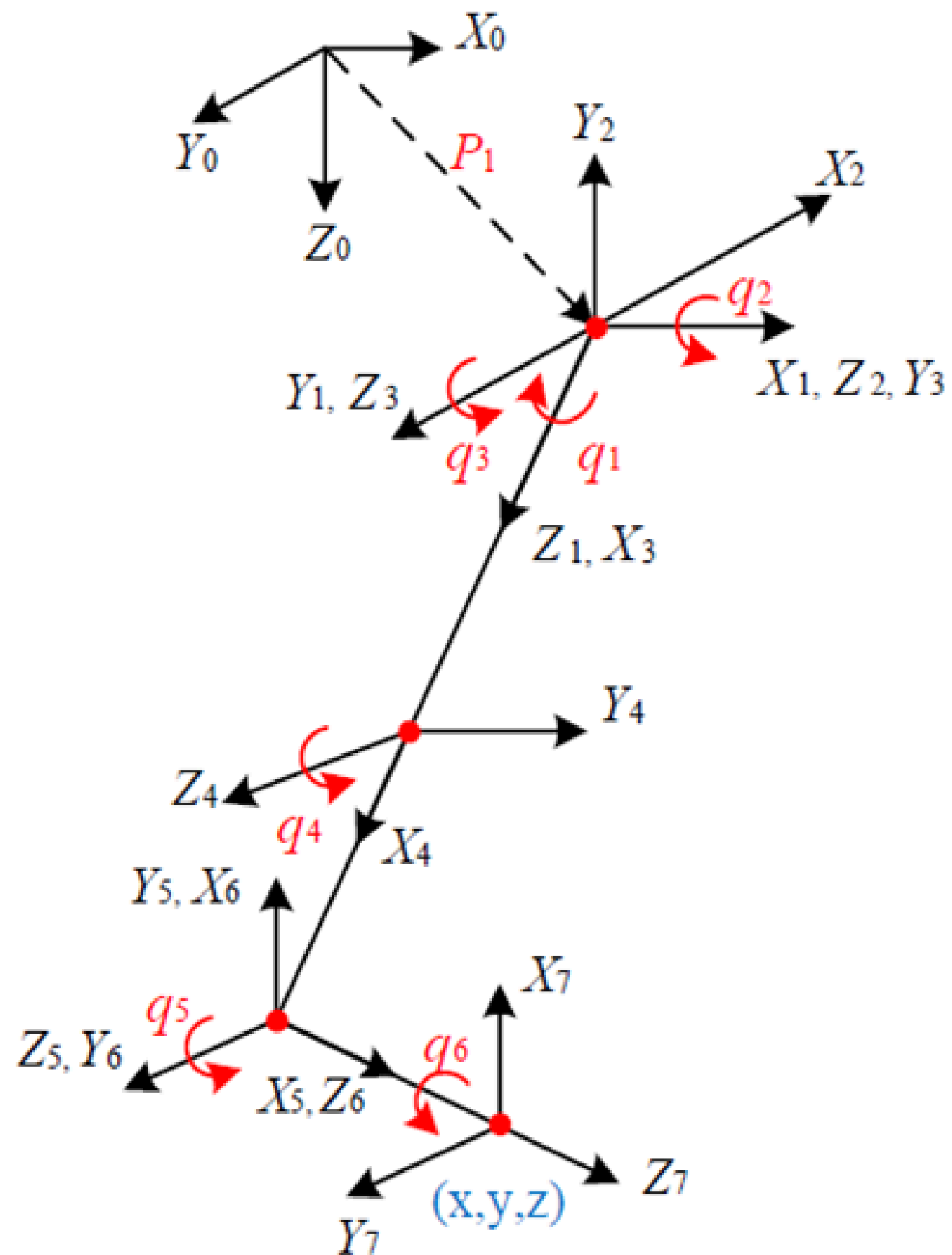# PRESENTACIÓN FINAL

Paola Rojas Domínguez A01737136

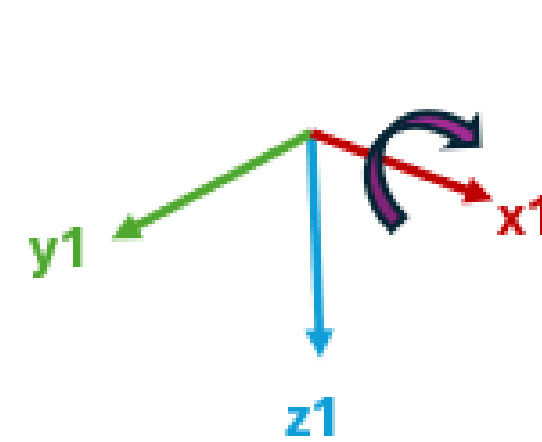*Presentación*

Matriz de Transformación local A1

```
/ cos(th0(t)), -sin(th0(t)), 0, 0 \
|                                  |
| sin(th0(t)),  cos(th0(t)), 0, 0 |
|                                  |
|      0,             0,     1, 0 |
