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Class: MECHANICS AND CONTROL OF ROBOT MANIPULATORS

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Home Work 2

1. For the 2-link manipulator shown, the link transformation  and  were determined. Their product is



The frame assignments used are indicated below in the figure. Note that frame 0 is coincident with frame 1 when  is 0. The length of the second link is. Find an expression for the vector  which locates the tip of arm relative to the 0 frame. (Courtesy of J. Craig)



Tip

1.  Consider the following PRP manipulator



1. Assign link frames {0} through {3} for the manipulator – that is, sketch the coordinate axes of each frame.
2. Find the Denavit - Hartenberg parameters for this manipulator – that is, fill in the entries for the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *i* |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

1. Derive the forward kinematics for this manipulator – that is, find the matrix .

Solutions

1. a) We have:



With:

 , ,

So, the answer is:



Final result: 

1. a) Assign link frames {0} through {3} for manipulator as the following figure:



To reduce parameter, we can place position of origin of frame {2} into origin of frame {3} as figure below:



b) Find the Denavit-Hartenberg parameters for this manipulator:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *i* |  |  |  |  |
| 1 | 0 | 0 | 0 |  |
| 2 |  | 90o |  | 0 |
| 3 | 0 | -90o | 0 |  |

c) We have:



Apply equation number 3.6 in the book, we will have:

,  , 

And the result would be:

