DH Parameters of Jaco

R&D

Version 1.1.5

August 27, 2013

Warning

Revisions

Version	Primary Author(s)	Description of Version	Date Completed
1.0.1	LJ Caron	First Draft	08-07-2010
1.0.2	LJ Caron	Added Cartesian to angular functions	15-08-2011
1.0.3	LJ Caron	Added angular directions of joints	29-08-2011
1.0.4	A Lecours	Added inertial parameters	27-11-2012
1.1.0	A Lecours	DH parameters review	28-03-2013
1.1.1	P Fauteux	Added 2D drawing with dimensions	04-06-2013
1.1.2	A Lecours	Added frame position	04-06-2013
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
L.-J. Caron			

Requirements Specification Review History

Reviewer	Version Reviewed	Signature	Date
C. Deguire			

Contents

1 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)

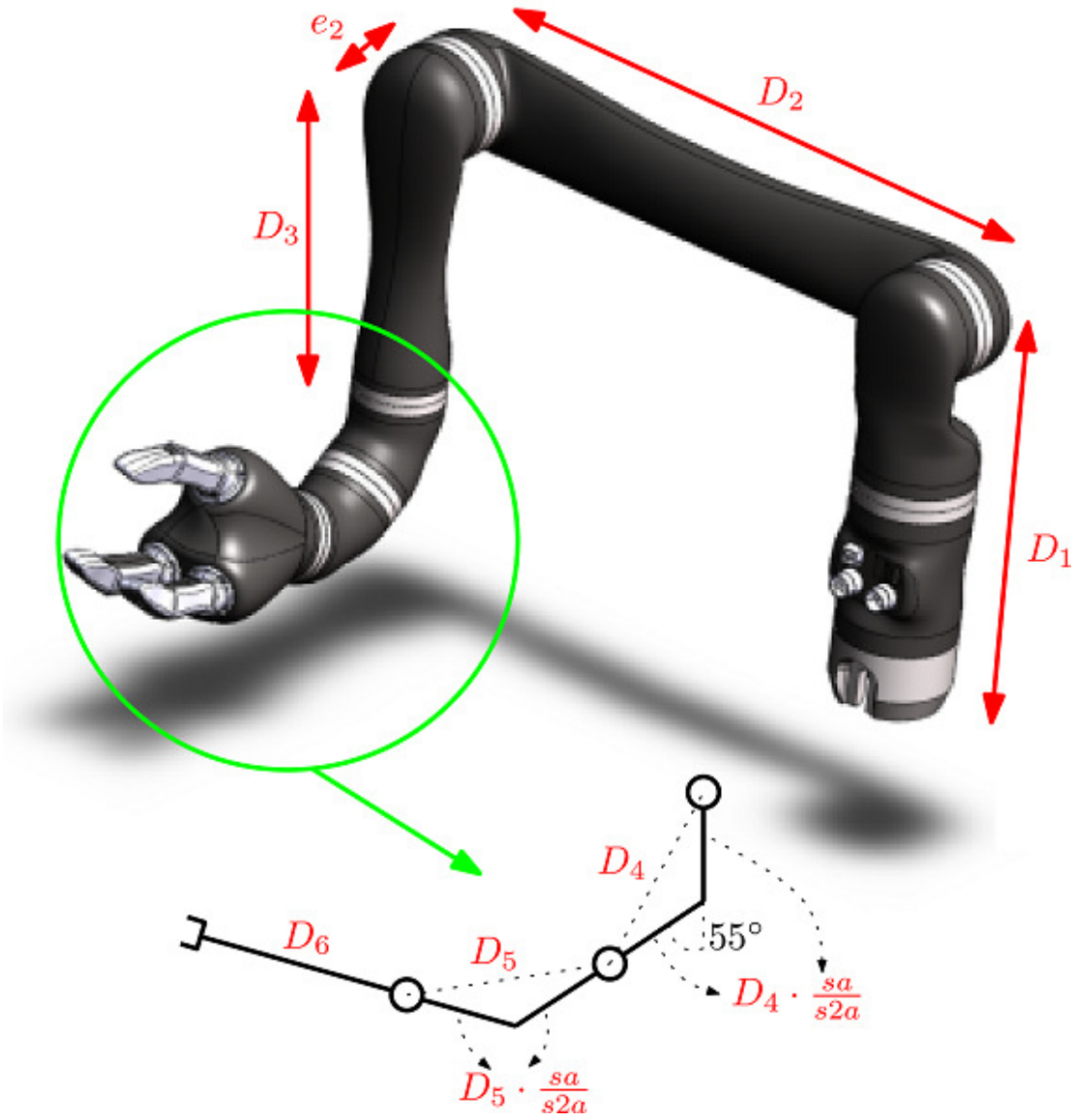

Figure 1 : Robot length values

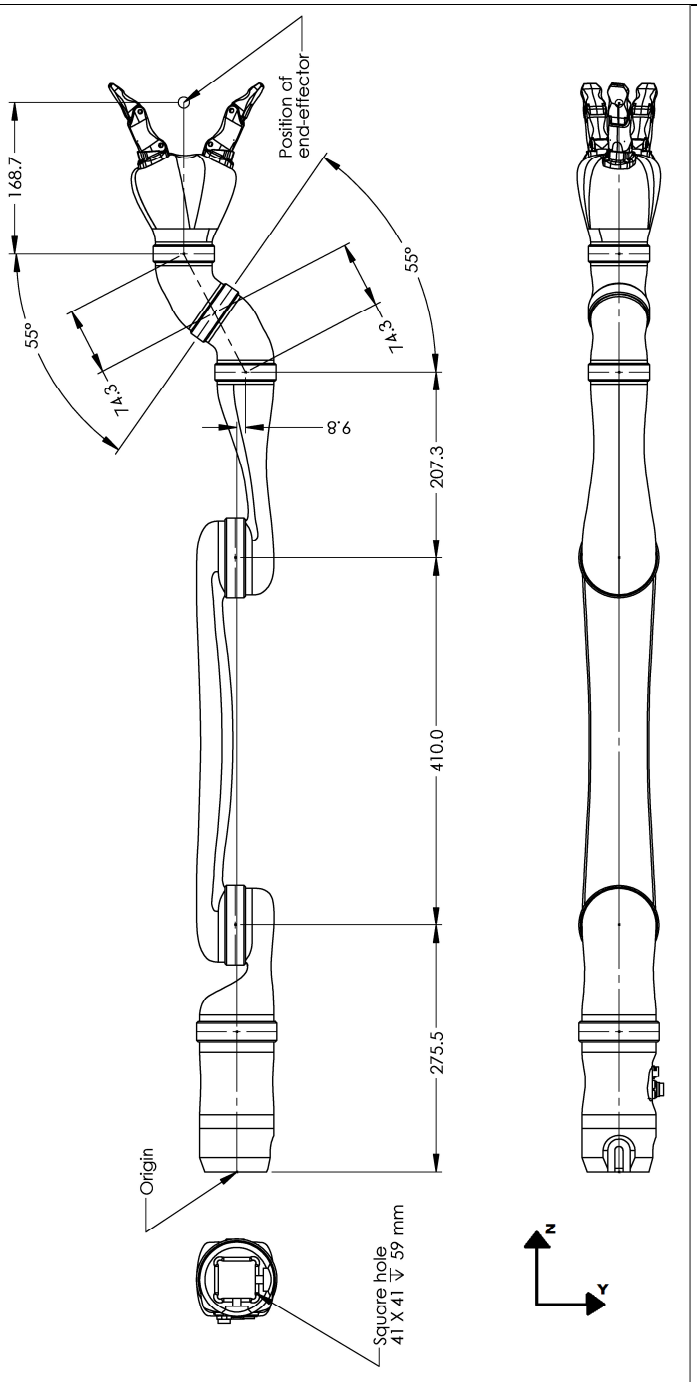

Figure 2 : Robot length values (units in mm)

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)