|                                  |
\      0,             0,     0, 1 /
```
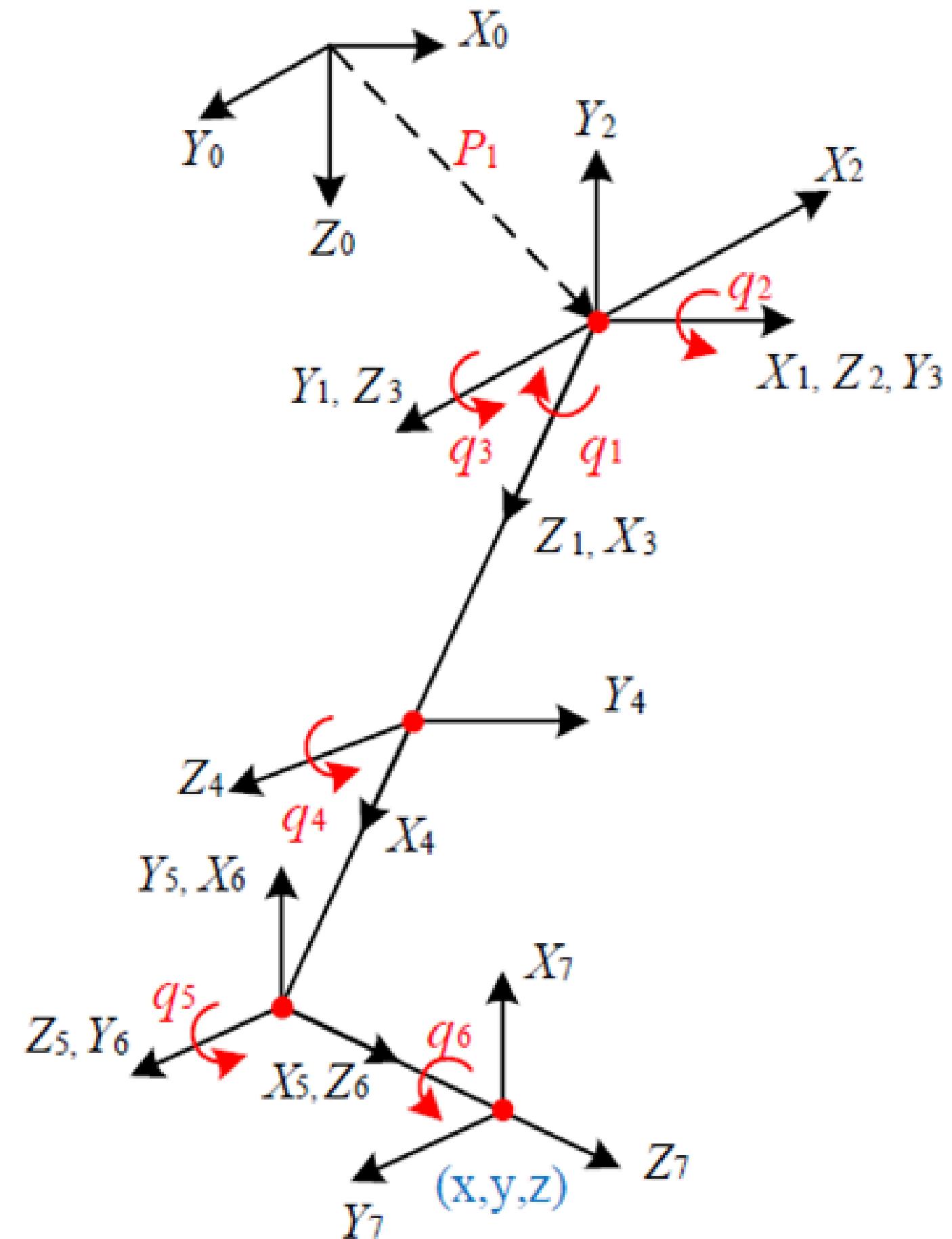
RotX(-90) RotY(90)
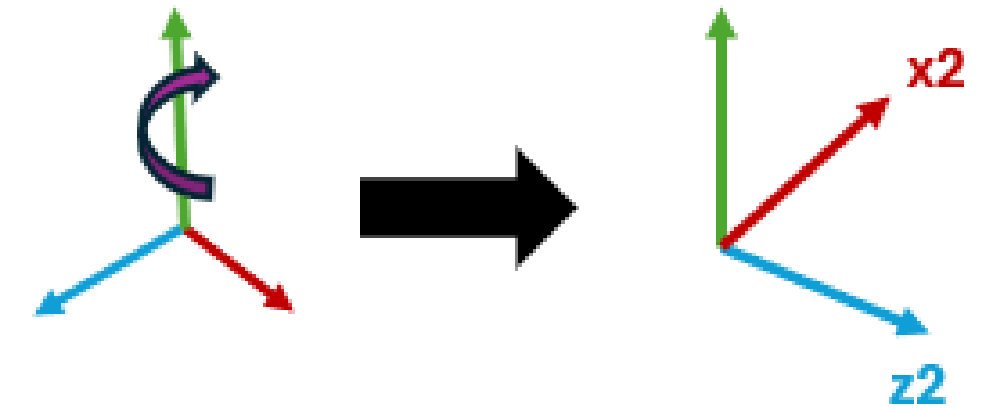
Matriz de Transformación local A2

$$\begin{pmatrix} \sin(th1(t)), & 0, & \cos(th1(t)), & 0 \\ -\cos(th1(t)), & 0, & \sin(th1(t)), & 0 \\ 0, & -1, & 0, & 0 \\ 0, & 0, & 0, & 1 \end{pmatrix}$$

RotZ(-90) RotX(90)

