

<https://in.mathworks.com/matlabcentral/fileexchange/50233-a-complete-analytical-solution-to-inverse-kinematics-of-8-or-higher-dof-manipulator>

this program calculates the end effector position by giving the parameters of the manipulator in form of dh notation using forward kinematics

and also calculates theeta values by giving end effector position using inverse kinematics

Description

Type the following in command window (for 4 DOF manipulator)

```
parameters = [0 pi/4 1 pi/2;0 pi/4 1 0;0 pi/4 1 0;0 pi/4 1 0]
```

and press enter

```
parameters =
```

```
0 0.7854 1.0000 1.5708
```

```
0 0.7854 1.0000 0
```

```
0 0.7854 1.0000 0
```

```
0 0.7854 1.0000 0
```

where

d = parameter(1) = coloum 1

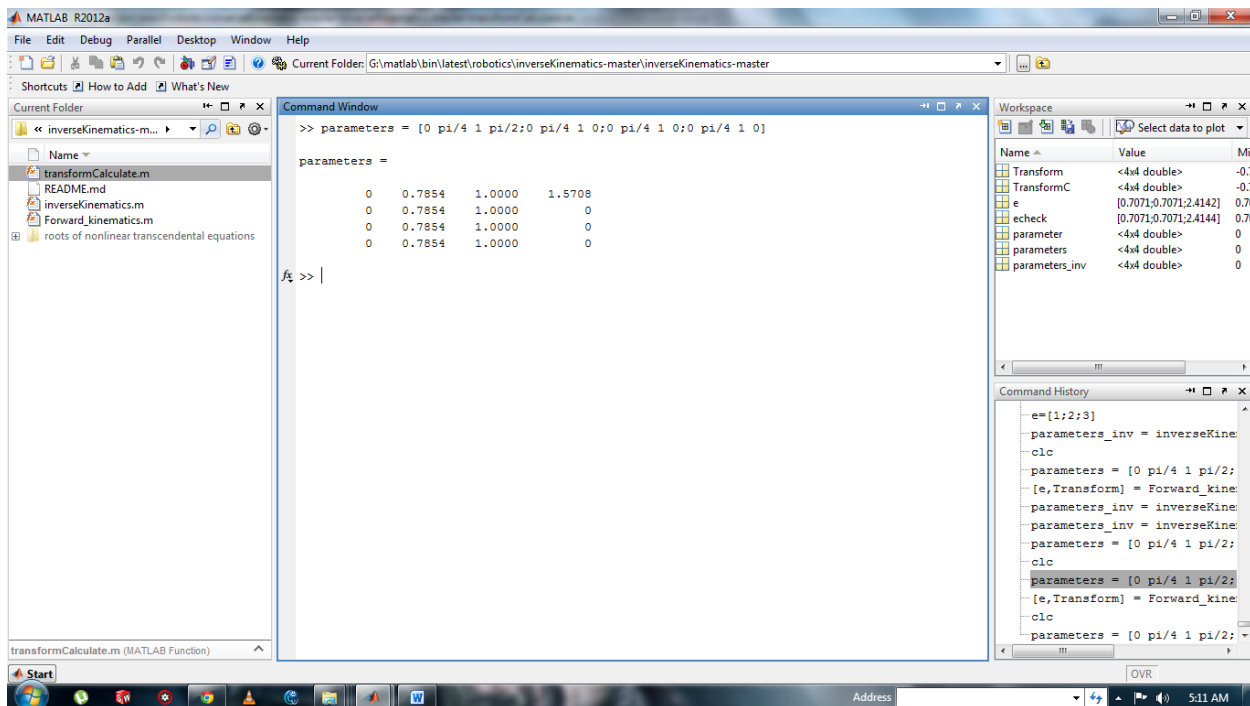
theta = parameter(2) = coloum 2

r = parameter(3) = coloum 3

alpha = parameter(4) = coloum 4

```
%-----%
%-----Copyright (c) 2015, sai kumar-----%
%-----All rights reserved.-----%
```