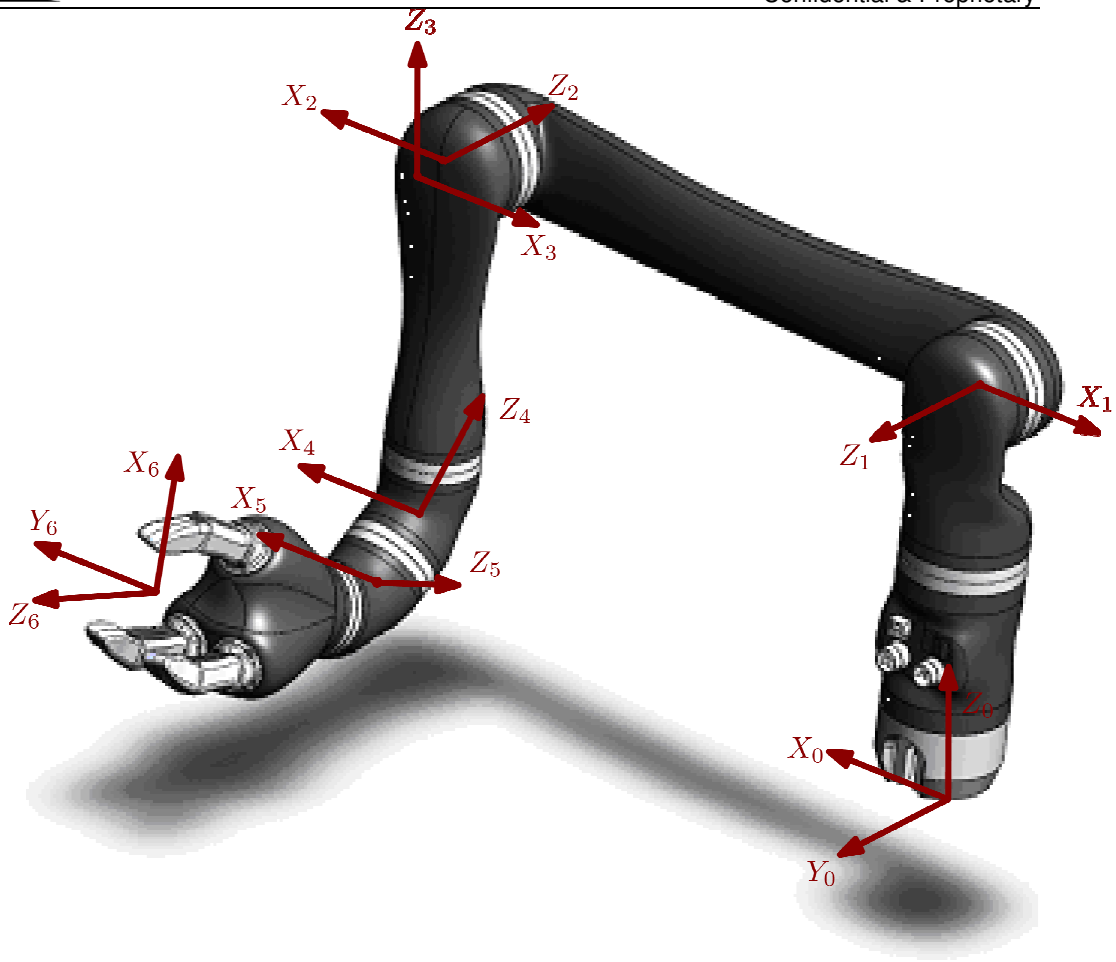

Figure 3 : Classic DH parameters frame position

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

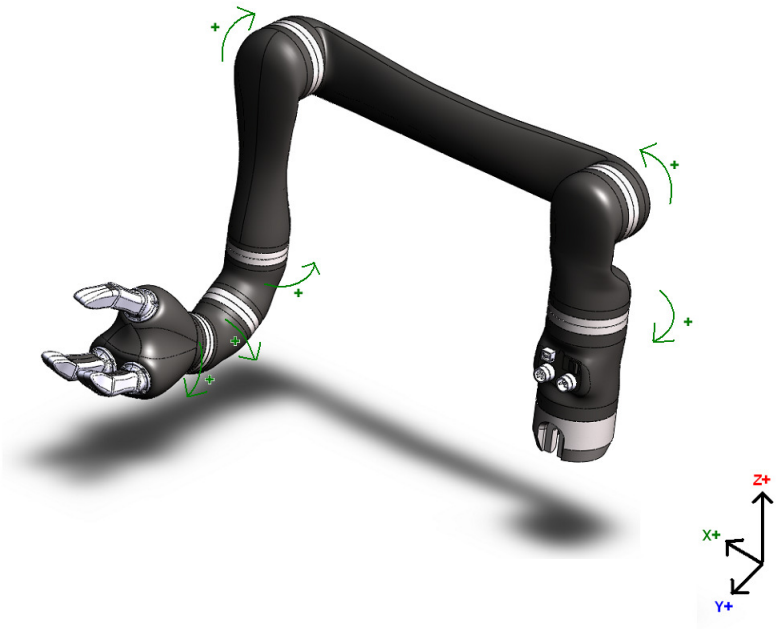

Figure 4 : Directions of each joint in the angular space of the robot