Matriz de Transformación local A3
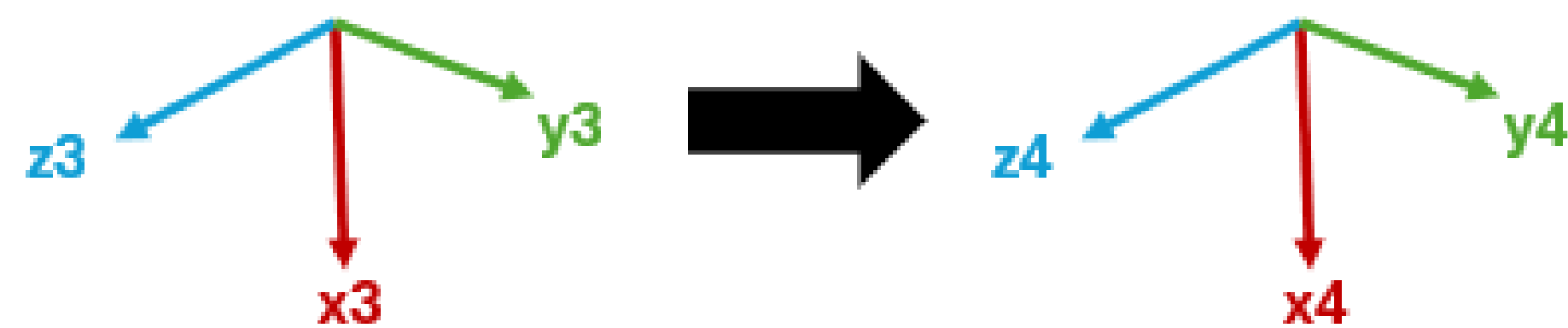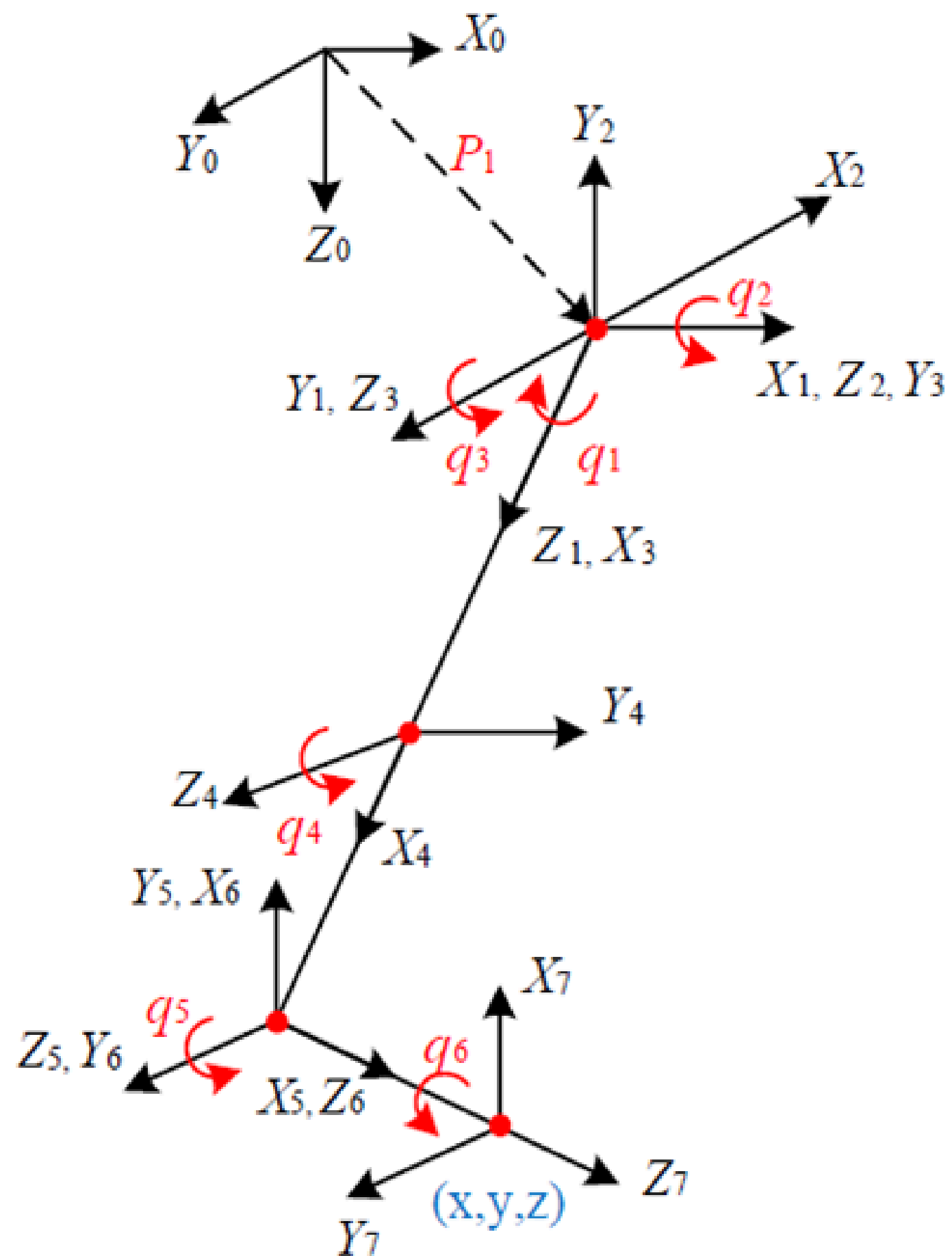
$$
\begin{pmatrix}
\sin(th2(t)), & 0, & -\cos(th2(t)), & 0 \\
-\cos(th2(t)), & 0, & -\sin(th2(t)), & 0 \\
0, & 1, & 0, & 0 \\
0, & 0, & 0, & 1
\end{pmatrix}
$$

