

1-)

From Project 2

$$A = \begin{bmatrix} c\theta_2 & -s\theta_2 & 0 & 4c\theta_2 \\ s\theta_2 & c\theta_2 & 0 & 4s\theta_2 \\ 0 & 0 & 1 & 6.35+d_1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

R_2^0 O_2^0

$$R_1^0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$J = \begin{bmatrix} \frac{dO_2^0}{dd_1} & \frac{dO_2^0}{d\theta_2} \\ P_1^k & P_2 R_1^0 k \end{bmatrix} = \begin{bmatrix} 0 & -4s\theta_2 \\ 0 & 4c\theta_2 \\ 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}$$

↓

0. $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

2. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

```
goksel@goksel-N551VM:~/GitHub/IntroToRobotics/myrobotws$ rosrn manipulator_core robot_model_node_pr3
[ INFO] [1610715857.059756152]: Loading robot model 'pr_robot'...
[ INFO] [1610715857.103938755]: Model frame: base_link
[ INFO] [1610715857.108557089]: Loading robot model 'pr_robot'...
[ INFO] [1610715858.187899432]: Ready to take commands for planning group pr_robot.
[ WARN] [1610715858.697968501]: Topic '/rviz_visual_tools' unable to connect to any subscribers within 0.5 sec. It is possible initially published visual messages will be lost.
hand, pr_robot, [ INFO] [1610715858.928158901]: Starting Joint Values joint1_base_link_to_link1: 0.000000
[ INFO] [1610715858.928279677]: Starting Joint Values joint2_link1_to_link2: 0.000000
[ INFO] [1610715858.928438277]: Translation of initial joint states:
  4
  0
6.35
Time: 0
[ INFO] [1610715858.932093359]: Jacobian:
0 0
0 4
1 0
0 0
0 0
0 1
```

As seen from the picture when $d1=0$ and $\theta_2 = 0$, the jacobian confirm my calculation.

2-)

The code will work just fine.

However, if you are not able to run the code for any reason the result shown below too.

When I run the codes below in different terminal I get the result as →

\$roslaunch config_files demo.launch rviz_tutorial:=true

\$roslaunch manipulator_core robot_model_node_pr3

And this can should be seen when you run the code too:

hand, pr_robot, [INFO] [1610716864.028679929]: Starting Joint Values joint1_base_link_to_link1:
0.000000

[INFO] [1610716864.028788075]: Starting Joint Values joint2_link1_to_link2: 0.000000

[INFO] [1610716864.028898425]: Translation of initial joint states:

4

0

6.35

Time: 0

[INFO] [1610716864.029152799]: Jacobian:

0 0

0 4

1 0

0 0

0 0

0 1

[INFO] [1610716864.029283151]: Linear and Angular Velocities :

0

0

0

0

0

0

[INFO] [1610716864.029448341]: Change in position and orientation :

0

0

0

0

0

0

[INFO] [1610716864.029761113]: Updated kinematic map :

1 -0 0 4

0 1 0 0

0 0 1 6.35

0 0 0 1

Time: 0.2

[INFO] [1610716864.130581296]: Jacobian:

0 0
0 4
1 0
0 0
0 0
0 1

[INFO] [1610716864.130719870]: Linear and Angular Velocities :

0
0
0
0
0
0

[INFO] [1610716864.130824317]: Change in position and orientation :

0
0
0
0
0
0

[INFO] [1610716864.130974700]: Updated kinematic map :

1 -0 0 4
0 1 0 0
0 0 1 6.35
0 0 0 1

Time: 0.4

[INFO] [1610716864.739825485]: Jacobian:

0 -0.016
0 3.99997
1 0
0 0
0 0
0 1

[INFO] [1610716864.739971249]: Linear and Angular Velocities :

-6.39998e-05
0.0159999
0.0004
0
0
0.004

[INFO] [1610716864.740133652]: Change in position and orientation :

-1.28e-05
0.00319997
8e-05

0
0
0.0008

[INFO] [1610716864.740410705]: Updated kinematic map :

1 -0 0 4
0 1 0 0
0 0 1 6.35
0 0 0 1

Time: 0.6

[INFO] [1610716865.439889906]: Jacobian:

0 -0.0479988
0 3.99971
1 0
0 0
0 0
0 1

[INFO] [1610716865.440032378]: Linear and Angular Velocities :