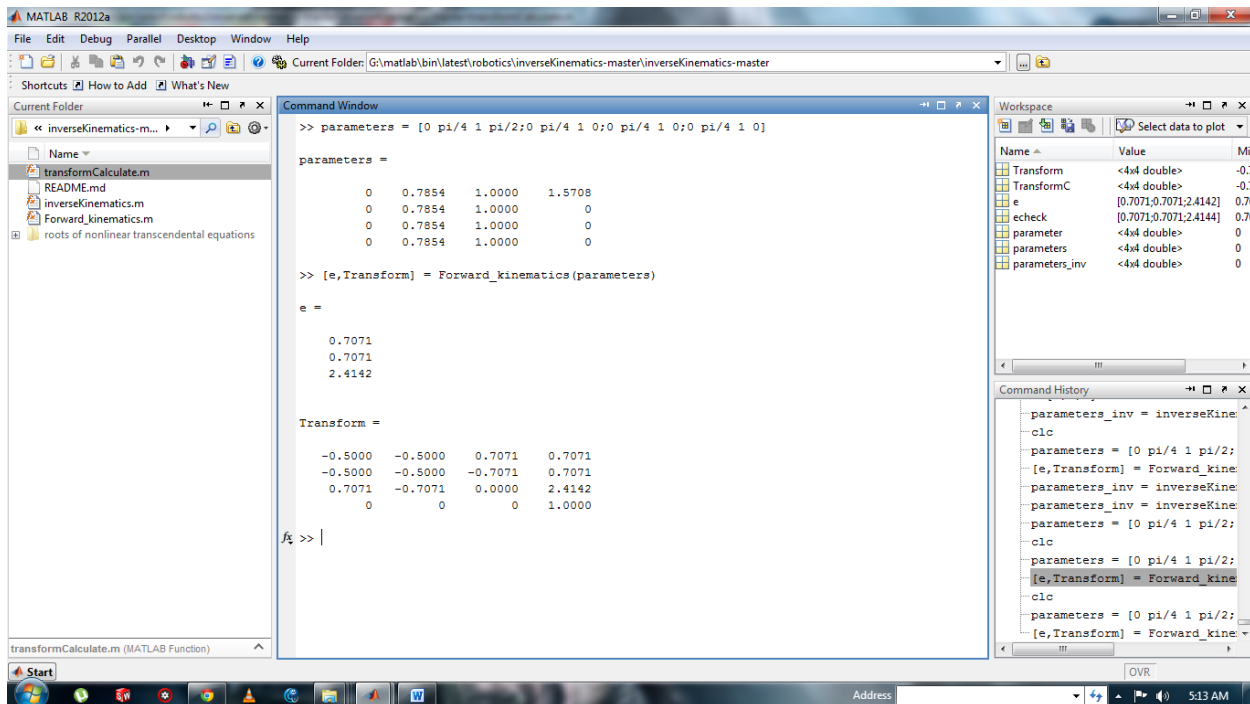
<https://in.mathworks.com/matlabcentral/fileexchange/50233-a-complete-analytical-solution-to-inverse-kinematics-of-8-or-higher-dof-manipulator>



Next Type the following

`[e,Transform] = Forward_kinematics(parameters)`

Which gives end effector position ie 'e' and transform matrix



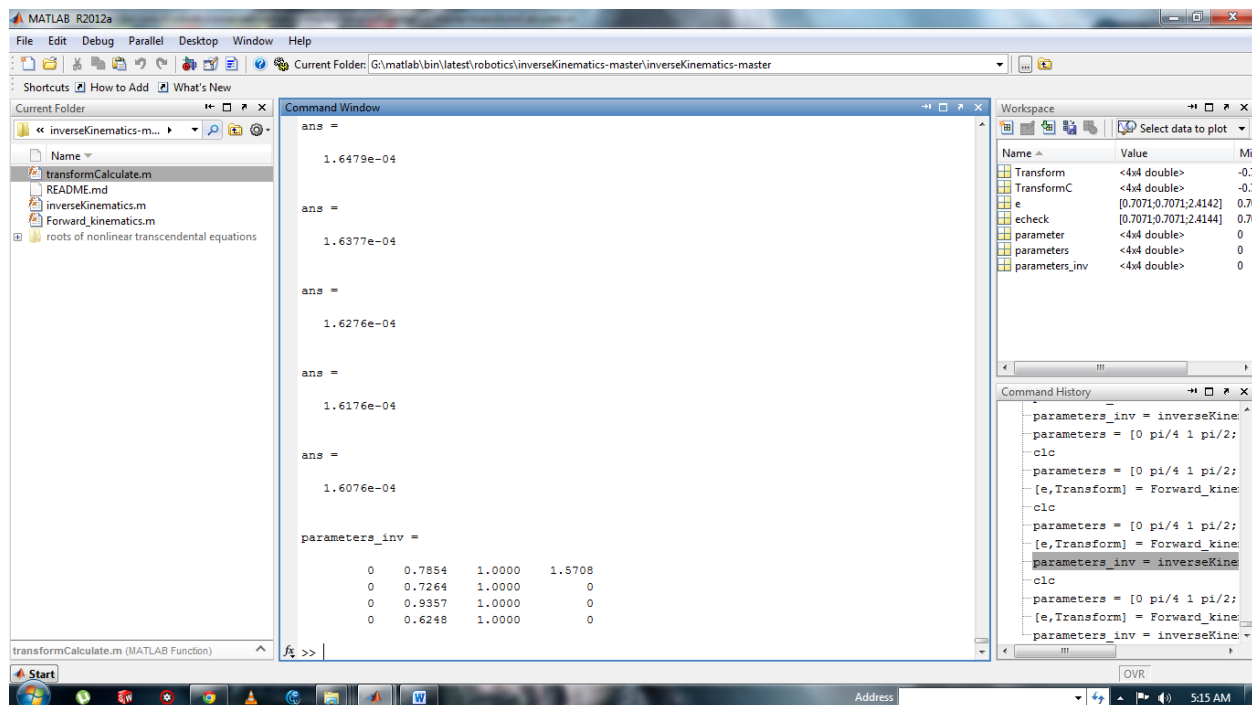
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Now 'e' as a input we can find the joint angles using inverse kinematics