z3   y3   x3 ➡ z4   y4   x4

Matriz de Transformación local A4

```
/ cos(th3(t)), -sin(th3(t)), 0, L1 cos(th3(t)) \
|                                              |
| sin(th3(t)),  cos(th3(t)), 0, L1 sin(th3(t)) |
|                                              |
|      0,             0,      1,        0      |
|                                              |
\      0,             0,      0,        1      /
```
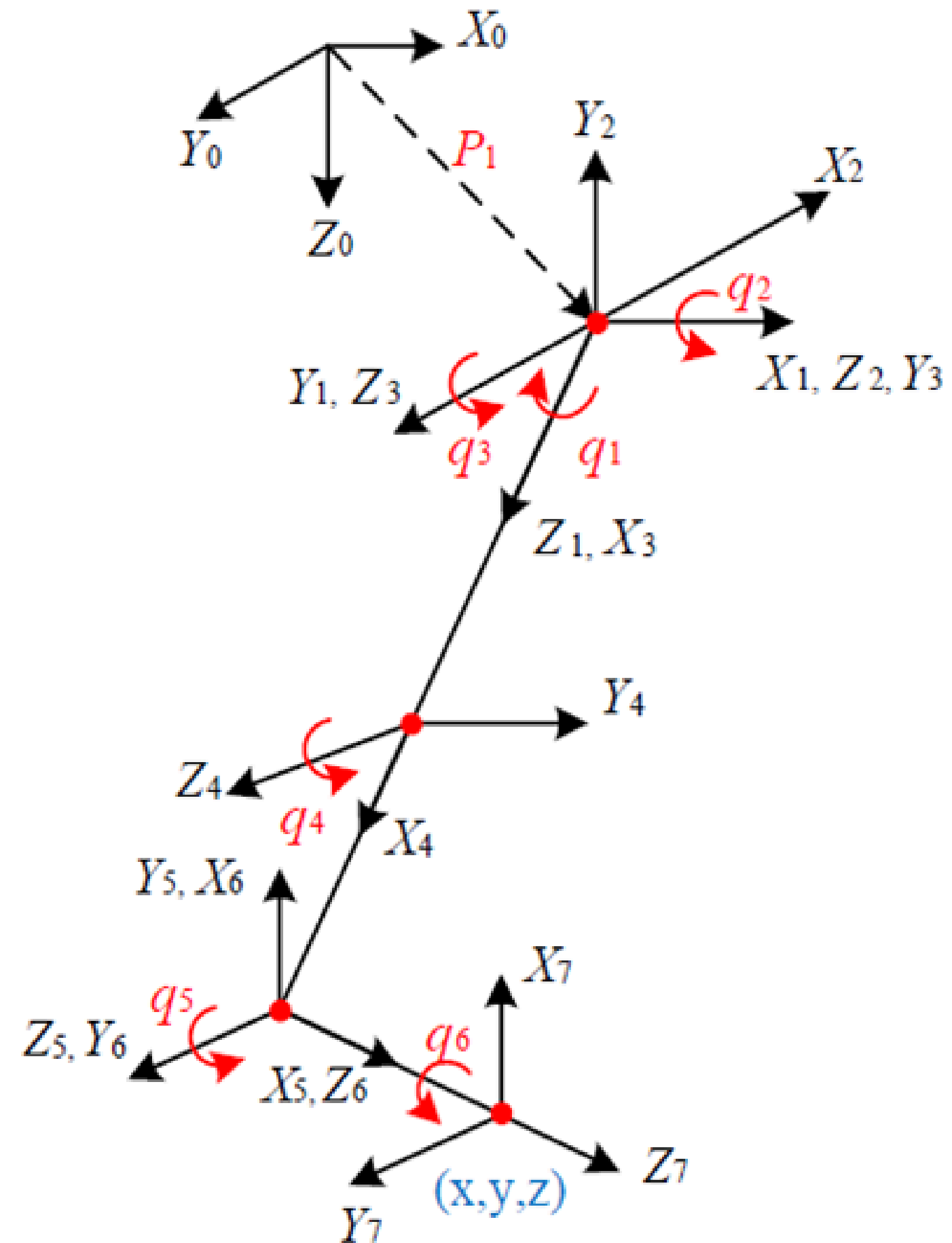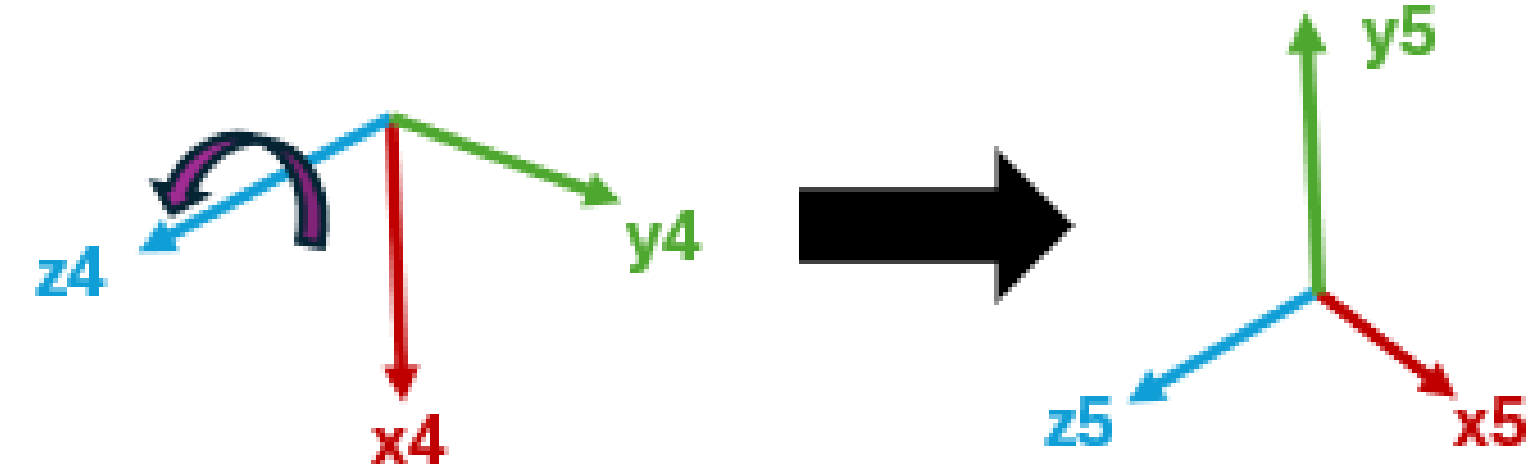
RotZ(90)

Matriz de Transformación local A5

$$
\begin{pmatrix}
-\sin(th4(t)) & -\cos(th4(t)) & 0 & L2\,\cos(th4(t)) \\
\cos(th4(t)) & -\sin(th4(t)) & 0 & L2\,\sin(th4(t)) \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{pmatrix}
$$