-0.000383991
0.0319977
0.0008
0
0
0.008

[INFO] [1610716865.440176312]: Change in position and orientation :

-7.67982e-05
0.00639954
0.00016
0
0
0.0016

[INFO] [1610716865.440364206]: Updated kinematic map :

1 -0.0008 0 3.99999
0.0008 1 0 0.00319997
0 0 1 6.35008
0 0 0 1

Time: 0.8

[INFO] [1610716866.129524862]: Jacobian:

0 -0.0959908
0 3.99885
1 0
0 0
0 0
0 1

[INFO] [1610716866.129671941]: Linear and Angular Velocities :

-0.00115189
0.0479862
0.0012
0
0
0.012

[INFO] [1610716866.129820591]: Change in position and orientation :

-0.000230378
0.00959724
0.00024
0
0
0.0024

[INFO] [1610716866.130057129]: Updated kinematic map :

0.999997	-0.0024	0	3.99991
0.0024	0.999997	0	0.00959951
0	0	1	6.35024
0	0	0	1

Time: 1

[INFO] [1610716866.829878760]: Jacobian:

0	-0.159957
0	3.9968
1	0
0	0
0	0
0	1

[INFO] [1610716866.830040096]: Linear and Angular Velocities :

-0.00255932
0.0639488
0.0016
0
0
0.016

[INFO] [1610716866.830197655]: Change in position and orientation :

-0.000511863
0.0127898
0.00032
0
0
0.0032

[INFO] [1610716866.830407953]: Updated kinematic map :

0.999988	-0.00479998	0	3.99968
0.00479998	0.999988	0	0.0191967
0	0	1	6.35048

0 0 0 1

Time: 1.2

[INFO] [1610716867.639437187]: Jacobian:

0 -0.239856
0 3.9928
1 0
0 0
0 0
0 1

[INFO] [1610716867.639580130]: Linear and Angular Velocities :

-0.00479712
0.079856
0.002
0
0
0.02

[INFO] [1610716867.639681972]: Change in position and orientation :

-0.000959424
0.0159712
0.0004
0
0
0.004

[INFO] [1610716867.639831596]: Updated kinematic map :

0.999968 -0.00799991 0 3.99917
0.00799991 0.999968 0 0.0319865
0 0 1 6.3508
0 0 0 1

Time: 1.4

[INFO] [1610716869.129923839]: Jacobian:

0 -1.02832
0 3.86556
1 0
0 0
0 0
0 1

[INFO] [1610716869.130083138]: Linear and Angular Velocities :

-0.205664
0.773112
0.02
0
0
0.2

[INFO] [1610716869.130202745]: Change in position and orientation :
-0.0411329
0.154622
0.004
0
0
0.04

[INFO] [1610716869.130432585]: Updated kinematic map :
0.999928 -0.0119997 0 3.99821
0.0119997 0.999928 0 0.0479577
0 0 1 6.3512
0 0 0 1

Time: 1.6

[INFO] [1610716870.639910612]: Jacobian:
0 -1.77579
0 3.58421
1 0
0 0
0 0
0 1

[INFO] [1610716870.640117132]: Linear and Angular Velocities :
-0.355158
0.716842
0.02
0
0
0.2

[INFO] [1610716870.640303334]: Change in position and orientation :
-0.0710317
0.143368
0.004
0
0
0.04

[INFO] [1610716870.640567914]: Updated kinematic map :
0.998648 -0.0519766 0 3.95708
0.0519766 0.998648 0 0.20258
0 0 1 6.3552
0 0 0 1

Time: 1.8

[INFO] [1610716872.139976730]: Jacobian:
0 -2.45247
0 3.15997
1 0

0 0
0 0
0 1

[INFO] [1610716872.140162208]: Linear and Angular Velocities :

-0.490493

0.631994

0.02

0

0

0.2

[INFO] [1610716872.140347214]: Change in position and orientation :

-0.0980987

0.126399

0.004

0

0

0.04

[INFO] [1610716872.140687691]: Updated kinematic map :

0.995771 -0.0918703 0 3.88604

0.0918703 0.995771 0 0.345949

0 0 1 6.3592

0 0 0 1

Time: 2

[INFO] [1610716873.629840832]: Jacobian:

