

# ROBOTIC TOOLBOX

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Note: If a link parameter has to be edited after updating, all successive parameters has to be updated again

- 1) Download the robotictoolbox file and unzip the contents of the folder and save it to the directory
- 2) Open MATLAB
- 3) Add the toolbox folder to the path
- 4) Run the MAINFILE.m file
- 5) Click on the function you want to perform (Example: Click on Forward kinematics to perform forward kinematics operation)
- 6) Close the GUI after performing the operation

## I) DESCRIPTION OF THE FRAME

In this function, the user can describe the homogenous transformation of frame B relative to frame A

- 1) Enter the rotation angles and the axis of rotation for rotation 1, 2 and 3 of frame B relative to frame A
- 2) Enter the position vector of the origin in frame A
- 3) Select the frame of rotation (Current frame or Fixed frame)
- 4) Click the Update button
- 5) The transformation matrix  $T_B^A$  is displayed

## II) TRANSFORMATION OPERATOR

- 1) Enter translation vector in frame A
- 2) Enter the rotation angles and the axis of rotation for rotation 1, 2 and 3 of frame B relative to frame A
- 3) Enter translation vector in frame B(Enter zeros if the vector is subjected only to rotation )
- 4) Click the Update button
- 5) The transformation operator is displayed

### **III) TRANSFORM MAPPING**

- 1) Enter the rotation angles and the axis of rotation for rotation 1, 2 and 3 of frame B relative to frame A
- 2) Enter position vector of Frame B relative to A
- 3) Enter vector in Frame B
- 4) Select the frame of rotation (Current frame or Fixed frame)
- 5) Click the Update button
- 6) The transformation mapping is displayed

### **IV) EULER ANGLES**

- 1) Enter the rotation matrix
- 2) Select the frame of rotation (Current frame or Fixed frame)
- 3) Click the Update button
- 4) Euler angles are displayed

### **V) FORWARD KINEMATICS**

- 1) Enter the total number of links
- 2) Enter the link number
- 3) Enter the DH parameters numeric values only ( $a_i$   $\alpha_i$   $d_i$   $\theta_i$ )
- 4) Click the update button after entering DH parameters of each link
- 5) The transformation matrix and plot is displayed
- 6) Use the reset button to reset the GUI

### **VI) FORWARD KINEMATICS (PARAMETERS)**

- 1) Enter the initial parameters (Number of joints and the type of joint 0)
- 2) Enter the link parameters (Link number, length of the link, joint variable (value of  $d_i$  or  $\theta_i$ ), type of the joint at the end of the link (i.e., at  $i$  ))
- 3) Select the direction cosines of Z in previous frame
- 4) Click the update button after every iteration
- 5) The transformation matrix and the plot is displayed
- 6) Use the reset button to reset the GUI

## **VII) WORKSPACE**

Note : The number of iterations for to create workspace =  $\text{density}^{\text{no\_of\_links}}$ . Hence try to keep the value below 2,00,000 to run the program quickly. Please wait for the workspace to complete

- 1) Enter the total number of links
- 2) Enter the link number
- 3) Enter the DH parameters numeric values only ( $a_i$   $\alpha_i$   $d_i$   $\theta_i$ )
- 4) Click the update button after entering DH parameters of each link
- 5) The Workspace is displayed
- 6) Use the reset button to reset the GUI

## **VIII) INVERSE KINEMATICS**

- 1) Enter the total number of links
- 2) Enter the transformation matrix
- 3) Enter the link number
- 4) Enter the DH parameters numeric values only ( $a_i$   $\alpha_i$   $d_i$   $\theta_i$ )
- 5) Click the update button after entering DH parameters of each link
- 6) The joint variables are displayed
- 7) Use the reset button to reset the GUI

## **IX) DIFFERENTIAL KINEMATICS**

- 1) Enter the total number of links
- 2) Enter the DH parameters numeric values only ( $a_i$   $\alpha_i$   $d_i$   $\theta_i$  type of joint)
- 3) Click the update button after entering DH parameters of each link
- 4) The Jacobian matrix is displayed
- 5) Use the reset button to reset the GUI

## **X) INVERSE DIFFERENTIAL KINEMATICS**

- 1) Enter the total number of links and end effector velocities
- 2) Enter the jacobian for each link
- 3) Click the update button after entering jacobian of each link
- 4) The joint velocities are displayed (in unit/second)

- 5) Use the reset button to reset the GUI

## **XI) INVERSE KINEMATICS USING JACOBIAN**

- 1) Enter the total number of links and the position of the end effector
- 2) Enter the linear part of jacobian
- 3) Click the update button after entering jacobian of each link
- 4) The joint variables are displayed
- 5) Use the reset button to reset the GUI