

Tutorial 1 - Solution

7.

(a)

$$\xi_A = \begin{bmatrix} -0.3827 & 0.9239 & 123 \\ -0.9239 & -0.3827 & -74.6 \\ 0 & 0 & 1 \end{bmatrix}$$

(b)

$$\begin{bmatrix} {}^A p \\ 1 \end{bmatrix} = \xi_A^{-1} \begin{bmatrix} {}^0 p \\ 1 \end{bmatrix} = \begin{bmatrix} -35.5085 \\ -140.0491 \\ 1 \end{bmatrix}$$

8.

Approach 1:

$$\begin{cases} \xi_B = \xi_F \oplus {}^F \xi_B \\ \xi_B = \xi_R \oplus {}^R \xi_C \oplus {}^C \xi_B \end{cases} \Rightarrow$$

$$\begin{aligned} \Rightarrow \xi_F \oplus {}^F \xi_B &= \xi_R \oplus {}^R \xi_C \oplus {}^C \xi_B \\ \ominus (\xi_R \oplus {}^R \xi_C) \oplus \xi_F \oplus {}^F \xi_B &= {}^C \xi_B \Rightarrow \end{aligned}$$

$$\Rightarrow TRB = \text{inv}(TR * TRC) * TF * TFB = \begin{bmatrix} 0.61938 & 0.536 & 0.57365 & 10.009 \\ -0.70541 & 0.70069 & 0.10694 & 17.411 \\ -0.34463 & -0.4709 & 0.81209 & 17.819 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Approach 2:

$${}^R \xi_C \oplus {}^C \xi_B = {}^R \xi_B \quad \Longrightarrow \quad {}^C \xi_B = \ominus {}^R \xi_C \oplus {}^R \xi_B$$

$$\Rightarrow TRB = \text{inv}(TRC) * TRB$$

9.

$${}^R \xi_B = \left[\underbrace{10.009 \quad 17.411 \quad 17.819}_{\text{position}} \quad \underbrace{0.8849 \quad -0.16325 \quad 0.25943 \quad -0.35072}_{\text{unit-quaternion}} \right]$$