

HOMEWORK 5 ECE 4560

1. a) $g_{ab} = (d_1 + R(\theta_1) d_2, R(\theta_1) R(\theta_2))$

b) $\begin{bmatrix} R(\theta) & \vec{d} \\ 0 & 1 \end{bmatrix}$

c) $g^{-1} = (-R^T d_1, R^T) = \begin{bmatrix} R^T & -R^T d \\ 0 & 1 \end{bmatrix}$

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

e) $\begin{matrix} \vec{x}_s \\ \vec{x}_b \end{matrix} = \begin{matrix} g_{sb} & g_{sb}^{-1} \\ g_{sb}^{-1} & g_{sb} \end{matrix}$

2) a) $g_e(\vec{\alpha}) = g_{wa} g_{ab} g_{b'c} g_{ce}$

$= \begin{bmatrix} R(\alpha_1) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} R(\alpha_2) & \alpha_2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} R(\alpha_3) & l_1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} R(\alpha_4) & l_2 \\ 0 & 0 & 1 \end{bmatrix}$ WHERE $R(\theta) = \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$

c) $g_s(\vec{\alpha}_1)^{-1} g_c(\vec{\alpha}_2)$

d) $h^{-1} g_e(\vec{\alpha}_1)^{-1} g_e(\vec{\alpha}_2) h$

3) a) TO SIMPLIFY, TAKING $-\hat{z}_c \rightarrow -\hat{y}_{LEG}$ & $\hat{y}_c \rightarrow \hat{x}_c$

$\Rightarrow g_f = \begin{bmatrix} R(\theta_1) & 0 \\ & -L \\ 0 & 1 \end{bmatrix} \begin{bmatrix} R(\theta_2) & 0 \\ & -L \\ 0 & 1 \end{bmatrix} \begin{bmatrix} R(\theta_3) & W \\ & 0 \\ 0 & 1 \end{bmatrix}$

1 a) $\vec{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$