RotY(90)   RotZ(90)
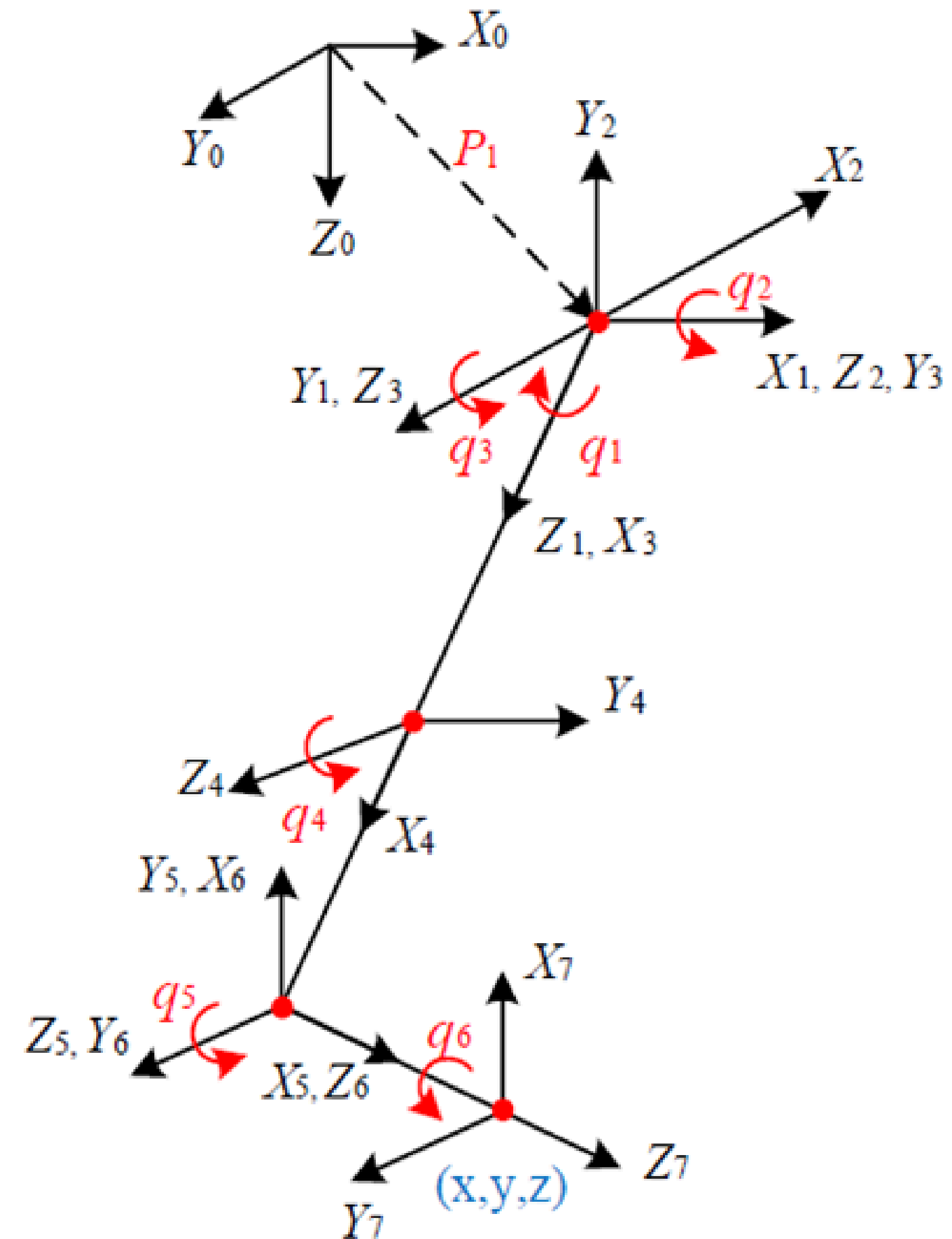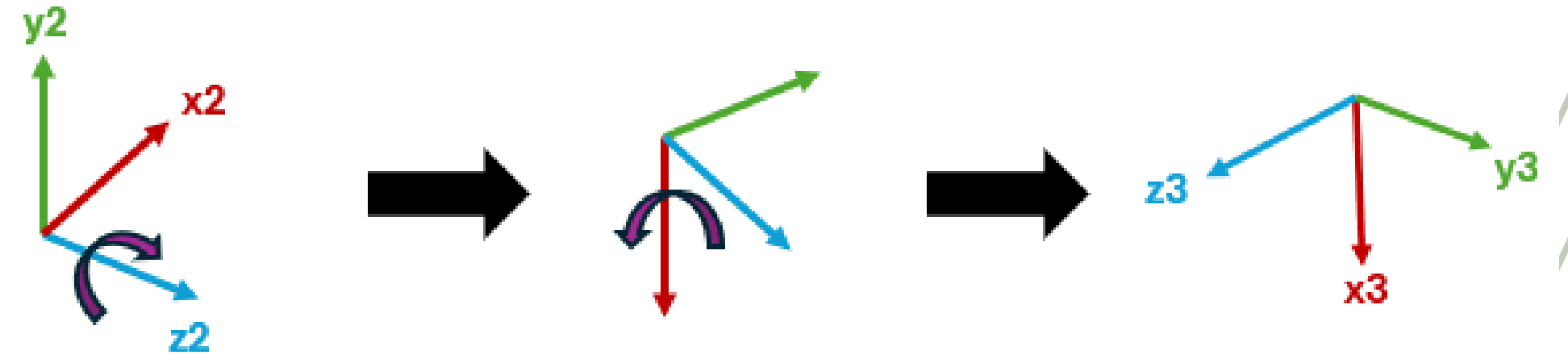
Matriz de Transformación local A6