Type the following

```
parameters_inv = inverseKinematics(e, parameters )
```



the column 2 displays the new values of theta w r t the given point 'e' (see the figure 1)

next

for validation type 'echeck' which will display the end effector given position

next

type 'e' which will display the end effector final position where both should be same

```
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```

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The screenshot shows the MATLAB R2012a interface. The Command Window displays the following output:

```

1.6176e-04

ans =

1.6076e-04

parameters_inv =

    0    0.7854    1.0000    1.5708
    0    0.7264    1.0000         0
    0    0.9357    1.0000         0
    0    0.6248    1.0000         0

>> echeck

echeck =

    0.7071
    0.7071
    2.4144

>> e

e =

    0.7071
    0.7071
    2.4142

```

The Workspace window shows the following variables:

Name	Value	Min	Max
Transform	<4x4 double>	-0.7	0.7
TransformC	<4x4 double>	-0.7	0.7
e	[0.7071;0.7071;2.4142]	0.7	2.4
echeck	[0.7071;0.7071;2.4144]	0.7	2.4
parameter	<4x4 double>	0	1
parameters	<4x4 double>	0	1
parameters_inv	<4x4 double>	0	1

The Command History window shows the following commands:

```

>> clc
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> clc
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> parameters_inv = inverseKine
>> clc
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> parameters_inv = inverseKine
>> echeck
>> e

```

The column 2 ie the values of theta wrt given point are correct

This can be further extended to 5 or higher dof manipulator In the same procedure (for 5 DOF manipulator)

The screenshot shows the MATLAB R2012a interface. The Command Window displays the following output:

```

-0.5000    -0.5000    0.7071    0.7071
-0.5000    -0.5000   -0.7071    0.7071
 0.7071    -0.7071    0.0000    2.4142
         0         0         0    1.0000

>> parameters = [0 pi/4 1 pi/2;0 pi/4 1 0;0 pi/4 1 0;0 pi/4 1 0;0 pi/4 5 0]

parameters =

    0    0.7854    1.0000    1.5708
    0    0.7854    1.0000         0
    0    0.7854    1.0000         0
    0    0.7854    1.0000         0
    0    0.7854    5.0000         0

>> [e,Transform] = Forward_kinematics(parameters)

e =

   -2.8284
   -2.8284
    2.4142

Transform =

   -0.7071   -0.0000    0.7071   -2.8284
   -0.7071   -0.0000   -0.7071   -2.8284
    0.0000   -1.0000    0.0000    2.4142
         0         0         0    1.0000

```

The Workspace window shows the following variables:

Name	Value	Min	Max
Transform	<4x4 double>	-2.8	2.8
TransformC	<4x4 double>	-0.7	0.7
e	[-2.8284;-2.8284;2.4142]	-2.8	2.4
echeck	[0.7071;0.7071;2.4144]	0.7	2.4
parameter	<4x4 double>	0	1
parameters	<5x4 double>	0	1
parameters_inv	<4x4 double>	0	1

The Command History window shows the following commands:

```

>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> parameters_inv = inverseKine
>> echeck
>> e
>> clc
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> clc
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine
>> parameters = [0 pi/4 1 pi/2;
>> [e,Transform] = Forward_kine

```

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