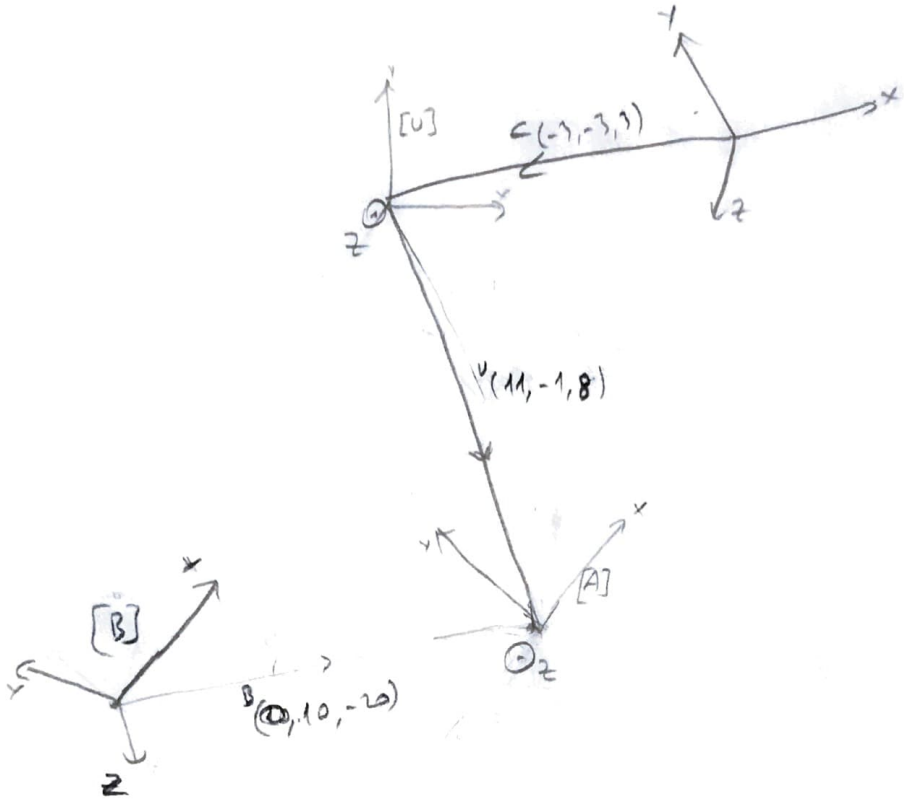
Ahmet Burak KOÇ
N20152984

Q8)



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Q8)

$$ {}^{B}_{C}T = {}^{B}_{A}T\,{}^{A}_{U}T\,{}^{U}_{C}T = {}^{B}_{A}T\,{}^{U}_{A}T^{-1}\,{}^{C}_{U}T^{-1} $$

${}^{B}_{A}T$ is known

$$ {}^{U}_{A}T^{-1} = \begin{bmatrix} {}^{U}_{A}R^{T} & -{}^{U}_{A}R^{T}\,{}^{U}P_{A\,ORG} \\ 0\ \ 0\ \ 0 & 1 \end{bmatrix} \quad \text{where} \quad {}^{U}_{A}R = \begin{bmatrix} 0.866 & -0.500 & 0.000 \\ 0.500 & 0.866 & 0.000 \\ 0.000 & 0.000 & 1.000 \end{bmatrix} $$

$$ {}^{U}P_{A\,ORG} = \begin{bmatrix} 11.0 \\ -1.0 \\ 8.0 \end{bmatrix} $$

$$ {}^{U}_{A}T^{-1} = \begin{bmatrix} 0.866 & 0.500 & 0.000 & -9.026 \\ -5.000 & 0.866 & 0.000 & 6.366 \\ 0.000 & 0.000 & 1.000 & -8.000 \\ 0.000 & 0.000 & 0.000 & 1.000 \end{bmatrix} $$

$$ {}^{C}_{U}T^{-1} = \begin{bmatrix} {}^{C}_{U}R^{T} & -{}^{C}_{U}R^{T}\,{}^{C}P_{U\,ORG} \\ 0\ \ 0\ \ 0 & 1 \end{bmatrix} \quad \text{where} \quad {}^{C}_{U}R = \begin{bmatrix} 0.866 & -0.500 & 0.000 \\ 0.433 & 0.750 & -0.500 \\ 0.250 & 0.433 & 0.866 \end{bmatrix} $$