$$\begin{pmatrix} -\sin(th5(t)), & 0, & \cos(th5(t)), & 0 \\ \cos(th5(t)), & 0, & \sin(th5(t)), & 0 \\ 0, & 1, & 0, & 0 \\ 0, & 0, & 0, & 1 \end{pmatrix}$$
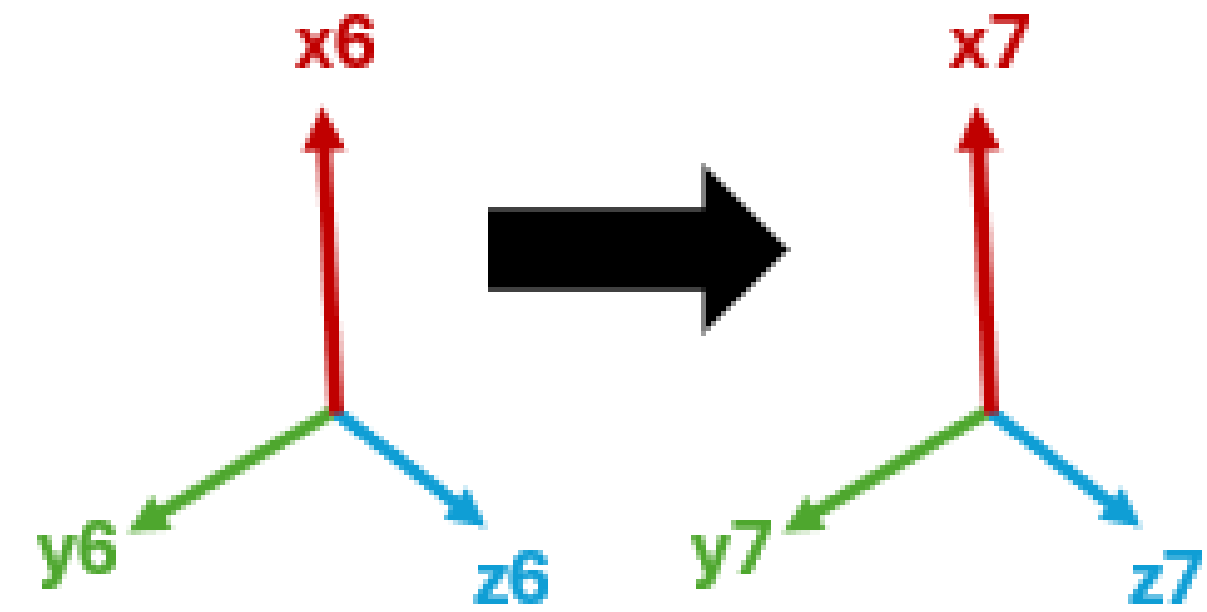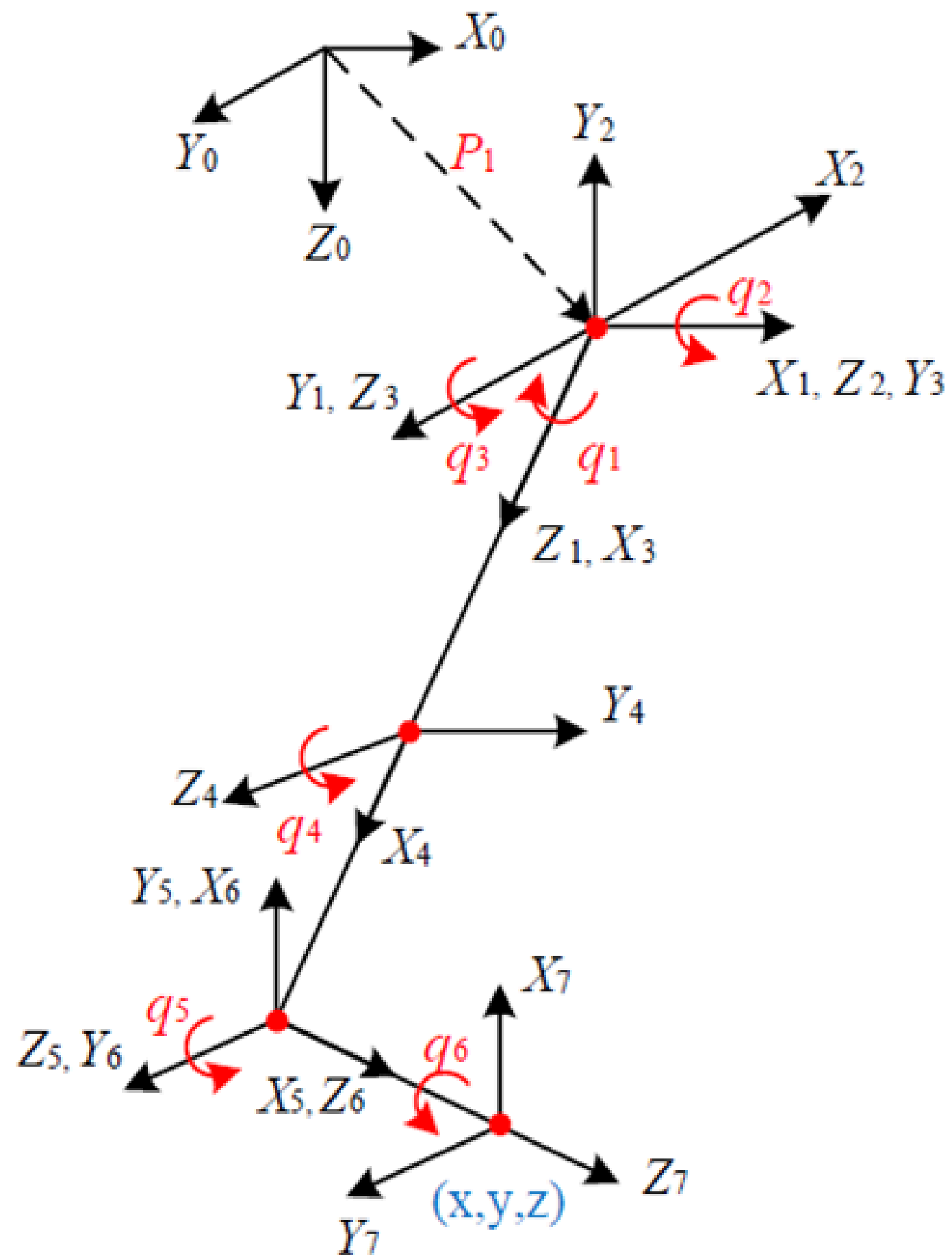
Matriz de Transformación local A7

$$
\begin{pmatrix}
\cos(\text{th6}(t)), & -\sin(\text{th6}(t)), & 0, & 0 \\
\sin(\text{th6}(t)), & \cos(\text{th6}(t)), & 0, & 0 \\
0, & 0, & 1, & L3 \\
0, & 0, & 0, & 1
\end{pmatrix}
$$