0 -3.03137

0 2.60975

1 0

0 0

0 0

0 1

[INFO] [1610716873.630026953]: Linear and Angular Velocities :

-0.606274

0.52195

0.02

0

0

0.2

[INFO] [1610716873.630176239]: Change in position and orientation :

-0.121255

0.10439

0.004

0

0

0.04

[INFO] [1610716873.630403437]: Updated kinematic map :

0.991301	-0.131617	0	3.78795
0.131617	0.991301	0	0.472347
0	0	1	6.3632
0	0	0	1

Time: 2.2

[INFO] [1610716875.129572459]: Jacobian:

0	-3.48942
0	1.95549
1	0
0	0
0	0
0	1

[INFO] [1610716875.129710539]: Linear and Angular Velocities :

-0.697884
0.391098
0.02
0
0
0.2

[INFO] [1610716875.129822686]: Change in position and orientation :

-0.139577
0.0782195
0.004
0
0
0.04

[INFO] [1610716875.130043758]: Updated kinematic map :

0.985244	-0.171153	0	3.66669
0.171153	0.985244	0	0.576737
0	0	1	6.3672
0	0	0	1

Time: 2.4

[INFO] [1610716876.629668697]: Jacobian:

0	-3.80836
0	1.22327
1	0
0	0
0	0
0	1

[INFO] [1610716876.629858950]: Linear and Angular Velocities :

-0.761672
0.244654
0.02

0
0
0.2

[INFO] [1610716876.630012058]: Change in position and orientation :

-0.152334

0.0489307

0.004

0

0

0.04

[INFO] [1610716876.630250398]: Updated kinematic map :

0.977612 -0.210416 0 3.52711

0.210416 0.977612 0 0.654957

0 0 1 6.3712

0 0 0 1

Time: 2.6

[INFO] [1610716878.139633021]: Jacobian:

0 -3.97547

0 0.442279

1 0

0 0

0 0

0 1

[INFO] [1610716878.139778904]: Linear and Angular Velocities :

-0.795095

0.0884558

0.02

0

0

0.2

[INFO] [1610716878.139906733]: Change in position and orientation :

-0.159019

0.0176912

0.004

0

0

0.04

[INFO] [1610716878.140045904]: Updated kinematic map :

0.968416 -0.249341 0 3.37478

0.249341 0.968416 0 0.703888

0 0 1 6.3752

0 0 0 1

Time: 2.8

[INFO] [1610716879.630003022]: Jacobian:

0	-3.9841
0	-0.356342
1	0
0	0
0	0
0	1

[INFO] [1610716879.630161647]: Linear and Angular Velocities :

-0.796819
-0.0712683
0.02
0
0
0.2

[INFO] [1610716879.630268207]: Change in position and orientation :

-0.159364
-0.0142537
0.004
0
0
0.04

[INFO] [1610716879.630419604]: Updated kinematic map :

0.95767	-0.287868	0	3.21576
0.287868	0.95767	0	0.721579
0	0	1	6.3792
0	0	0	1

Time: 3

[INFO] [1610716881.129687874]: Jacobian:

0	-3.83389
0	-1.14076
1	0
0	0
0	0
0	1

[INFO] [1610716881.129837068]: Linear and Angular Velocities :

-0.766777
-0.228151
0.02
0
0
0.2

[INFO] [1610716881.130015212]: Change in position and orientation :

-0.153355
-0.0456302
0.004

0
0
0.04

[INFO] [1610716881.130286647]: Updated kinematic map :

0.945392 -0.325934 0 3.0564
0.325934 0.945392 0 0.707325
0 0 1 6.3832
0 0 0 1

Time: 3.2

[INFO] [1610716882.629796766]: Jacobian:

0 -3.53083
0 -1.87969
1 0
0 0
0 0
0 1

[INFO] [1610716882.629938077]: Linear and Angular Velocities :

-0.706166
-0.375938
0.02
0
0
0.2

[INFO] [1610716882.630046230]: Change in position and orientation :

-0.141233
-0.0751877
0.004
0
0
0.04

[INFO] [1610716882.630192955]: Updated kinematic map :

0.931602 -0.363479 0 2.90304
0.363479 0.931602 0 0.661695
0 0 1 6.3872
0 0 0 1

Time: 3.4

[INFO] [1610716884.129495838]: Jacobian:

