CMSC425 Lecture notes 10/3
Skeletons, rigging and animation

These notes parallel the PowerPoint “Skeletons and Skins”, Day 11.

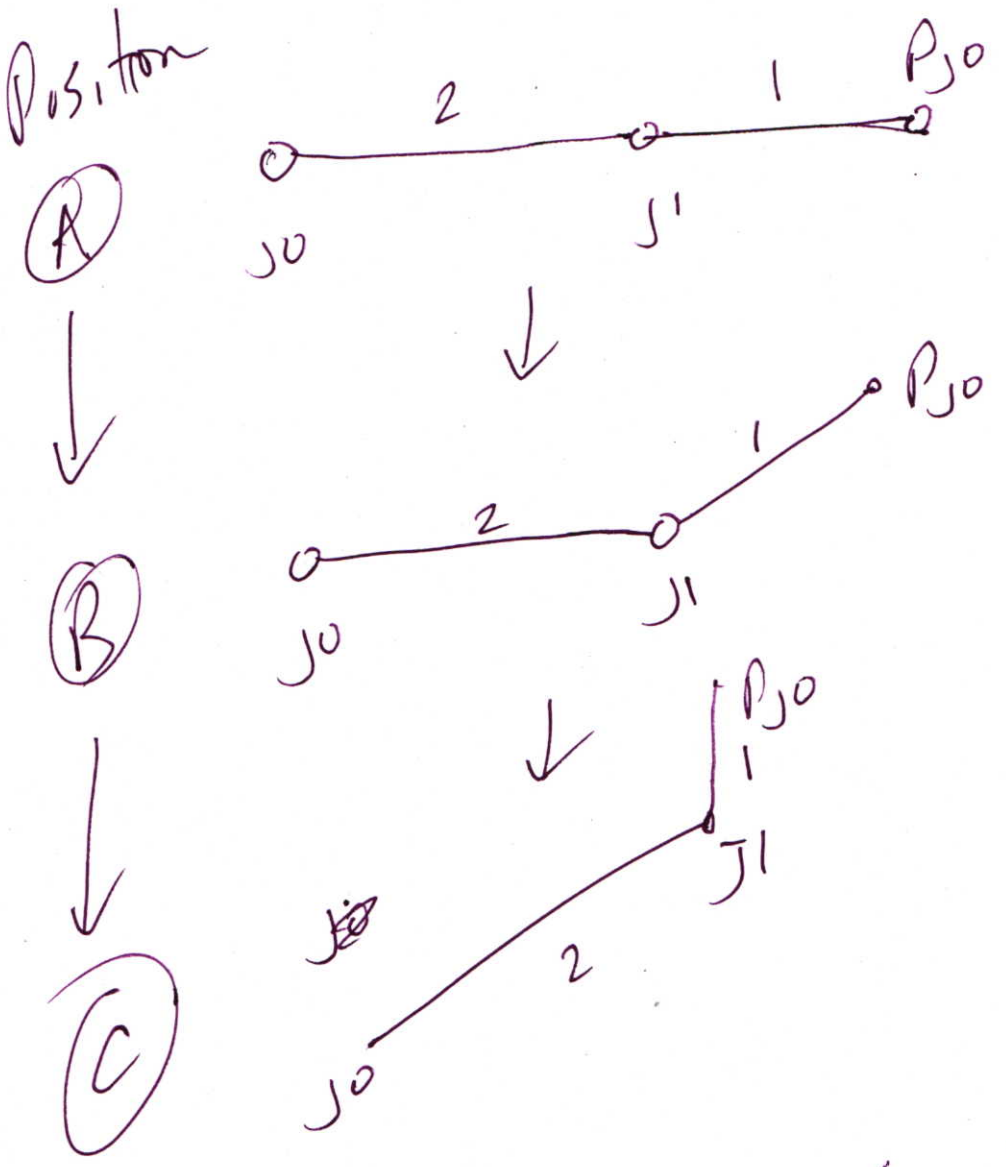
Pages:

1) Three positions of a two joint skeleton with a point Pj0 defined in joint 1 (j1) coordinate system. The transform matrix M of the point around the two joints will be in sequence as on the notes.

2) Example of an animation file with joint rotations for J3, J4 and J5 over time – the entries in the grid are angles (or I for identify matrix).

3) Example of Scene graph for objects on a table – see PowerPoint PDF for example

4) Example of joint rotations embedded in larger world coordinate system.