Matriz de Transformación global T7

$$
\begin{pmatrix}
-\cos(th6(t))\ \#5 - \cos(th2(t))\ \sin(th6(t))\ \sin(\#14), & \sin(th6(t))\ \#5 - \cos(th2(t))\ \cos(th6(t))\ \sin(\#14), & \#2, & L3\ \#2 + L2\ \cos(th4(t))\ \#13 + L2\ \sin(th4(t))\ \#12 + L1\ \sin(th3(t))\ \sin(\#14) + L1\ \cos(th3(t))\ \sin(th2(t))\ \sin(\#14) \\
\cos(th2(t))\ \sin(th6(t))\ \cos(\#14) - \cos(th6(t))\ \#4, & \sin(th6(t))\ \#4 + \cos(th2(t))\ \cos(th6(t))\ \cos(\#14), & \#3, & L3\ \#3 + L2\ \cos(th4(t))\ \#10 + L2\ \sin(th4(t))\ \#11 + L1\ \sin(th3(t))\ \sin(\#14) - L1\ \cos(th3(t))\ \sin(th2(t))\ \cos(\#14) \\
\sin(th2(t))\ \sin(th6(t)) - \cos(th2(t))\ \cos(th6(t))\ \cos(\#1), & \cos(th6(t))\ \sin(th2(t)) + \cos(th2(t))\ \sin(th6(t))\ \cos(\#1), & -\cos(th2(t))\ \sin(\#1), & \cos(th2(t))\ (\cos(th3(t) + th4(t))\ L2 + \cos(th3(t))\ L1) - \cos(th2(t))\ \sin(\#1)\ L3 \\
0, & 0, & 0, & 1
\end{pmatrix}
$$

where

$\#1 == th3(t) + th4(t) + th5(t)$

$\#2 == \cos(th5(t))\ \#8 - \sin(th5(t))\ \#9$

$\#3 == \cos(th5(t))\ \#6 - \sin(th5(t))\ \#7$

$\#4 == \cos(th5(t))\ \#7 + \sin(th5(t))\ \#6$

$\#5 == \cos(th5(t))\ \#9 + \sin(th5(t))\ \#8$

$\#6 == \cos(th4(t))\ \#11 - \sin(th4(t))\ \#10$

$\#7 == \cos(th4(t))\ \#10 + \sin(th4(t))\ \#11$

$\#8 == \cos(th4(t))\ \#12 - \sin(th4(t))\ \#13$

$\#9 == \cos(th4(t))\ \#13 + \sin(th4(t))\ \#12$

$\#10 == \sin(th3(t))\ \sin(\#14) - \cos(th3(t))\ \sin(th2(t))\ \cos(\#14)$

$\#11 == \cos(th3(t))\ \sin(\#14) + \sin(th2(t))\ \sin(th3(t))\ \cos(\#14)$

$\#12 == \cos(th3(t))\ \cos(\#14) - \sin(th2(t))\ \sin(th3(t))\ \sin(\#14)$

$\#13 == \sin(th3(t))\ \cos(\#14) + \cos(th3(t))\ \sin(th2(t))\ \sin(\#14)$

$\#14 == th0(t) + th1(t)$

MATRIZ DE TRANSFORMACIÓN

Velocidad lineal obtenida mediante el Jacobiano lineal

$$\begin{pmatrix} \#4\ \sin(\#43)\ \#10 - \#3\ (L1\ \sin(th2(t))\ \sin(th3(t))\ \sin(\#43) - L1\ \cos(th3(t))\ \cos(\#43)) - \#33 + \#31 + \#21 + \#20 + \#19 + \#30 + \#29 - \#25 + \#18 - \#16 - \#15 - \#14) - \#7\ \#8 - \#6\ \#8 - \#2\ (\#31 - \#33 + \#21 + \#20 + \#19 + \#30 + \#29 - \#25 + \#18 - \#16 - \#15 - \#14) - \#1\ (L3\ \sin(th2(t))\ \#35 + L3\ \#5\ \sin(\#37)\ \cos(\#43)) \\ \#1\ (L3\ \sin(th2(t))\ \#36 - L3\ \#5\ \sin(\#37)\ \sin(\#43)) + \#3\ (L1\ \cos(th3(t))\ \sin(\#43) - \#32 + \#34 + L1\ \sin(th2(t))\ \sin(th3(t))\ \cos(\#43) + \#28 + \#27 - \#24 - \#23 - \#22 + \#26 + \#17 - \#13 - \#12 - \#11) + \#7\ \#9 + \#6\ \#9 - \#2\ (\#32 - \#34 - \#28 - \#27 + \#24 + \#23 + \#22 - \#26 - \#17 + \#13 + \#12 + \#11) - \#4\ \cos(\#43)\ \#10 \\ - L3\ \#1\ \left(\dfrac{\cos(th2(t) + th3(t) + th4(t) + th5(t))}{2} + \dfrac{\cos(th3(t) - th2(t) + th4(t) + th5(t))}{2} \right) - \#2\ \cos(th2(t))\ (\cos(\#37)\ L3 + \sin(\#38)\ L2) - \#4\ \sin(th2(t))\ (-\sin(\#37)\ L3 + \cos(\#38)\ L2 + \cos(th3(t))\ L1) - \#3\ \cos(th2(t))\ (\cos(\#37)\ L3 + \sin(\#38)\ L2 + \sin(th3(t))\ L1) \end{pmatrix}$$

