DH Parameters of JacoR&D

Version 1.1.5

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Revisions

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1.0.2	LJ Caron	Added Cartesian to angular functions	15-08-2011
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1.1.1	P Fauteux	Added 2D drawing with dimensions	04-06-2013
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1.1.3	A Lecours	Changed hand frame position	25-07-2013
1.1.4	A Lecours	Changed D1 Length on figure	06-08-2013
1.1.5	A Lecours	Added joint limits	27-08-2013
1.1.6	A Lecours	Reset position and torque zero	18-10-2013



Review & Approval

Requirements Specification Approval History

Approving Party	Version Approved	Signature	Date
LJ. Caron			

Requirements Specification Review History

Reviewer	Version Reviewed	Signature	Date
C. Deguire			



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Introduction

1.1 DH Parameters of Jaco

Theses following parameters are all necessary DH values for kinematics of Jaco.

Robot lenght values (meters)			
D1	0.2755	Base to elbow	
D2	0.4100	Arm lengh	
D3	0.2073	Front arm lengh	
D4	0.0743	First wrist lengh	
D5	0.0743	Second wrist lengh	
D6	0.1687	Wrist to center of the hand	
e2	0.0098	Joint 3-4 lateral offset	

Alternate parameters		
aa	((11.0*PI)/72.0)	
ca	(cos(aa))	
sa	(sin(aa))	
c2a	(cos(2*aa))	
s2a	(sin(2*aa))	
d4b	(D3 + sa/s2a *D4)	
d5b	(sa/s2a*D4 + sa/s2a *D5)	
d6b	(sa/s2a*D5 + D6)	



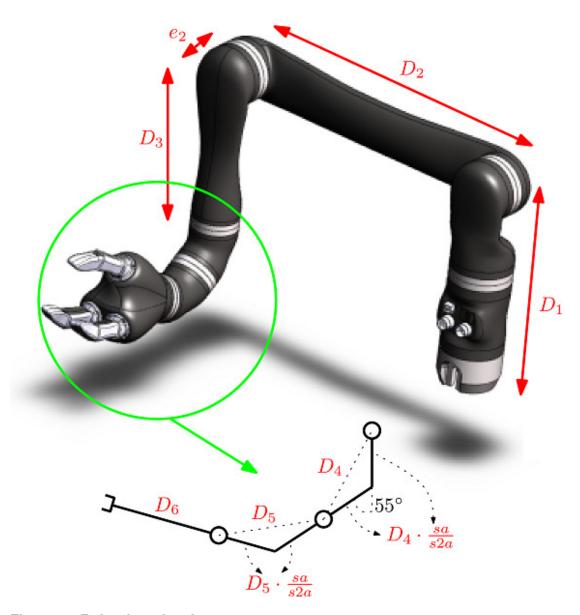


Figure 1 : Robot length values



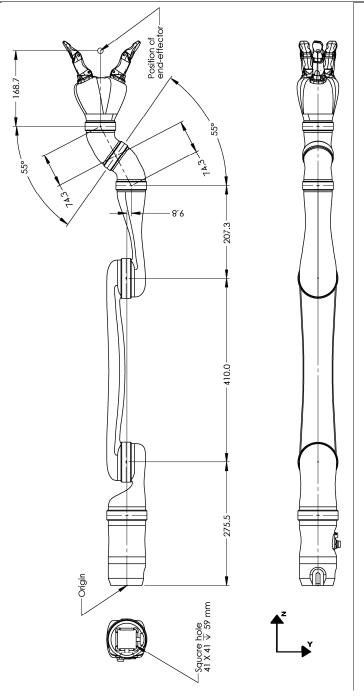


Figure 2 : Robot length values (units in mm)

Angular position: [270, 180, 180, 0, 0, 0]



1.1.1 Classic DH Parameters

DH Parameters				
i	alpha(i-1)	a(i-1)	di	teta1
1	pi/2	0	D1	q1
2	pi	D2	0	q2
3	pi/2	0	-e2	q3
4	2*aa	0	-d4b	q4
5	2*aa	0	-d5b	q5
6	pi	0	-d6b	q6

Equations for transformation from DH algorithm to Jaco physical angles
Q1(Jaco) = -Q1(DH Algo)
Q2(Jaco) = Q2(DH Algo) + 90
Q3(Jaco) = Q3(DH Algo) - 90
Q4(Jaco) = Q4(DH Algo)
Q5(Jaco) = Q5(DH Algo) + 180
Q6(Jaco) = Q6(DH Algo) - (180 - 80)