$P_{J0} = (1, 0)$ (J1)

$M = M_{R(45)}$ $M_{T(2,0)}$ $M_{R(45)}(P_{J0})$

Animation

Time

J_3	0	10	20	30
J_4	0	20	45	20
J_5	I	I	I	I

$$M = M_{k} M_{-j0} * M_{-j1} * M_{j2} \cdots$$

$$M(p)$$

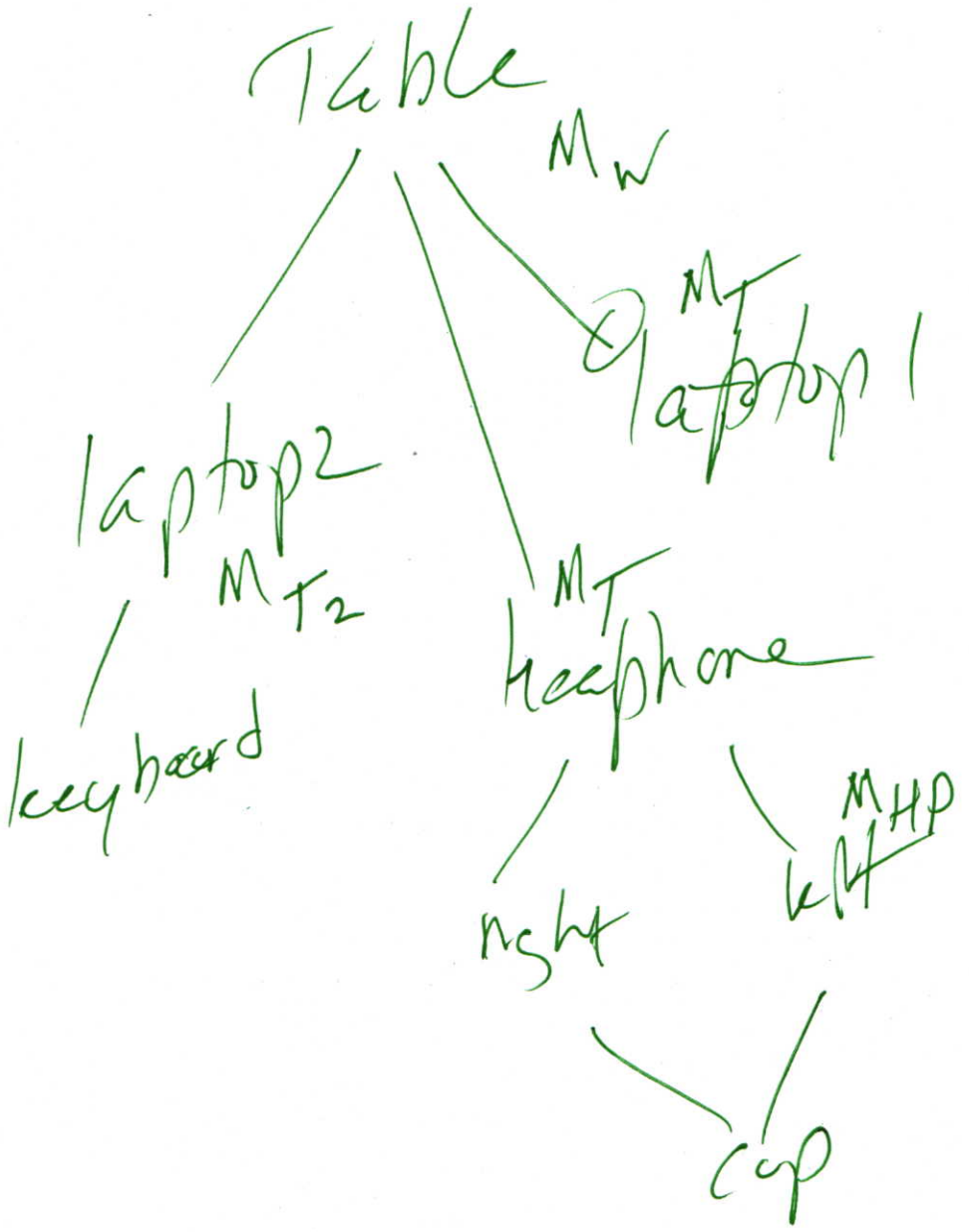
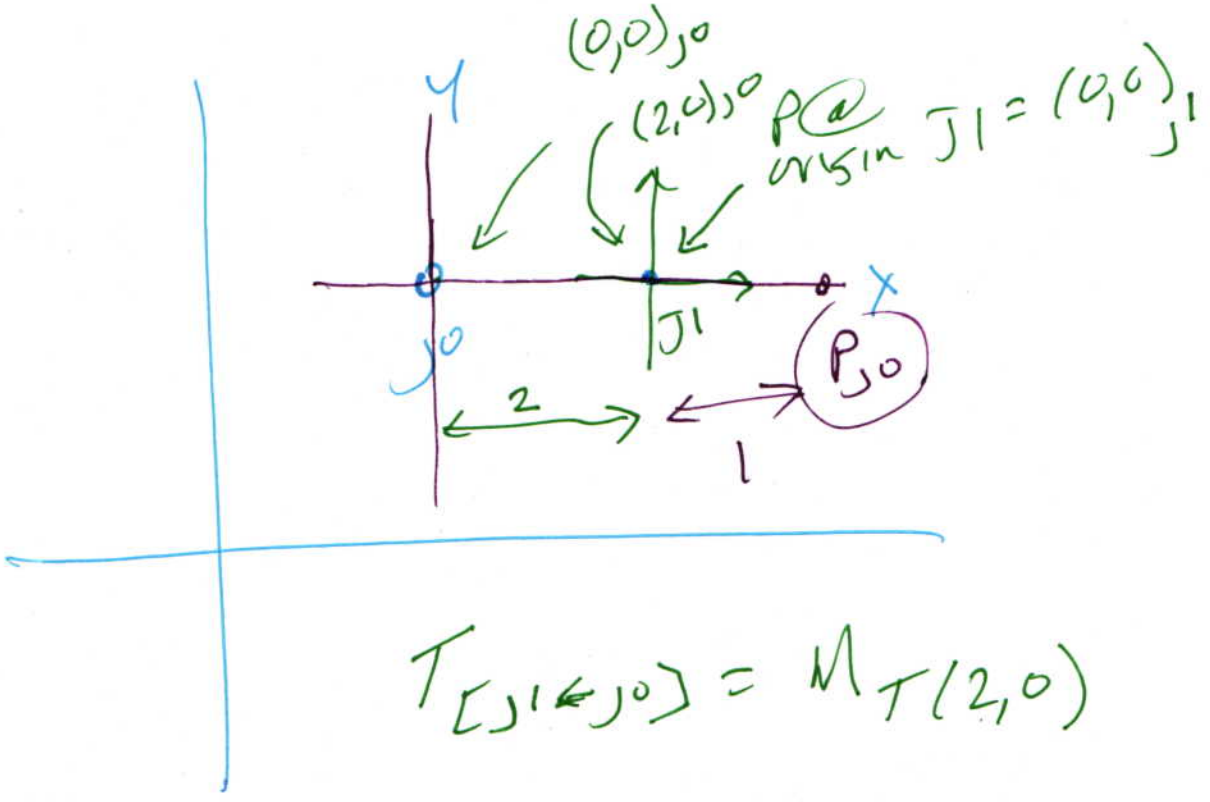