where

$$\#1 == \dfrac{d}{dt}\,th5(t)$$

$$\#2 == \dfrac{d}{dt}\,th4(t)$$

$$\#3 == \dfrac{d}{dt}\,th3(t)$$

$$\#4 == \dfrac{d}{dt}\,th2(t)$$

$$\#5 == \cos(th2(t))$$

$$\#6 == \dfrac{d}{dt}\,th1(t)$$

$$\#7 == \dfrac{d}{dt}\,th0(t)$$

$\#8 == L3\ \#35 + L2\ \cos(th4(t))\ \#39 + L2\ \sin(th4(t))\ \#40 + L1\ \sin(th3(t))\ \sin(\#43) - L1\ \cos(th3(t))\ \sin(th2(t))\ \cos(\#43)$

$\#9 == L3\ \#36 + L2\ \cos(th4(t))\ \#42 + L2\ \sin(th4(t))\ \#41 + L1\ \sin(th3(t))\ \cos(\#43) + L1\ \cos(th3(t))\ \sin(th2(t))\ \sin(\#43)$

$\#10 == \cos(th2(t))\ (L2\ \cos(\#38) + L1\ \cos(th3(t))) - \cos(th2(t))\ \sin(\#37)\ L3$

$\#11 == L3\ \cos(th5(t))\ \sin(th2(t))\ \sin(th3(t))\ \sin(th4(t))\ \cos(\#43)$

$\#12 == L3\ \cos(th4(t))\ \sin(th2(t))\ \sin(th3(t))\ \sin(th5(t))\ \cos(\#43)$

$\#13 == L3\ \cos(th3(t))\ \sin(th2(t))\ \sin(th4(t))\ \sin(th5(t))\ \cos(\#43)$

$\#14 == L3\ \cos(th5(t))\ \sin(th2(t))\ \sin(th3(t))\ \sin(th4(t))\ \sin(\#43)$

$\#15 == L3\ \cos(th4(t))\ \sin(th2(t))\ \sin(th3(t))\ \sin(th5(t))\ \sin(\#43)$

$\#16 == L3\ \cos(th3(t))\ \sin(th2(t))\ \sin(th4(t))\ \sin(th5(t))\ \sin(\#43)$

$\#17 == L3\ \cos(th3(t))\ \cos(th4(t))\ \cos(th5(t))\ \sin(th2(t))\ \cos(\#43)$

$\#18 == L3\ \cos(th3(t))\ \cos(th4(t))\ \cos(th5(t))\ \sin(th2(t))\ \sin(\#43)$

$\#19 == L3\ \cos(th4(t))\ \cos(th5(t))\ \sin(th3(t))\ \cos(\#43)$

$\#20 == L3\ \cos(th3(t))\ \cos(th5(t))\ \sin(th4(t))\ \cos(\#43)$

$\#21 == L3\ \cos(th3(t))\ \cos(th4(t))\ \sin(th5(t))\ \cos(\#43)$

$\#22 == L3\ \cos(th4(t))\ \cos(th5(t))\ \sin(th3(t))\ \sin(\#43)$

$\#23 == L3\ \cos(th3(t))\ \cos(th5(t))\ \sin(th4(t))\ \sin(\#43)$

VELOCIDAD LINEAL

Velocidad angular obtenida mediante el Jacobiano angular

$$
\begin{pmatrix}
\#5\cos(\#10) + \#1\,(\cos(th5(t))\,(\cos(th4(t))\,\#7 - \sin(th4(t))\,\#8) - \sin(th5(t))\,(\cos(th4(t))\,\#8 + \sin(th4(t))\,\#7)) - \#4\cos(th2(t))\sin(\#10) - \#3\cos(th2(t))\sin(\#10) - \#2\cos(th2(t))\sin(\#10) \\[2mm]
\#5\sin(\#10) + \#1\,(\cos(th5(t))\,(\cos(th4(t))\,\#9 - \sin(th4(t))\,\#6) - \sin(th5(t))\,(\cos(th4(t))\,\#6 + \sin(th4(t))\,\#9)) + \#4\cos(th2(t))\cos(\#10) + \#3\cos(th2(t))\cos(\#10) + \#2\cos(th2(t))\cos(\#10) \\[2mm]
\dfrac{d}{dt}th0(t) + \dfrac{d}{dt}th1(t) + \#4\sin(th2(t)) + \#3\sin(th2(t)) + \#2\sin(th2(t)) - \#1\cos(th2(t))\sin(th3(t)+th4(t)+th5(t))
\end{pmatrix}
$$

where

$$\#1 == \frac{d}{dt}\,th6(t)$$

$$\#2 == \frac{d}{dt}\,th5(t)$$

$$\#3 == \frac{d}{dt}\,th4(t)$$

$$\#4 == \frac{d}{dt}\,th3(t)$$

$$\#5 == \frac{d}{dt}\,th2(t)$$

$$\#6 == \sin(th3(t))\sin(\#10) - \cos(th3(t))\sin(th2(t))\cos(\#10)$$

$$\#7 == \cos(th3(t))\cos(\#10) - \sin(th2(t))\sin(th3(t))\sin(\#10)$$

$$\#8 == \sin(th3(t))\cos(\#10) + \cos(th3(t))\sin(th2(t))\sin(\#10)$$

$$\#9 == \cos(th3(t))\sin(\#10) + \sin(th2(t))\sin(th3(t))\cos(\#10)$$

$$\#10 == th0(t) + th1(t)$$

VELOCIDAD ANGULAR

ANIMACIÓN

Matriz de transformación homogenea global

0	0.4481	-0.894	-2.682
0	0.894	0.4481	1.344
1	0	0	-6
0	0	0	1