

GG1: Direct Kinematics

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Abstract

In this short report is described the direct kinematics of the GG1 robot.

Formulation

The DH parameters of the GG1 robot are presented in Table 1

Table 1

	d	θ	a	α
D1	d_1	π	0	$\frac{\pi}{2}$
R1	0.258	R_1	0	$\frac{\pi}{2}$
R2	0.141	R_2	0.4347	π
R3	0.120	R_3	0.430	π
R4	0.120	R_4	0	$\frac{\pi}{2}$
R5	0.5365	R_5	0	0

Knowing the DH parameters of the robot the Transformation matrix for consecutive

joints is the following:

$${}^{n-1}T_n = \begin{bmatrix} \cos \theta_n & -\sin \theta_n \cos \alpha_n & \sin \theta_n \sin \alpha & a_n \cos \theta_n \\ \sin \theta_n & \cos \theta_n \cos \alpha_n & -\cos \theta_n \sin \alpha & a_n \sin \theta_n \\ 0 & \sin \alpha_n & \cos \alpha_n & d_n \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (1)$$

Thus the following code has been written in Matlab and calculates the final transformation matrix from the base to the end effector of the robot:

```
%% Forward kinematics GG1
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close all
clear all
clc

%% World reference frame and variables declaration
Tf = eye(4);
syms d_1 theta_1 theta_2 theta_3 theta_4 theta_5

%% Correct DK

% DH Params
d = [d_1, 0.258, 0.141, 0.120, 0.120, 0.5365];
t = [pi, theta_1, theta_2, theta_3, theta_4, theta_5];
a = [0, 0, 0.4347, 0.430, 0, 0];
```

```

al = [0.5*pi, 0.5*pi, pi, pi, 0.5*pi, 0];

for i = 1:1:6
    T(:, :, i) = [cos(t(i)), -sin(t(i))*cos(al(i)), sin(t(i))*sin(al(i)), a(i)*cos(t(i));
                  sin(t(i)), cos(t(i))*cos(al(i)), -cos(t(i))*sin(al(i)), a(i)*sin(t(i));
                  0,          sin(al(i)),          cos(al(i)),          d(i);
                  0,          0,          0,          1];
    Tf = Tf*T(:, :, i);
end

```