$$ {}^{C}P_{U\,ORG} = \begin{bmatrix} -3.0 \\ -3.0 \\ 3.0 \end{bmatrix} $$

$$ {}^{C}_{U}T^{-1} = \begin{bmatrix} 0.866 & 0.433 & 0.250 & 3.1472 \\ -0.500 & 0.750 & 0.433 & -0.549 \\ -0.000 & -0.500 & 0.866 & -4.098 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

$$ {}^{B}_{C}T = {}^{B}_{A}T\,{}^{U}_{A}T^{-1}\,{}^{C}_{U}T^{-1} = \begin{bmatrix} 0.500 & 0.750 & 0.433 & -6.575 \\ -0.750 & 0.625 & -0.216 & 19.788 \\ -0.433 & -0.216 & 0.875 & -28.318 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

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Q9)

question 2.32 from book

$$ {}^{A}_{C}T = {}^{A}_{B}T \, {}^{B}_{C}T $$

$$ {}^{A}_{B}T = \begin{bmatrix} {}^{A}_{B}R & {}^{A}P_{BORG} \\ 0\ 0\ 0 & 1 \end{bmatrix} $$

$$ {}^{A}_{B}R_{XYZ}(\gamma, \beta, \alpha) = {}^{A}_{B}R_{z}(\alpha) \cdot {}^{A}_{B}R_{y}(\beta) \, {}^{A}_{B}R_{x}(\gamma) $$

$$ {}^{A}x = -{}^{B}x $$
$$ {}^{A}y = -{}^{B}z \quad \text{where} \quad \begin{bmatrix} {}^{A}x \\ {}^{A}y \\ {}^{A}z \end{bmatrix} = {}^{A}_{B}R \begin{bmatrix} {}^{B}x \\ {}^{B}y \\ {}^{B}z \end{bmatrix} $$
$$ {}^{A}z = -{}^{B}y $$

$$ \rightarrow {}^{A}_{B}R = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & -1 & 0 \end{bmatrix} $$

and

$$ {}^{A}P_{BORG} = [0, 4, 2] $$

$$ \Rightarrow {}^{A}_{B}T = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 4 \\ 0 & -1 & 0 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

$$ {}^{B}_{C}T = \begin{bmatrix} {}^{B}_{C}R & {}^{B}P_{CORG} \\ 0\ 0\ 0 & 1 \end{bmatrix} $$

$$ {}^{B}x = -{}^{C}x \cdot \cos 36.9^\circ - {}^{C}y \cdot \sin 36.9^\circ $$
$$ {}^{B}y = {}^{C}z $$
$$ {}^{B}z = -{}^{C}x \cdot \sin 36.9^\circ + {}^{C}y \cdot \cos 36.9^\circ $$

$$ {}^{B}_{C}R = \begin{bmatrix} -\cos 36.9^\circ & -\sin 36.9^\circ & 0 \\ 0 & 0 & 1 \\ -\sin 36.9^\circ & \cos 36.9^\circ & 0 \end{bmatrix} $$

$$ {}^{B}P_{CORG} = [3, 0, 0] $$

$$ \rightarrow {}^{B}_{C}T = \begin{bmatrix} -0.8 & -0.6 & 0 & 3 \\ 0 & 0 & 1 & 0 \\ -0.6 & 0.8 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

$$ \Rightarrow {}^{A}_{C}T = {}^{A}_{B}T \cdot {}^{B}_{C}T = \begin{bmatrix} 0.8 & 0.6 & 0 & -3 \\ 0.6 & -0.8 & 0 & 4 \\ 0 & 0 & -1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

question 2.34 from book

$$ {}^{C}_{A}T = {}^{A}_{C}T^{-1} = \begin{bmatrix} 0.8 & 0.6 & 0 & 0 \\ 0.6 & -0.8 & 0 & 5 \\ 0 & 0 & -1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$