1.3 Inertial parameters

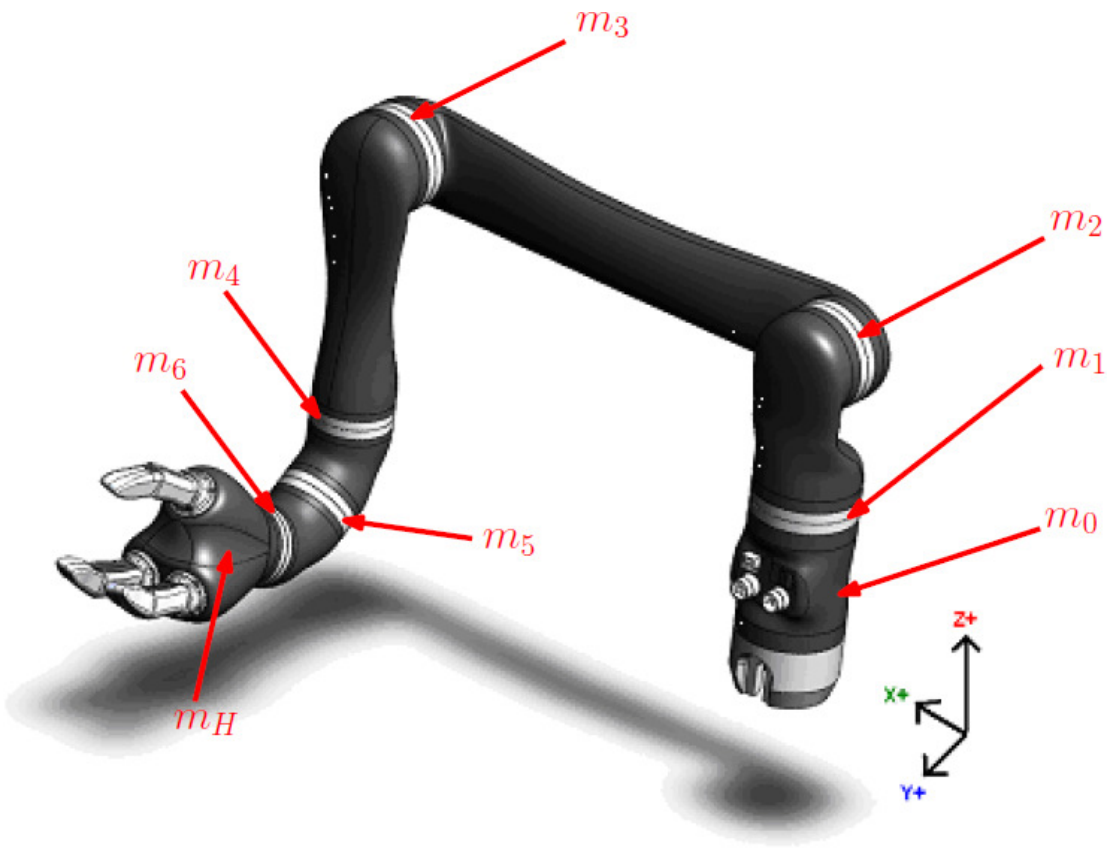

Figure 5 : Inertial parameters

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
mH	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]