0 -3.08701
0 -2.54369
1 0
0 0
0 0
0 1

[INFO] [1610716884.129648840]: Linear and Angular Velocities :

-0.617402
-0.508738
0.02
0
0
0.2

[INFO] [1610716884.129772050]: Change in position and orientation :

-0.12348
-0.101748
0.004
0
0
0.04

[INFO] [1610716884.129939559]: Updated kinematic map :

0.916322	-0.400443	0	2.76181
0.400443	0.916322	0	0.586507
0	0	1	6.3912
0	0	0	1

Time: 3.6

[INFO] [1610716885.639521736]: Jacobian:

0	-2.52012
0	-3.10628
1	0
0	0
0	0
0	1

[INFO] [1610716885.639694185]: Linear and Angular Velocities :

-0.504025
-0.621256
0.02
0
0
0.2

[INFO] [1610716885.639856579]: Change in position and orientation :

-0.100805
-0.124251
0.004
0
0
0.04

[INFO] [1610716885.640146507]: Updated kinematic map :

0.899575	-0.436766	0	2.63833
0.436766	0.899575	0	0.484759
0	0	1	6.3952

0 0 0 1

Time: 3.8

[INFO] [1610716887.129497563]: Jacobian:

0 -1.85277
0 -3.54503
1 0
0 0
0 0
0 1

[INFO] [1610716887.129682679]: Linear and Angular Velocities :

-0.370553
-0.709007
0.02
0
0
0.2

[INFO] [1610716887.129833497]: Change in position and orientation :

-0.0741106
-0.141801
0.004
0
0
0.04

[INFO] [1610716887.130041010]: Updated kinematic map :

0.88139 -0.47239 0 2.53752
0.47239 0.88139 0 0.360508
0 0 1 6.3992
0 0 0 1

Time: 4

[INFO] [1610716888.639446844]: Jacobian:

0 -1.11154
0 -3.84246
1 0
0 0
0 0
0 1

[INFO] [1610716888.639626836]: Linear and Angular Velocities :

-0.222309
-0.768491
0.02
0
0
0.2

[INFO] [1610716888.639768677]: Change in position and orientation :
-0.0444617
-0.153698
0.004
0
0
0.04

[INFO] [1610716888.639994412]: Updated kinematic map :
0.861794 -0.507258 0 2.46341
0.507258 0.861794 0 0.218707
0 0 1 6.4032
0 0 0 1

Time: 4.2

[INFO] [1610716890.139940614]: Jacobian:
0 -0.326009
0 -3.98669
1 0
0 0
0 0
0 1

[INFO] [1610716890.140098059]: Linear and Angular Velocities :
-0.0652017
-0.797339
0.02
0
0
0.2

[INFO] [1610716890.140223560]: Change in position and orientation :
-0.0130403
-0.159468
0.004
0
0
0.04

[INFO] [1610716890.140420119]: Updated kinematic map :
0.84082 -0.541315 0 2.41895
0.541315 0.84082 0 0.0650086
0 0 1 6.4072
0 0 0 1

Time: 4.4

[INFO] [1610716891.139740926]: Jacobian:
0 0.472523
0 -3.97199
1 0

0 0
0 0
0 1

[INFO] [1610716891.139915156]: Linear and Angular Velocities :

0.0945047

-0.794398

0.02

0

0

0.2

[INFO] [1610716891.140024011]: Change in position and orientation :

0.0189009

-0.15888

0.004

0

0

0.04

[INFO] [1610716891.140260052]: Updated kinematic map :

0.818501 -0.574506 0 2.40591

0.574506 0.818501 0 -0.0944591

0 0 1 6.4112

0 0 0 1

Time: 4.6

[INFO] [1610716891.829649425]: Jacobian:

0 1.25222

0 -3.79894

1 0

0 0

0 0

0 1

[INFO] [1610716891.829811213]: Linear and Angular Velocities :

0.250443

-0.759788

0.02

0

0

0.2

[INFO] [1610716891.829935639]: Change in position and orientation :

0.0500887

-0.151958

0.004

0

0

0.04

[INFO] [1610716891.830144753]: Updated kinematic map :

0.794872	-0.606777	0	2.42481
0.606777	0.794872	0	-0.253339
0	0	1	6.4152
0	0	0	1

Time: 4.8

[INFO] [1610716892.539688315]: Jacobian:

