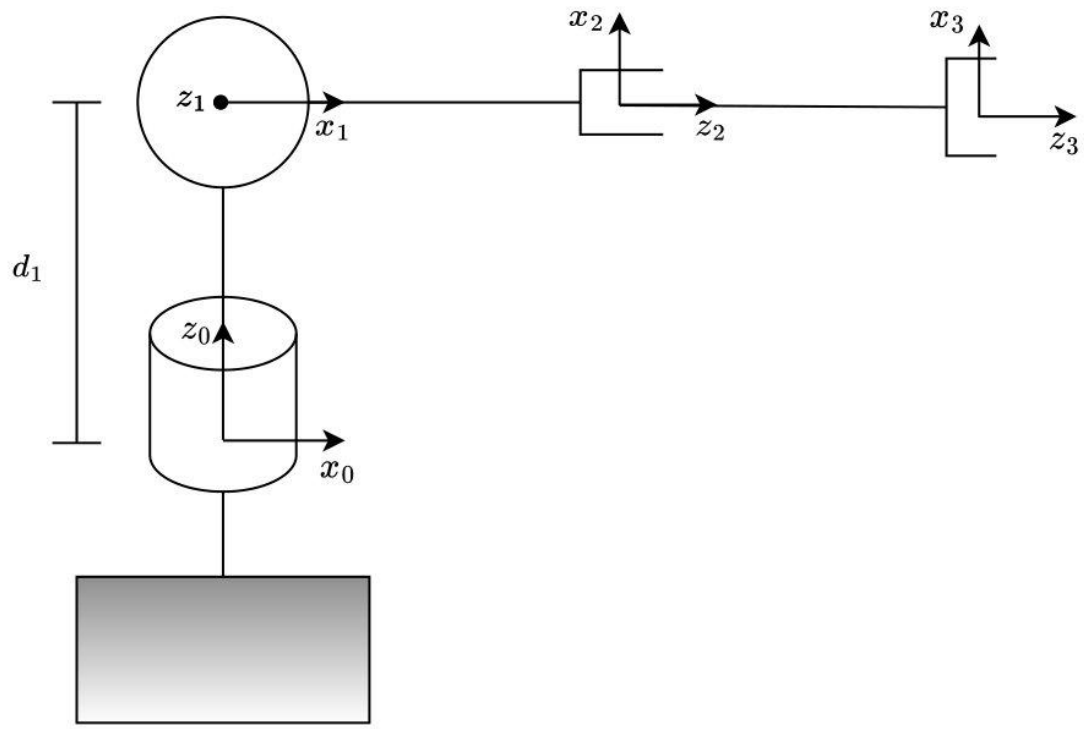
Cinematica inversa del robot RRP polare

Robot polare RRP




```
syms q1 q2 q3 d1
DHRRPpolare = [0, pi/2, d1, q1;
               0, pi/2, 0, q2+pi/2;
               0, 0, q3, 0]
```

DHRRPpolare =

$$\begin{pmatrix} 0 & \frac{\pi}{2} & d_1 & q_1 \\ 0 & \frac{\pi}{2} & 0 & q_2+\frac{\pi}{2} \\ 0 & 0 & q_3 & 0 \end{pmatrix}$$

```
tList = cinDirDH(DHRRPpolare);
T03 = tList{4}
```

T03 =

$$\begin{pmatrix} -\cos(q_1)\sin(q_2) & \sin(q_1) & \cos(q_1)\cos(q_2) & q_3\cos(q_1)\cos(q_2) \\ -\sin(q_1)\sin(q_2) & -\cos(q_1) & \cos(q_2)\sin(q_1) & q_3\cos(q_2)\sin(q_1) \\ \cos(q_2) & 0 & \sin(q_2) & d_1+q_3\sin(q_2) \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

```
r = T03(1:3, 4)
```

r =

$$\begin{pmatrix} q_3\cos(q_1)\cos(q_2) \\ q_3\cos(q_2)\sin(q_1) \\ d_1 + q_3\sin(q_2) \end{pmatrix}$$

```
Jr = jacobian(r, [q1, q2, q3])
```

Jr =

$$\begin{pmatrix} -q_3\cos(q_2)\sin(q_1) & -q_3\cos(q_1)\sin(q_2) & \cos(q_1)\cos(q_2) \\ q_3\cos(q_1)\cos(q_2) & -q_3\sin(q_1)\sin(q_2) & \cos(q_2)\sin(q_1) \\ 0 & q_3\cos(q_2) & \sin(q_2) \end{pmatrix}$$

```
Jr.'
```

ans =

$$\begin{pmatrix} -q_3\cos(q_2)\sin(q_1) & q_3\cos(q_1)\cos(q_2) & 0 \\ -q_3\cos(q_1)\sin(q_2) & -q_3\sin(q_1)\sin(q_2) & q_3\cos(q_2) \\ \cos(q_1)\cos(q_2) & \cos(q_2)\sin(q_1) & \sin(q_2) \end{pmatrix}$$

Cinematica inversa analitica

```
P = [1; 1; 1];
d_1 = 0.5;
q_an = cinInvAnaliticaRRPpolare(P, d_1)
```

```
q_an = 3×1
    0.7854
    0.3398
    1.5000
```

```
round(subs(r, [q1, q2, q3, d1], [q_an(1), q_an(2), q_an(3), d_1]), 10)
```

ans =

$$\begin{pmatrix} 1.0 \\ 1.0 \\ 1.0 \end{pmatrix}$$

Cinematica inversa numerica

```
qi = [1; 0.4; 0];
q_num = cinInvNumericaRRPpolare(P, d_1, qi)
```

```
q_num = 3×1
    0.7854
    0.3398
    1.5000
```

```
round(subs(r, [q1, q2, q3, d1], [q_num(1), q_num(2), q_num(3), d_1]), 10)
```

ans =

$$\begin{pmatrix} 0.9999999946 \\ 0.9999999946 \\ 0.9999999973 \end{pmatrix}$$

```
errore = round(norm(q_an - q_num), 10)
```

```
errore = 8.1000e-09
```