
```

clear, clc
syms q1 q2 q3 px py pz

L1 = 12
L2 = L1

EqX = px == (L2+q3)*cos(q2)*cos(q1)
EqY = py == (L2+q3)*cos(q2)*sin(q1)
EqZ = pz == L1 + (L2 + q3)*sin(q2)

[Sol_q1, Sol_q2, Sol_q3] = solve([EqX EqY EqZ], [q1 q2 q3]), param, cond] ,
    "ReturnConditions",true);
%disp(Sol_q3)

Sol_q1 = simplify(Sol_q1)
Sol_q2 = simplify(Sol_q2)
Sol_q3 = simplify(Sol_q3)

L1 =

    12

L2 =

    12

EqX =

px == cos(q1)*cos(q2)*(q3 + 12)

EqY =

py == cos(q2)*sin(q1)*(q3 + 12)

EqZ =

pz == sin(q2)*(q3 + 12) + 12

Warning: Solutions are only valid under certain conditions. To include
parameters and conditions in the solution, specify the 'ReturnConditions'
value
as 'true'.

Sol_q1 =

-2*atan((px - (12*(((px^2 + py^2 + pz^2 - 24*pz + 144)^(1/2) - pz + 12)*(pz +
(px^2 + py^2 + pz^2 - 24*pz + 144)^(1/2) - 12))^(1/2) + (px^2 + py^2 + pz^2

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$$\begin{aligned}
& - 24*px + 144)^{(1/2)}))/ (pz - 12) - (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} \\
& + (pz*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} + (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12))/py) \\
& - 2*atan((px + (12*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + \\
& (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} + (px^2 + py^2 + pz^2 - \\
& 24*px + 144)^{(1/2)}))/ (pz - 12) + (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} \\
& - (pz*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} + (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12))/py) \\
& - 2*atan((px - (12*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + \\
& (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - \\
& 24*px + 144)^{(1/2)}))/ (pz - 12) + (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} \\
& + (pz*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12))/py) \\
& - 2*atan((px + (12*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + \\
& (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - \\
& 24*px + 144)^{(1/2)}))/ (pz - 12) - (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} \\
& - (pz*((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12))/py)
\end{aligned}$$

Sol_q2 =

$$\begin{aligned}
& 2*atan((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} + (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12)) \\
& - 2*atan((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} + (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12)) \\
& 2*atan((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12)) \\
& - 2*atan((((px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - pz + 12)*(pz + (px^2 + \\
& py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12))^{(1/2)} - (px^2 + py^2 + pz^2 - 24*px + \\
& 144)^{(1/2)}))/ (pz - 12))
\end{aligned}$$

Sol_q3 =

$$\begin{aligned}
& (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12 \\
& - (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12 \\
& - (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12 \\
& (px^2 + py^2 + pz^2 - 24*px + 144)^{(1/2)} - 12
\end{aligned}$$

Sol_q1 =

$$\begin{aligned}
& - 2*atan((px + (px^2 + py^2)^{(1/2)}))/py) \\
& - 2*atan((px - (px^2 + py^2)^{(1/2)}))/py) \\
& - 2*atan((px + (px^2 + py^2)^{(1/2)}))/py) \\
& - 2*atan((px - (px^2 + py^2)^{(1/2)}))/py)
\end{aligned}$$

Sol_q2 =

$$\begin{aligned} & 2*\operatorname{atan}((px^2 + py^2)^{(1/2)} + (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)})/(pz - 12)) \\ & -2*\operatorname{atan}((px^2 + py^2)^{(1/2)} + (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)})/(pz - 12)) \\ & 2*\operatorname{atan}((px^2 + py^2)^{(1/2)} - (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)})/(pz - 12)) \\ & -2*\operatorname{atan}((px^2 + py^2)^{(1/2)} - (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)})/(pz - 12)) \end{aligned}$$

Sol_q3 =

$$\begin{aligned} & (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)} - 12 \\ & - (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)} - 12 \\ & - (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)} - 12 \\ & (px^2 + py^2 + pz^2 - 24*pz + 144)^{(1/2)} - 12 \end{aligned}$$

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