0	1.98199
0	-3.47444
1	0
0	0
0	0
0	1

[INFO] [1610716892.539840114]: Linear and Angular Velocities :

0.396398
-0.694888
0.02
0
0
0.2

[INFO] [1610716892.539943628]: Change in position and orientation :

0.0792796
-0.138978
0.004
0
0
0.04

[INFO] [1610716892.540092871]: Updated kinematic map :

0.769971	-0.638078	0	2.4749
0.638078	0.769971	0	-0.405296
0	0	1	6.4192
0	0	0	1

Time: 5

[INFO] [1610716893.329781225]: Jacobian:

0	2.63275
0	-3.01142
1	0
0	0
0	0
0	1

[INFO] [1610716893.329916978]: Linear and Angular Velocities :

0.526549
-0.602284
0.02

0
0
0.2

[INFO] [1610716893.330010473]: Change in position and orientation :

0.10531
-0.120457
0.004
0
0
0.04

[INFO] [1610716893.330159298]: Updated kinematic map :

0.743839	-0.668359	0	2.55418
0.668359	0.743839	0	-0.544274
0	0	1	6.4232
0	0	0	1

Time: 5.2

[INFO] [1610716894.039463276]: Jacobian:

0	3.17854
0	-2.42835
1	0
0	0
0	0
0	1

[INFO] [1610716894.039608929]: Linear and Angular Velocities :

0.635709
-0.485669
0.02
0
0
0.2

[INFO] [1610716894.039731440]: Change in position and orientation :

0.127142
-0.0971338
0.004
0
0
0.04

[INFO] [1610716894.039931820]: Updated kinematic map :

0.716517	-0.69757	0	2.65949
0.69757	0.716517	0	-0.664731
0	0	1	6.4272
0	0	0	1

Time: 5.4

[INFO] [1610716894.739570678]: Jacobian:

0	3.5906
0	-1.76284
1	0
0	0
0	0
0	1

[INFO] [1610716894.739716741]: Linear and Angular Velocities :

0.703757
-0.345516
0.0196
0
0
0.196

[INFO] [1610716894.739902745]: Change in position and orientation :

0.140751
-0.0691033
0.00392
0
0
0.0392

[INFO] [1610716894.740083242]: Updated kinematic map :

0.688048	-0.725665	0	2.78663
0.725665	0.688048	0	-0.761865
0	0	1	6.4312
0	0	0	1

Time: 5.6

[INFO] [1610716895.429914738]: Jacobian:

0	3.86101
0	-1.04528
1	0
0	0
0	0
0	1

[INFO] [1610716895.430104959]: Linear and Angular Velocities :

0.741314
-0.200693
0.0192
0
0
0.192

[INFO] [1610716895.430263852]: Change in position and orientation :

0.148263
-0.0401387
0.00384

0
0
0.0384

[INFO] [1610716895.430465429]: Updated kinematic map :

0.659081 -0.752072 0 2.92738
0.752072 0.659081 0 -0.830968
0 0 1 6.43512
0 0 0 1

Time: 5.8

[INFO] [1610716896.129951005]: Jacobian:

0 3.98834
0 -0.305259
1 0
0 0
0 0
0 1

[INFO] [1610716896.130098819]: Linear and Angular Velocities :

0.749807
-0.0573887
0.0188
0
0
0.188

[INFO] [1610716896.130209923]: Change in position and orientation :

0.149961
-0.0114777
0.00376
0
0
0.0376

[INFO] [1610716896.130366444]: Updated kinematic map :

0.629723 -0.77682 0 3.07564
0.77682 0.629723 0 -0.871107
0 0 1 6.43896
0 0 0 1

Time: 6

[INFO] [1610716896.839618064]: Jacobian:

0 3.97686
0 0.429614
1 0
0 0
0 0
0 1

[INFO] [1610716896.839761854]: Linear and Angular Velocities :

0.731743
0.0790489
0.0184
0
0
0.184

[INFO] [1610716896.839865834]: Change in position and orientation :

0.146349
0.0158098
0.00368
0
0
0.0368

[INFO] [1610716896.840051971]: Updated kinematic map :

0.600076	-0.799943	0	3.22561
0.799943	0.600076	0	-0.882584
0	0	1	6.44272
0	0	0	1