①

Siendo: $t = (2,-1,5)$; $t = (O_2 - O_1)$; M_T = Translación
M_B = T.L. para ajustar a una base diferente

$$M_{S_1 \to S_2} = M_B M_T = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -5 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & -5 \\ 0 & 1 & 0 & 1 \\ -1 & 0 & 0 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M_{S_2 \to S_1} = M_{S_1 \to S_2}^{-1} = \begin{bmatrix} 0 & 0 & -1 & 2 \\ 0 & 1 & 0 & -1 \\ 1 & 0 & 0 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$P = \begin{bmatrix} 0 & 0 & 1 & -5 \\ 0 & 1 & 0 & 1 \\ -1 & 0 & 0 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -3 \\ 6 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} -3 \\ 7 \\ 5 \\ 1 \end{bmatrix}$$

($M_{S_1 \to S_2}$ y P_o)

⑫

$$M_{S_1 \to S_2} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 90 & -\operatorname{sen} 90 & 0 \\ 0 & \operatorname{sen} 90 & \cos 90 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M_{S_2 \to S_3} = \begin{bmatrix} \cos -90 & -\operatorname{sen}(-90) & 0 & 0 \\ \operatorname{sen} -90 & \cos 90 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M_{S_1 \to S_3} = M_{S_2 \to S_3} \cdot M_{S_1 \to S_2} = \begin{bmatrix} 0 & 0 & -1 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} ; \quad M_{S_3 \to S_1} \cdot P = \begin{bmatrix} 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} P_x \\ P_y \\ P_z \\ 1 \end{bmatrix}$$