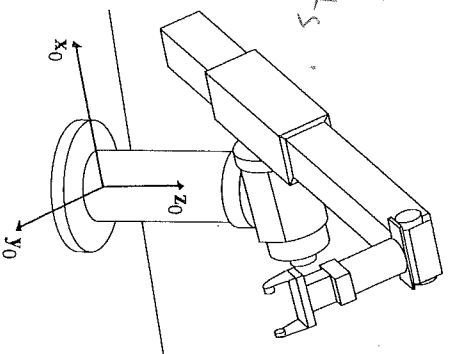


2.12 A Stanford robot arm has moved to the position shown in the figure below. The joint variables at this position are: $\mathbf{q} = (90^\circ, -120^\circ, 22 \text{ cm}, 0^\circ, 70^\circ, 90^\circ)^T$. Establish the orthonormal link coordinate systems (x_i, y_i, z_i) for $i = 1, 2, \dots, 6$, for this arm and complete the table.

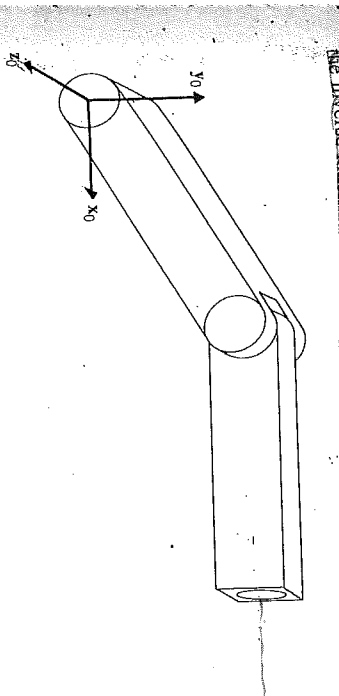
Do only the first 3 joints



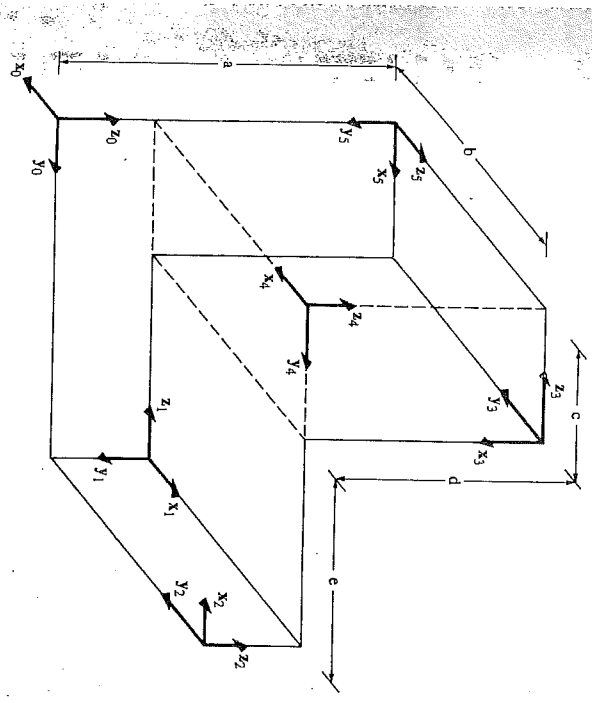
| Stanford arm link coordinate parameters | | | | | |
|---|------------|------------|-------|-------|--|
| Joint i | θ_i | α_i | a_i | d_i | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |

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2.15 A two degree-of-freedom manipulator is shown in the figure below. Given that the length of each link is 1 m, establish its link coordinate frames and find 0A_1 and 1A_2 . Find the inverse kinematics solution for this manipulator.



2.6 For the figure shown below, find the 4×4 homogeneous transformation matrices ${}^{i-1}A_i$ and 0A_i for $i = 1, 2, 3, 4, 5$.



Do only

0A_1 , 1A_2 , 2A_3

and 0A_3