

$$c) \quad g_A^0 = (7.0, 2.0, \frac{-3\pi}{4}) \quad g_B^0 = (0, 8.0, \frac{\pi}{2})$$

$$g_B^A = (g_A^0)^{-1} g_B^0 = (R_B^A, d_B^A)$$

$$g_P^B = (R_B^A - I)^{-1} (-d_B^A) \leftarrow \text{calculations in Matlab file HW3prob2}$$

$$g_P^B = (-1.5503, -4.7426) \leftarrow \text{pole in frame B (same as A)}$$

$$(3) \quad a) \quad \begin{bmatrix} x \\ y \\ \theta \end{bmatrix} = \begin{bmatrix} l_2 \cos(\alpha_1 + \alpha_2) + l_1 \cos(\alpha_1) + l_3 \cos(\alpha_1 + \alpha_2 + \alpha_3) \\ l_2 \sin(\alpha_1 + \alpha_2) + l_1 \sin(\alpha_1) + l_3 \sin(\alpha_1 + \alpha_2 + \alpha_3) \\ \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 \end{bmatrix}$$

$$b) \quad g_E^0 = g_1^0 g_2^1 g_3^2 g_4^3 g_E^4$$

$$g_E^0 = \underbrace{\begin{bmatrix} R(\alpha_1) & 0 \\ 0 & 1 \end{bmatrix}}_{g_1^0} \underbrace{\begin{bmatrix} R(\alpha_2) & \begin{bmatrix} l_1 \\ 0 \end{bmatrix} \\ 0 & 1 \end{bmatrix}}_{g_2^1} \underbrace{\begin{bmatrix} R(\alpha_3) & \begin{bmatrix} l_2 \\ 0 \end{bmatrix} \\ 1 & 0 \end{bmatrix}}_{g_3^2} \underbrace{\begin{bmatrix} 1 & \begin{bmatrix} l_3 \\ 0 \end{bmatrix} \\ 1 & 0 \end{bmatrix}}_{g_4^3} \underbrace{\begin{bmatrix} R(\alpha_4) & 0 \\ 1 & 0 \end{bmatrix}}_{g_E^4}$$

$$c) \quad g_E^0 = \begin{bmatrix} -1 & 0 & -2.386 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \text{calculated in Matlab file HW3prob3}$$