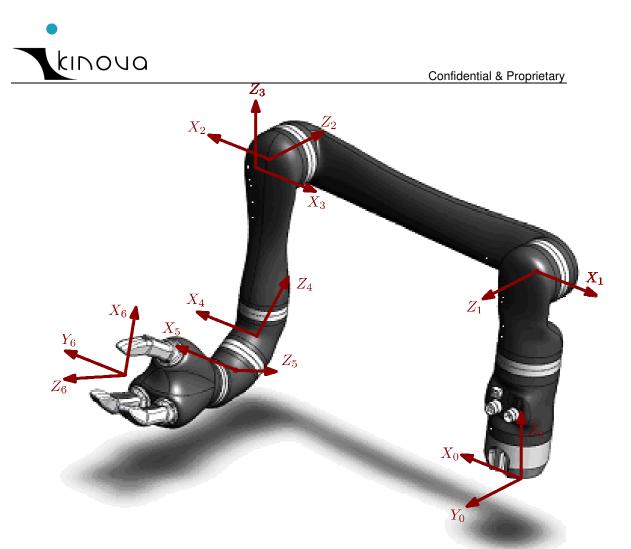


Figure 3 : Classic DH parameters frame position

Angular position is: [180, 270, 90, 180, 180, 350]



1.1.2 Modified DH Parameters (Craig)

DH Parameters				
i	alpha(i-1)	a(i-1)	di	teta1
1	0	0	D1	q1
2	-pi/2	0	0	q2
3	0	D2	e2	q3
4	-pi/2	0	d4b	q4
5	2*aa	0	d5b	q5
6	2*aa	0	d6b	q6

Equations for transformation from DH algorithm to Jaco physical angles
Q1(Jaco) = -Q1(DH Algo) + 180
Q2(Jaco) = Q2(DH Algo) + 270
Q3(Jaco) = -Q3(DH Algo) + 90
Q4(Jaco) = -Q4(DH Algo) + 180
Q5(Jaco) = -Q5(DH Algo) + 180
Q6(Jaco) = -Q6(DH Algo) + (180 + 80)



1.2 Directions of each joints in angular space

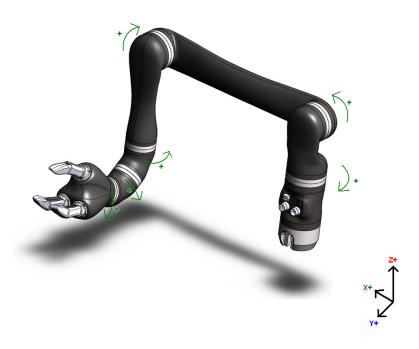
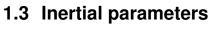


Figure 4: Directions of each joint in the angular space of the robot





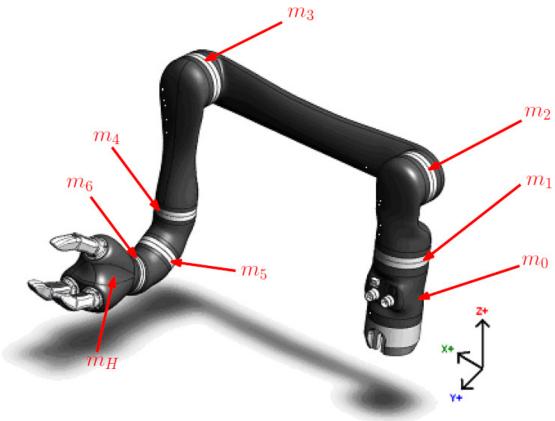


Figure 5: Inertial parameters

Inertial parameters			
m0	0.63 kg		
m1	0.64 kg		
m2	0.64 kg		
m3	0.64 kg		
m4	0.39 kg		
m5	0.39 kg		
m6	0.39 kg		
mΗ	0.93 kg		

From Joint 6 to center of mass of the hand: ~8 cm



1.4 Joint limits

Joint	Minimum (degrees)	Maximum (degrees)
1	-10 000	10 000
2	47	313
3	19	341
4	-10 000	10 000
5	-10 000	10 000
6	-10 000	10 000



1.5 Zero Position



Figure 6 : Reset position

Angular position is: [180, 180, 180, 180, 180, 180]