Table
M_W
M_T
laptop 1
laptop 2
M_{T_2}
keyboard
M_T
headphone
right
M_{HP}
left
cup



$$T_{[j1 \leftarrow j0]} = M_{T(2,0)}$$

$$T_{[j1 \leftarrow j0]}(0,0) =$$

$$M_{T(2,0)} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$= [2, 0, 1]$$

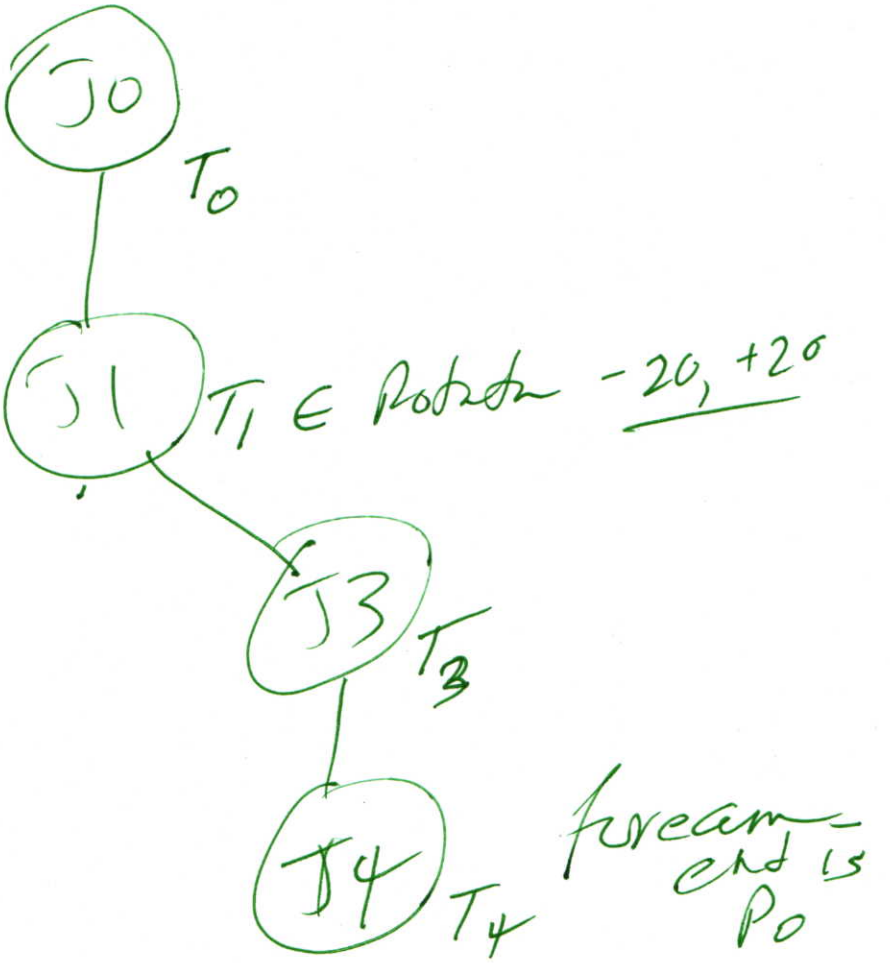
Homogeneous matrices

$$M_{T(\Delta x, \Delta y)} = \begin{bmatrix} 1 & 0 & \Delta x \\ 0 & 1 & \Delta y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} x + \Delta x \\ y + \Delta y \\ 1 \end{bmatrix}$$

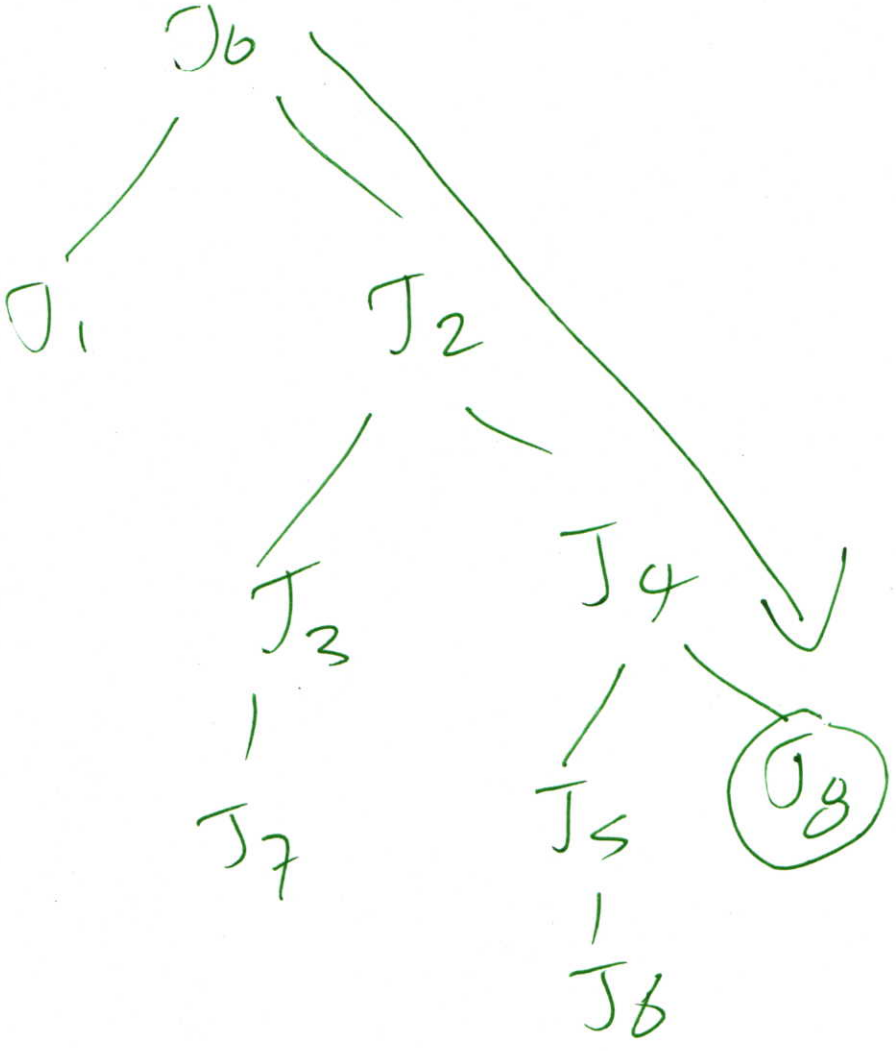
$$M_{S(\alpha)} = \begin{bmatrix} \alpha & 0 & 0 \\ 0 & \alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$M_{R(\theta)} = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$



forearm position =

$$T_4(T_3(T_1(T_0(P_0))))$$


J6
J1
J2
J3
J4
J7
J5
J8
J6